LANGE'S

Handbook of Chemistry

CFTRI-MYSORE
769
Handbook of chem

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Dedication

To those workers in science who through their labors determined the values recorded herein, this compilation is dedicated. Their devotion to the search for the constants of nature and the dissemination of this knowledge are the foundations upon which rest the achievements of applied science.

PREFACE TO THE SEVENTH EDITION

As with previous editions both the publishers and the compiler have felt that consideration should first be given to a thorough revision of materials previously presented, rather than merely an addition of new tables without bringing standing matter up-to-date. Consequently, in this edition many changes in numerical values scattered here and there throughout the book have been made. Such changes and corrections are hardly noticeable on casual inspection but are necessary for maintaining that confidence which we believe users of this book have come to place upon its standard of reliability and accuracy. The compiler appreciates the interest taken by users of previous editions who have brought to his attention both errors and better values as disclosed in recent research work. To these he gives his assurance that every error of which he is cognizant has been corrected and that a careful search of the literature was made in checking suggested changes in values.

In such a rapidly growing science as chemistry the pressure to include new subject matter is always present. The writer is grateful to users of previous editions who have suggested the inclusion of subject matter not previously given but which seemed to them necessary in providing a volume of maximum usefulness. However, the compiler is hereby confronted with the difficult problem of finding space in one volume without producing a work of ungainly size and bulk. Moreover, this book which is intended for ready reference on the desk or laboratory bench must be of such a size that it can be published at a price which most users will feel justified in paying. This pressure to add essential information has finally forced upon the compiler the decision to eliminate a portion of the mathematical data which appeared as an appendix in all previous editions. This decision was based on the belief that most chemists and students of chemistry would find the added chemical information of more value than the eliminated mathematical subject matter. For those chemists who have need for a more comprehensive treatment of mathematics the publishers can supply the omitted appendix of mathematical tables and formulas in a separately bound volume as announced on page 1868 of this edition.

The following tables have been extended or completely rewritten:

PERIODIC CHART OF THE ELEMENTS
DESCRIPTION OF THE ELEMENTS
TABLE OF ISOTOPES
PLASTICS AND SYNTHETIC RUBBERS
COMPOSITION AND USE OF FOODS
TYPICAL ANALYSES OF VARIOUS PUBLIC WATER SUPPLIES
CORROSION AND HEAT RESISTANT ALLOYS
COMMONLY USED CERAMIC MATERIALS
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TRUE CAPACITY OF GLASS VESSELS
STANDARD VOLUMETRIC (TITRIMETRIC) SOLUTIONS
SPECIFIC GRAVITY OF AQUEOUS ETHYL ALCOHOL
VAPOR PRESSURES OF VARIOUS SUBSTANCES
PROPERTIES OF SATURATED AMMONIA

HEAT OF VAPORIZATION OF COMPOUNDS
VISCOSITY OF WATER
STANDARD LETTER SYMBOLS AND ABBREVIATIONS
GAS CONSTANT
DEFINITIONS OF CHEMICAL, PHYSICAL AND PHARMACEUTICAL TERMS
PHOTOGRAPHIC EMULSION SPEED RATINGS
FORMULAS AND PROPERTIES OF DENATURED ALCOHOLS

The following is a list of tables not in the previous edition and now offered for the first time:

ABUNDANCE OF THE ELEMENTS
GLYCERIDE CONTENT OF DRYING OILS
PROPERTIES OF HORMONES
ASTM CLASSIFICATION OF COALS BY RANK
FORMULAS FOR CALCULATING MINERAL-FREE BTU AND FIXED CARBON
DENSITY OF FUMING SULFURIC ACID SOLUTIONS
DIELECTRIC CONSTANTS
DIPOLE MOMENTS
MASS OF WATER IN SATURATED AIR
PARTIAL PRESSURES OF AQUEOUS AMMONIA SOLUTIONS
KOPP'S RULE FOR CALCULATING SPECIFIC HEAT
LOGARITHMS OF EQUILIBRIUM CONSTANTS
VISCOSITY OF AQUEOUS SUCROSE SOLUTIONS
VISCOSITY OF AQUEOUS ETHYL ALCOHOL SOLUTIONS

The compiler in presenting this *SEVENTH EDITION* wishes to express his indebtedness and appreciation to users of previous editions who have made suggestions for improvement and called attention to errors. Acknowledgment for assistance is also due Professor J. A. Campbell of Oberlin College, Oberlin, Ohio, whose name was inadvertently omitted from those given in the *Acknowledgment* on the following pages. The friendly criticisms and suggestions from users of previous editions and from book reviewers have had much to do in the improvement of each succeeding edition and in giving encouragement to the aim of making each edition better than the preceding ones. It is hoped that this coöperation will continue.

May, 1949. N. A. Lange.

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ACKNOWLEDGMENT

Grateful acknowledgment is hereby made of an indebtedness to my former teachers and many members of the chemical profession who by their criticisms and suggestions in past years have been of unconscious assistance towards the preparation of this book. Sincerest appreciation is likewise expressed to the various manufacturers, trade associations, and the managements of technical publications who have supplied and permitted reprinting of certain information as acknowledged within the text. In particular is acknowledgment made of the services of the following who have been of material assistance in this work:—

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FIRST AID MEASURES FOR ACCIDENTS AND ANTIDOTES OF POISONS

By W. F. von Oettingen, M. D., Ph. D.

The following directions are intended as first aid measures for accidents and different forms of poisoning. In laboratories connected with institutions or plants which have first aid stations or emergency hospitals, any injury should be reported immediately. If such facilities are not available, and whenever the case is of a more serious nature, a physician should be summoned at once and, in order to avoid any delay, the items in parentheses should be ready for his use upon his arrival.

Treatment of Burns

In any case of extensive burns of any degree, call physician.

1. From fire, steam and hot objects.

(*a*) *First degree* (*reddening*): Oil dressing or bland ointment; gauze saturated with pure vegetable or mineral oil.

(*b*) *Second degree* (*blisters*): Cover blister with sterile gauze saturated with olive oil or some burn ointment; apply oil dressing until the wound is healed.

(*c*) *Third degree* (*destruction of tissue*): Cover wound with a sterile dressing and call a physician. (Prepare sterile bandaging material; arrange facilities for sterilizing instruments with boiling water; in case of shock: caffeine sodio-benzoate or salicylate for hypodermic injection; normal saline solution.)

2. From acids (hydrochloric, nitric, phosphoric, and sulfuric acids, and chlorine or bromine). Wash with large quantities of water, then with 5% sodium bicarbonate solution, and apply oil dressing. (In case of extensive and severe burns prepare materials for physician as directed under 1, *c*.)

Burns from **hydrofluoric acid.** Wash burn immediately in cold running water until the white coagulated appearance of the area has been replaced by redness, or for a period of at least 4 to 6 hours. Then apply a freshly prepared 20% suspension of magnesium oxide in glycerol. (Prepare a 10% magnesium sulfate solution; material for oil dressing; facilities for the sterilization of instruments with boiling water.)

3. From alkalies: Wash the injury with large quantities of water, and cover the wound with an oil dressing or bland ointment. (In case of extensive burns prepare materials for physician as directed under 1, *c*.)

4. From phenols: Wash liberally with alcohol and then apply an oil dressing. (In case of extensive burns prepare materials for physician as directed under 1, *c*.)

5. Burns of the eye should be flushed first with large quantities of water, and then in case of alkalies with 2% boric acid solution, and in case of acids with 3% sodium bicarbonate solution, after which the eye should be covered with gauze moistened with olive oil.

Treatment of Cuts

Clean the wound mechanically using *sterile* forceps or *sterile* gauze and paint the area *surrounding* the injury with 3.5% tincture of iodine.

If the cut is *small*, scrub with soap and water, cover with sterile gauze and bandage or adhesive tape.

If the cut is *severe* and bleeding freely apply a ligature between the site of the injury and the heart in case the blood is red and the flow intermittent; if the blood is dark and the flow continuous, apply the ligature between the injury and the periphery. Cover the wound with sterile gauze until arrival of the physician. (Prepare sterile bandaging material, facilities for sterilizing instruments with boiling water; and in case of severe hemorrhage several liters of sterilized physiological saline solution (0.9% solution of sodium chloride in water) and caffeine sodio-benzoate for hypodermic injection.)

Collapse

Lay the patient flat on the floor and let him inhale *dilute* vapors of ammonia or smelling salts; stimulate the skin by rubbing with stiff brushes. Administer whiskey or coffee *if patient is able to swallow.* In case the respiration is shallow or arrested, start artificial respiration preferably with simultaneous administration of oxygen or oxygen-6% carbon dioxide mixture. (Prepare camphor oil, caffeine sodio-benzoate for hypodermic injection, sterilized physiological saline solution (0.9% solution of sodium chloride in water) and a cylinder of oxygen-6% carbon dioxide.)

Treatment of Poisonings

Call physician. If cause is known, follow immediately the directions given below.

Acids. When taken orally, rinse the mouth with water then with 5% sodium bicarbonate; give milk and a suspension of 10 grams of magnesium oxide (magnesia) in 150 cc of water; or limewater and oil; or a thin flour paste. (Prepare sterilized physiological saline solution as directed under *collapse*, camphor oil and solution of caffeine sodio-benzoate.

Alcohols. Give large quantities of warm water and if possible gastric lavage, emetics such as mustard water, and coffee. (Prepare caffeine sodio-benzoate, and oxygen-6% carbon dioxide mixture; stomach tube.)

Aldehydes. Give a tumbler full of 0.2% ammonia solution followed within a few minutes by milk. (Prepare stomach tube, caffeine sodio-benzoate, physiological saline solution as directed above and oxygen.)

Alkaloids. Immediately give one or two tablespoonfuls of purified charcoal in suspension in a glass of water; then give an emetic such as soap water. (Prepare caffeine sodio-benzoate, chloral hydrate, chloroform, and oxygen-6% carbon dioxide mixture.)

Ammonia. Administer large quantities of water containing vinegar or lemon juice and later give olive oil. (Prepare materials as given above for *acids* for use of the physician upon his arrival.) If inhaled, transfer patient to fresh air and keep him at rest.

Aniline. If taken by mouth, give large quantities of soap water, administer oxygen freely, combined with artificial respiration if necessary, saline cathartics, *give no alcohol or oils*. If inhaled, transfer patient to fresh air, let him have absolute rest and let him inhale oxygen. (Prepare materials as given under *acids*. Keep oxygen or oxygen-6% carbon dioxide mixture ready.)

Arsenic or Antimony. Give an emetic such as soap water and a cathartic such as epsom salts; *do not rely upon chemical antidotes.* (Prepare stomach tube, physiological saline, and caffeine sodio-benzoate.)

Arsine. Absolute rest; free administration of oxygen. (Prepare facilities for sterilizing instruments with boiling water, caffeine sodio-benzoate, and oxygen.)

Barium salts. Give emetics such as soap water, and saline cathartics such as epsom or Glaubers salts. (Prepare stomach tube, and a 25% magnesium sulfate solution for hypodermic injection.)

Benzene. If taken by mouth, give emetics such as soap water or mustard water, cathartics, artificial respiration with simultaneous administration of oxygen, coffee. (Prepare stomach tube, caffeine sodio-benzoate, and oxygen.) If inhaled, transfer patient to fresh air, prevent chilling, let him have absolute rest, if necessary let him inhale oxygen until physician arrives.

Carbolic acid. Give soap water as an emetic, large quantities of water, syrup of lime, or a solution of one part of potassium permanganate in 4000 parts of water. (Prepare stomach tube, caffeine sodio-benzoate, oxygen.)

Carbon monoxide, Ethylene, Acetylene, Illuminating gas. Transfer patient to fresh air, prevent chilling, administer oxygen, if respiration is slow, irregular or intermittent, this should be combined with the administration of oxygen and artificial respiration in case the respiration has stopped. (Prepare caffeine sodio-benzoate, oxygen.)

Chlorine, Bromine. If taken orally, rinse mouth with 3% sodium bicarbonate and magnesium oxide in water; give milk and suspension of 10 g. magnesium oxide in 150 cc of water. (Make preparations for the arrival of physician as directed under *acids.*) If inhaled, follow the treatment as given under *phosgene.*

Hydrocyanic acid, Cyanides. If taken orally, give a 1% solution of sodium thiosulfate or 0.025% solution of potassium permanganate alkalinized with sodium bicarbonate. Give an emetic such as mustard water or soap water and have patient inhale the contents of one pearl of amyl nitrite. Give artificial respiration with free administration of oxygen. (Prepare caffeine sodio-benzoate, oxygen-6% carbon dioxide mixture, stomach tube, several liters of an aqueous 0.05% potassium permanganate solution.) If inhaled, start with inhalation of one pearl of amyl nitrite and artificial respiration with administration of oxygen.

Hydrogen sulfide. Artificial respiration with simultaneous administration of oxygen. (Prepare oxygen-6% carbon dioxide mixture.)

Iodine. Give an emetic such as soap water; a 1% aqueous solution of sodium thiosulfate (Hypo); starch paste; milk. (Prepare stomach tube and several liters of an aqueous 1% sodium thiosulfate solution.)

Lead compounds. Give large quantities of epsom salt. (Prepare stomach tube.)

Mercury compounds. Immediately give three raw eggs in a quart of milk and an emetic such as soap water. (Prepare stomach tube, hydrogen peroxide, and an hypophosphite-peroxide mixture composed of 1 gram sodium hypophosphite, 5 cc hydrogen peroxide, and 10 cc of water for each 0.1 gram of mercuric chloride in the stomach of the patient.)

Morphine alkaloids. Give strong coffee, hot bath and artificial respiration. (Prepare oxygen-6% carbon dioxide mixture, caffeine sodio-benzoate, 0.1% atropine sulfate solution for hypodermic use, stomach tube, and several liters of a 0.1% solution of potassium permanganate in water.)

Nitric vapors. *Absolute rest ! ! !*, even in moderate poisoning; inhalation of oxygen. (Prepare caffeine sodio-benzoate, facilities for sterilization of instruments with boiling water, and physiological saline solution as directed under *collapse*.)

Nitro compounds. Give emetic such as mustard water, and saline cathartics; *avoid alcohol, fats* and *oil*. (Prepare stomach tube, caffeine sodio-benzoate, and oxygen-6% carbon dioxide mixture.)

Oxalic acid. Give emetic such as mustard water; syrup of lime, lime water; castor oil. (Prepare stomach tube; sterile aqueous 3% solution of calcium lactate or calcium gluconate in ampoules for intravenous injection.)

Permanganate. Give water; emetic such as mustard water; starch paste. (Prepare stomach tube.)

Phosgene. *Absolute rest ! ! !*, even in moderate cases; inhalation of oxygen. (Prepare caffeine sodio-benzoate, and facilities for sterilization of instruments with boiling water.)

Phosphorus. Give 200 cc of a 0.2% aqueous solution of copper sulfate. *Avoid fats and oils.* (Prepare stomach tube, several liters of a 0.2% aqueous solution of copper sulfate, a 0.1% aqueous solution of potassium permanganate, liquid petrolatum.)

Pyridine. Give large quantities of tea or coffee; artificial respiration. (Prepare stomach tube, caffeine sodio-benzoate, and oxygen.)

Sodium fluoride, Roach powder insecticide. Give lime water or weak solutions (2%) of calcium chloride. (Prepare for gastric lavage, keep lime water ready and sterile 1% solution of calcium chloride for intravenous injection, or calcium gluconate for intramuscular injection.)

Silver compounds. Give large quantities of common salt or sodium chloride solution. (Prepare stomach tube.)

Tin compounds. Give emetic such as soap water; milk of magnesia; oils. (Prepare stomach tube, caffeine sodio-benzoate.)

Zinc compounds. Give emetic such as soap water, and an egg in milk. (Prepare stomach tube, caffeine sodio-benzoate.)

ATOMIC WEIGHTS AND NUMBERS

(See also Table of Physical Constants of Inorganic Compounds)

Name	Symbol	Atomic Weight*	Logarithm of Atomic Weight	Atomic Number	Valence
Aluminum	Al	26.97	1.43088	13	3
Antimony	Sb	121.76	2.08551	51	3, 5
Argon	A	39.944	1.60145	18	0
Arsenic	As	74.91	1.87454	33	3, 5
Barium	Ba	137.36	2.13786	56	2
Beryllium	Be	9.02	0.95521	4	2
Bismuth	Bi	209.00	2.32015	83	3, 5
Boron	B	10.82	1.03423	5	3
Bromine	Br	79.916	1.90264	35	1, 3, 5, 7
Cadmium	Cd	112.41	2.05081	48	2
Calcium	Ca	40.08	1.60293	20	2
Carbon	C	12.010	1.07954	6	2, 3, 4
Cerium	Ce	140.13	2.14653	58	3, 4
Cesium	Cs	132.91	2.12355	55	1
Chlorine	Cl	35.457	1.54970	17	1, 3, 4, 5, 7
Chromium	Cr	52.01	1.71609	24	2, 3, 6
Cobalt	Co	58.94	1.77041	27	2, 3
Columbium	Cb	92.91	1.96806	41	3, 4, 5
Copper	Cu	63.54	1.80305	29	1, 2
Dysprosium	Dy	162.46	2.21075	66	3
Erbium	Er	167.2	2.22324	68	3
Europium	Eu	152.0	2.18184	63	3
Fluorine	F	19.00	1.27875	9	1
Gadolinium	Gd	156.9	2.19562	64	3
Gallium	Ga	69.72	1.84336	31	2, 3
Germanium	Ge	72.60	1.86094	32	2, 4
Gold	Au	197.2	2.29491	79	1, 3
Hafnium	Hf	178.6	2.25188	72	4
Helium	He	4.003	0.60239	2	0
Holmium	Ho	164.94	2.21352	67	3
Hydrogen	H	1.0080	0.0034605	1	1
Indium	In	114.76	2.05979	49	3
Iodine	I	126.92	2.10353	53	1, 3, 5, 7
Iridium	Ir	193.1	2.28578	77	3, 4
Iron	Fe	55.85	1.74695	26	2, 3
Krypton	Kr	83.7	1.92273	36	0
Lanthanum	La	138.92	2.14276	57	3
Lead	Pb	207.21	2.31641	82	2, 4
Lithium	Li	6.940	0.84136	3	1
Lutecium	Lu	174.99	2.24304	71	3
Magnesium	Mg	24.32	1.38596	12	2
Manganese	Mn	54.93	1.73981	25	2, 3, 4, 6, 7

*International Atomic Weights: Jour. Am. Chem. Soc. 69, 734 (1947).

ATOMIC WEIGHTS AND NUMBERS

Name	Symbol	Atomic Weight*	Logarithm of Atomic Weight	Atomic Number	Valence
Mercury	Hg	200.61	2.30235	80	1, 2
Molybdenum	Mo	95.95	1.98204	42	3, 4, 5, 6
Neodymium	Nd	144.27	2.15918	60	3
Neon	Ne	20.183	1.30499	10	0
Nickel	Ni	58.69	1.76856	28	2, 3
Nitrogen	N	14.008	1.14638	7	3, 5
Osmium	Os	190.2	2.27921	76	2, 3, 4, 6, 8
Oxygen	O	16.0000	1.20412	8	2
Palladium	Pd	106.7	2.02816	46	2, 3, 4
Phosphorus	P	30.98	1.49108	15	3, 5
Platinum	Pt	195.23	2.29055	78	2, 4
Potassium	K	39.096	1.59218	19	1
Praseodymium	Pr	140.92	2.14897	59	3
Protactinium	Pa	231	2.36361	91	5
Radium	Ra	226.05	2.35421	88	2
Radon	Rn	222	2.34635	86	....
Rhenium	Re	186.31	2.27023	75	4, 6, 7
Rhodium	Rh	102.91	2.01246	45	2, 3
Rubidium	Rb	85.48	1.93186	37	1
Ruthenium	Ru	101.7	2.00732	44	2(?), 3, 4, 6, 8
Samarium	Sm	150.43	2.17734	62	3
Scandium	Sc	45.10	1.65418	21	3
Selenium	Se	78.96	1.89741	34	2, 4, 6
Silicon	Si	28.06	1.44809	14	4
Silver	Ag	107.880	2.03294	47	1
Sodium	Na	22.997	1.36167	11	1
Strontium	Sr	87.63	1.94265	38	2
Sulfur	S	32.066	1.50604	16	2, 4, 6
Tantalum	Ta	180.88	2.25739	73	3, 4, 5
Tellurium	Te	127.61	2.10588	52	2, 4, 6
Terbium	Tb	159.2	2.20194	65	3
Thallium	Tl	204.39	2.31046	81	1, 3
Thorium	Th	232.12	2.36572	90	4
Thulium	Tm	169.4	2.22891	69	3
Tin	Sn	118.70	2.07445	50	2, 4
Titanium	Ti	47.90	1.68034	22	3, 4
Tungsten	W	183.92	2.26463	74	2, 4, 6
Uranium	U	238.07	2.37671	92	4, 6
Vanadium	V	50.95	1.70714	23	2, 3, 4, 5
Xenon	Xe	131.3	2.11826	54	0
Ytterbium	Yb	173.04	2.23815	70	3
Yttrium	Y	88.92	1.94900	39	3
Zinc	Zn	65.38	1.81544	30	2
Zirconium	Zr	91.22	1.96009	40	4

*International Atomic Weights; Jour. Am. Chem. Soc. 69, 734 (1947).

A TABLE OF COMMON

Prepared by Committees of the National Fire Protection

Tentatively adopted 1928, *adopted* 1929,

These columns are informative only; it is not considered necessary that the material be kept or stored only in the containers as listed, nor that each package be labeled.

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Acetic Acid (Glacial)		
Glass carboys and barrels. Expands on solidification and may burst container unless kept at a temperature above 16° C. (60.8° F.).	May cause painful burns of skin.	Extinguishing agent, water.
Acetone		
Carboys, steel drums, tank cars.	Toxicity of a comparatively low order.	Lighter than water. (Sp. gr. 0.792) but soluble in it in all proportions. Water, particularly in the form of spray, is the best extinguisher. Carbon dioxide may also be used. Automatic sprinkler systems or total-flooding carbon dioxide systems may be employed for protection in storage rooms.
Aluminum Dust		
Barrels or boxes.		Smother with sand, ashes, or rock dust. Do not use water, which may cause explosion.
Aluminum Resinate		
Wooden barrels.		
Ammonia (Anhydrous)		
Steel cylinders or steel tank cars.	Irritant. An outstanding serious effect produced by ammonia in concentrations of the order of ½% by volume for duration of exposure of the order of ½ hour is blindness. A concentration of 0.03% of ammonia in air for duration of exposure of the order of ½ to 1 hour, according to Lehmann, does not cause serious effects.	Soluble in water. Hose streams comparatively effective in removing the gas from the atmosphere.

HAZARDOUS CHEMICALS

Association and American Chemical Society.

amended 1931, 1935, 1938, 1939, 1941, 1942.

The requirements in the table on the storage of containers refer to chemicals in usual containers, and are not intended to apply to small bottles of chemicals such as are found in drug stores and chemical laboratories.

Fire Hazard	Storage
Dangerous in contact with chromic acid, sodium peroxide or nitric acid; yields moderately flammable vapors above flash point 104° F.	Safeguard against mechanical injury. Isolate from oxidizing materials as noted under Fire Hazard.
A volatile liquid. Gives off vapors which form with air flammable and explosive mixtures. Flash point −16° C. (3° F.). Explosive range 2.55% to 12.8% (upward propagation). The ignition temperature is comparatively high, being within the range 538° to 566° C. (1000° to 1050° F.). The vapors are heavier than air (vapor density 2). Fire hazard slightly less than that of gasoline.	Safeguard containers against mechanical injury. Only electrical equipment of the explosion-proof type, Group D classification, permitted in atmospheres containing acetone vapor in flammable proportions.
Forms flammable and explosive mixtures with air.	Keep in dry place. In case of fire do not use water; it may cause an explosion.
Combustible.	Storage should be ventilated and safeguarded as for oil storage building.
Gas density 0.60 (air = 1). Not flammable in air except in comparatively high concentration, which is seldom encountered under practical conditions, the low limit of the flammable or explosive range being about 15% to 16% and the upper limit about 25% to 26% by volume (horizontal propagation). The presence of oil will increase the fire hazard. Ammonia aqua does not burn.	Safeguard against mechanical injury and excessive heating of cylinders or tanks. Fire-resistive storage recommended. In combustible buildings or if near combustibles, sprinklered storage recommended. Isolate from other chemicals, particularly chlorine, bromine, iodine and mineral acids.

A TABLE OF COMMON

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Ammonium Perchlorate		
Wooden barrels or kegs and glass bottles.		
Antimony Pentasulfide; (Golden Antimony Sulfide) Sb_2S_5		
Fiber drums or tins. Used in manufacture of matches, ammunition and fire works, and of certain rubber compounds.	Gaseous products of combustion contain sulfur dioxide and are irritating and corrosive.	Practically insoluble in water. Use water.
Barium Chlorate		
Wooden boxes, barrels or kegs.		See potassium chlorate.
Barium Nitrate		
Wooden boxes; barrels.	Soluble in water. Poisonous when taken internally.	See sodium nitrate.
Barium Peroxide		
Tightly closed metal containers packed in wooden boxes or barrels; or in bulk in metal barrels or drums.		Smother with sand, ashes, or rock dust. Do not use water.
Benzoyl Peroxide (Dry granular or powdered wet)		
Dry granular material in individual one-pound containers inside wooden boxes; finely powdered material shipped wet (30% water by weight) in glass containers placed inside tightly sealed metal containers in wooden boxes or in aluminum drums.	Dust irritating to eyes and lungs. Use goggles and dust respirator in dusty atmospheres.	Water, carbon dioxide, foam, sand, soda ash, or rock dust may be used as extinguishing agents.
Bleaching Powder; Calcium Hypochlorite; Chlorinated Lime; Chloride of Lime (incorrect name)		
Air-tight tin containers, wooden barrels, and steel drums. Encountered in paper, textile, disinfectant and alkali industries; also where water purification processes are employed.	Corrosive. Irritating to skin, eyes, and lungs. See chlorine.	Fires where the compound is present may be fought with water, preferably spray. Protect eyes and skin, using gas mask of a type approved by Bureau of Mines.

HAZARDOUS CHEMICALS

Fire Hazard	Storage
Oxidizing material. May explode in a fire. Hazard classes with potassium chlorate.	Safeguard against mechanical injury. Isolate from mineral acids, also from combustibles.
Combustible. Readily ignited by a small flame. Hazardous in contact with oxidizing material. Yields flammable hydrogen sulfide on contact with mineral acid.	Safeguard against mechanical injury. Isolate from acids, chlorates, nitrates, and other oxidizing agents.
Oxidizing material. Hazard classes with potassium chlorate.	Isolate.
Oxidizing material. Hazard in class with sodium nitrate.	Do not store with combustible materials.
Oxidizing material. Hazard in class with sodium peroxide.	Do not store with combustible materials.
Highly flammable in the dry state. Strong supporter of combustion. Do not subject dry material to heat of friction or grinding. Not miscible with water.	Store in a cool ventilated place. Powder should be stored with not less than 30% water by weight. Keep away from all sources of heat and separate from all combustible materials and acids.
Not combustible but evolves chlorine and at higher temperatures oxygen. With acids or moisture evolves chlorine freely at ordinary temperatures. See chlorine.	Store in cool, dry, well ventilated place away from combustibles. See chlorine. Rupture of drums containing bleaching powder, particularly if the chlorine content is high, may result from exposure to heat.

	Usual Shipping Container	Life Hazard	Fire Fighting Phases
Borneol	Barrels, kegs, boxes and tins.		See camphor.
Bromine	Glass bottles; earthen jugs. Bottles should be surrounded by incombustible packing.	Corrosive; at ordinary temperatures gives off poisonous suffocating vapors.	
Bronze Dust	Barrels or boxes.		Smother with sand or ashes.
Butane	Steel cylinders.		
Calcium Carbide	Iron drums and tin cans.	Serious under fire conditions.	Smother with sand or ashes. Do not use water.
Calcium Oxide; Quick Lime	Wooden barrels and bags.		
Camphene	Tins.		Smother with sand or ashes. Avoid water.
Camphor	Tins and wooden kegs.		Smother with sand or ashes. Chemical streams. Avoid water.
Carbolic Acid—*See Phenol.*			
Carbon Disulfide	Small glass, earthenware, or metal containers packed in outside barrels or boxes (See I. C. C. Regulations). Steel drums, steel tank cars. Carbon disulfide should never be transferred by means of air. Use inert gas, water, or pump. Use a wood measuring stick for	Toxic. 3200 to 3850 parts of vapor per million (0.32 to 0.385% by volume) may cause dangerous illness in ½ to 1 hour. Direct contact with the skin should be avoided. Products of combustion contain sulfur dioxide, which in concentrations of 0.2% by volume in air may cause serious injury in	Heavier than water (Sp. gr. 1.29) and sparingly soluble in it. Use sand, carbon dioxide, or other inert gas as extinguishing agents. Cooling and blanketing action of water may be utilized in case of fires in metal containers or tanks. Total-flooding carbon dioxide systems may be employed for protection in storage rooms. Foam not effective. Do not

HAZARDOUS CHEMICALS

Fire Hazard	Storage
Combustible. Hazard similar to camphor.	Store in well-ventilated compartment or building.
Causes oxidizing effect, resulting in heating and may cause fire when in contact with organic material.	Isolate; safeguard against mechanical injury.
When aluminum is present forms flammable and explosive mixtures with air. Composition usually free from aluminum.	Bronze dust free from aluminum not considered dangerous.
Flammable gas under pressure. Classes with gasoline vapor in fire hazard.	Safeguard against mechanical injury. Keep cool.
Gives off acetylene gas on contact with water or moisture.	Store in dry, well-ventilated place in accordance with N.F.P.A. Standards.
Heats upon contact with water or moisture and may cause ignition of organic material. Swells when moist and may burst container.	Isolate; store in dry place away from water or moisture.
When heated gives off flammable vapors. Classes with turpentine.	Isolate; keep in unheated compartment away from fire or heat.
Flammable; gives off flammable vapors when heated which may form explosive mixture with air. Flash point 180° F.	Detach from other storage. Keep in well-ventilated room remote from fire.
A highly volatile liquid with an offensive odor, giving off even at comparatively low temperatures vapors which form with air flammable and explosive mixtures. Flash point −30° C. (−22° F.). Flammable range 1% to 50% (upward propagation). The ignition temperature is dangerously low, being about 100° to 106° C. (212° to 223° F.). It is endothermic, and the vapor may be ignited by a heavy blow. The vapors are heavier than air (vapor density 2.62), and may travel a considerable distance to a source of ignition and flash back. More hazardous than gasoline.	Isolate and safe-guard containers against mechanical injury and metallic blows, and keep in unheated compartment away from sunlight and any source of ignition, including electric lighting fixtures and other electrical equipment. Storage tanks should be constructed over concrete basins containing water, and the carbon disulfide kept blanketed

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Carbon Disulfide (*Continued*)		
measuring contents of storage tanks or tank cars. Tank cars when being loaded or unloaded should be well grounded. Do not dispose of carbon disulfide by pouring it on the ground. Provide a safe place for burning it.	½ hour or less. Often poisonous carbon monoxide is present in the products of combustion.	use carbon tetrachloride. Use of gas masks or oxygen helmets of the type approved for the purpose by U. S. Bureau of Mines recommended.
Charcoal (Wood)		
Boxes, barrels, bags, or bulk.	There is danger from carbon monoxide poisoning during burning unless adequate ventilation is provided.	Use water, completely extinguishing the fire, after which the storage pile should be moved.
Chinese Wax		
Burlap bags and wooden barrels.		
Chlorine		
Steel cylinders and tank cars.	Corrosive. Irritating to eyes and mucous membrane. Toxic. 0.004% to 0.006% by volume in air causes dangerous illness in ½ to 1 hour.	Use gas masks on entering atmospheres containing chlorine gas. If, however, concentration is high, or there is doubt as to the degree of concentration, use oxygen helmet of a type approved for such use by U. S. Bureau of Mines.
Chromium Trioxide or Chromium Anhydride CrO_3 (often called "Chromic Acid")		
Iron drums and glass bottles. It is used in chromium plating, in electric batteries, and in photography.	Irritating to skin. Poisonous.	Use water, completely extinguishing the fire, after which the storage pile should be removed.
Cobaltous Nitrate		
Wooden barrels.		
Colophony; Rosin		
Barrels.		
Copper Nitrate		
Wooden barrels and kegs.	Poisonous when taken internally. Soluble in water.	

Fire Hazard	Storage
	with water or inert gas at all times.
Spontaneously ignitable when freshly calcined and exposed to air, or when wet; hazardous when freshly ground and tightly packed.	Isolate; prevent dust accumulations; ventilate well; make daily inspections.
Combustible.	Detach from other storage.
Is not combustible in air but reacts chemically with many common substances and may cause fire or explosion when in contact with them. See remarks under "Storage." Dangerous to neutralize chlorine in a room with ammonia.	Isolate from turpentine, ether, ammonia gas, illuminating gas, hydrocarbons, hydrogen, and finely divided metals. Safeguard against mechanical injury of containers.
Oxidizing material; will ignite on contact with acetic acid and alcohol. Chars organic material such as wood, sawdust, paper, or cotton, and may cause ignition. Combustible material in presence of chromium trioxide when ignited burns with great intensity. May cause explosion in fire.	Isolate.
Oxidizing material. Classes with sodium nitrate.	See sodium nitrate.
Combustible; gives off flammable vapors when heated.	Ventilate storage; avoid dust; keep away from fire or heat.
Oxidizing material. Hazard classes with sodium nitrate.	Safeguard against mechanical injury; isolate. See sodium nitrate.

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Cyclopropane Steel cylinders.	Anaesthetic.	Use water to cool cylinders not on fire. If gas is burning at valves or safety releases, usually the best course to follow is not to disturb or attempt to extinguish flame. To do so will cause the release of unburned gas and quickly create highly dangerous explosive atmospheres. If cylinder is mounted on an anaesthetic machine or truck, it may be possible to move it to a safe place. Carbon dioxide or carbon tetrachloride are best extinguishing agents.
Didymium Nitrate Wooden kegs.		
Dioxane Glass bottles, metal cans, and metal drums.	Irritant and toxic in high concentrations.	Water best extinguishing agent. Slightly heavier than and completely soluble in water (Sp. gr. 1.03).
Ethyl Ether Glass bottles or tin cans in boxes, steel drums.	Anaesthetic. See National Board of Fire Underwriters' Recommended Safeguards for the Installation and Operation of Anaesthetical Apparatus Employing Combustible Anaesthetics.	Lighter than water. (Sp. gr. 0.7135.) Soluble in about ten times its own volume of water. Water may be utilized only to cool metal containers. Best extinguishing agents are carbon dioxide and sand, also carbon tetrachloride in case of fires involving limited amounts of ether. Total-flooding carbon dioxide systems may be employed for protection in storage rooms.
Ethylene Steel cylinders.	Anaesthetic.	Use water to cool cylinders not on fire. If gas is burning at valves or safety releases, usually the best course to follow is not to disturb or attempt to extinguish flame. To do so

Fire Hazard	Storage
Highly flammable gas. Forms flammable and explosive mixtures with air or oxygen. Explosive range 2.40% to 10.4% (upward propagation). Only electrical equipment of the explosion-proof type, Group C classification tentative pending further tests, permitted in atmospheres containing cyclopropane in flammable proportions.	Isolate from oxygen cylinders and store in a cool, well ventilated storeroom.
Oxidizing material. Classes with sodium nitrate.	Isolate. See sodium nitrate.
Moderately volatile flammable liquid. Flash point 54° F. Explosive range 1.97% to 22.25% (upward propagation). Vapors are heavier than air (vapor density 3.03). Capable of forming peroxides under certain conditions, and there may be danger of explosion if redistilled, unless certain precautions are taken.	Isolate and safeguard against mechanical injury.
A highly volatile liquid, giving off even at comparatively low temperatures vapors which form with air or oxygen flammable and explosive mixtures. Explosive range 1.85% to 36.5% (upward propagation). The ignition temperature is comparatively low, being approximately 180° C. (356° F.). Spontaneously explosive peroxides sometimes form on long standing or exposure in bottles to sunlight. The vapors are heavier than air (vapor density 2.6) and may travel a considerable distance to a source of ignition and flash back. More hazardous than gasoline.	Safeguard containers against mechanical injury. Isolate and keep in unheated compartment away from sunlight and any source of ignition. Only electrical equipment of the explosion-proof type, Group C classification, permitted in atmospheres containing ether vapor in flammable proportions.
Highly flammable gas. Forms flammable and explosive mixtures with air or oxygen. Explosive range 2.75% to 28.6% (upward propagation). Ignition temperature about 450° C. (842° F.). Slightly lighter than air (density 0.97). The gas is spontaneously explosive in sunlight with chlorine.	Isolate from oxygen cylinders and store in a cool, well ventilated storeroom.

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Ethylene (*Continued*)		
		will cause the release of unburned gas and quickly create highly dangerous explosive atmospheres. If cylinder is mounted on an anaesthetic machine or truck, it may be possible to move it to a safe place. In a closed storeroom carbon dioxide or carbon tetrachloride are best extinguishing agents.
Ferric Nitrate		
Wooden barrels.		
Formic Acid		
Barrels and carboys.	Corrosive; has caustic effect on the skin.	
Fulminate of Mercury		
Fulminate of Silver		
Hydrochloric Acid (Muriatic Acid)		
Tank cars (rubber-lined), carboys, and glass bottles.	Aqueous solution is corrosive, irritating, and poisonous. Fumes are corrosive and irritating to mucous membranes.	Use water or chemically basic substances such as soda ash or slaked lime.
Hydrocyanic Acid (Prussic Acid)		
Cylinders, or when completely absorbed in inert material in metal cans with outside wooden boxes.	Poisonous. Few breaths may cause unconsciousness and death. Avoid contact with the skin.	The gas is slightly lighter than air. Soluble in water. Water is the best extinguisher. When entering premises where used or stored during a fire, use oxygen helmet or gas mask equipped with canister of a type approved by the Bureau of Mines for hydrocyanic acid.
Hydrofluoric Acid (HF)		
Aqueous solution in lead carboys and wax or gutta percha bottles.	Acid and its vapors highly toxic and irritating to skin, eyes and respiratory tract. Fumes produced by contact with ammonia and many metals poisonous. May be neutralized with	Use water in case of fires involving hydrofluoric acid. Use oxygen helmet of a type approved for such use by the U. S. Bureau of Mines on entering atmospheres known to contain hydrofluoric acid vapors.

Fire Hazard	Storage
Only electrical equipment of the explosion-proof type, Group C classification, permitted in atmospheres containing ethylene in flammable proportions.	
Oxidizing material.	Isolate. Safeguard against mechanical injury.
Flammable; gives off flammable vapors which may form explosive mixtures with air.	Safeguard against mechanical injury.
High explosive.	Explosive restrictions.
High explosive.	Explosive restrictions.
Not combustible (in air) but if allowed to come in contact with common metals hydrogen is evolved, which may form explosive mixtures with air.	Safeguard containers against mechanical injury. Keep away from oxidizing agents, particularly nitric acid and chlorates. Avoid contact by leakage or otherwise with all common metals.
Forms flammable and explosive mixtures with air. Explosive range 6% to about 40% by volume (horizontal propagation). Concentrations of the gas ordinarily employed for fumigation (1% or less) are considerably below the lower limit of flammability (6% by volume). Some methods of fumigation, however, are employed which temporarily yield flammable mixtures even though the final concentration is low.	Isolate. Keep away from any source of heat. Safeguard containers against mechanical injury.
Colorless, volatile liquid. Not combustible but reacts with glass and most substances, platinum being an exception. Aqueous solution also attacks glass and several metals.	Isolate. Ventilate. Safeguard against mechanical injury. Encountered in glass works and chemical laboratories. Used to remove sand from castings and in the manufacture of filter paper. Vapors have been known to cause ser-

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Hydrofluoric Acid (HF)	*(Continued)*	
	chalk. Bicarbonate of soda solution may be immediately applied to burns as first-aid and used as gargle.	
Hydrofluosilicic Acid		
Lead carboys, hard rubber or paraffin bottles.	Corrosive.	
Hydrogen Peroxide (27.5 per cent by weight)		
Glass carboys, aluminum drums, aluminum tank cars (all containers must be vented).	Prolonged exposure to vapor irritating to eyes and lungs. Causes skin irritation. Use goggles to protect eyes from splash.	Use water.
Hydrogen Sulfide (Sulfuretted Hydrogen)		
Steel cylinders.	Toxic. 0.05 to 0.07 per cent by volume in air causes dangerous illness in ½ to 1 hr. Should be used under hoods in chemical laboratories to avoid danger of breathing dangerous concentrations.	Use gas masks in entering atmospheres containing hydrogen sulfide. If, however, concentration is high, use oxygen helmet of a type approved for such use by U. S. Bureau of Mines.
Lead Nitrate		
Wooden barrels.	Poisonous.	
Lime (unslaked)— *See Calcium Oxide.*		
Magnesium		
Shavings or powder in tightly closed metal or metal-lined containers. Ingots and bars in ordinary boxes.	Serious under fire conditions. Danger of explosion and from flying particles. Do not attempt to smother unless at a safe distance, or else protection is provided for eyes and face.	Smother with an excess of dry graphite. Dry sand may be used on small fires. Not advisable to use sand around machinery. Do not use water, foam, carbon tetrachloride, or carbon dioxide.
Magnesium Alloys (high percentage of magnesium)		
	Protect eyes and skin from flying particles in case of fire.	Smother with an excess of dry graphite. Dry sand may be used on small fires. Not advisable to use sand around machinery. Do not use water, foam, carbon tetrachloride, or carbon dioxide.

Fire Hazard	Storage
	ious corrosion of sprinkler piping and heads.
None.	Safeguard against mechanical injury.
Oxidizing liquid. May cause ignition of combustible material if left standing in contact with it. May decompose violently if contaminated with iron, copper, chromium, and most metals or their salts.	Store in a cool place in ventilated containers remote from combustible material and catalytic metals such as iron, copper, chromium.
Flammable gas. Forms flammable and explosive mixture with air or oxygen. Explosive range in air (upward propagation) 4.3 (low limit) to 46. Heavier than air. Specific gravity 1.19 (air = 1). Ignition temperature 346°-379° C. (655°-714° F.)	Store in ventilated place away from fuming nitric acid and oxidizing materials. Encountered in chemical laboratories, metallurgical and smelting works, gas works, sewers.
Oxidizing material. Classes with sodium nitrate	Isolate; safeguard against mechanical injury.
Combustible, particularly in the form of powder, shavings, or thin sheets. When powder is disseminated in the air, explodes by spark. In finely divided form liberates hydrogen in contact with water. In massive form (ingots or blocks) comparatively difficult to ignite.	Store remote from water or moisture, oxidizing materials, chlorine, bromine, iodine, acids, and alkalies.
In compact or bulk form (castings, plates, etc.) difficult to ignite. Readily combustible in form of dust, turnings, and hazardous in such form with chlorine, bromine, iodine, oxidizing agents, acids, and alkalies.	Store dust, shavings, and turnings in metal containers in detached building or fire-resistive room. Detailed safety precautions for handling are usually supplied by manufacturers of magnesium alloys.

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Magnesium Nitrate Wooden boxes.		See sodium nitrate.
Muriatic Acid — *See Hydrochloric Acid.*		
Naphthalene Tins, barrels, and burlap bags.	Irritant. Slight narcotic effect on the skin. The hot vapors produce itching, pain, and eczema.	Water is the best extinguishing agent. Foam or water applied to molten naphthalene at temperatures over 230° F. will cause foaming.
Nickel Nitrate Wooden kegs.	Poisonous when taken internally.	
Nitric Acid Carboys and glass bottles.	Corrosive; causes severe burns by contact; deadly if inhaled.	
Nitraniline or Nitro Aniline Wooden kegs.	Poisonous.	
Nitrochloro-Benzene Wooden kegs.	Serious under fire conditions.	
Phenol	Poisonous.	
Phosphorus, Red Hermetically sealed tin cans inside of wooden boxes.	Yields toxic fumes when burning.	Flood with water, and when fire is extinguished cover with wet sand or dirt. Under certain conditions at high temperatures reverts to white phosphorus.
Phosphorus, White, (or Yellow) Under water usually in hermetically sealed cans enclosed in other hermetically sealed cans with outside wooden boxes, or in drums or tank cars.	Poisonous. Serious under fire conditions. Yields highly toxic fumes when burning. Contact of phosphorus with the skin causes severe burns.	Deluge with water until fire is extinguished and phosphorus solidified; then cover with wet sand or dirt.

Fire Hazard	Storage
Oxidizing material. Classes with sodium nitrate.	See sodium nitrate.
Gives off flammable vapors when heated. Flash point 176° F. Naphthalene dust forms explosive mixtures with air. Ignition temperature 559° C. (1038° F.).	Isolate; keep away from fire or heat.
Oxidizing material. Classes with sodium nitrate.	Safeguard against mechanical injury.
May cause ignition when in contact with combustible materials; corrodes iron or steel; may cause explosion when in contact with hydrogen sulfide and certain other chemicals.	Safeguard against mechanical injury of containers; isolate from turpentine, combustible materials, carbides, metallic powders, fulminates, picrates or chlorates.
In presence of moisture causes nitration of organic materials and may result in spontaneous ignition.	Store in dry place; safeguard against mechanical injury.
Gives off flammable vapors when heated, which may form explosive mixtures with air.	Isolate, preferably in the open; if inside should be in unheated compartment or building.
When heated yields flammable vapors. Flash point 172.4° F.	Soluble in water. Never store with or above food products.
Flammable. Explosive when mixed with oxidizing materials. Not as dangerous to handle as white phosphorus, and when afire, more readily extinguished.	Isolate from other chemicals; safeguard against mechanical injury of container.
Highly flammable. Explosive in contact with oxidizing material. Ignites spontaneously on contact with air.	Isolate from chemicals. Store large quantities under water in underground iron or concrete tanks.

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Phosphorus Sesquisulfide, P_2S_5		
Wooden boxes, iron drums, glass bottles.	Fumes in fire toxic.	
Picric Acid		
Wooden kegs, boxes, bottles.	Classes with high explosives in respect to life hazard.	
Potassium (Metallic Potassium)		
Hermetically sealed steel drums, tin cans, and tank cars.	Strong caustic reaction. Dangerous.	Smother with an excess of dry graphite or dry sand. Do not use water. It is difficult to extinguish fires in large quantities of potassium.
Potassium Chlorate		
Wooden barrels or kegs.	Dangerous under fire conditions.	Water is the best extinguishing agent.
Potassium Cyanide		
Tightly closed glass, earthenware, or metal containers; wooden boxes with inside metal containers, or with hermetically-sealed metal lining; metal barrels or drums.	Highly poisonous when taken internally. Evolves hydrocyanic acid gas (poisonous) on contact with acids or moisture.	
Potassium Hydroxide		
Wooden barrels, glass bottles.		
Potassium Nitrate		
Bags, tins and glass bottles.		See sodium nitrate.
Potassium Perchlorate		
Paper-lined metal containers.		Use water to prevent the spread of fire.
Potassium Permanganate		
Tins.		

Fire Hazard	Storage
Highly flammable. Ignites by friction.	Isolate from chemicals. Safeguard container against shock.
Flammable, explosive. Oxidizing material.	Isolate or store under water, keep away from other material, including metals, with which it forms sensitive and explosive picrates.
Oxidizes rapidly on exposure to atmosphere, igniting spontaneously if warm enough. Water is decomposed suddenly by contact with potassium, sufficient heat being generated to ignite spontaneously the evolved hydrogen (in the presence of air). Its reaction with water is more violent than that of sodium.	Do not tier if it can be avoided. Keep away from water, avoiding sprinkler systems. Safeguard against mechanical injury of containers.
Oxidizing material; explosive when in contact with combustible material.	Isolate from combustible material, acids, and sulfur.
Cyanides not flammable but evolve hydrocyanic acid (see) on contact with acids or moisture.	Isolate. Safeguard containers against mechanical injury.
Generates heat on contact with water. Classes with calcium oxide (lime) in hazard.	Store in dry place; keep remote from water or moisture.
In contact with organic materials causes violent combustion on ignition. Classes with sodium nitrate.	Store in dry place, prevent contact with organic material.
Oxidizing material. Combustible in contact with organic materials. More stable than chlorates. Explosive in contact with concentrated sulfuric acid.	Store in dry place away from acids and combustible material.
Oxidizing material. Explosive when treated with sulfuric acid, and in contact with alcohol, ether, flammable gases, and combustible materials.	Isolate from other chemicals, especially those noted under fire hazard.

A TABLE OF COMMON

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Potassium Peroxide Tins and steel drums.	Strong caustic reaction and dangerous under fire conditions. Avoid breathing dust in handling, and wear goggles to protect eyes.	Smother with dry sand, soda ash, or rock dust. Do not use water.
Potassium Persulfate Glass bottles and stone jars.		
Potassium Sulfide Iron drums, cans, glass bottles.	Yields irritating and corrosive gases when burning.	
Salicylic Acid Bottles, cartons, kegs and barrels.	Used in manufacture of aspirin, salol, and methyl salicylate, also in manufacture of azo dyes. Preservative. There have been explosions in sublimation chambers.	Slightly soluble in water. Extinguish with water or smother with carbon dioxide or sand.
Saltpeter — See ***Potassium Nitrate.***		
Silver Nitrate Amber or black glass bottles.	Corrosive and poisonous.	
Soda, Caustic — See ***Sodium Hydroxide.***		
Sodium Hermetically sealed steel drums, tin cans, and tank cars.	Strong caustic reaction. Dangerous.	Smother with an excess of dry graphite or dry sand. Do not use water. It is difficult to extinguish fires in large quantities of sodium.
Sodium Chlorate Wooden barrels, glass bottles.	See potassium chlorate	See potassium chlorate.
Sodium Chlorite ($NaClO_2$) Wooden boxes with inside containers which	Poisonous when taken internally. Dangerous	Soluble in water. Water is best extinguishing agent.

Fire Hazard	*Storage*
Does not burn or explode *per se* but mixtures of potassium peroxide and combustible substances are explosive and ignite easily even by friction or on contact with a small amount of water. Reacts vigorously with water and in large quantities this reaction may be explosive.	Store remote from organic substances and water. Do not expose to sprinkler systems.
Oxidizing material. May cause explosion in a fire.	Keep dry; safeguard against mechanical injury of containers.
Moderately flammable, yields flammable hydrogen sulfide on contact with mineral acids and sulfur dioxide when burning.	Safeguard against mechanical injury of containers.
Combustible solid. Flash point 157° C. (315° F.). Ignition temperature 545° C. (1013° F.). Salicylic dust forms explosive mixtures with air.	Store in dry place.
Oxidizing material.	Store in dark place; keep cool and away from combustible material.
Water is suddenly decomposed by contact with sodium with the evolution of hydrogen, which may ignite spontaneously (in the presence of air). Classes with potassium in respect to fire hazard but its reaction with water is less violent than that of potassium.	Do not tier if it can be avoided. Keep away from water, avoiding sprinkler systems. Safeguard against mechanical injury of containers.
Oxidizing material. Classes with potassium chlorate. See potassium chlorate.	See potassium chlorate.
Strong oxidizing material. Decomposes with evolution of heat at about 175° C. (347° F.). Ex-	Isolate from combustible material, sulfur, and acids

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Sodium Chlorite ($NaClO_2$) (*Continued*)		
must be glass or earthenware not over 2¼ lb. capacity, or metal not over 5 lb. capacity each.	under fire conditions. Used in bleaching textiles and paper.	
Sodium Cyanide— ***See Potassium Cyanide.***		
Sodium Hydrosulfite		
Wooden barrels, kegs, or boxes with inside glass bottles of capacity not exceeding 5 lb. each, or metal containers.	Bleaching agent for removing dyes.	Smother with sand or foam.
Sodium Hydroxide		
Iron drums.		
Sodium Nitrate		
Bags, tins and glass bottles.		Most fires involving sodium nitrate can safely be fought with water in the early stages; at such times it should be flooded with water. When large quantities are involved in the fire, the sodium nitrate may fuse or melt, in which condition application of water may result in extensive scattering of the molten material, and, therefore, care should be taken in applying water to the material after fire has been burning for some time.
Sodium Perchlorate		
Paper-lined metal containers.		See potassium perchlorate.
Sodium Peroxide — *See Potassium Peroxide.*		
Sodium Sulfide		
Iron drums and bottles.	See potassium sulfide.	

Fire Hazard	Storage
plosive in contact with combustible material. See potassium chlorate. In contact with strong acid liberates chlorine dioxide, an extra hazardous gas.	
Combustible. Heats spontaneously in contact with moisture and air, and may ignite nearby combustible material.	Store in dry place away from combustible materials.
Classes with potassium hydroxide and calcium oxide.	Isolate from heat and water. See calcium oxide and potassium hydroxide.
Oxidizing material. Bags or barrels may become impregnated with nitrate, in which condition they are readily ignitable. In contact with organic or other readily oxidizable (combustible) substances it will cause violent combustion on ignition.	Store in dry place; prevent contact with organic or combustible material. Fire hazard less if removed from bags and stored in noncombustible bins.
See potassium perchlorate.	See potassium perchlorate. Sodium perchlorate in anhydrous form is very hygroscopic and not used much in industries.
Moderately flammable. Classes with potassium sulfide.	See potassium sulfide.

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Strontium Nitrate Barrels and boxes.		See sodium nitrate.
Strontium Peroxide (SrO_2) Metal cans.		Smother with sand, ashes, or rock dust. Do not use water.
Sulfur Sacks, boxes, barrels and box cars.	When burning forms sulfur dioxide, which in concentrations of 0.2% by volume in air may cause serious injury in ½ hour or less.	Water in form of spray best extinguisher. Small fires may be smothered with sand or additional sulfur. (Sulfur dioxide does not support combustion.) Avoid use of pressure hose (solid) streams, and do not scatter sulfur dust. If spray nozzle is not available, water may be allowed to flow out of hose (without nozzle) on to a burning pool of sulfur, or saturated steam may be used. See N. F. P. A. Code for the Prevention of Sulfur Dust Explosions and Fires.
Sulfuric Acid Carboys, iron drums, glass bottles and tank cars.	Corrosive; dangerous fumes under fire conditions.	Smother with sand, ashes, or rock dust, but avoid water.
Thorium Nitrate Wooden kegs.		See sodium nitrate.
Uranium Nitrate Glass bottles, boxes.		
Vinyl Ether Glass bottles and metal cans.	Anaesthetic.	Lighter than water (Sp. gr. 0.774). Not soluble in water. Water may be used only to cool metal containers. Best extinguishing agents are carbon dioxide, sand, and carbon tetrachloride.

Fire Hazard	Storage
Oxidizing material. Classes with sodium nitrate.	Safeguard against mechanical injury; keep away from other materials.
Oxidizing material. Hazards in class with barium peroxide.	Store in dry place away from combustible materials.
Flammable. Dust or vapor forms explosive mixtures with air. Hazardous in contact with oxidizing material.	Provide good ventilation. Isolate from chlorates, nitrates and other oxidizing materials.
May cause ignition by contact with combustible materials. Corrodes metal.	Safeguard against mechanical injury, isolate from saltpeter, metallic powders, carbides, picrates, fulminates, chlorates and combustible materials.
Oxidizing material. Classes with sodium nitrate.	Store in dry place, remote from water or moisture.
Oxidizing material. Classes with sodium nitrate.	See sodium nitrate.
Highly volatile flammable liquid. Flash point below −22° F. Gives off even at comparatively low temperatures vapors which form flammable mixtures with air or oxygen. Explosive range 1.70% to 27.0% (upward propagation). Hazard in a class with ethyl ether. Only electrical equipment of the explosion-proof type, Group C classification tentative pending further tests, permitted in atmospheres containing vinyl ether vapor in flammable proportions.	Isolate. Safeguard containers against mechanical injury. Store in a cool, well ventilated storeroom.

Usual Shipping Container	Life Hazard	Fire Fighting Phases
Zinc Chlorate Glass bottles, iron drums.	Serious under fire conditions.	
Zinc Powder or Dust Cartons, wooden barrels, or steel drums.	Zinc is comparatively volatile at elevated temperatures. Under fire conditions precautions should be taken to avoid breathing fumes, which may cause metal fume fever.	Smother with sand, ashes, or rock dust. Do not use water.
Zirconium Wooden kegs, glass bottles.		Available data, indicate fires can be controlled by foam or sand. Carbon tetrachloride, carbon dioxide, soda and acid extinguishers ineffective.

HAZARDOUS CHEMICALS

Fire Hazard	Storage
When in contact with organic material explodes by slight friction, percussion or shock. Classes with potassium chlorate.	Safeguard against mechanical injury; avoid tiering; isolate.
Hydrogen is evolved when commercial zinc is in contact with acids, sodium hydroxide, or potassium hydroxide. Hydrogen also evolved by acid-forming combinations containing zinc, such as zinc chloride and moisture. Dust may form explosive mixtures with air. Zinc dust in bulk in a damp state may heat and ignite spontaneously on exposure to the air.	Store in dry, ventilated place away from water or moisture. Isolate from acids.
Has comparatively low ignition temperature. Highly flammable in dry state. Burns with intensely brilliant flame. Explosive in contact with oxidizing agents. Powder very susceptible to ignition by static electricity, and explosion may be caused when disbursed into a cloud in air by static charges generated.	Encountered in granular, finely divided powder; also in form of small, friable, spongy lumps. Store only in wet condition and in small quantities. Isolate from oxidizing materials.

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

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The following table gives pertinent data as to the fire hazard of liquids, gases, and solids found in industrial plants. It has been assembled from the results of tests made by the Factory Mutual Laboratories and from other data carefully chosen as the most reliable.

Abbreviations and Symbols

The following abbreviations are not used in the alphabetical listing but are shown with some names to identify the compound exactly.

o, ortho
m, meta
n, normal
p, para
prim, primary
sec, secondary
sym, symmetrical
ter, tertiary

The numerical prefixes mono-, di-, tri-, and tetra- will be found in regular alphabetical order.

d., decomposes
>, greater than
sub., sublimes
<, less than

* An asterisk following the name of a metal indicates that hydrogen will be liberated when the metal is in contact with water. With the exception of potassium and sodium, hydrogen will be liberated in hazardous quantities only if the metal is in a finely divided form.

The properties of asphalts, naphthas, and oils vary over a large range as indicated. When it is necessary to know the exact hazard of a material, a sample should be sent to the Factory Mutual Laboratories at 184 High St., Boston, Mass., for test.

Flash Point. The approximate closed-cup flash points of hydrocarbons (organic compounds composed of only carbon and hydrogen) may be determined by the use of the following formula:

Closed cup flash point °F. = 0.73 × [initial] boiling point °F. − 122

For petroleum and coal-tar distillates, the formula is applicable between initial boiling points of −150° F. and +550° F.

Explosive Limits. The data given for the lower and upper explosive limits are, with few exceptions, the values for upward flame propagation through a cylindrical tube.

Vapor Densities for the most part, have been calculated.

Suitable Extinguishing Agents. The code numbers in the last column indicate the following extinguishing agents.

1 Water (See note below)
2 Foam
3 Carbon dioxide
4 Dry chemical
5 Powdered talc

Note: Water discharged from spray nozzles behaves much differently from water discharged from sprinklers or hose streams. The finely divided drops from a spray nozzle absorb much more heat than an equal volume of water from a sprinkler or hose stream and also partially smother the fire by excluding air. In general, water spray nozzles are suitable for use on fires in flammable liquids having a flash point over 150° F., but before purchasing new equipment, consult your Insurance Company or the Inspection Department.

If either water or foam is applied to a body of flammable liquid, all of which is heated above 250° F., the hot liquid may foam over and spread the fire.

I.C.C. Shipping Labels

Red —Flammable liquids with flash points at or below 80° F. and flammable compressed gases.
Yellow—Flammable solids (except explosives) and oxidizing materials (chlorates, permanganates, peroxides, nitrates).
White —Corrosive liquids (mineral acids).
Green —Non-flammable compressed gases.

Labels are required only for interstate shipments or for intrastate shipments by common carrier engaged in interstate or foreign commerce. Absence of a label does not necessarily mean that the material is non-hazardous.

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Acetaldehyde	−17	....	4.0	57.0	365	No	0.783	1.52	−191	70	1, 3, 4
Acetanilide	345	345	....	....	....	..	1.21	4.65	237	581	1, 2, 3, 4
Acetic Acid (Glacial)	104	110	4.0	....	1050	No	1.05	2.07	62	245	1, 3, 4
Acetic Anhydride	121	130	....	....	752	No	1.08	3.52	−100	284	1, 3, 4
Acetic Ether, see ethyl acetate	....	....	....	....	....	..	....	....	....	....	.....
Acetoacetic Ester, see ethyl acetoacetate	....	....	....	....	....	..	....	....	....	....	.....
Acetone	0	15	2.15	13.0	1118	No	0.792	2.00	−137	134	3, 4
Acetophenone	221	....	....	....	....	No	1.03	4.14	68	396	1, 2, 3, 4
p-Acetotoluide	335	355	....	....	....	..	1.212	5.14	307	584	1, 2, 3, 4
Acetyl Chloride	40	....	....	....	....	No	1.105	2.70	−170	124	1, 3, 4
Acetylene	gas	....	2.5	80	635	No	....	0.91	....	−119	.....
Acetylene Dichloride, see dichloroethylene-1, 2	....	....	....	....	....	..	....	....	....	....	.....
Acetylene Tetrabromide	non-flammable		....	....	....	No	2.97	....	< −4	276	....
Acetylene Tetrachloride	non-flammable		....	....	....	No	1.58	5.73	−33	297	.....
Adipic Acid	385	....	....	....	....	..	....	5.04	303	700	1, 2, 3, 4
Aldol	181	....	....	....	....	No	1.11	3.04	....	380	1, 2, 3, 4
Allyl Alcohol	70	75	3.0	....	713	No	0.854	2.00	−200	206	3, 4
Allylene	gas	....	1.74	....	....	..	....	0.66	−156	−18	.....
Almond Oil (artificial), see benzaldehyde	....	....	....	....	....	..	....	....	....	....	.....
Aluminum (Powder) *	....	....	....	....	....	No	....	....	1218	3240	5
Amino Benzene, see aniline	....	....	....	....	....	..	....	....	....	....	.....
Ammonia (Anhydrous)	gas	....	16.0	27.0	1436	No	....	0.597	−107	−37	.....
Amyl Acetate-*n*	76	80	1.1	....	714	No	0.879	4.49	....	300	3, 4
Amyl Acetate-*iso*	92	100	....	....	715	No	0.876	4.49	....	290	3, 4
Amy Alcohol-*n*	91	120	1.2	....	621	No	0.817	3.04	−108	280	3, 4
Amyl Alcohol-*prim. iso*	109	115	....	....	667	No	0.813	3.04	−178	270	3, 4
Amyl Alcohol-*sec. n*	94	....	....	....	650-725	No	0.810	3.04	....	245	3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Amyl Alcohol-***sec. iso***	103	....	....	....	....	No	0.819	3.04	....	235	3, 4
Amyl Chloride	....	....	1.4	....	....	No	0.878	3.67	....	223	2, 3, 4
Amylene-***n***	....	....	1.6	....	....	No	0.666	2.42	−191	98	2, 3, 4
Amyl Salicylate	270	....	....	....	....	..	1.065	7.17	....	512	1, 2, 3, 4
Aniline	168	....	....	....	1418	No	1.022	3.22	21	363	2, 3, 4
Aniline Hydrochloride	....	380	....	....	....	No	1.22	4.46	388	473	1, 3, 4
Anthracene	250	385	0.63	....	881 in O_2	No	1.25	1.15	424	644	1, 2, 3, 4
Anthraquinone	365	485	....	....	....	No	1.438	7.16	544	716	1, 2, 3, 4
Antifebrin, see acetanilide	....	....	....	....	....	..	....	....	....	....	.....
Asphalt (Typical)	400+	535+	....	....	905	No	0.95-1.1	....	180-220	>700	1, 2, 3, 4
Benzaldehyde	148	165	....	....	....	No	1.05	3.66	−15	355	1, 2, 3, 4
Benzene	12	....	1.4	8	1076	No	0.88	2.77	41	176	2, 3, 4
Benzine, see naphtha V.M. & P.	....	....	....	....	....	..	....	....	....	....	.....
Benzoic Acid	250	....	....	....	....	No	1.266	4.21	252	482	1, 3, 4
Benzol, see benzene	....	....	....	....	....	..	....	....	....	....	.....
Benzyl Acetate	216	....	....	....	862	No	1.06	5.17	−80	417	1, 2, 3, 4
Benzyl Alcohol	213	220	....	....	817	No	1.04	3.72	5	403	1, 2, 3, 4
Benzyl Benzoate	298	....	....	....	....	No	1.114	7.31	65	614	1, 2, 3, 4
Benzyl Cellosolve	....	265	....	....	....	No	1.07	....	....	493	1, 3, 4
Benzyl Chloride	140	....	1.1	....	....	No	1.103	4.36	−41	349	1, 2, 3, 4
Borneol	150	....	....	....	....	No	1.01	5.31	sub. 413	....	1, 2, 3, 4
Bromobenzene	149	....	....	....	....	No	1.497	5.41	−23	313	1, 2, 3, 4
Bromoethane, see ethyl bromide	....	....	....	....	....	..	....	....	....	....	.....
Bromomethane, see methyl bromide	....	....	....	....	....	..	....	....	....	....	.....
Bronze Dust (Aluminum Free)	No Hazard		....	....	....	No	....	....	....	....	.....
Butane-***n***	−76	gas	1.6	8.5	806	No	....	2.046	−211	33	.....
Butyl Acetate-***n***	72	90	1.7	15	790	No	0.88	4.00	−107	260	3, 4
Butyl Acetate-***iso***	64	....	....	....	....	No	0.871	4.00	−148	244	3, 4
Butyl Alcohol-***n***	84	110	1.7	....	693	No	0.806	2.55	−120	243	3, 4
Butyl Alcohol-***iso***	82	....	1.68	....	825	No	0.805	2.55	−162	225	3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Butyl Alcohol-*ter.*	52	....	....	....	901	No	0.786	2.55	77	181	3, 4
Butyl Benzene-*sec.*	126	....	....	....	....	No	0.86	4.62	....	345	2, 3, 4
Butyl Carbinol, see amyl alcohol-*prim. iso*	....	....	....	....	....	..	....	....	....	....	.....
Butyl Carbitol	172	200	....	....	442	No	0.955	5.58	< −40	448	1, 3, 4
Butyl Carbitol Acetate	....	240	....	....	....	No	0.987	....	....	474	1, 2, 3, 4
Butyl Cellosolve	141	165	....	....	472	No	0.902	4.07	< −40	340	1, 3, 4
Butylene-*n*	gas	....	1.7	9.0	....	No	....	0.668	−202	23	.....
Butylene Glycol	104	....	....	....	....	No	1.019	3.10	....	379	3, 4
Butyl Formate-*n*	64	....	....	....	....	No	0.911	3.52	−130	225	2, 3, 4
Butyl Lactate	160	....	....	....	....	No	0.968	5.04	....	320	2, 3, 4
Butyl Phthallyl Butyl Glycollate	385	390	....	....	....	No	>1	....	....	....	1, 2, 3, 4
Butyl Propionate-*n*	90	110	....	....	800	No	0.875	5.00	....	295	2, 3, 4
Butyl Ricinoleate	230	....	....	....	....	..	0.906	....	....	790	1, 2, 3, 4
Butyl Stearate-*n*	320	385	....	....	....	..	0.855	....	61	650	1, 2, 3, 4
Butyraldehyde	20	....	....	....	....	No	0.817	2.48	−148	169	3, 4
Butyric Acid-*n*	170	....	....	....	....	No	0.960	3.04	18	327	1, 3, 4
Butyric Anhydride-*n*	190	....	....	....	....	..	0.978	5.38	−102	388	1, 3, 4
Butyrone	120	....	....	....	....	No	0.815	3.93	....	290	3, 4
Camphor	150	200	....	....	871	No	0.999	5.24	354	408	1, 2, 3, 4
Camphor Oil (Light)	117	125	....	....	....	No	0.88	....	....	347-392	2, 3, 4
Carbitol	201	215	....	....	....	No	0.99	4.62	....	396	1, 3, 4
Carbitol Acetate	225	230	....	....	....	No	1.013	6.07	....	424	1, 3, 4
Carbolic Acid, see phenol	....	....	....	....	....	..	....	....	....	....	.....
Carbon, see charcoal	....	....	....	....	....	..	....	....	....	....	.....
Carbon Disulfide	−22	....	1.0	50	257	No	1.256	2.64	−167	114	1, 3, 4
Carbon Monoxide	gas	....	12.5	74.2	1204	No	....	0.967	−339	−314	.....
Carbon Oxysulfide, see carbonyl sulfide	....	....	....	....	....	..	....	....	....	....	.....
Carbonyl Sulfide	....	....	11.9	28.5	....	..	1.24	2.10	−216	122	1, 3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Carnauba Wax	540	595	....	....	....	..	....	....	185	....	1, 3, 4
Castor Oil	445	545	....	....	840	Yes	0.96	....	10	595	1, 2, 3, 4
Cellosolve	104	120	2.6	15.7	460	No	0.931	3.10	....	275	3, 4
Cellosolve Acetate	124	135	1.71	....	715	No	0.975	4.72	....	313	3, 4
Charcoal	....	....	....	....	....	Yes	3.51	....	>6300	7600	1
China Wood Oil, see tung oil	....	....	....	....	....	..	....	....	....	....	.....
Chlorobenzene	90	....	....	....	....	No	1.11	3.88	−49	270	2, 3, 4
Chloroethane, see ethyl chloride	....	....	....	....	....	..	....	....	....	....	.....
Chloroethyl Acetate	129	....	....	....	....	..	1.178	4.21	....	293	1, 2, 3, 4
Chloroform	non-flammable		....	....	....	No	1.489	4.13	−82	142	.....
Chloromethane, see methyl chloride	....	....	....	....	....	..	....	....	....	....	.....
Coal Tar Pitch	405	490	....	....	....	..	....	....	....	....	1, 2, 3, 4
Cocoanut Oil	420	510	....	....	....	Yes	0.91	....	72	....	1, 2, 3, 4
Colophony, see pine resin	....	....	....	....	....	..	....	....	....	....	.....
Corn Oil	490	....	....	....	....	Yes	0.92	....	14	....	1, 2, 3, 4
Cottonseed Oil	590	....	....	....	650	Yes	0.925	....	15–30	....	1, 2, 3, 4
Creosote Oil	165	185	....	....	637	No	>1	....	....	382–752	1, 2, 3, 4
o-Cresol	178	....	....	....	....	No	1.05	3.72	88	376	1, 2, 3, 4
p-Cresol	187	....	....	....	....	No	1.04	3.72	95	395	1, 3, 4
Cresylic Acid, see *p*-cresol	....	....	....	....	....	..	....	....	....	....	.....
Crotonaldehyde	55	....	2.95	15.5	....	No	0.853	2.41	−92	216	3, 4
Crotonylene	....	....	1.37	....	....	..	....	....	....	83	2, 3, 4
Cumene, see propylbenzene-*iso*	....	....	....	....	....	..	....	....	....	....	.....
Cyanamide	285	405	....	....	....	..	1.073	1.45	113	500	1, 3, 4
Cyclohexane	1	....	1.31	8.35	....	No	0.779	2.90	43	176	2, 3, 4
Cyclohexanol	154	....	....	....	....	No	0.962	3.45	75	322	1, 2, 3, 4
Cyclohexanone	147	....	....	....	....	No	0.947	3.38	−50	313	3, 4
Cyclohexanone delta	93	....	....	....	....	No	....	3.31	....	....	3, 4
Cyclohexyl Acetate	136	....	....	....	....	No	....	4.90	....	....	2, 3, 4
Cyclopropane	gas	....	2.41	10.3	....	No	....	1.45	−195	−29	.....

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
p-Cymene	117	145	....	....	921	No	0.86	4.62	−101	334	2, 3, 4
Decahydronaphthalene	136	....	....	....	504	No	0.895	4.76	−194	379	2, 3, 4
Decalin, see decahydronaphthalene	....	....	....	....	....	..	....	....	....	....	.....
Decane-*n*	115	....	0.67	2.6	>500	No	0.730	4.90	−26	344	2, 3, 4
Denatured Alcohol—95%	60	....	....	....	....	No	0.82	1.60	−60	175	3, 4
Diacetone Alcohol (comm'l)	48	55	....	....	....	No	0.931	4.00	....	329	3, 4
Diamyl Phthalate	245	340	....	....	....	..	....	....	....	648	1, 2, 3, 4
Dianisidine	403	....	....	....	....	..	....	....	269	....	1, 3, 4
Dibenzyl Ether	275	....	....	....	....	No	1.036	6.82	41	568	1, 2, 3, 4
Dibutyl Ether-*n*	77	....	....	....	....	No	0.769	4.48	....	286	3, 4
Dibutyl Oxalate-*n*	220	....	....	....	....	No	1.01	....	....	....	1, 2, 3, 4
Dibutyl Phthalate-*n*	315	335	....	....	....	No	1.045	9.58	....	690	1, 2, 3, 4
Dibutyl Phthalate-*iso*	322	....	....	....	....	No	....	9.58	....	....	1, 2, 3, 4
Dibutyl Tartrate-*n*	195	230	....	....	....	No	1.098	9.03	72	650	1, 2, 3, 4
Dicaproate, see triethylene glycol	....	....	....	....	....	..	....	....	....	....	.....
o-Dichlorobenzene	151	165	....	....	....	No	1.325	5.07	2	354	1, 2, 3, 4
p-Dichlorobenzene	150	165	....	....	....	No	1.458	5.07	127	345	1, 3, 4
Dichlorodifluoromethane	non-flammable		....	....	....	No	....	....	....	−21.5	.....
Dichloro Ethane-1, 2, see ethylene dichloride	....	....	....	....	....	..	....	....	....	....	.....
Dichloroethene-1, 1, see dichloroethylene-1, 1	....	....	....	....	....	..	....	....	....	....	.....
Dichloro Ethylene-1, 1	57	.	5.6	13	856	No	1.250	3.35	....	98.6	1, 2, 3, 4
Dichoro Ethylene-1, 2	43	....	9.7	12.8	....	No	1.282	3.35	−113	141	1, 2, 3, 4
Dichloroethyl Ether-sym.	131	185	....	....	696	No	1.22	4.93	−58	352	1, 2, 3, 4
Dichloroisopropyl Ether	....	185	....	....	....	No	1.113	....	....	369	1, 2, 3, 4
Dichloromethane, see methylene chloride	....	....	....	....	....	..	....	....	....	....	.....
Dichloropropene-1, 2, see propylene dichloride	....	....	....	....	....	..	..	....	....	....	.....

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Dichlorotetrafluoroethane	non-flammable		....	....	....	No	....	....	....	38.5	.....
Diethanolamine	....	280	....	....	1224	No	1.097	3.65	82	514	1, 3, 4
Diethylaminoethanol	....	140	....	....	....	No	0.885	....	....	322	3, 4
Diethyl Carbitol	....	180	....	....	....	No	0.908	....	....	367	1, 3, 4
Diethyl Carbonate	77	....	....	....	....	No	0.977	4.07	−45	259	2, 3, 4
Diethyl Cellosolve	....	95	....	....	....	No	0.842	....	....	251	3, 4
Diethyl Diphenyl Urea	302	....	....	....	....	..	....	....	....	....	1, 2, 3, 4
Diethylene Glycol	255	290	....	....	444	No	1.119	3.66	21	472	1, 3, 4
Diethylene Oxide	65	....	1.97	22.2	....	..	1.035	3.03	50	214	3, 4
Diethylene Triamine	....	215	....	....	....	..	0.954	3.48	....	404	1, 3, 4
Diethyl Ether	−20	....	1.7	48.0	366	No	0.71	2.55	−177	95	3, 4
Diethyl Glycophthalate	343	....	....	....	....	..	....	....	....	....	1, 3, 4
p-Diethyl Phthalate	243	305	....	....	....	..	1.110	7.66	112	576	1, 2, 3, 4
Diethyl Selenide	....	....	2.5	....	....	No	1.23	4.73	....	226	1, 2, 3, 4
Diethyl Sulfate	220	....	....	....	....	No	1.184	5.31	−12	406	1, 2, 3, 4
Diglycol Chlorohydrin	....	225	....	....	....	No	1.172	....	....	387	1, 3, 4
Dihexyl, see dodecane	....	....	....	....	....	..	....	....	....	....	.....
o-Dihydroxy Benzene, see pyrocatechol	....	....	....	....	....	..	....	....	....	....	.....
m-Dihydroxy Benzene, see resorcinol	....	....	....	....	....	..	....	....	....	....	.....
Dimethoxy Tetraglycol	....	285	....	....	....	No	1.013	....	....	528	1, 3, 4
Dimethyl Aniline	145	170	....	....	700	No	0.956	4.17	36	379	1, 2, 3, 4
Dimethyl Aniline, see also xylidine	....	....	....	....	....	..	....	....	....	....	.....
Dimethyl Carbinol, see propyl alcohol, *sec.*	....	....	....	....	....	..	....	....	....	....	.....
p-Dimethyl Cyclohexane	52	....	....	....	....	No	0.77	3.86	−123	248	2, 3, 4
Dimethyl Ether	−42	....	....	....	....	No	....	1.617	−216	−11	3, 4
Dimethyl Glycophthalate	369	....	....	....	....	No	....	9.72	....	....	1, 3, 4
Dimethyl Ketone, see acetone	....	....	....	....	....	..	....	....	....	....	.....
o-Dimethyl Phthalate	295	325	....	....	....	No	1.189	6.69	....	540	1, 2, 3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Dimethyl Sulfate	182	240	....	....	....	No	1.332	4.35	−16	370	1, 2, 3, 4
Dinitro Aniline-2, 4	435	510	....	....	....	..	1.615	6.31	370	....	1, 3, 4
Dinitro Benzene	302	....	....	....	....	..	1.59	5.79	243	605	1, 3, 4
Dinitro Chlorobenzene	382	405	....	....	....	..	1.68	6.98	109	....	1, 3, 4
Dinitro Toluene-2, 4	....	....	....	....	....	No	1.52	6.27	158	572	1, 3, 4
Dioxane, see diethylene oxide	....	....	....	....	....	..	....	....	....	....	.....
Diphenyl	235	255	....	....	....	No	1.041	5.31	158	491	1, 3, 4
Diphenylamine	307	....	....	....	....	No	1.16	5.82	127	575	1, 3, 4
Diphenyl Ether, see diphenyl oxide	....	....	....	....	....	..	....	....	....	....	.....
Diphenyl Methane	266	....	....	....	....	No	1.006	5.79	79	508	1, 2, 3, 4
Diphenyl Oxide	239	....	....	....	....	No	1.073	5.86	81	500	1, 2, 3, 4
Dipropylene Glycol	....	280	....	....	....	No	1.040	....	....	372	1, 3, 4
Ditane, see diphenyl methane	....	....	....	....	....	..	....	....	....	....	.....
Divinyl Ether	< −22	....	1.7	27.0	680	No	0.774	....	....	102	3, 4
Dodecane	165	....	0.6	....	....	No	0.750	5.86	10	421	1, 2, 3, 4
Ester Gum	375	555	....	....	....	No	....	....	285	495	1, 3, 4
Ethane	gas	....	3.12	15.0	950	No	....	1.049	−278	−128	.....
Ethanol, see ethyl alcohol	....	....	....	....	....	..	....	....	....	....	.....
Ethanolamine	....	200	....	....	....	No	1.02	2.10	51	342	1, 3, 4
Ether, see diethyl ether	....	....	....	....	....	..	....	....	....	....	.....
Ethyl Acetanilide	126	....	....	....	....	..	0.942	4.72	....	400	2, 3, 4
Ethyl Acetate	24	30	2.18	11.5	907	No	0.899	3.04	−116	171	3, 4
Ethyl Acetoacetate	184	....	....	....	....	No	1.03	4.48	−48	356	1, 3, 4
Ethyl Alcohol	55	....	3.28	19	799	No	0.79	1.59	−178	173	3, 4
Ethyl Benzene	59	75	....	....	....	No	0.868	3.66	−134	277	2, 3, 4
Ethyl Bromide	....	....	6.75	11.25	952	No	1.430	3.76	−182	100	1, 3, 4
Ethyl Butyl Carbonate	122	....	....	....	....	No	....	5.03	....	....	2, 3, 4
Ethyl Butyrate	78	85	....	....	....	No	0.879	4.00	−135	248	3, 4
Ethyl Cellosolve, see cellosolve	....	....	....	....	....	..	....	....	....	....	.....
Ethyl Chloride	−58	−45	3.6	14.8	....	No	0.910	2.22	−220	54	3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Ethylene	gas	....	3.02	34	1009	No	....	0.975	−272	−155	.....
Ethylene Chlorohydrin	....	140	....	....	....	No	1.213	2.78	−94	264	1, 3, 4
Ethylene Diamine	93	110	....	....	....	No	0.890	2.07	47	241	3, 4
Ethylene Dichloride	56	65	6.2	15.9	775	No	1.258	3.42	−33	183	1, 2, 3, 4
Ethylene Glycol	232	240	....	....	775	No	1.113	2.14	3	387	3, 4
Ethylene Oxide	....	....	3	80	804	No	0.887	1.52	−168	51	3, 4
Ethyl Formate	−4	10	3.5	16.5	....	No	0.922	2.55	−112	130	2, 3, 4
Ethyl Glycol Acetate	117	....	....	....	....	No	....	4.55	....	....	3, 4
Ethyl Lactate	115	....	....	....	....	No	1.03	4.41	....	309	3, 4
Ethyl Nitrate	50	50	3.8	....	....	No	1.105	3.14	−152	190	2, 3, 4
Ethyl Nitrite	−31	−30	3.01	>50	....	No	0.900	2.59	....	63	2, 3, 4
Ethyl Oxalate	....	....	....	....	....	No	1.080	5.04	−40	367	1, 3, 4
Ethyl Phthalyl Ethyl Glycollate	365	385	....	....	....	..	>1	....	....	....	1, 2, 3, 4
Ethyl Propionate	54	....	....	....	....	No	0.891	3.52	−99	210	2, 3, 4
Ethyl Propyl Carbinol Acetate	135	....	....	....	....	No	0.83	4.97	....	290	3, 4
Ethyl *p*-Toluene Sulfonamide	260	380	....	....	....	..	....	....	....	....	1, 3, 4
Ethyl *p*-Toluene Sulfonate	316	....	....	....	....	..	....	....	....	....	1, 2, 3, 4
F-11, see monofluorotrichloromethane	....	....	....	....	....	..	....	....	....	....	.....
F-12, see dichlorodifluoromethane	....	....	....	....	....	..	....	....	....	....	.....
F-114, see dichlorotetrafluoroethane	....	....	....	....	....	..	....	....	....	....	.....
Formaldehyde (soln. of gas in water)	130	200	....	....	806	No	....	1.03	−134	−6	3, 4
Freon, see dichlorodifluoromethane	....	....	....	....	....	..	....	....	....	....	.....
Fuel Oil No. 1	100-165	....	....	....	490	No	<1	....	....	....	2, 3, 4
Fuel Oil No. 2	110-190	....	....	....	494	No	<1	....	....	....	2, 3, 4
Fuel Oil No. 3	125-200	....	....	....	498	No	<1	....	....	....	2, 3, 4
Fuel Oil No. 4	150+	250	....	....	505	No	<1	....	....	....	1, 2, 3, 4
Fuel Oil No. 5	150+	....	....	....	....	No	<1	....	....	....	1, 2, 3, 4
Fuel Oil No. 6	150+	320	....	....	765	No	<1	....	....	....	1, 2, 3, 4
Furfural	140	155	2.1	....	739	No	1.159	3.31	−36	322	1, 2, 3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Fusel oil, see *n*-amylalcohol	....	....	....	....	....	..	....	....	....	....	.....
Gas, Blast Furnace	....	....	35	74	....	No	....	....	....	....	.....
Gas, Coal Gas	....	....	5.3	31	1200	No	....	....	....	....	.....
Gas, Illuminating	....	....	5.3	31	1094	No	....	....	....	....	.....
Gas, Natural	....	....	4.8	13.5	....	No	....	....	....	....	.....
Gas, Oil Gas	....	....	6.0	13.5	637	No	....	....	....	....	.....
Gas, Producer	....	....	20.7	73.7	....	No	....	....	....	....	.....
Gas, Water	....	....	9.0	55.0	....	No	....	....	....	....	.....
Gas Oil	150+	....	....	....	640	No	<1	....	....	....	1, 2, 3, 4
Gasoline	−50	....	1.3	6	495	No	0.75	3-4	< −50	100-400	2, 3, 4
Glycerine	320	350	....	....	739	No	1.26	3.17	64	554	1, 3, 4
Glycerol, see glycerine	....	....	....	....	....	..	....	....	....	....	.....
Glyceryl Triacetate	280	295	....	....	....	No	1.161	7.52	−108	496	1, 2, 3, 4
Glyceryl Trinitrate, see nitroglycerin	....	....	....	....	....	..	....	....	....	....	.....
Glycol, see ethylene glycol	....	....	....	....	....	..	....	....	....	....	.....
Glycol Diacetate	....	220	....	....	....	No	1.100	4.53	−24	370	1, 2, 3, 4
Heptane-*n*	25	....	1	6	452	No	0.683	3.45	−130	208	2, 3, 4
Hexahydro-xylol, see *p*-dimethyl cyclohexane	....	....	....	....	....	..	....	....	....	....	.....
Hexalin, see cyclohexanol	....	....	....	....	....	..	....	....	....	....	.....
Hexalin Acetate, see cyclohexyl acetate	....	....	....	....	....	..	....	....	....	....	.....
Hexane-*n*	−7	....	1.25	6.90	477	No	0.661	2.97	−137	156	3, 4
Hexanol-1	145	....	....	....	....	No	0.82	3.52	−62	311	3, 4
Hexanol-3	137	....	....	....	....	No	0.818	3.52	....	275	3, 4
Hexanol-2	114	....	....	....	....	No	0.804	3.52	....	266	3, 4
Hexanone, see methyl butyl ketone	....	....	....	....	....	..	....	....	....	....	.....
Hexyl Acetate, see ethyl propyl carbinol acetate and methyl butyl carbinol acetate	....	....	....	....	....	..	....	....	....	....	.....

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Suscepti-bility to Sponta-neous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extin-guishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Hydrocyanic Acid	0	....	5.6	40	1000	No	0.697	0.9	10	79	.....
Hydrogen	gas	....	4.1	74.2	1076	No	....	0.069	−435	−422	.....
Hydrogen Sulfide	gas	....	4.3	45.5	....	No	....	1.189	−117	−76	.....
Hydroquinone	329	....	....	....	....	..	1.332	3.81	338	545	1, 3, 4
Kerosene, see fuel oil No. 1	....	....	....	....	....	..	....	....	....	....	.....
Lanolin	460	560	....	....	833	Yes	<1	....	100±	....	1, 2, 3, 4
Lard Oil (Commercial)	395	....	....	....	833	Yes	<1	....	28	....	1, 2, 3, 4
Lead Tetramethyl	....	....	1.8	....	....	..	1.995	9.20	−18	230	1, 2, 3, 4
Linseed Oil	435	535	....	....	820	Yes	0.93	....	−2	600+	1, 2, 3, 4
Lubricating Oil, Cylinder	....	535	....	....	783	No	<1	....	....	....	1, 2, 3, 4
Lubricating Oil, Light Machine	318	370	....	....	....	No	<1	....	....	....	1, 2, 3, 4
Lubricating Oil, Motor	....	450	....	....	....	No	<1	....	....	....	1, 2, 3, 4
Lubricating Oil, Spindle	169	200	....	....	....	No	<1	....	....	....	1, 2, 3, 4
Lubricating Oil, Turbine	....	400	....	....	700	No	<1	....	....	....	1, 2, 3, 4
Magnesium (Powder or Chips) *	....	....	....	....	....	No	....	....	1200	2048	5
Manganese (Powder) *	....	....	....	....	....	No	....	....	2300	3450	5
Marsh Gas, see methane	....	....	....	....	....	..	....	....	....	....	.....
Menhaden Oil	435	....	....	....	828	Yes	0.927	....	....	....	1, 2, 3, 4
Metaldehyde	97	135	....	....	....	No	....	6.06	475	....	1, 3, 4
Methanal, see formaldehyde	....	....	....	....	....	..	....	....	....	....	.....
Methane	gas	....	5.3	13.9	999	No	....	0.554	−300	−258	.....
Methanol, see methyl alcohol	....	....	....	....	....	..	....	....	....	....	1, 2, 3, 4
Methox, see methoxy ethyl phthalate	....	....	....	....	....	..	....	....	....	....	.....
Methoxy Ethyl Phthalate	275	370	....	....	....	No	....	....	....	....	1, 2, 3, 4
Methyl Acetate	15	20	4.1	13.9	935	No	0.925	2.56	−146	140	3, 4
Methyl Acetoacetate	180	....	....	....	....	No	1.077	4.00	82	338	1, 2, 3, 4
Methyl Alcohol	54	60	6.0	36.5	878	No	0.792	1.11	−144	147	3, 4
Methyl Amine	0	10	....	....	....	No	0.699	....	−134	19	3, 4
Methyl Aniline, see toluidine	....	....	....	....	....	..	....	....	....	....	.....

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Methyl Bromide	practically non-flammable		13.5	14.5	....	No	1.732	3.27	−135	40	.....
Methyl Butyl Carbinol Acetate	113	....	....	....	....	No	0.855	4.97	....	285	3, 4
Methyl *n*-Butyl Ketone	....	95	1.22	8.0	....	No	0.830	3.45	−70	262	2, 3, 4
Methyl *iso*-Butyl Ketone	73	....	....	....	....	No	0.803	3.45	−121	244	2, 3, 4
Methyl Butyrate	57	....	....	....	....	No	0.898	3.52	< −142	215	2, 3, 4
Methyl Carbitol	....	200	....	....	....	No	1.035	4.14	....	379	1, 3, 4
Methyl Cellosolve	107	115	....	....	551	No	0.966	2.62	....	255	3, 4
Methyl Cellosolve Acetate	132	140	....	....	....	No	1.005	4.07	....	289	3, 4
Methyl Chloride	gas	....	8.2	19.7	....	No	0.92	1.78	−142	−11	.....
Methyl Cyclohexane	25	....	1.15	....	....	No	0.770	3.38	−195	214	2, 3, 4
Methyl Cyclohexanol	154	....	....	....	....	No	0.933	3.93	....	329	1, 2, 3, 4
Methyl Cyclohexanone	118	....	....	....	....	No	0.925	4.86	....	325	2, 3, 4
Methyl Cyclohexyl Acetate	147	....	....	....	...	No	....	5.37	....	...	2, 3, 4
Methylene Chloride	practically non-flammable		....	....	1224	No	1.336	2.93	−143	104	1, 2, 3, 4
Methyl Ether, see dimethyl ether	....	....	....	....	....	..	....	....	....	....	.....
Methyl Ethyl Ether	−35	....	2	10.1	374	No	0.697	2.07	....	50	3, 4
Methyl Ethyl Ketone	30	....	1.81	11.5	....	No	0.805	2.41	−123	176	3, 4
Methyl Formate	−2	....	5.0	22.7	840	No	0.975	2.07	−148	90	3, 4
Methyl Glycol	97	....	....	....	....	No	....	2.62	....	....	3, 4
Methyl Glycol Acetate	111	....	....	....	....	No	....	4.07	....	....	3, 4
Methyl Hexalin, see methyl cyclohexanol	....	....	....	....	....	..	....	....	....	....	.....
Methyl Phenol, see *o*-cresol	....	....	....	....	....	..	....	....	....	....	.....
Methyl Phthalyl Ethyl Glycollate	375	380	....	....	....	No	>1	....	....	....	1, 2, 3, 4
Methyl Propionate	28	....	....	....	....	No	0.915	3.03	−126	176	2, 3, 4
Methyl *iso*-Propyl Carbinol, see amyl alcohol, *sec. iso*	....	....	....	....	....	..	....	....	....	....	.....
Methyl *n*-Propyl Ketone	....	60	1.55	8.15	...	No	0.812	2.96	−108	216	3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Methyl Salicylate	214	225	....	....	850	No	1.182	5.24	18	432	1, 2, 3, 4
Methyl Sulfate, see dimethyl sulfate	....	....	....	....	....	..	....	....	....	....	.....
Mineral Seal Oil (Typical)	170	255	....	....	....	No	....	....	....	....	1, 2, 3, 4
Mineral Spirits, see naphtha, safety solvent	....	....	....	....	....	..	....	....	....	....	.....
Monocresyl Diphenyl Phosphate	450	450	....	....	....	No	>1	....	....	....	1, 2, 3, 4
Monofluorotrichloromethane	non-flammable		....	....	....	No	....	....	....	76	.....
Mustard Oil	566	....	....	....	....	Yes	1.02	....	....	300	1, 2, 3, 4
Naphtha, Coal Tar	100-110	....	....	....	900-950	No	<1	....	< −50	300-400	2, 3, 4
Naptha, Safety Solvent	100-110	....	1.1	6.0	450-500	No	<1	....	< −50	300-400	2, 3, 4
Naphtha, V. M. & P.	20-45	....	1.2	6.0	450-500	No	<1	....	< −50	212-320	2, 3, 4
Naphtha (high flash), see naphtha, coal tar	....	....	....	....	....	..	....	....	....	....	.....
Naphthalene	174	190	0.9	....	1053	No	1.145	4.42	176	424	1, 3, 4
Naphthol (β)	307	340	....	....	....	No	1.22	4.97	252	547	1, 3, 4
Naphthylamine (α)	315	....	....	....	....	No	1.171	4.93	122	572	1, 3, 4
Neatsfoot Oil	470	....	....	....	828	Yes	0.92	....	84-106	....	1, 2, 3, 4
Nitric Ether, see ethyl nitrate	....	....	....	....	....	..	....	....	....	....	.....
p-Nitroaniline	390	390	....	....	....	..	1.437	....	295	>545	1, 3, 4
Nitrobenzene	190	....	....	....	924	..	1.2	4.25	42	412	1, 2, 3, 4
p-Nitrochlorobenzene	261	....	....	....	....	..	1.52	5.43	181	468	1, 3, 4
Nitroglycerin	Explodes	....	....	....	518	No	1.601	7.84	....	....	.....
Nitronaphthalene (α)	327	....	....	....	....	..	1.331	5.96	140	579	1, 3, 4
p-Nitrotoluene	223	....	....	....	....	..	1.286	4.72	126	460	1, 3, 4
m-Nitro *p*-Toluidine	315	345	....	....	....	..	1.312	5.24	241	....	1, 3, 4
Nitrous Ether, see ethyl nitrite	....	....	....	....	....	..	....	....	....	....	.....
Nonane-*n*	88	....	0.74	2.9	....	No	0.718	4.41	−60	302	3, 4
Octane-*n*	56	....	0.84	3.2	450	No	0.706	3.86	−69	257	3, 4
Octyl Acetate-*n*	180	....	....	....	....	No	0.885	5.93	−37	410	1, 2, 3, 4
Octyl Alcohol-*n*	178	....	....	....	....	No	0.827	4.48	3	381	2, 3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Racemic Acid, see tartaric acid	....	....	....	....	....	..	....	....	....	....	.....
Range Oil, see Fuel oil, No. 1	....	....	....	....	....	..	....	....	....	....	.....
Rape Seed Oil	325	550	....	....	836	Yes	0.915	....	63	....	1, 2, 3, 4
Red Oil, see oleic acid	....	....	....	....	....	..	....	....	....	....	.....
Resorcinol	261	....	....	....	....	No	1.272	3.79	230	529	1, 3, 4
Rosin Oil	266	....	....	....	648	Yes	0.98-1.1	....	....	....	1, 2, 3, 4
Sodium *	....	....	....	....	....	No	0.97	....	208	1612	5
Soya Bean Oil	540	....	....	....	833	Yes	0.925	....	72	....	1, 2, 3, 4
Sperm Oil, see whale oil	....	....	....	....	....	..	....	....	....	....	.....
Stearic Acid	385	425	....	....	743	Yes	0.847	9.80	157	726	1, 3, 4
Stoddard Solvent, see naphtha, safety solvent	....	....	....	....	....	..	....	....	....	....	.....
Sulfur	405	440	....	....	450	No	2.046	....	234	832	1
Sulfur Chloride	245	None	....	....	453	No	1.687	3.31	−112	280	1, 3, 4
Tallow	509	....	....	....	....	Yes	0.895	....	88-100	....	1, 3, 4
Tallow Oil	492	....	....	....	....	Yes	0.914	....	109	....	1, 3, 4
Tannic Acid	....	390	....	....	....	No	....	....	d.392	....	1
Tartaric Acid	....	410	....	....	....	No	1.667	....	284	....	1
Tetrabromoethane, see acetylene tetrabromide	....	....	....	....	....	..	....	....	....	....	.....
Tetrachloroethane, see acetylene tetrachloride	....	....	....	....	....	..	....	....	....	....	.....
Tetrachloroethylene	non-flammable		....	....	....	No	1.623	5.72	−8	248	.....
Tetradecane	212	....	0.5	....	....	No	0.765	6.83	41	486	1, 2, 3, 4
Tetraethylene Glycol		345	....	....	....	No	1.126	....	....	621	1, 3, 4
Tetralin, see tetrahydronaphthalene	....	....	....	....	....	..	....	....	....	....	.....
Tetrahydronaphthalene	171	180	....	....	....	No	0.973	4.55	−24	403	1, 2, 3, 4
Tin Tetramethyl	....	....	1.9	....	....	No	1.314	....	....	172	2, 3, 4
Toluene	40	45	1.27	7.0	1026	No	0.866	3.14	−134	232	2, 3, 4
o-Toluidine	185	....	....	....	900	No	0.999	3.90	3	392	1, 2, 3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
p-Toluidine	188	205	....	....	900	No	0.973	3.90	111	392	1, 3, 4
Toluol, see toluene	....	....	....	....	....	..	....	....	....	....	.....
Tolylacetamide, see *p*-acetoluide	....	....	....	....	....	..	....	....	....	....	.....
o-Tolyl *p*-Toluene Sulfonate	363	....	....	....	....	..	....	....	....	....	1, 3, 4
Transformer Oil, see transil oil	....	....	....	....	....	..	....	....	....	....	.....
Transil Oil	....	295	....	....	....	No	0.9	....	....	....	1, 2, 3, 4
Triacetin, see glyceryl triacetate	....	....	....	....	....	..	....	....	....	....	.....
Tributyl Phosphate	....	295	....	....	....	No	0.973	8.86	< −112	560	1, 2, 3, 4
Trichloroethylene	non-flammable		....	....	....	No	1.47	4.53	−99	189	.....
Trichloromethane, see chloroform	....	....	....	....	....	..	....	....	....	....	.....
o-Tricresyl Phosphate	460	504	....	....	....	No	....	....	....	d.770	1, 2, 3, 4
Triethanolamine	355	365	....	....	....	No	1.13	5.14	68	650	1, 3, 4
Triethylene Glycol	350	385	....	....	....	No	1.125	5.17	23	550	1, 3, 4
Triethylene Tetramine	....	260	....	....	....	No	0.982	....	....	532	1, 3, 4
Triglycol Dichloride	....	250	....	....	....	No	1.197	....	....	466	1, 3, 4
Triisopropanolamine	....	305	....	....	....	No	1.020	....	....	570	1, 3, 4
Trimethylene, see cyclopropane	....	....	....	....	....	..	....	....	....	....	.....
Trinitrophenol, see picric acid	....	....	....	....	....	..	....	....	....	....	.....
Triphenyl Phosphate	428	....	....	....	....	No	....	....	122	750	1, 3, 4
Tung Oil	552	....	....	....	855	Yes	0.94	....	88	....	1, 3, 4
Turkey Red Oil	476	....	....	....	833	No	....	....	....	....	1, 2, 3, 4
Turpentine	95	....	0.8	....	488	Yes	<1	....	....	300	2, 3, 4
Vinyl Acetate	18	30	....	....	800	No	....	....	....	....	2, 3, 4
Vinyl Chloride	....	....	4	22	....	No	0.97	2.15	−256	57	3, 4
Vinyl Ether, see divinyl ether	....	....	....	....	....	..	....	....	....	....	.....
Whale Oil	446	....	....	....	....	Yes	0.925	....	32	....	1, 2, 3, 4
Wintergreen oil, see methyl salicylate	....	....	....	....	....	..	....	....	....	....	.....
Wool Grease, see lanolin	....	....	....	....	....	.	....	....	....	....	.....
o-Xylene	63	75	1.0	....	924	No	0.88	3.66	−17	291	2, 3, 4

PROPERTIES OF FLAMMABLE LIQUIDS, GASES, AND SOLIDS

Name	Flash Point °F.		Explosive Limits % by Vol. in Air		Auto-ignition Temp. °F.	Susceptibility to Spontaneous Heating	Specific Gravity (Water = 1.00)	Vapor Density (Air = 1.00)	Melting Point °F.	Boiling Point °F.	Suitable Extinguishing Agents
	Closed Cup	Open Cup	Lower	Upper							
Xylol, see xylene	....	....	....	....	....	..	....	....	....	....	.....
o-Xylidine	206	....	....	....	....	No	0.99	4.17	<5	435	1, 2, 3, 4
Zinc (Dust or Powder) *	....	....	....	....	....	No	....	....	787	1706	5
Zirconium (Powder)	....	....	....	....	550	No	....	....	3092	>5250	5

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE * MYSORE *

MODERN CONCEPTS OF MATTER

By Helen M. Davis, *Science News Letter*, October 6, 1945.

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1. A single ATOM is the tiniest particle of any chemical element that can exist by itself and retain the qualities that mark it as that element.

2. All material things in the universe known to our senses are composed of one or more CHEMICAL ELEMENTS.

3. Substances composed of more than one element are known as COMPOUNDS. Atoms of elements are held together in compounds by electrical forces in the outer parts of their structure.

4. The smallest unit of a compound, usually composed of two or more atoms, is known as a MOLECULE.

5. There used to be 92 chemical elements, from hydrogen ($_1H^1$) the lightest, to uranium ($_{92}U^{238}$), the heaviest. There are now two new elements, NEPTUNIUM ($_{93}Np^{239}$) and PLUTONIUM ($_{94}Pu^{239}$).

6. When elements are represented, as above, by their chemical SYMBOLS, the subscript number is the atomic number. This is different for each element. The superscript number represents the atomic weight.

7. One of the qualities characteristic of matter is weight or mass. ATOMIC WEIGHT is expressed on a relative scale, as compared with the weight of hydrogen which is taken as one.

8. ATOMIC NUMBER is the measure of the electric charge on the nucleus of the atom. Atomic weight is the measure of the atom's mass.

9. Different samples of the same element, when tested by chemists, are sometimes found to have different atomic weights. Lead which occurs with radium, for example, has a different atomic weight from ordinary lead.

10. In all other ways the two kinds of lead are chemical twins, exactly alike except for weight. Elements which differ in weight only are called ISOTOPES.

11. Uranium has several isotopes. The usual kind, whose atomic weight is 238, was used to produce the two new elements. U-235 was used to make the ATOMIC BOMB.

12. Each of the new elements, neptunium and plutonium, has two isotopes whose atomic weights are 238 and 239.

13. Different elements, quite distinct in chemical behavior, may have the same atomic weight. We have $_{92}U$-238, and $_{93}Np$-238, and $_{94}Pu$-238, all with different properties. Such elements are now called ISOBARS.

14. All atoms are composed of standard interchangeable parts. These are PROTONS, NEUTRONS and ELECTRONS.

15. Protons and neutrons make up the NUCLEUS of the atom. The structure of the atom is much like that of the solar system. The nucleus corresponds to the sun at the center. The planets are electrons.

16. The proton and the neutron each have a mass about equal to that of a hydrogen atom, which is 1 on the chemist's scale. Each is about 1800 times heavier than the electron.

17. The ELECTRONS, light in weight and some distance away from the heart or nucleus of the atom, revolve around the nucleus much as planets revolve around the sun. They are held in their courses by electric attraction.

18. The proton has a POSITIVE charge of electricity, the electron has a NEGATIVE charge equal and opposite to the positive charge of the proton. The neutron has no charge at all.

19. The difference in chemical properties of the elements is caused by difference in the number of protons in the nucleus. This is the ATOMIC NUMBER.

20. Atomic Weight is the SUM of the weights of the protons and neutrons in the nucleus.

21. It is the NEUTRON which figures in the transmutations which give atomic power. Neptunium and plutonium were formed by bombarding uranium 238 with neutrons.

22. Neutrons can PENETRATE to the nucleus of heavy atoms when charged particles would be repelled by charges in the atom.

23. The HYDROGEN atom is believed to have just one proton as its nucleus, with one electron circling around it. Hydrogen's atomic weight and atomic number are each one.

24. Hydrogen has one isotope which is just like ordinary hydrogen except that it is twice as heavy. It is known as "heavy hydrogen" and sometimes as DEUTERIUM. Its compound with oxygen is called "heavy water".

25. The nucleus of HEAVY HYDROGEN contains one proton and one neutron. The atomic number of heavy hydrogen is one, corresponding to one proton. The atomic weight is two, corresponding to the two heavy particles, proton and neutron.

26. HELIUM has two protons and two neutrons in its nucleus. The two protons correspond to helium's atomic number two. The combined weights of protons and neutrons in the nucleus give helium its atomic weight 4. Two electrons, held in their orbits by the two protons, revolve around the nucleus.

27. The VOLUME of an atom is determined by the orbits of its outermost revolving electrons. Only a small fraction of the size of an atom is actually occupied by the protons, neutrons and electrons, just as the space occupied by the sun, the earth and other planets is only a small part of our solar system.

28. In spite of all the unoccupied SPACE, an atom is quite IMPENETRABLE to other atoms and to larger bodies. The electrons revolve millions of times a second, and keep everything out of the space within quite as effectively as though they were everywhere at once.

29. The only things that can get inside an atom are smaller things, FRAGMENTS of other atoms, protons, neutrons or electrons. They must be shot with just the right speed. These fragments of atoms are observed as radiations given off by radio-active elements which are breaking up spontaneously.

30. RADIATION is wave motion, known to us as the electro-magnetic waves used for radio transmission, heat, light, X-rays and cosmic rays. Large numbers of extremely tiny particles in motion together act like waves.

31. Three types of radiation are given off by radio-active substances. ALPHA particles are high-speed nuclei of helium atoms. BETA particles are high-speed electrons. GAMMA rays are electromagnetic radiations similar to X-rays and light.

32. Of these, only the gamma rays are properly called radiations, and even these act very much like particles because of their short wave-length. Such a "particle" or quantum of gamma radiation is called a PHOTON.

33. In general, the gamma rays are very penetrating, the alpha and beta rays less so. Even though the alpha and beta rays are not very penetrating, they have enormous SPEED.

34. The speed with which atom particles travel is the source of atomic energy. ENERGY is capacity to do work. It is work stored up for future use.

35. If you raise a weight to a height above the ground and suspend it there by some device, the WORK you put into raising it can be stored there indefinitely as POTENTIAL ENERGY. It will be there, ready, whenever you decide to release it.

36. The energy which a moving body has because it is in motion is called KINETIC ENERGY. The kinetic energy of any particle depends upon its mass and the square of its velocity. Energy is conserved by the moving particle until it strikes an object, then work is done.

37. All ENERGY is either potential or kinetic. Either one can be converted into the other. These two conversions are continually occurring.

38. Particles of atomic size have kinetic energy arising from several different kinds of MOTION. All atoms are constantly in motion.

39. If the atoms are so dispersed that the material constituting them is a GAS, that gas will exert pressure on all sides of the container that holds it. If the container is a balloon bag, the imprisoned gas can do work by lifting heavy weights into the air.

40. Atoms which compose an element that will combine readily with another element, as hydrogen or carbon will combine with oxygen, have unsymmetrical arrangements of the outer electrons in their systems. These unsymmetrical arrangements tend to set up a sort of strain, which causes CHEMICAL COMBINATION to take place when elements with suitable combining powers are brought together.

41. These unsymmetrical arrangements give rise to FORCES which result in kinetic energy. This energy appears, for example, when carbon and oxygen burn to carbon dioxide, giving off heat, or hydrogen and oxygen explode to form water, again giving off heat.

42. Chemicals combining to form stable compounds give off energy in the process. These are known as EXOTHERMIC REACTIONS. Combinations which absorb energy, forming unstable compounds, are known as ENDOTHERMIC REACTIONS. Explosives, for example, which are highly unstable, are formed by endothermic reactions.

43. Chemical forces, electricity and heat are all forms of energy. Potential and kinetic energy may be distinguished in each case.

44. These energies all arise from motion of the atom as a whole, or motion resulting from attractions and repulsions between the outer PLANETARY ELECTRONS of the atom's structure.

45. Energy resulting from motion of particles deep within the structure of the atom was unknown until the discovery of RADIOACTIVITY.

46. Radioactive elements undergo SPONTANEOUS breaking up of their atoms, giving off alpha and beta particles and gamma rays. Loss of these particles causes the radio-active elements to change into other elements.

47. The energies shown in these TRANSFORMATIONS are thousands of times greater than the kinetic energies which the molecules of a gas have by reason of their motion when heated. They are thousands of times greater than the energy changes per atom in chemical reactions.

48. The property of matter that connects it with motion is INERTIA. Inertia is opposition to change of motion.

49. One conclusion that appeared early in the development of the theory of RELATIVITY was that the mass due to inertia of a moving body increases as its speed is increased.

50. This increase implied an equivalence between an increase in energy of motion of a body (kinetic energy) and an increase in its MASS.

51. It was for this reason that Einstein suggested that studies of radioactivity might show the EQUIVALENCE of mass and energy.

52. Einstein's statement is that the amount of energy, E, equivalent to a mass, m, is given by the equation $E=mc^2$ where c is the VELOCITY OF LIGHT.

53. From this equation, one kilogram (2.2 pounds) of matter, if converted ENTIRELY into energy, would give 25 billion kilowatt hours of energy. This is equal to the energy that would be generated by the total electric power industry in the United States (as of 1939) running for approximately two months.

54. Compare this fantastic figure with the 8.5 kilowatt hours of heat energy which may be produced by BURNING an equal amount of coal.

55. Until the atomic power research program, no instance was known of matter being converted into energy without more energy being used to produce the transformation than was released by it.

56. Two axioms of physics stated: (1) MATTER can be neither created nor destroyed; (2) ENERGY can be neither created nor destroyed. For all practical purposes they were true and separate principles until about 1940.

57. It is now known that they are, in fact, two phases of a single principle, for we have discovered that energy may sometimes be CONVERTED into matter and matter into energy.

58. Such conversion is observed in the phenomenon of nuclear FISSION of uranium, a process in which atomic nuclei split into fragments with the release of an enormous amount of energy.

59. The extreme size of the CONVERSION FACTOR explains why the equivalence of mass and energy is never observed in ordinary chemical combustion.

60. We now believe that the heat given off in such COMBUSTION has mass associated with it, but this mass is so small that it cannot be detected by the most sensitive balances available.

61. Transformation of matter into energy is an entirely different sort of phenomenon than the usual chemical transformations, where the matter is changed into a different form but its MASS persists.

62. From the standpoint of the Laws of the Conservation of Matter and of Energy alone, transformation of matter into energy results in the DESTRUCTION of matter and CREATION of energy.

63. The OPPOSITE transformation, which astronomers believe may be going on in some of the stars, amounts to the destruction of energy and the creation of matter.

64. It is difficult for us to imagine the reconciliation of two such different concepts as matter, with its characteristic mass or weight, and energy, which does not have this quality. We shall, perhaps, be forced to think of the stuff of the universe as some such combination of matter and energy as would be symbolized by the coined word "MATTERGY"

PERIODIC ARRANGEMENT OF

Series	Zero Group	Group I — R_2O	Group II — RO	Group III — R_2O_3	Group IV RH_4 RO_2
1		Hydrogen H = 1.0080 No. 1			
2	Helium He = 4.003 No. 2	Lithium Li = 6.940 No. 3	Beryllium Be = 9.02 No. 4	Boron B = 10.82 No. 5	Carbon C = 12.010 No. 6
3	Neon Ne = 20.183 No. 10	Sodium Na = 22.997 No. 11	Magnesium Mg = 24.32 No. 12	Aluminum Al = 26.97 No. 13	Silicon Si = 28.06 No. 14
4	Argon A = 39.944 No. 18	Potassium K = 39.096 No. 19	Calcium Ca = 40.08 No. 20	Scandium Sc = 45.10 No. 21	Titanium Ti = 47.90 No. 22
5		Copper Cu = 63.54 No. 29	Zinc Zn = 65.38 No. 30	Gallium Ga = 69.72 No. 31	Germanium Ge = 72.60 No. 32
6	Krypton Kr = 83.7 No. 36	Rubidium Rb = 85.48 No. 37	Strontium Sr = 87.63 No. 38	Yttrium Y = 88.92 No. 39	Zirconium Zr = 91.22 No. 40
7		Silver Ag = 107.880 No. 47	Cadmium Cd = 112.41 No. 48	Indium In = 114.76 No. 49	Tin Sn = 118.70 No. 50
8	Xenon Xe = 131.3 No. 54	Cesium Cs = 132.91 No. 55	Barium Ba = 137.36 No. 56	La No. 57 Nos. 58-71 See La Series	Hafnium Hf = 178.6 No. 72
9		Gold Au = 197.2 No. 79	Mercury Hg = 200.61 No. 80	Thallium Tl = 204.39 No. 81	Lead Pb = 207.21 No. 82
10	Radon Rn = 222 No. 86	Francium Fr = ? No. 87	Radium Ra = 226.05 No. 88	Ac No. 89 Nos. 90-96 See Ac Series	Thorium Th = 232.12 No. 90

Lanthanide Series, Nos. 57-71:

Lanthanum La = 138.92 No. 57	Cerium Ce = 140.13 No. 58	Praseodymium Pr = 140.92 No. 59	Neodymium Nd = 144.27 No. 60	Prometheum Pm = ? No. 61
Samarium Sm = 150.43 No. 62	Europium Eu = 152.0 No. 63	Gadolinium Gd = 156.9 No. 64	Terbium Tb = 159.2 No. 65	Dysprosium Dy = 162.46 No. 66
Holmium Ho = 164.94 No. 67	Erbium Er = 167.2 No. 68	Thulium Tm = 169.4 No. 69	Ytterbium Yb = 173.04 No. 70	Lutecium Lu = 174.99 No. 71

THE ELEMENTS (REVISED TO 1948)

Group V RH_3 R_2O_5	Group VI RH_2 RO_3	Group VII RH R_2O_7	Group VIII		
Nitrogen N = 14.008 No. 7	Oxygen O = 16.0000 No. 8	Fluorine F = 19.00 No. 9			
Phosphorus P = 30.98 No. 15	Sulfur S = 32.066 No. 16	Chlorine Cl = 35.457 No. 17			
Vanadium V = 50.95 No. 23	Chromium Cr = 52.01 No. 24	Manganese Mn = 54.93 No. 25	Iron Fe = 55.85 No. 26	Cobalt Co = 58.94 No. 27	Nickel Ni = 58.69 No. 28
Arsenic As = 74.91 No. 33	Selenium Se = 78.96 No. 34	Bromine Br = 79.916 No. 35			
Columbium Cb = 92.91 No. 41	Molybdenum Mo = 95.95 No. 42	Technetium Tc = ? No. 43	Ruthenium Ru = 101.7 No. 44	Rhodium Rh = 102.91 No. 45	Palladium Pd = 106.7 No. 46
Antimony Sb = 121.76 No. 51	Tellurium Te = 127.61 No. 52	Iodine I = 126.92 No. 53			
Tantalum Ta = 180.88 No. 73	Tungsten W = 183.92 No. 74	Rhenium Re = 186.31 No. 75	Osmium Os = 190.2 No. 76	Iridium Ir = 193.1 No. 77	Platinum Pt = 195.23 No. 78
Bismuth Bi = 209.00 No. 83	Polonium Po = 210 ± No. 84	Astatine At = ? No. 85			
Protoactinium Pa = 231 No. 91	Uranium U = 238.07 No. 92				

Actinide Series, Nos. 89-96:

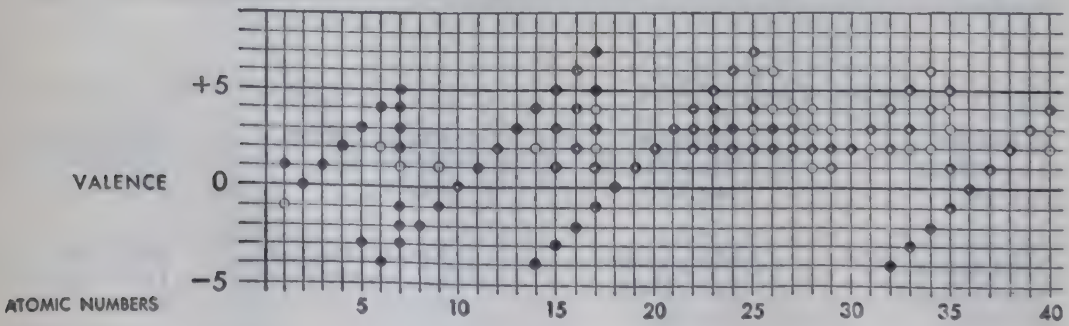
Actinium Ac = 227 ± No. 89	Thorium Th = 232.12 No. 90	Protactinium Pa = 231 No. 91	Uranium U = 238.07 No. 92
Neptunium Np = 238 ± No. 93	Plutonium Pu = 238 ± No. 94	Americum Am = 242 ± No. 95	Curium Cm = 243 ± No. 96

PERIODIC CHART

(From *Fundamental Chemistry*, 2nd Edition, by H. G. Deming.

																1	1 H 1.008
LIGHT METALS				HEAVY METALS													
				BRITTLE										DUCTILE			
I A		II A		III B		IV B		V B		VI B		VII B		VIII			
2 1	3 Li 6.940	2 2	4 Be 9.02														
2 8 1	11 Na 22.997	2 8 2	12 Mg 24.32														
2 8 8 1	19 K 39.096	2 8 8 2	20 Ca 40.08	2 8 9 2	21 Sc 45.10	2 8 10 2	22 Ti 47.90	2 8 11 2	23 V 50.95	2 8 13 1	24 Cr 52.01	2 8 13 2	25 Mn 54.93	2 8 14 2	26 Fe 55.85	2 8 15 2	27 Co 58.94
2 8 18 8 1	37 Rb 85.48	2 8 18 8 2	38 Sr 87.63	2 8 18 9 2	39 Y 88.92	2 8 18 10 2	40 Zr 91.22	2 8 18 12 1	41 Cb 92.91	2 8 18 13 1	42 Mo 95.95	2 8 18 13 2	43 Tc	2 8 13 15 1	44 Ru 101.7	2 8 18 16 1	45 Rh 102.91
2 8 18 18 8 1	55 Cs 132.91	2 8 18 18 8 2	56 Ba 137.36	57-71 See Lanthanide Series		2 8 18 32 10 2	72 Hf 178.6	2 8 18 32 11 2	73 Ta 180.88	2 8 18 32 12 2	74 W 183.92	2 8 18 32 13 2	75 Re 186.31	2 8 13 32 14 2	76 Os 190.2	2 8 13 32 17	77 Ir 193.1
2 8 18 32 18 8 1	87 Fr	2 8 18 32 18 8 2	88 Ra 226.05	89-96 See Actinide Series													

Lanthanide Series (Rare Earth Elements)	2 8 18 18 9 2	57 La 138.92	2 8 18 19 9 2	58 Ce 140.13	2 8 18 20 9 2	59 Pr 140.92	2 8 18 22 8 2	60 Nd 144.27
ACTINIDE SERIES	2 8 18 32 18 9 2	89 Ac 227±	2 8 18 32 19 9 2	90 Th 232.12	2 8 18 32 20 9 2	91 Pa 231	2 8 18 32 21 9 2	92 U 238.07



OF THE ELEMENTS

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INERT GASES

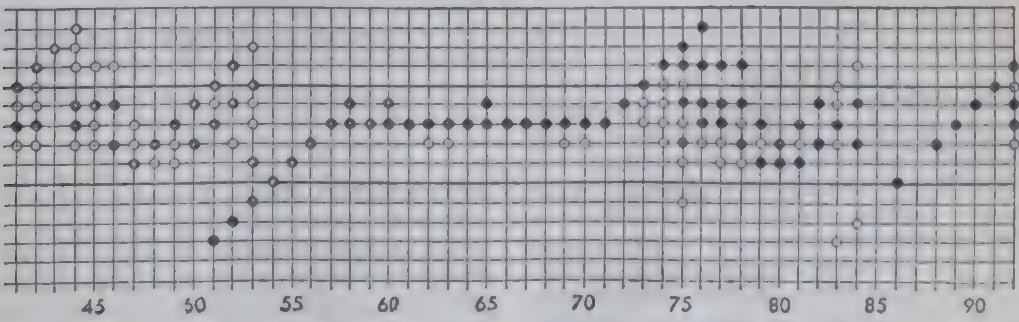
NON METALS

LOW MELTING

	I B	II B	III A	IV A	V A	VI A	VII A	INERT GASES
								2 2 He 4.003
			2, 3 5 B 10.82	2, 4 6 C 12.010	2, 5 7 N 14.008	2, 6 8 O 16.000	2, 7 9 F 19.00	2, 8 10 Ne 20.183
			2, 8, 3 13 Al 26.97	2, 8, 4 14 Si 28.06	2, 8, 5 15 P 30.98	2, 8, 6 16 S 32.066	2, 8, 7 17 Cl 35.457	2, 8, 8 18 A 39.944
2, 8, 16, 2 28 Ni 58.69	2, 8, 18, 1 29 Cu 63.54	2, 8, 18, 2 30 Zn 65.38	2, 8, 18, 3 31 Ga 69.72	2, 8, 18, 4 32 Ge 72.60	2, 8, 18, 5 33 As 74.91	2, 8, 18, 6 34 Se 78.96	2, 8, 18, 7 35 Br 79.916	2, 8, 18, 8 36 Kr 83.7
2, 8, 18, 18 46 Pd 106.7	2, 8, 18, 18, 1 47 Ag 107.880	2, 8, 18, 18, 2 48 Cd 112.41	2, 8, 18, 18, 3 49 In 114.76	2, 8, 18, 18, 4 50 Sn 118.70	2, 8, 18, 18, 5 51 Sb 121.76	2, 8, 18, 18, 6 52 Te 127.61	2, 8, 18, 18, 7 53 I 126.92	2, 8, 18, 18, 8 54 Xe 131.3
2, 8, 18, 32, 17, 1 78 Pt 195.23	2, 8, 18, 32, 18, 1 79 Au 197.2	2, 8, 18, 32, 18, 2 80 Hg 200.61	2, 8, 18, 32, 18, 3 81 Tl 204.39	2, 8, 18, 32, 18, 4 82 Pb 207.21	2, 8, 18, 32, 18, 5 83 Bi 209.00	2, 8, 18, 32, 18, 6 84 Po 210±	2, 8, 18, 32, 18, 7 85 At	2, 8, 18, 32, 18, 8 86 Rn 222

2, 8, 18, 23, 8, 2 61 Pm*	2, 8, 18, 24, 8, 2 62 Sm 150.43	2, 8, 18, 25, 8, 2 63 Eu 152.0	2, 8, 18, 25, 9, 2 64 Gd 156.9	2, 8, 18, 26, 9, 2 65 Tb 159.2	2, 8, 18, 28, 8, 2 66 Dy 162.46	2, 8, 18, 29, 8, 2 67 Ho 164.94	2, 8, 18, 30, 8, 2 68 Er 167.2	2, 8, 18, 31, 8, 2 69 Tm 169.4	2, 8, 18, 32, 8, 2 70 Yb 173.04	2, 8, 18, 32, 9, 2 71 Lu 174.99
2, 8, 18, 32, 22, 9, 2 93 Np 238±	2, 8, 18, 32, 23, 9, 2 94 Pu 238±	2, 8, 19, 32, 24, 9, 2 95 Am 242±	2, 8, 18, 32, 25, 9, 2 96 Cm 243±							

* NOT YET OFFICIAL



THE ELEMENTS

ACTINIUM (Gr. *aktis*, ray) Ger. *Aktinium.* Fr. *actinium.* A radioactive element discovered in 1900 by Debierne in pitchblende. Actinium has not yet been isolated nor have any of its salts been prepared in a pure state, but always contaminated by thorium and the rare earths. Actinium is constantly breaking down into actinium-X, which in turn breaks down until actinium-D, the end product, is formed. Actinium is always associated with uranium and radium in nature and for every 1000 kilograms of uranium there are 0.34 grams of radium and only about 0.06 milligrams of actinium. It is very difficult to separate actinium from lanthanum, and, according to Mme. Curie, the preparation of pure actinium salts does not appear imminent. The half life is 13.5 years.

ALABAMINE (State of Alabama, and Alabama Polytechnic Institute) Alabamine (ekaiodine) was discovered in 1931 by F. Allison and his co-workers Murphy, Bishop and Sommer. They digested one hundred pounds of monazite sand with aqua regia, extracted it with water, and examined the solution by means of their magneto-optic method of chemical analysis. They found the new halogen to be present in the form of peralabamic acid, $HAbO_4$. This compound was reduced to HAb, which was then converted into LiAb in which form they believe it to have been present to the extent of 2.5×10^{-6} gram of alabamine. Much research remains to be done on this element before many of its properties are known. See also *astatine.*

ALUMINUM (L. *alumen*, substance having an astringent taste) Ger. *Aluminium.* Fr. *aluminium.* Aluminum is a light, silvery metal, very malleable and ductile. Lavoisier predicted in 1782 that alumina was the oxide of a metal not then known. The first isolation of the metal is usually credited to Wöhler who in 1827 obtained the element by heating aluminum chloride with metallic potassium. Recent search of the early literature discloses, however, that the discovery should really be credited to Oerstedt, a Dane, who in 1825 heated aluminum chloride with a 1.5% potassium mercury amalgam and thus obtained the first metallic aluminum. The commercial method of isolation of the metal by electrolyzing a solution of the oxide in fused cryolite is based upon the work of Hall. Aluminum does not occur in the free state but its compounds are very widely distributed, aluminum being the most abundant metal. Cast aluminum is about as hard as silver. The metal takes a high polish but tends to become coated with a film of oxide. Although soluble in dilute HCl or H_2SO_4 and in solutions of KOH or NaOH, it is practically insoluble in HNO_3 or acetic acid even when hot. It is a very important metal being widely used in electrical transmission, since its conductivity per pound is greater than that of copper. Light alloys containing aluminum are used in making parts for automobiles, motorcycles and aircraft. About 70% of the frames and 25% of the engines and propellers of military aircraft are made of aluminum. It is also used in counter-radar in the form of foil, two ounces being made to appear on radar screens like an entire bomber. It is used in making cooking utensils, chemical apparatus, etc. In metallurgy aluminum is used as a degasifier, while aluminum powder is used in certain explosives, as a flashlight powder, in aluminum paints, and in the laboratory as a reducing agent. The thermite process is one that uses large amounts of aluminum. Cement, one of the most important building materials, is made up largely of aluminum silicate. Al_2O_3 or alumina, $Al_2(SO_4)_3$, $AlCl_3$ and $Al(NO_3)_3$ are typical aluminum compounds. The price is about 15¢ per pound (33¢ per kilogram).

AMERICUM (from America, where it was first produced). This is one of the trans-uranium elements (No. 95) produced by the research on atomic fission. Seaborg, James, Morgan, Ghiorso, Hamilton and others produced this element by the action of helium ions of very high energy on uranium. It is now believed that Pu-241 is first formed and this breaks down by beta-emission to form Am-241. This isotope has a half-life of 500 years with 7 billion alpha disintegrations per minute per milligram. In its electronic configuration americum bears the same relation to actinium as europeum does to lanthanum. As would be expected, americum has a very stable tri-valent state and resists oxidation under conditions which would produce higher valencies with uranium, neptunium, or plutonium.

ANTIMONY (Gr. *antimonos*, opposed to solitude, as antimony is always associated with other minerals) Ger. *Antimon*. Fr. *antimoine*. Antimony compounds have been known from ancient times, although the metal was probably confused with lead. Antimony was known to Georgius Agricola in the 16th century, to Libavius in 1615, and to one Basil Valentine, probably the pseudonym of one or more adepts who lived in the 15th or 16th century, whose works in Dutch and Latin were published from 1609 to 1676. Native antimony is known, but it is too rare to be commercially important. The ores of antimony are the sulfides and various antimonides and sulfantimonides of the heavy metals. The most important ore is stibnite, Sb_2S_3. The method of extraction used with this ore is the iron reduction process, which involves fusing the ore with iron turnings or shavings and slagging off the resulting iron sulfide with sodium chloride or sodium sulfate. The ordinary form of antimony is the metallic or gray variety. An unstable yellow antimony corresponding to yellow arsenic has been made. Antimony is one of the scarcer elements making up about $2.3 \times 10^{-5}\%$ of the earth's crust. Black antimony is amorphous and is more active and more easily volatilized than metallic antimony. Electrolytic antimony deposited by a weak current from an HCl solution of $SbCl_3$ is known as explosive antimony. This form has also been made in other ways; it explodes when scratched, when touched with a red-hot wire, or when heated to 125° C. Many antimony salts are poisonous but the metal is not. Antimony is used in making many important alloys such as bearing metal, type metal, hard lead, pewter, etc., chiefly for its property of hardening the softer metals. Its compounds are used in making pigments, in pharmaceutical preparations, as a mordant, in making percussion caps, fireworks and signal lights, and in the preparation of certain aniline dyes. A few common antimony compounds are $SbCl_3$, Sb_2O_3, SbH_3 or stibine, Sb_2O_5, and Sb_2S_3. The price of the metal is about 33¢ per pound (73¢ per kilogram).

ARGON (Gr. *argos*, neutral, inactive) Ger. *Argon*. Fr. *argon*. A colorless, odorless gas, somewhat heavier than air. It was discovered in 1894 by Lord Rayleigh and W. Ramsay, but over a century before Cavendish had found that air contained about 1/120th part of some gas other than oxygen, nitrogen and carbon dioxide. This small part was later proved to be mostly argon. It occurs in the atmosphere to the extent of about 0.93% by volume, or 1.29% by weight. Each square mile of the earth's surface supports about 800,000,000 pounds of argon. The gas is seldom prepared pure, it being sufficient in most cases to remove oxygen, nitrogen and carbon dioxide, leaving argon and traces of the rare inert gases. These can be removed by several fractional distillations of liquid air. Argon and the other inert gases are used to fill incandescent electric bulbs as well as various radio and rectifier tubes. A cylinder holding 200 cubic feet (5663 liters) of argon at normal pressure can be refilled for about $28.00.

ARSENIC (Gr. *arsenicos*, valiant or bold, from its action on other metals. L. *arsenicum*, yellow orpiment) Ger. *Arsen*. Fr. *arsenic*. Arsenic and its compounds have been known from ancient times, the metal being found in the free state as well as combined. Arsenic occurs as metallic arsenic, which is steel gray, opaque, and conducts electricity; as yellow arsenic, which is translucent and a non-conductor; as gray arsenic, which is gray to black, translucent and a non-conductor; and as brown arsenic, which is a pale reddish brown, opaque, amorphous, and a non-conductor of electricity. The yellow form is very unstable, it being necessary to keep it very cold and in the dark. Arsenic is not very abundant, it being present in the earth's crust to the extent of about $5.5 \times 10^{-4}\%$. The ores of arsenic are the two sulfides As_2S_3 and As_2S_5, $FeAsS$, and various arsenides and arsenates. It is usually prepared by heating $FeAsS$ or $FeAs_2$ in the absence of air, whereupon the arsenic sublimes. It is also obtained by treating ores from tin, copper, and tungsten mines. The compounds of arsenic in general are deadly poisons, but some are used in medicine, usually as a tonic. The natives of certain parts of Europe take large doses of As_2O_3, enough to be fatal to one not habituated, in the belief that their endurance is increased. Certain organic arsenic compounds such as salvarsan are important remedial agents, having specific power against blood parasites with little damage to the host when property administered. The metal is used to harden lead in making shot, and in certain bronzes. Arsenic compounds, chiefly arsenious oxide or white arsenic, Paris green, $Cu(C_2H_3O_2)_2 \cdot 3CuAs_2O_4$, and lead arsenate are used as insecticides. As_2S_3 or orpiment is used as a pigment. As_2O_3, As_2O_5, As_2S_3, As_2S_5, AsH_3 or arsine, $KAsO_2$, $FeAsO_4$, and $AsCl_3$ are common arsenic compounds. The metal costs about 72¢ per pound ($1.56 per kilogram), whereas the oxide As_2O_3, white arsenic, costs only 6¢ per pound (13¢ per kilogram).

ASTATINE (Gr. *astatos*, unstable). This is the heaviest of the halogens, element No. 85, or Mendeleev's ekaiodine. It was discovered in 1940 by Corson, McKenzie and Segre who prepared it artificially by bombarding bismuth with high energy alpha particles accelerated in the Berkeley cyclotron. All the known isotopes are short-lived, the most stable having a half-life of only 7.5 hours. It is an alpha emitter and has properties similar to polonium. See also *alabamine*.

BARIUM (Gr. *baros*, heavy) Ger. *Barium*, Fr. *barium*. A soft, white metal of the alkaline earth group. It was first isolated by H. Davy in 1808. It never occurs native, but is fairly common as the sulfate, barite, and the carbonate, witherite. Barium is stable in dry air but is readily oxidized by moist air or water at ordinary temperatures. It is malleable and ductile. The element has no important uses but several of its compounds have commercial applications. The carbonate, $BaCO_3$, is used in glass making and is recommended as a poison for destruction of rodents; the sulfate and carbonate are used in the manufacture of paints; $BaCl_2$ is used in purifying salt, in analytical chemistry, and in certain medicinal and photographic preparations; the nitrate and chlorate are used to produce a green color in signal lights and pyrotechny, and for certain explosive mixtures; barium peroxide, BaO_2, is used as a bleach. The porous monoxide is an excellent desiccant. Soluble barium compounds are poisonous. A pound of barium in the form of a chemically pure powder sells for about $30 (7¢ per gram), but the crude sulfate, barytes, costs only about $30 per ton (3¢ per kilogram).

BERYLLIUM (L. *beryl*) Ger. *Beryllium*. Fr. *béryllium*. Also known as **GLUCINUM** (Gr. *glykys*, sweet) Ger. *Glucinium*. Fr. *glycinium*. The symbols are Be and Gl. Beryllium is a dark gray metal lighter than aluminum. It was discovered by L. N. Vauquelin in 1797. It occurs in small amounts in many different minerals but its chief source is beryl, a beryllium aluminum silicate. The metal is made commercially by converting the beryl to $BeCl_2$ and electrolyzing a fused mixture of $BeCl_2$ and an alkali chloride. Beryllium salts are generally white and do not color the non-luminous flame. The metal is used in making light alloys, hard copper, and brass which has remarkable resistance to fatigue. Beryllium was considered an essential metal during the war because of its use as an alloy constituent in springs, cams, gears, precision bearings and contact brushes, and because it was used to produce slow neutrons in the production of the atom bomb. Beryllium salts are used in the manufacture of phosphors in fluorescent lamps, in ceramics and in the manufacture of synthetic gems and incandescent mantles. BeO or beryllia, $BeCl_2$, $BeSO_4$, $BeSiO_4$, $Be(NO_3)_2$, and $Be(AlO_2)_2$ are a few of the most common beryllium salts. A copper alloy having 4% beryllium costs $20 per pound ($44 per kilogram) of contained beryllium.

BISMUTH (Ger. *weisse masse*, white mass. Called by miners *wismat;* changed to *bismat* when latinized) Ger. *Wismut.* Fr. *bismuth.* Bismuth is a tin-white metal with a high luster. It is thought to have been known to the ancients who confused it with tin and lead. Bismuth is not very abundant, making up only about $3.4 \times 10^{-6}\%$ of the rocky crust of the earth. Its chief source is native bismuth occurring either alone or with tin, gold, silver, etc. It can also be obtained commercially from sulfide or oxide ores. Bismuth is a soft, brittle metal which has the lowest heat conductivity of any metal. Bismuth melts at about 260° C. and its most important use is in the form of low-melting alloys with tin, cadmium, and lead. Some of these alloys melt at 75-80° C. and are used in automatic sprinklers, etc. The electrical resistance of bismuth increases in a magnetic field, which makes it useful in determining the strength of these fields. Certain salts of bismuth such as the salicylate and the subnitrate are used in medicine, while bismuth oxide is used in making an optical glass and an enamel for cast iron. Bi_2O_3, $BiOCl$, Bi_2O_5, $BiONO_3$, $Bi(NO_3)_3 \cdot 10H_2O$, and $Bi_2(SO_4)_3$ are typical bismuth salts. The metal of about 99.7% purity sells in ton lots for $2.00 per pound ($4.40 per kilogram).

BORON (Ar. or Pers. *borak*, white) Ger. *Bor.* Fr. *bore.* Boron is a black, crystalline powder. It was first prepared in 1808 by J. L. Gay Lussac and L. J. Thenard. It occurs chiefly as borax in which form it is widely used as a cleaning powder. It is present in the earth's crust only to the extent of about $5 \times 10^{-4}\%$, but nature has so concentrated it in a few places that it is a common and inexpensive element. It is essential to plant growth in very small amounts. Boron can be prepared by heating powdered magnesium with boric anhydride until an energetic reaction takes place. The resulting magnesium borate is leached out with water and HCl leaving the boron undissolved. It is seldom made for it has no important commercial uses. Boron is remarkable in that its electrical resistance at room temperature is about two million times its resistance at a red heat. Its most important compounds are borax, $Na_2B_4O_7 \cdot 10H_2O$, and boric acid, H_3BO_3, which is used as an antiseptic and in the plating industry. Borax and boric oxide, B_2O_3, are very important in the ceramic industries. The element costs about a dollar per gram, but borax sells for less than 4¢ per pound (9¢ per kilogram).

BROMINE (Gr. *bromos*, a stench) Ger. *Brom.* Fr. *brome.* Bromine, one of the halogen elements, is a red, caustic, fuming liquid with a very strong, disagreeable odor. It was discovered in 1826 by A. J. Balard. It never occurs in the free state but its compounds are present in sea water and to a greater degree in certain saline springs, especially those of Stassfurt in Germany, and Ohio and Michigan in the United States. The earth's rocky crust contains about $6 \times 10^{-4}\%$ of the element, it being more abundant than iodine, but less so than chlorine or fluorine. Bromine will liberate iodine from its compounds and is in turn liberated from its compounds by chlorine, which is the basis of all technical processes for the production of bromine. Bromine and mercury are the only elements that are liquid at ordinary temperatures. The fumes of bromine are poisonous if inhaled in sufficient volume, and when the liquid is spilled on the skin it produces painful sores. Bromine is used in the preparation of various chemicals, in photography, as a disinfectant, in analytical chemistry, as a bleach, a military gas, and for gold extraction, but its largest use is in the production of ethylene bromide which is added to tetra-ethyl lead when the latter is used as an antiknock in internal combustion engines. The element is usually monovalent, but it exists with valencies of three, five, and seven as well. KBr, NaBr, AgBr, HBr, $CaBr_2$, BrCl, $AgBrO_3$, and $NaBrO_3$ are well known bromine compounds. The wholesale price of bromine is about 21¢ per pound (46¢ per kilogram).

CADMIUM (Gr. *kadmia*, Cadmean (earth) or L. *cadmia*, calamine, a zinc ore) Ger. *Cadmium*. Fr. *cadmium*. Cadmium is a silver-white metal with a bluish tinge. It was discovered in 1817 by F. Stromeyer. It occurs chiefly as greenockite, CdS, which is found with zinc ores, usually in small quantities. Cadmium makes up only about $1 \times 10^{-5}\%$ of the earth's crust. The metal is generally obtained as a by-product in the distillation of zinc. The cadmium, being more volatile, distills off in the first fraction. This high cadmium fraction is then redistilled at a lower temperature, yielding cadmium up to 99.5% purity. Cadmium is malleable and ductile, about as hard as magnesium, and melts around 320° C. It is used in making low-melting alloys with bismuth, for making a dental amalgam, as an alloy with silver in electroplating, and as a protective coating on nails, bolts and nuts. Artificially prepared cadmium sulfide and selenide, alone or in combination, are used to produce a variety of paint pigments ranging from lemon yellow to dark red. The sulfide is also used in radar and television phosphors. CdO, CdS, $CdSO_4$, $CdCl_2$, $Cd(NO_3)_2$, and $Cd(OH)_2$ are typical cadmium compounds. The wholesale price of cadmium is about $1.75 per pound ($3.85 per kilogram).

CALCIUM (L. *calx*, *calcis*, lime) Ger. *Calcium*. Fr. *calcium*. A soft, silver-white metal of the alkaline earth group. The metal was first prepared by H. Davy in 1808. None of the alkaline earths occur free in nature, but calcium compounds are very abundant, calcium making up 3.22% of the earth, air, and sea. Calcium is necessary for human nutrition, about one gram a day being required by the average person. Animal skeletons owe their rigidity mainly to calcium phosphate, and the shells of mollusks and birds' eggs to the carbonate. Calcium is also essential to plant growth. The metal may be prepared by the electrolysis of $CaCl_2$ at a temperature slightly above its melting point. It is used as a reducing agent in the preparation of metals from their oxygen and halogen compounds; as a reagent in the purification of inert gases; as a scavenger and decarbonizer in metallurgy; as a means of fixing atmospheric nitrogen; and for making alloys, especially with aluminum. Calcium compounds are widely used in the manufacture of lime, mortar, bricks, cement, glass, glazes, sugar, paint, paper, and in tanning. Calcium hypochlorite is a common bleaching agent and deodorant, while calcium carbide is used to produce acetylene. CaO, $CaCl_2$, $CaCO_3$, $CaSO_4$, $Ca(NO_3)_2$, and $Ca(OH)_2$ are a few well known calcium salts. The metal costs about $1.85 per pound ($4.00 per kilogram), but slaked lime, $Ca(OH)_2$, sells for as little as $10 per ton (1¢ per kilogram).

CARBON (L. *carbo*, coal) Ger. *Kohlenstoff*. Fr. *carbone*. Carbon occurs free in nature and has been known from ancient times. The element exists in two crystalline forms, diamond and graphite, as well as in the amorphous condition as exemplified by lampblack, boneblack, etc. The diamond is the hardest known substance, and has a very high melting point and index of refraction as well. Because of these properties it is much prized as a gem, but it is also used to cut glass, drill rocks, and as bearings in watches and other precise instruments. The chief source of diamonds is the blue clay near Johannesburg, South Africa. Graphite occurs as nodules in granite, slate and other rocks, but it is sometimes found in large masses. It is gray with a metallic luster and is opaque even in the thinnest flakes. It is very soft and greasy to the touch. Graphite can, like the diamond, be burned to CO_2 at high temperatures. It is used in pencils, as crucibles for melting metals, in electrotyping, for protecting iron from rust, and as a lubricant. It is also used as a moderator slowing down the fast neutrons of the uranium pile in atomic fission.

Amorphous carbon, of which there are several kinds, is made by burning various organic substances in an insufficient supply of air. It is soft, black, and slightly more active than graphite, probably because it is in a more finely divided state. Special forms of carbon (activated) are used for their absorptive properties in removing odors, tastes, colors, etc. Carbon is the basic substance around which all organic life revolves. It is found in all plants and animals in the combined state, while great deposits of coal are known which consist mainly of carbon either free or combined. The carbon dioxide present in the air is the sole source of carbon in plant life. The number of known carbon compounds is around a quarter of a million, while the number of possible compounds is almost unlimited. $CaCO_3$, CO_2, CO, CS_2, CCl_4, $CHCl_3$, C_2H_5OH, CH_3COOH, $(COOH)_2$, and $C_2H_5OC_2H_5$ are a few of the most important carbon compounds. The wholesale price of graphite is from 14¢ to 24¢ per pound (31¢ to 53¢ per kilogram), while carbon black runs from 5¢ to 10¢ per pound (11¢ to 22¢ per kilogram).

CERIUM (Named from the asteroid, *Ceres*, which was discovered three years before the element) Ger. *Cerium*. Fr. *cérium*. A steel-like appearing metal of the rare earth group, which is malleable and ductile and can be cut with a knife. It was discovered by Berzelius and Hisinger in 1804. Cerium, the most abundant of the rare earths, is usually found in monazite sand, cerite, gadolinite and samarskite. The metal can be prepared by the electrolysis of the chloride. Cerium is separated from mixtures with the other rare earths by oxidation to the ceric state and subsequent removal. Iron-cerium alloys are pyrophoric and are used in automatic lighters. An alloy of cerium with lanthanum and the other rare earths, known as *mischmetall*, is a valuable reducing agent. Gas mantles contain about one percent CeO_2; cerium salts, especially the fluoride are introduced into arc-lamp electrodes which makes them burn more brightly, quietly, and evenly. Ceria is used to make glass of good heat protecting properties. Cerous salts (valence 3) are colorless; ceric salts (valence 4) are yellow, orange or red. Cerium is used in certain photoelectric cells. Ceric oxalate is used in medicine, and the sulfate is being used in titrimetric analysis in place of $KMnO_4$ or $K_2Cr_2O_7$, it having the advantage of yielding colorless reaction products. Ce_2O_3 or ceria, CeO_2, $Ce_2(CO_3)_3$, and $CeCl_3$ are a few of the better known cerium compounds. A technical grade of the element costs $36 per pound ($79 per kilogram) but some of its compounds are relatively cheap.

CESIUM (L. *coesius*, sky-blue) Ger. *Cäsium*. Fr. *césium*. Cesium is a silvery white alkali metal resembling rubidium and potassium. It was discovered with the aid of the spectroscope in 1860 by Bunsen and Kirchhoff. Cesium is the heaviest of the known members of the alkali series of metals, and is the most electropositive of all metals. It is the softest of all solid metals, being softer than beeswax, and must be kept out of contact with air or water. Its chief source is the mother liquors from the production of KCl from carnallite. Cesium is never found in large quantities and makes up only about $7 \times 10^{-5}\%$ of the earth's crust. It is used in certain photoelectric cells, and in vacuum tubes to remove traces of gases. Cesium compounds color the non-luminous flame violet. CsOH, CsCl, CsCN, and $CsHC_4H_4O_6$, the acid tartrate, are some common cesium salts. The price is about $14 a gram.

CHLORINE (Gr. *chloros*, grass green) Ger. *Chlor*. Fr. *chlore*. Chlorine is a greenish-yellow gas with a disagreeable odor. It was produced by Scheele in 1774 but its elemental nature was first proved by Davy in 1808. Chlorine, the most abundant of the halogens, does not occur free in nature but chlorides and other chlorine-containing compounds are very common. Sodium chloride is the most important source for both chlorine and sodium, it being found in huge deposits as well as being present in sea water and in most brines. Chlorine is generally made by the electrolysis of sodium chloride, it being a secondary product in the manufacture of sodium hydroxide. Chlorine is non-combustible, but it will support the combustion of certain compounds. A candle will burn in chlorine with a smoky flame, the hydrogen in the paraffin combining with the chlorine while the carbon is liberated. Chlorine is used as a bleaching agent, a water disinfectant, a war gas, and as an intermediate in the preparation of other compounds, one of the most important of which is calcium hypochlorite or bleaching powder. Sodium chloride is a necessary constituent of animal diets. Chlorine can act with a valence of 1, 3, 4, 5, and 7 as illustrated by the compounds NaCl, $KClO_2$, ClO_2, $KClO_3$, and $KClO_4$. Hydrochloric acid, HCl, is one of the three common mineral acids. The wholesale price is about 2½¢ per pound in tank car quantities and in 150 pound cylinders about 9¾¢ per pound (21½¢ per kilogram).

CHROMIUM (Gr. *chroma*, color) Ger *Chrom*. Fr. *chrome*. A hard, bright, silvery metal capable of taking a high polish. It was discovered in 1797 by L. N. Vauquelin, whose work was confirmed by M. H. Klaproth. The principal ore of chromium is chromite, $FeO \cdot Cr_2O_3$. Most of the chromium comes from New Caledonia, the United States, India, and Canada. The metal is generally prepared by the reduction of Cr_2O_3 with silicon, hydrogen or some other reducing agent, the chromic oxide being made from chromite by heating the refined ore with an alkali, acidifying to form the alkali dichromate, and reducing this to the insoluble Cr_2O_3 and a soluble alkali salt, the latter being leached out with water. The metal which has been electrically deposited has a hardness of 9 on the scale where diamond is 10 and is much harder than metal prepared in other ways. Objects electroplated with chromium have a beautiful silvery finish that is very resistant to all kinds of corrosion. There are many important chromium alloys such as steel with about two percent chromium, as well as various nickel-chromium and chrom-vanadium steels. The addition of chromium to an alloy generally adds to its toughness, hardness, strength and resistance to corrosion. Perhaps the largest use of chromium is in the form of chromite as a refractory lining in open-hearth and other furnaces. Chromium compounds are highly colored and are much used as pigments. They are also used in tanning, in making safety matches, as antiseptics, as components in certain galvanic cells, and for many other purposes. K_2CrO_4, $Cr(OH)_3$, Cr_2O_3, CrO_3, and $PbCrO_4$ are typical chromium compounds. The price is about 89¢ per pound ($1.96 per kilogram).

COBALT (Gr. *kobolos*, a goblin) Ger. *Kobalt*. Fr. *cobalt*. Cobalt is a bright silvery metal and is a member of the iron-cobalt-nickel triad. It was first prepared by Georg Brandt in 1735; cobalt compounds, however, were first studied by Thenard in 1802. It is not very widely distributed; among the more important ores are cobaltite (CoAsS), smaltite ($CoAs_2$), erythrite ($Co_3(AsO_4)_2 \cdot 8H_2O$), and wad ($Co_3S_4$). The most important deposit of cobalt ores is the one at Cobalt, Ontario, where the cobalt arsenide is mixed with nickel and silver. These ores are ground, smelted, roasted, and washed in a series of steps that result in the recovery of nickel and cobalt oxides, silver, and arsenious oxide. The Co_3O_4 which is the form usually sent to the refinery is reduced to the metal with carbon, hydrogen or aluminum. Cobalt is not quite as magnetic as iron, but is harder than iron or nickel; like iron, its hardness and tensile strength are much improved by the addition of small amounts of carbon, usually to the extent of 0.25% or less. Too much carbon makes cobalt brittle. Unlike iron, cobalt is not attacked by air and water at ordinary temperatures but it is superficially oxidized at a red heat. Cobalt may be electroplated, depositing a coating with properties superior to that obtained by nickel plating. Many valuable cobalt alloys are known such as stellite and cochrome, the latter being the same as nichrome with the nickel replaced by cobalt. This alloy, which is used for electrical heating units, melts at a higher temperature and is more resistant to corrosion than the corresponding nickel alloy. Combined with nickel and aluminum, cobalt is used in making the very powerful Alnico magnets. A cobalt amalgam is used in dentistry. Certain cobalt salts are used to impart a beautiful blue color to glass, pottery, enamels and paints. Several organic cobalt salts such as the oleate, acetate, linoleate, etc. are used as dryers in the paint and varnish industry. Cobalt forms divalent and trivalent compounds but the latter are generally unstable except in the double salts. $CoCl_2$, $Co(ClO_3)_2$, $Co(OH)_2$, Co_3O_4 or cobalto-cobaltic oxide, $CoSO_4$, and $Co(NO_3)_2$ are common cobalt salts. The price of cobalt is about $1.65 per pound ($3.63 per kilogram).

COLUMBIUM (from *Columbia*, America, as the original ore came from the United States of America). Also called **NIOBIUM** (Gr. myth. Niobe, daughter of Tantalus, as it is found associated with tantalum) Ger. *Columbium* or *Niobium*. Fr. *columbium* or *niobium*. Columbium is platinum-white in color and has a bright metallic luster. It was discovered in 1801 by C. Hatchett. Columbium does not occur in the free state and its minerals are relatively rare, the element making up about $4 \times 10^{-6}\%$ of the earth's crust. It is generally found with tantalum as the columbates and tantalates of calcium, iron, uranium, manganese, and the rare earths. The two metals are separated by taking advantage of the different solubilities of potassium fluotantalate and potassium fluocolumbate. Columbium is malleable and ductile, and very resistant to corrosion withstanding the action of the common mineral acids including aqua regia although it is dissolved by hydrofluoric acid. An alloy containing 0.5% to 0.8% of columbium is used in engine parts which are subjected to temperatures in excess of 800° C. Like its companion metal, tantalum, a columbium electrode acts as an electrolytic valve allowing an alternating current to pass only in one direction through an electrolytic cell. Columbium has been used in lamp filaments and in jewelry, it being capable of being colored by an electrolytic process. Columbium forms the oxides Cb_2O_3, CbO_2, and Cb_2O_5, the pentoxide giving rise to salts known as columbates or niobates. CbF_5, $CbCl_3$, $CbCl_5$, and $CbOCl_3$ are other compounds. The retail price is about $255 per pound (56¢ per gram).

COPPER (L. *cuprum*, copper) Ger. *Kupfer*. Fr. *cuivre*. Copper is a reddish-brown, ductile metal. It is found native in large masses, and has been known from the earliest times. The metal is also obtained from ores such as covellite (CuS), tenorite (CuO), cuprite (Cu_2O), chalcocite (Cu_2S) and azurite ($Cu_3(OH)_2(CO_3)_2$. Copper ores are found in many countries, but the United States is the largest producer. The metal is usually prepared by roasting and smelting the ore and then making the final purification by electrolysis. Copper is one of the best conductors of heat and electricity, and consequently is widely used in making boilers, steam pipes, cooking utensils, chemical apparatus, and wires for telephones and telegraphs as well as for the distribution of current. Copper rollers are used in calico printing. Its alloys are very important, including brass, bronze, gun-metal, German silver and many others. All United States coins contain from 10% to 95% copper. Copper salts are used in medicine, for combating pests, and as antiseptics. CuO, Cu_2O, $CuSO_4 \cdot 5H_2O$, $CuOH$, $CuCl$, and $Cu(NO_3)_2$ are well known copper salts. In large quantities the price of copper is about 21¢ per pound (46¢ per kilogram).

CURIUM (Named for the Curies, discoverers of radium) This trans-uranium element, No. 96, was named after a person as was its homologue, gadolinium. Curium was discovered in 1945 by Seaborg, James, Morgan, and Ghiorso in connection with their work on the atom bomb project at the University of California. It was the third of the trans-uranium elements to be discovered and was produced by the irradiation of Pu-239 with helium ions in a cyclotron. It can also be made from americum by neutron bombardment. Curium is an alpha emitter with a half-life of five months. It gives off 7 billion alpha particles per minute per microgram going from Cm-242 to Pu-238. So far it is known only in the trivalent state.

CYCLONIUM (Named for the cyclotron in which it was first produced) This name for element No. 61 was suggested by Quill, Law, Pool and Kurbatov who worked with the Manhattan Project at The Ohio State University. Operating in the neodymium-samarium region, they were able to produce enough cyclonium to be able to demonstrate its presence by radioactive measurements. All known isotopes of this element are radioactive but at least one of them has a half-life of 3.7 years so that it is not impossible for it to occur in nature. See also *florentium*, *illinium* and *promethium*.

DYSPROSIUM (Gr. *dysprositos*, hard to get at) Ger. *Dysprosium*. Fr. *dysprosium*. Dysprosium is a rare earth metal of the yttrium group and has not yet been described. It was discovered in 1886 by Lecoq de Boisbaudran. The compounds of dysprosium are found in very small quantities in the minerals blomstrandine, euxenite, fergusonite, gadolinite, and polycrase, together with the other rare earths. It is widely distributed, being present to the extent of $4.3 \times 10^{-4}\%$ in the earth's crust. Dysprosium salts are yellow or greenish-yellow in color. Dy_2O_3 or dysprosia, $DyCl_3$, $Dy_2(SO_4)_3$, $Dy(NO_3)_3 \cdot 6H_2O$, $Dy_2(CO_3)_3 \cdot 4H_2O$ and a few others have been described. They have no commercial application.

ERBIUM (*Ytterby*, a town in Sweden) Ger. *Erbium*. F. *erbium*. Erbium has been isolated as a dark gray metallic powder which was probably impure. It was discovered in 1843 by C. G. Mosander. Erbium occurs with other rare earths in minerals such as gadolinite, blomstrandine, euxenite and a few others. It is rather scarce, making up about $2.4 \times 10^{-4}\%$ of the rocky crust of the earth. Its compounds are pink or rose colored and have a sweet, astringent taste. A few compounds of erbium including Er_2O_3 or erbia, $Er_2(SO_4)_3$, $Er(NO_3)_3 \cdot 5H_2O$ and others have been prepared. They are not used commercially.

EUROPIUM (*Europe*) Ger. *Europium*. Fr. *europium*. Europium is one of the least abundant of the rare earth elements, it being present in the earth's crust in the amount of only $1.0 \times 10^{-4}\%$. The metal has not yet been prepared, and few of its salts are known. Europia (Eu_2O_3) was isolated in 1900 by Demarcay, and prepared in a state of purity by Urbain and Lacombe in 1904. Europium compounds are pale pink in color. $EuCl_3$, $EuCl_2$, Eu_2O_3, $Eu_2(SO_4)_3$ and a few organic salts have been prepared and described.

FLORENTIUM (named for Florence, Italy) This name for element No. 61 was proposed by Rolla and Fernandez who did their investigations at the Royal University in Florence. A sealed packet describing their preliminary results was deposited with the Academy of Lincei in 1924. Their claim is based on X-ray and spectral absorption curves on a didymium earth concentrate which was fractionated by means of the double sulfates with thallium. See also *cyclonium*, *illinium* and *promethium*.

FLUORINE (L. *fluere*, to flow) Ger *Fluor*. Fr. *fluor*. Fluorine is a pale, greenish-yellow gas of the halogen family and is very pungent and corrosive. The gas was isolated in 1886 by H. Moissan after a period of more than 75 years of effort on the part of many experimenters. Fluorine is the most chemically active of the elements. It occurs in the combined form in fairly large quantities being second only to chlorine in abundance among the halogens. The moist gas will attack glass but dry fluorine is without action. It is prepared by electrolyzing a solution of potassium fluoride in liquid HF or molten KHF_2. The chief ores of fluorine are fluorspar (CaF_2), and cryolite (Na_3AlF_6). Fluorine will combine with all elements except the inert gases. It is so active that solid fluorine and liquid hydrogen explode when brought together at −252° C. The free element is difficult to prepare and is seldom used except in research work. An important war use of fluorine was to prepare uranium hexafluoride for use in the atom bomb project. Fluorine gas is used to make SF_6, an insulating gas used in high voltage X-ray machines, and also to make Cl_3F, a material nearly as active as fluorine itself but which, unlike fluorine, can be shipped in liquid form in cylinders. Cryolite is an essential material in the production of aluminum and is used, as is sodium ferric fluoride, as a "getter" in incandescent lamp manufacture. Hydrogen fluoride is used for etching glass; in the fermentation industries for checking the growth of wild yeasts; to coagulate rubber latex; in the laboratory for analytical purposes, especially the estimation of silica; and for opening boring holes in gas and petroleum wells, the acid being used to dissolve the siliceous material. Soluble fluorides are poisonous; NaF, for example, being a common insecticide. Boron fluoride is used as a catalyst. Traces of fluorides in the water supply are believed to prevent tooth decay in children but small amounts greater than traces cause a detrimental effect known as "mottled teeth." A few typical fluorine compounds are NaF, CaF_2, KF, AgF, and AlF_3. Fluorine gas is never sold as such but generators can be purchased in which the gas can be produced for from 50¢ to $2.00 per pound ($1.10 to $4.40 per kilogram) depending on the quantity made.

FRANCIUM (Named for France, the native country of its discoverer) This is element No. 87, the heaviest of the alkali metals. It was discovered in 1939 by Marguerite Perey at the Curie Institute, Paris. Francium, formerly called *actinium K* by Mlle. Perey, occurs as an alpha disintegration product of actinium. This particular isotope is a beta-emitter with a half-life of 21 minutes. See also *virginium*.

GADOLINIUM (Named for J. Gadolin, the Finnish chemist) Ger. *Gadolinium*. Fr. *gadolinium*. The element has not been prepared, but several of its salts are known. Gadolinium was discovered in 1886 by Marignac. It is generally found with other rare earths, especially those of the terbium family, of which it is a member. It makes up about $3.5 \times 10^{-4}\%$ of the earth's crust. The gadolinium ion is colorless. Among the salts of this element which have been prepared are Gd_2O_3 or gadolinia, $GdCl_3$, GdF_3, Gd_2S_3, $Gd_2(SO_4)_3$, $Gd(NO_3)_3{\cdot}6H_2O$, and several organic salts.

GALLIUM (L. *Gallia*, France) Ger. *Gallium*. Fr. *gallium*. Gallium is a steel-gray metal. It was discovered in 1875 by L. de Boisbaudran. The element is present to the extent of about $5 \times 10^{-4}\%$ in the earth's crust and, though widely distributed, occurs in very small quantities. It is obtained from certain zinc blendes in which it occurs as a very slight impurity. Gallium is unique in that it melts at 30° C. and yet is not very volatile at a red heat. These properties make the metal valuable for use in thermometers for high temperatures. It is also capable of being greatly supercooled; and, when solid, is much harder than other low-melting metals. Gallium has a valence of three, and forms salts resembling those of aluminum, such as $GaCl_3$, Ga_2O_3, Ga_2S_3, and $Ga_2(SO_4)_3$. It also forms divalent salts such as $GaCl_2$, etc. The price is about $8 a gram.

GERMANIUM (L. *Germania*, Germany) Ger. *Germanium*. Fr. *germanium*. Germanium is a grayish-white metal of the silicon family, appearing in the periodic table between silicon and tin. It was discovered in 1886 by C. Winkler, but it had been predicted before this by Mendeleev, who called it eka-silicon. The element is rather scarce making up about $1 \times 10^{-4}\%$ of the earth's crust. It is found in small quantities in the ores of silver, copper, zinc, and a few other metals. It can be separated from most of its associates by precipitation from acid solution with H_2S. The metal may be prepared by reducing the sulfide with hydrogen or carbon. Germanium compounds are plant stimulants in very low concentrations, toxic in higher. Germanium resembles silicon in forming a gaseous hydride GeH_4, while K_2GeF_6 is like K_2SiF_6. GeO_2, GeS_2, GeO, GeS are typical compounds. The retail price is about 14¢ a gram.

GOLD (Anglo-Saxon, *gold*. Sanskrit, *juel*, to shine) Ger. *Gold*. Fr. *aurum*. Like most metals that are found in the free state, gold has been known from ancient times. It is bright yellow in color, is very soft and heavy, is the most malleable and ductile of all metals, is a good conductor of heat and electricity, and is not acted upon by air, water, or most reagents. The metal is generally found native in rocky or sandy deposits. After concentrating the ores, the gold is extracted by the amalgamation process or the cyanide method. Gold is a rare metal, only $5 \times 10^{-7}\%$ being present in the earth's crust. It is widely used in coinage, being the standard for monetary value in most countries. The metal is generally alloyed with copper or silver to make it hard enough to stand wear; such alloys are used in jewelry and other ornaments. Gold forms compounds in which it is either tri- or mono-valent. Gilding is often accomplished electrolytically, usually with sodium gold cyanide or chloroauric acid, $HAuCl_4$. Many gold compounds are used in medicine, and several, notably $AuCl_3$, are of use in photography. The United States Government sets the price of gold at $510.42 per pound avoirdupois.

HAFNIUM (L. *Hafnia*, Copenhagen) Ger. *Hafnium*. Fr. *hafnium*. Hafnium is a metal resembling zirconium, and is found in nearly all ores of that metal. It was discovered in 1922 by D. Coster and G. Hevesy. The average hafnium content of all zirconium ores is about three percent of the amount of zirconium in the ore, but the minerals alvite, cyrtolite, and thortveitite are much richer than this in hafnium. This element is number 72 in the periodic table. Urbain thought he had discovered number 72 in Marignac's ytterbium and named his new element "celtium," but this is now believed to have been a concentrated sample of lutecium. It is very difficult to separate hafnium from zirconium. This is generally accomplished by many fractional crystallizations of the mixed potassium hexafluorides, K_2HfF_6 and K_2ZrF_6. The metal is prepared by reducing K_2HfF_6 with sodium. The probable concentration of hafnium in the earth's crust is about $2 \times 10^{-3}\%$.

HELIUM (Gr. *helios*, the sun) Ger. *Helium*. Fr. *hélium*. Helium is a very light, colorless, odorless, inert, atmospheric gas. It was found spectroscopically in the atmosphere of the sun by Lockyear in 1868. The gas was first isolated by Ramsay in 1895. Helium is present to a very slight degree in air, and to a much larger extent in certain mine gases and dissolved in spring water. Helium is a disintegration product of radioactive substances, so it is generally found in the ores of uranium, radium, etc. and from which it may be obtained by heating the mineral and pumping off the resulting gases. The chief source of helium is certain gas wells in the Texas-Panhandle containing 1 to 2% of the element; a more recently discovered supply has been found in wells of southeastern Colorado yielding as high as 7%, while a field in northwestern New Mexico produces gas with an 8% helium content. The best known foreign source, the blue rock salt of Germany, yields gas with only 0.001% to 0.19% helium. It is an extremely rare element in the crust of the earth where it is present in an occluded state or trapped in tiny holes in the rocks; however, it is probable that the atmosphere above 13 miles is made up almost entirely of hydrogen and helium. The chief use for helium is to inflate lighter-than-air machines; although heavier than hydrogen its advantage is due to the fact that it will neither burn nor support combustion. It has been used for the production of the lowest temperatures ever obtained; i.e., below −271° C. The most important use of helium is to replace the nitrogen in the air in caissons and for administration in asthmatic conditions. For the former it is less soluble in blood than is nitrogen; for the latter it is lighter and more penetrative in the narrowed passages permitting easier breathing. When multiple optical lenses are arranged in series, helium may be used to fill the spaces between them as light rays passing from a lens to helium are refracted less than in any other gas. Because of the ease of its detection it has been used as a tracer gas and allowed to diffuse through reservoir formations. Helium has been used to reduce the hazards of welding magnesium and as a diluent for anesthetic gases where its rapid diffusion aids in lung penetration and subsequent clearing of the anesthetic, and its inertness serves to prevent explosion of flammable anesthetic gas. In tank car quantities the price of helium is about \$11.00 per 1000 cubic feet (39¢ per 1000 liters), while the cost of refilling a 200 cubic foot cylinder is about \$16.00 (\$2.83 per 1000 cubic liters).

HOLMIUM (from *Holmia,* latinized form of Stockholm, near which the rare earth minerals are found) Ger. *Holmium.* Fr. *holmium.* Holmium is one of the least abundant of the rare earth metals, making up only about $5 \times 10^{-5}\%$ of the earth's crust. It has never been isolated, the oxide holmia, Ho_2O_3, being very difficult to obtain in a pure state. The element was discovered in 1879 by P. T. Cleve. Holmium salts, a few of which have been prepared, are yellow with an orange tinge.

HYDROGEN (Gr. *hydro genes,* water former) Ger. *Wasserstoff.* Fr. *hydrogène.* Hydrogen is a colorless, odorless, combustible gas. Although it was known to the alchemists, hydrogen was first recognized as a distinct substance by Cavendish in 1766. Hydrogen occurs in the free state in certain natural gases and in volcanic exhalations. Hydrogen and helium are probably the major constituents of the earth's atmosphere above 13 miles. In water one part of hydrogen is combined with eight parts of oxygen and from which it can be separated by electrolysis, the usual method of preparing the pure gas. It is also obtained by the action of acids on metals and by the action of steam on certain metals such as iron at a red heat. Hydrogen is element number one in the periodic table; it has the lowest atomic weight of any element and is the lightest gas; the hydrogen molecule diffuses faster than any other. The gas is used in the oxy-hydrogen flame in welding, in hydrogenating oils, fats and other substances, for filling balloons, and as a reducing agent. Hydrogen is a necessary constituent in hundreds of important compounds. All acids owe their acidity to the presence of the hydrogen ion in their solutions. All hydrocarbons, carbohydrates, proteins, fats, in fact nearly all organic compounds contain hydrogen. A cylinder holding the equivalent of 200 cubic feet (5663 cubic liters) of hydrogen at atmospheric pressure can be refilled for about \$6.00.

DEUTERIUM (Symbol D) is the isotope of hydrogen with an atomic weight of two. It was discovered in 1931 by H. C. Urey with the aid of F. G. Brickwedde and G. M. Murphy in distilling liquid hydrogen near its triple point of 13.92° *K.* Normally hydrogen contains about one part deuterium in 5,000. Most deuterium is produced by an electrolytic process as a compound with oxygen; namely, as heavy water or D_2O. In atomic energy research heavy water became important because of its action as a moderator. Plants and animals cannot live in water containing a high percentage of D_2O. The use of deuterium makes possible the tracing of food in metabolic processes. Incorporating small amounts in an animal's food and later locating the deuterium in the various tissues or excretory products is the method employed in this work. A very pure deuterium in glass at normal pressure sells for about \$10 per 100 cc.

ILLINIUM (Named for the University and State of Illinois, U. S. A.) Ger. *Illinium.* Illinium, element number 61, was the last of the rare earths to be discovered. It was found in 1926 by Harris, Yntema, and Hopkins, as the result of work carried on at the University of Illinois. These investigators did not actually isolate illinium or its salts but based their claim of discovery on the appearance of 135 lines in the arc spectrum, two bands in the absorption spectrum, and two lines in the *L* series. They worked with cerium earths, fractionating the neodymium and samarium concentrates as magnesium double nitrates and bromates, and guiding the concentration of illinium by the shift of the spectral absorption band. See also *cyclonium*, *florentium*, and *promethium*.

INDIUM (From its indigo-blue spectrum line) Ger. *Indium*. Fr. *indium*. A metal of the aluminum family, it is silvery white, very malleable and ductile, softer than lead, unaffected by air or water but on ignition forms In_2O_3. It was first isolated in 1863 by F. Reich and T. Richter. Indium is a rare metal, making up about $1 \times 10^{-5}\%$ of the earth's crust. It never occurs native but is found as an impurity to the extent of about 0.1% in various zinc ores. As an alloying material with non-ferrous metals it increases corrosion resistance and decreases the melting point. An alloy of indium, cadmium, bismuth, lead and tin melts below 50° C. and is used to make casts for broken limbs. The metal is used to coat chemical pumps and to replace chromium in bright work. Indium and its compounds are used in jewelry, pharmaceuticals, electrical contacts, dental alloys, glass colorants, and mordants. Greater production and increased uses in recent years have lowered the price materially. The price is about $32 per pound ($70 per kilogram).

IODINE (Gr. *iodes*, violet) Ger. *Jod*. Fr. *iode*. The German symbol of J for iodine, and the French symbol of Az for nitrogen are the only instances of different national usage in this respect. Iodine, one of the halogen elements, is a bluish-black, crystalline solid which is converted into a violet vapor on heating. It was discovered in 1811 by B. Courtois. Gay Lussac aided him in investigating the new substance and in proving it to be an element. Iodine does not occur free in nature but its compounds are found in sea water as well as in sea plants and animals. Certain varieties of kelp absorb it from the water in preference to bromine which occurs in much larger quantities. In the earth's rocky crust, iodine must be classed as a rare element being present there to the extent of only $6 \times 10^{-6}\%$. Iodine was formerly obtained from the ashes of seaweeds, but most of it is now made from the mother liquors after the extraction of sodium nitrate from the caliche of Chile in which iodine is present in the form of iodates. The iodine is obtained from iodates by heating them with sodium bisulfite. Iodine plays an important part in animal economy, it being present in small quantities in all the organs, especially the thyroid gland. The element is used in medicine, both as a tincture (the free element dissolved in alcohol) and in compounds, mostly for external use as antiseptics. Iodine is important in analytical chemistry as are several of its compounds, notably KI and KIO_3. Some iodides are used in photography. A considerable amount of iodine is used in the aniline dye industry. It acts as a powerful poison. Iodine usually has a valence of one, forming iodides such as NaI, KI, AgI, BiI_3, CaI_2, etc. It also forms iodates (salts of iodic acid, HIO_3) and periodates (salts of periodic acid, HIO_4). Tri-valent iodine is known in compounds like ICl_3. The wholesale price of crude iodine is about $1.70 per pound ($3.75 per kilogram).

IRIDIUM (So named from the iridescent color of its salts) Ger. *Iridium*. Fr. *iridium*. Iridium is a metal of the platinum family. It is hard, brittle, nonductile, and in appearance lies between silver and tin. Iridium was first identified as a new metal by Tennant in 1804. It is found in alluvial deposits alloyed with platinum as platiniridium, or with osmium as osmiridium. Iridium is very rare making up only $1 \times 10^{-6}\%$ of the earth's crust. The metal is generally obtained by precipitation from solution as $(NH_4)_2IrCl_6$; this is then heated in a current of hydrogen, leaving the impure iridium which must further undergo a complicated process to remove traces of rhodium, ruthenium and iron. Iridium, when alloyed with platinum, forms a hard, resistant metal that is used to make scientific apparatus, surgical tools, standard weights and lengths, and pen points. Because of its hardness the element itself is used to make pivots and magneto contacts. Iridium black, made by the action of light on alcoholic sulfate solutions, is used as a catalytic agent. Acids, even aqua regia, do not act on iridium, while fluorine and chlorine do not act until a red heat is reached. Fusion with KOH and KNO_3 results in the formation of K_2IrO_4. $IrCl_4$, $IrCl_3$, $K_3IrCl_6 \cdot 3H_2O$, Ir_2O_3, IrO_2, and $K_3Ir(CN)_6$ are some typical iridium compounds. The wholesale price of the metal is about $1,250 per pound ($2.75 per gram).

IRON (Anglo-Saxon, *iren*, or *isern*. Latin, *ferrum*, from which is derived the symbol Fe) Ger. *Eisen*. Fr. *fer*. Iron is a bright, silvery white metal which tarnishes in air or water. Perfectly dry air does not affect it, but under normal atmospheric conditions an unprotected sample will, in time, rust away completely. Next to aluminum, iron is the most abundant of all metals, and has been known from very early times. It is sometimes found native in meteors, in which it is alloyed with from 1 to 10% of nickel. The usual source of the metal is magnetite (Fe_3O_4) and hematite (Fe_2O_3), which are the ores that are mined in vast quantities in the Lake Superior district. The iron is obtained by reducing the ores with carbon in a blast furnace. The fusible carbide, cast iron, can be purified by "puddling" in a reverberatory furnace with ore, limestone, etc. to remove C, S, P and Si with mechanical working to produce wrought iron; or completely fused at a higher temperature for steel, to which alloying additions may be made. Pure iron is rather soft, malleable and ductile. Small amounts of carbon greatly change these properties, making the iron harder and of higher tensile strength; too much carbon makes iron brittle. Iron is very strongly magnetic. It is readily attacked by dilute mineral acids, but can be rendered passive by concentrated nitric acid. Pure iron is seldom used except in medicine for treatment of anemia, and in analytical work as a reducing agent, but the so-called "ingot iron" and electrolytic iron are nearly pure, as are certain low carbon steels. The quality of steel is greatly improved by the addition of small amounts of nickel, cobalt, chromium, vanadium, or tungsten. FeO, Fe_2O_3, $FeSO_4$, FeS, $FeCl_3$ and $Fe(NO_3)_3$ are typical iron compounds. Crude pig iron sells for about $40 per ton ($44 per metric ton), but U. S. P. powdered iron costs about $1 per pound ($2.20 per kilogram).

KRYPTON (Gr. *kryptos*, hidden) Ger. *Krypton*. Fr. *crypton*. Krypton is one of the rare, inert atmospheric gases. It was first isolated by W. Ramsay and M. W. Travers in 1898 by fractionally distilling liquid argon which contained the other inert gases and among which krypton is present to the extent of about 0.01% of the crude argon. It is seldom used in the pure state but is usually allowed to remain in the argon which is used in filling light bulbs. Because of its greater heat conductivity pure krypton is used in place of argon in mine safety lamps. In glass at normal atmospheric pressure, a liter of pure krypton sells for about $45 ($1275 per cubic foot).

LANTHANUM (Gr. *lanthano*, to be concealed) Ger. *Lanthan*. Fr. *lanthane*. Lanthanum, a tin-white metal which is malleable but not ductile, was discovered in 1839 by C. G. Mosander. It burns in air at 440-460° C. to form the oxide La_2O_3, and generally occurs with the other rare earth elements in the combined form in such minerals as scheelite, monazite, apatite, cerite, orthite, as well as in certain kinds of calcite and fluorspar. The element is fairly common, making up about $3.5 \times 10^{-4}\%$ of the earth's crust. Lanthanum salts are colorless unless derived from a colored acid. Most of the usual salts of lanthanum have been prepared, such as the chloride, $LaCl_3$, from which the metal is made by reduction with sodium, the sulfate, $La_2(SO_4)_3$, etc. It has no important commercial applications. The price is about $9 per gram.

LEAD (Medieval *led*, *leed*, *lead*. Anglo-Saxon *léad*, akin to Danish *lood*. L. *plumbum*, from which we get the symbol Pb) Ger. *Blei*. Fr. *plomb*. Lead is a dull, gray, heavy metal with little tenacity.

It is very soft and easily fused, and has been known from ancient times. Lead is seldom found native, its most common ore being galena (PbS). Cerussite ($PbCO_3$), and anglesite ($PbSO_4$) occur in sufficient quantities to be mined, and a rare mineral plumbojarosite is used as an ore in Utah. Although lead is a common and useful metal, it is present in the earth's crust only to the extent of about $8 \times 10^{-4}\%$. The ores are roasted in some cases to form the sulfate, sulfide and oxide in such proportions that when the temperature is raised they react to form lead and sulfur dioxide. In the iron reduction process the ore is heated with iron, and the lead is set free. It is used in making pipes, sulfuric acid chambers, and other containers for corrosive liquids. Vast quantities are used in the lead plate type of storage battery, as well as in many valuable alloys such as Babbitt and type metal, shot, solder and pewter. Lead compounds are very important in the paint industry, white lead ($2PbCO_3 \cdot Pb(OH)_2$), red lead (Pb_3O_4), and lead chromates such as $PbCrO_4$ being common pigments while lead linoleate and other lead salts of fatty acids are well-known paint driers. Lead compounds are used in the manufacture of flint glass and enamels; lead oxide is used in vulcanizing rubber; the ethide, $Pb(C_2H_5)_4$ is a popular gasoline antiknock; and sodium plumbite (Na_2PbO_2) is used to sweeten gasoline by removing the sulfides as PbS. Lead is the stable end product of all natural radio-active elements. Radium D is one of the radio-active isotopes of lead. The nature of these isotopes as shown by the molecular weight of the lead found in a certain region is taken as an indication of its geological age. Lead and its soluble compounds are cumulative poisons, repeated small doses being as dangerous as a single large dose. Exposure to dust containing lead is a common cause of poisoning, "painters' colic" being an example. PbO, PbO_2, $Pb(NO_3)_2$, $Pb(C_2H_3O_2)_2$, and K_2PbO_3 are typical lead compounds. The wholesale price is about 15¢ per pound (33¢ per kilogram).

LITHIUM (Gr. *lithos*, stony) Ger. *Lithium*. Fr. *lithium*. Lithium, first in the alkali group of metals, is silvery white in color but it must be preserved in a well-stoppered bottle under a liquid which contains as little oxygen as possible to prevent tarnishing. Lithia, Li_2O, was discovered in 1817 by A. Arvedson in petalite. H. Davy, somewhat later, succeeded in isolating a little of the element by electrolyzing LiCl. The element, never occurring free, is widely distributed in its compounds and is slightly more abundant than copper in the earth's crust. The biggest United States deposits are in the Black Hills of South Dakota. It is the lightest of all metals, has the highest specific heat of any element, and is the hardest of the alkali metals being about as hard as lead. It is used as a degasifier, deoxidizer and desulfurizer for molten metals, as a hardener in lead base alloys, and as a grain refiner of nonferrous metals. Thus used as a refining agent, lithium is encased in aluminum, bronze or other metal and added to molten metal of the same type. The carbonate and the citrate are used in medicine, the carbonate in ceramic glazes, the chloride in air conditioning, the fluoride as a flux in welding aluminum, and the hydride in generating hydrogen. In the form of compounds such as the zirconate, cobaltite, or manganite the element is used in porcelain enamels to give greater adherence, improved thermal shock, lowering firing temperatures, improved acid resistance, and increased opacity. The stearate is put in lubricating greases to speed flow in sub-zero cold. Subject to solving processing technicalities, a future use may be in atomic energy since lithium is fissionable and on a pound for pound basis releases two or three times as much energy as uranium in addition to being a more abundant element. The price of lithium is about $11.00 per pound ($24.20 per kilogram).

LUTECIUM (From *Lutecia*, ancient name of Paris) Ger. *Lutetium*. Fr. *lutetium*. Lutecium is the last of the rare earth elements in the periodic table. It was discovered in 1905 by G. Urbain and is found in various rare earth minerals, especially those containing yttrium. Lutecium is one of the less abundant of the rare earths, it being present in the earth's crust in the amount of about $7 \times 10^{-5}\%$. The metal has not been prepared in the pure state, but a few salts are known, including lutecia, Lu_2O_3, and the sulfate, $Lu_2(SO_4)_3$.

MAGNESIUM (L. *Magnesia*, a district in Asia Minor) Ger. *Magnesium*. Fr. *magnésium*. Magnesium is a very light, silvery white metal that tarnishes slightly in air. In 1808 H. Davy proved that magnesia was the oxide of a metal which he called magnium. This name was later changed to magnesium. The metal was isolated by Bussy in 1829. It does not occur free in nature, but its compounds are quite common. Magnesite ($MgCO_3$), dolomite ($MgCO_3 \cdot CaCO_3$), carnalite ($KCl \cdot MgCl_2$), and Epsom salt ($MgSO_4 \cdot 7H_2O$) are common magnesium minerals. The metal is generally made by electrolyzing the fused chloride. In this country the chief sources of magnesium are the Michigan brines and sea water. Magnesium as a powder or a ribbon will burn in air with a brilliant, white flame, and in these forms is used as a "flashlight powder" and for pyrotechnics. It is the easiest of all metals to machine, and can also be cast, rolled, or forged. An alloy of about 90% magnesium and 10% aluminum is widely used because of its high strength per pound. Magnesium is also used to dehydrate oils, to form the Grignard reagent so important in organic chemistry, and as a deoxidizer in making certain alloys. The element is essential to both animal and vegetable life. MgO and $MgCO_3$ are used in ceramics, while several magnesium compounds are important medicinally. Only silver, copper and aluminum have a greater electrical conductivity than magnesium. Aluminum has also greater mass conductivity. During the war production of the metal was greatly increased to supply the needs for pyrotechnics, incendiaries, and aircraft. Peacetime uses, such as in garden tools, bicycles, rotating and reciprocating parts in machinery where lightness is desired, are finding ever greater acceptance. The price of the metal in ingot form is about 20¢ per pound (44¢ per kilogram).

MANGANESE (L. *magnes*, magnet, as pyrolusite was formerly confused with iron ores which are magnetic) Ger. *Mangan*. Fr. *manganèse*. Manganese is a hard, brittle metal with a brilliant luster and a reddish tinge. In 1740 Pott showed that pyrolusite (MnO_2), contained no iron, and formed a series of well-defined salts. In 1774 Scheele proved that it contained a new element. Gahn was the first to isolate the metal. Manganese is quite widely distributed in the combined state in such ores as pyrolusite (MnO_2), braunite (Mn_2O_3), and hausmannite (Mn_3O_4), as well as in the form of the sulfide, sulfate, carbonate, silicate, and tungstate. The metal can be prepared by reducing the oxides with carbon or aluminum; by reducing the halogen salts with sodium, magnesium, or aluminum; by reducing a manganese solution with various metals; and by electrolysis. The most important use of manganese is in the alloys ferromanganese and spiegeleisen in which form it is added to steel to impart toughness and hardness without brittleness. Manganese is essential to plant and animal life and to reproduction in animals. The oxide MnO_2 is used in the manufacture of chlorine and iodine, in making a black enamel for pottery, as a drier for oils, and as a depolarizer in dry cells; $MnCl_2$ is used in dyeing cotton; $MnSO_4$ is employed in calico printing; $KMnO_4$ and $NaMnO_4$ are used as disinfectants and in analytical chemistry. The chemical industry uses about 10% of the manganese produced, while metallurgy consumes the balance. The price has declined in recent years to about 30¢ per pound (66¢ per kilogram).

MASURIUM (From Masurian province belonging to Germany) Ger. *Masurium*. Masurium is a metal of the manganese family. It was discovered in 1924 by Noddack, Tacke, and Berg. It is found together with rhenium in the minerals gadolinite, molybdenite, sperryite, and in platinum ores. Its properties are not as well known as those of rhenium, as the latter element is much more abundant. The metal is thought to have a high melting point, and to form masurates such as Na_2MaO_4. The relative occurrence of masurium in the earth's crust is estimated at 1 × $10^{-7}\%$. See also *technetium*.

MERCURY (L. *Mercurius*, the god and planet. Symbol Hg from L. *hydrargyrum*) Ger. *Quecksilber*. Fr. *mercure*. Mercury, which is the only metal that is liquid at all ordinary temperatures is silvery white and heavier than lead. It was known in ancient times as liquid silver, and was much investigated by the alchemists. G. Agricola called it a metal, and Lavoisier showed its elemental nature. Mercury is neither abundantly nor widely distributed in nature being present in the earth's crust to the extent of only about 2.7 × $10^{-6}\%$. It sometimes occurs native in small amounts, or as a silver amalgam, but it is most often found as cinnabar (HgS). It is prepared from the sulfide by combining the sulfur with oxygen or lime and distilling the liberated mercury into condensers. Mercury is a shining, mobile liquid with little tendency to adhere to glass and is widely used in thermometers, barometers, and manometers. Gases inert to mercury do not penetrate it and hence they are often collected over it. The soluble salts of mercury are poisonous. Mercury alloys, which are called amalgams, are much used in dentistry. Mercurous chloride or calomel (HgCl) is used as a purgative. Mercuric chloride or corrosive sublimate ($HgCl_2$), a very poisonous substance, is used as an external antiseptic, as are some other mercury salts. These poisonous compounds are not very toxic to plants, and are often used in combatting plant diseases and insect pests. HgS is known as vermilion and is used as a pigment. Sodium amalgam is a valuable reducing agent. The metal is used in the extraction of gold and silver; in the mercury arc lamp; as the cathode in certain standard cells; in electric rectifiers and switches; in fluorescent lamps; and in the manufacture of mercury salts. Mercury is important in the electrolytic production of chlorine and sodium hydroxide. The chief wartime uses for mercury and its salts were in electric batteries, as fulminate primer, in scientific instruments, and in anti-fouling ship paints. A growing peacetime use is in mercury vapor boilers which require about 35 pounds of mercury per horsepower. The price of mercury, which often undergoes rapid changes, is about $80 per 76 pound flask ($2.30 per kilogram).

MOLYBDENUM (Gr. *molybdos*, lead. Or L. *molybdoena*, galena) Ger. *Molybdenum* or *Molybdän*. Fr. *molybdéne*. Molybdenum is a silvery white metal of the chromium group and is very hard and tough. It was discovered in 1778 by Scheele, and first prepared in 1782 by P. J. Hjelm. It does not occur free in nature and it is one of the scarcer components of the earth's crust being present to the extent of about 7.2 × $10^{-4}\%$. The two most important ores of molybdenum are molybdenite, MoS_2, and wulfenite, $PbMoO_4$. The concentrated ores are reduced with aluminum, carbon, or other reducing agents. The metal, of which the United States has a good supply is employed in large quantities to make filament supports in incandescent lamps and radio tubes. As ferro-molybdenum it is used to add hardness and toughness to tool steel, boiler plate, gun barrels, armor plate, and armor piercing shells. Molybdenum steels usually contain 0.15% to 0.4% molybdenum. During the war 95% of the total molybdenum production went into steel. Certain molybdenum compounds are used in coloring pottery and fabrics, while ammonium molybdate is used in analytical chemistry to detect and determine phosphates. Molybdenum forms salts in which it has valencies of 3, 4, or 6, but the hexavalent salts are the most stable. MoO_3, $(NH_4)_2MoO_4$, MoO_2Cl_2, MoO_2, $CaMoO_4$, $PbMoO_4$, and MoS_3 are common compounds. The wholesale price of the metal is about $2.60 per pound ($5.70 per kilogram).

NEODYMIUM (Gr. *neos*, new, and *didymos*, twin) Ger. *Neodym*. Fr. *néodyme*. Neodymium is a metal with a slight yellow tinge. It was discovered in 1885 by C. A. von Welsbach and is one of the most abundant of the rare earth elements, being second to cerium in this respect, and making up 9 × $10^{-4}\%$ of the earth's crust. It is three to four times as common as praseodymium, along with which it constitutes *didymium;* the latter was once thought to be an element. It is found in minerals which contain the other rare earths, such as cerite, monazite sand, gadolinite, etc. The compounds of neodymium are rose-red or reddish violet in color. The usual salts of this element have been prepared including Nd_2O_3 or neodymia, $NdCl_3$, $Nd(OH)_3$, $Nd_2(SO_4)_3$, $Nd(NO_3)_3 \cdot 6H_2O$ and others. Neodymium and its salts have no important applications.

NEON (Gr. *neos*, new) Ger. *Neon.* Fr. *néon.* Neon is one of the inert atmospheric gases. It was first isolated in 1898 by W. Ramsay and M. W. Travers who fractionally distilled liquid argon which contained the other inert gases, neon making up 0.16% of crude argon. Neon is in the first fraction of this distillation, it being the most volatile as well as the lightest of the inert gases with the exception of helium. Neon is slightly lower in density than oxygen and is being used to a large extent in the so-called neon lights which involve passing an electric discharge through an evacuated tube into which a little neon has been admitted. A brilliant orange-red glow is produced which has excellent fog-penetrating power, and which is quite efficient from the standpoint of light produced for current consumed. In glass containers, neon sells for about $6.00 per liter at normal pressure ($170.00 per cubic foot).

NEPTUNIUM (being the first trans-uranium element, it was named for Neptune, the first trans-Uranus planet) This element, No. 93, was first produced in 1940 by McMillan and Abelson by fast neutron bombardment of uranium. Other investigators, among them E. Fermi, Niels Bohr, O. Frisch, L. Meitner, O. Hahn, and F. Strassman, worked on uranium fission and contributed to the discovery of the trans-uranium elements. Several isotopes are known and one of them, with a half-life of 2.3×10^6 years, has been collected in macroscopic amounts. This particular isotope, Np-237, has the longest half-life of any of the synthetic elements so far known. Its alpha radioactivity is only about 1000 times that of uranium and the element can be handled with comparative safety. The chemical properties of neptunium closely resemble those of uranium; both elements have valencies of 3, 4, 5, and 6, but the lower valencies are more stable in neptunium than in uranium, which property is used in their separation.

NICKEL (Ger. *Nickel*, a goblin or devil) Ger. *Nickel.* Fr. *nickel.* Nickel is a bright, silvery metal of the iron-cobalt-nickel triad. It is hard, malleable, ductile, and has high tensile strength. The metal was used in nickel-copper alloys for coinage for several thousand years, but it was first recognized as a new metal by Cronstedt in 1750, who succeeded in isolating the metal in an impure form and named it nickel from *Kupfernickel*, an ore that appeared to contain copper yet yielded none. The element ranks 21st in abundance in the earth's crust. Nickel is found native in meteors alloyed with iron, but the commercial sources are such ores as are found in Ontario, New Caledonia, and Norway. These ores include $NiAs_2$, Ni_4As_3, $Ni_3(AsO_4)_2 \cdot 8H_2O$, Ni_2O_3, $(NiMg)\ SiO_3 \cdot xH_2O$ and $NiS \cdot 2FeS$. Each of these ores is treated in a different manner depending on the amount and character of the impurities. Sometimes copper and nickel are refined together, the resulting product being a natural alloy of nickel and copper known as *monel metal.* Nickel is always found associated with cobalt from which it is separated with difficulty. This can be done by forming the insoluble nickel dimethylglyoxime, or by fractional distillation of the mixed carbonyls which are then decomposed by heating. Nickel is magnetic at ordinary temperatures, but not at 360° C. Air and sea water have very little effect on nickel, nor do hydrochloric or sulfuric acids corrode it at ordinary temperatures. At a red heat, nickel slowly decomposes steam. The addition of up to 18% of tungsten greatly increases the resistance of nickel to corrosion. Nickel is widely used as a catalyst, since in the finely divided state it speeds up many reactions such as the hydrogenation of oils, the reduction of nitrogen oxides to ammonia, the decomposition of acetylene, etc. Nickel plated objects are very common, as are alloys of nickel such as invar, German silver, constantin, chromel, monel metal, etc. Nickel steels are much used because of their toughness and resistance to corrosion. Nichrome and chromel are the most widely used alloys in the manufacture of electrical heating units. Nickel was so necessary during the war that it was one of the first metals to be put on the priority list and one of the last to be taken off. Nickel and nickel bronze or other nickel alloys are used as coinage in several countries. Edison cells use nickel oxide or hydroxide for depolarizing electrodes. Nickel usually behaves as a divalent element, the trivalent salts being unstable as a rule. NiO, Ni_2O_3, $NiCl_2$, $Ni(OH)_2$, NiS, $NiSO_4$, and $Ni(NO_3)_2$ are common nickel salts. The wholesale price of nickel is about 35¢ per pound (77¢ per kilogram).

NITROGEN (L. *nitro*, native soda; *gen*, forming) Ger. *Stickstoff*. Fr. *azote*, symbol Az, this symbol and J for iodine being the only instances of differences in national usage of chemical symbols. The compound PbN_6 is called lead azide even in this country, an example of the persistence of the old French name. Nitrogen is a colorless, odorless gas present in the atmosphere to the extent of 75.5% by weight, and 78.06% by volume. D. Rutherford, in 1772 is credited with its discovery, but Cavendish, Lavoisier and others investigated "phlogisticated air," as air minus oxygen was called. Nitrogen is a vital constituent of animal and plant diets, and forms a part of all living bodies. Certain legumes, notably beans, have the power of absorbing nitrogen from the air and transforming it into proteins which is in turn food for animals. This nitrogen cycle in the soil is essential to life. Fixed or combined nitrogen is present in many mineral deposits as saltpeter, KNO_3, or soda niter, $NaNO_3$. Because of its slight solubility in water, nitrogen is contained in many natural waters and has been found in the gases from springs, geysers, and volcanos. It is prepared by removing the oxygen and carbon dioxide from the air with hot copper and lime. This, of course, leaves the nitrogen contaminated with the inert gases. It may be prepared in the laboratory by heating an aqueous solution of a mixture of 1 mole $NaNO_2$ and ½ mole $(NH_4)_2SO_4$. Nitrogen has been made by the fractional distillation of liquid air, and by reactions with substances containing nitrogen of which the following equation is an example: $2NH_3 + 3Cl_2 = 6HCl + N_2$. Gaseous nitrogen is often used to form an inert atmosphere for the preservation of materials, and to fill incandescent bulbs, although the gas is not entirely inert since it combines directly with lithium, calcium, and magnesium when it is heated with these metals. Nitrogen is also used in the manufacture of ammonia, which may in turn be oxidized to nitric acid. Nitrogen compounds are very numerous, all nitrates, nitrites, nitrides, cyanides, cyanates, and all nitro, amino, and ammonium compounds being included in this category. Many nitrogen compounds are explosive, some, like picric acid, being comparatively stable, while others, like nitrogen iodide, can be exploded by touching them with a feather. Nitrogen forms five oxides; N_2O, NO, N_2O_3, NO_2, and N_2O_5. Ammonia, NH_3, nitric acid, HNO_3, and urea are perhaps the most important nitrogen compounds. It is an essential substance in time of war since nitrogen is the basis of every military explosive, as well as an essential ingredient of fertilizer for the production of food. A cylinder of nitrogen containing 14½ pounds (6.6 kilograms) or 200 cubic feet (5663 liters) at normal pressure can be refilled for about $5.

OSMIUM (Gr. *osme*, a smell, from the odor of its volatile tetroxide) Ger. *Osmium*. Fr. *osmium*. Osmium is a brilliant metal of the platinum family, bluish in color and resembling zinc in appearance. It was discovered in 1804 by Tennant. It is found in nature alloyed with iridium in osmiridium, and in platinum sands in North and South America and the Urals. It may be precipitated from solution by H_2S as OsS_4, which on heating deposits osmium on the upper part of the crucible. Osmium may also be prepared by reducing OsO_4 with carbon monoxide or dioxide in a red hot porcelain tube. Osmium tetroxide melts at 45° and boils at 100°, yielding a very poisonous vapor which causes pathological disturbances even to the extent of blindness. Osmium has a specific gravity of 21.3 to 24 and has the greatest density of any known substance. It is harder than glass and is very brittle. The metal is readily dissolved by fuming nitric acid, aqua regia, or fused sodium or barium nitrate; it is also attacked by hot fluorine or chlorine. In the finely divided form osmium is a very effective catalyst, causing hydrogen and oxygen to explode at 40 to 50°. With an osmium catalyst ammonia can be made from its elements at 185 atmospheres and a temperature of 880 to 1000°. Its chief use is in the alloy osmiridium which is used to make pen points. Replacing jewels, alloys of osmium are used to make bearings for small instruments. Osmium is the only element which forms definite compounds with a valence of eight. It also forms salts in which it has valencies of 2, 3, 4, and 6. It is a scarce element forming only about $5 \times 10^{-6}\%$ of the earth's crust. $OsCl_2$, $OsCl_3$, H_2OsO_4, and OsO_4 are typical compounds. Osmium sells for about $50 per troy ounce ($1.60 per gram).

OXYGEN (Gr. *oxys*, sharp; *gen*, born) Ger. *Sauerstoff*. Fr. *oxygène*. Oxygen is a colorless, odorless, active gas. The liquid and solid forms have a pale blue color. It was discovered independently by Priestley and Scheele in 1774, and was known to the chemists of the 18th century as "dephlogisticated air." Oxygen is the most abundant element, making up 88.8% of the waters of the earth, 46% of the rocks and soils, and one-fourth of the atmosphere by weight or one-fifth by volume. The best commercial method of preparing oxygen is by the fractional distillation of liquid air, but it can also be obtained by the electrolysis of water containing dissolved electrolyte, or by heating HgO, BaO_2, $KClO_3$ or other oxygen-containing compounds. Oxygen is not combustible but supports combustion, and combines with all the elements except the inert gases of the argon group. All plant and animal life as we know it depends on oxygen either free or combined for its existence. The gas is used in the oxy-hydrogen and oxy-acetylene flames for welding; for ventilating submarines; for medical purposes; for oxidizing oils, etc.; for bleaching; and in determining the carbon content of steel and organic compounds. The element exists in two forms, the usual state being O_2, while ozone, a less common form is O_3. The name *ozone* was derived from a Greek word meaning "I smell"; the characteristic odor of the substance is often noticed around electrical machines. It is formed whenever an electric spark is produced, and can often be observed during thunder storms. Ozone is a very active oxidizing agent especially towards organic matter, and is used as a bactericide in sterilizing water. A cylinder holding 200 cubic feet (5663 liters) of oxygen at normal pressure can be refilled for about $5.60.

PALLADIUM (Named from the planetoid Pallas) Ger. *Palladium*. Fr. *palladium*. Palladium is a silvery white metal, less ductile but harder than platinum. It was discovered by Wollaston in 1803 and occurs native alloyed with platinum or gold, and as the selenide. It is present as an impurity in the nickeliferous ores of Sudbury, Ontario, from the matte of which it is sometimes isolated. Palladium is quite scarce, making up only about $5 \times 10^{-6}\%$ of the earth's crust. Palladium may be separated from the platinum group through precipitation as the iodide by adding potassium iodide to the solution. The metal is obtained by reduction of its salts with hydrogen, or by deposition from its solutions in the presence of zinc. Palladium occludes gases to a remarkable degree, especially hydrogen, and like other members of the platinum family, it is a very good catalyst, particularly when in a finely divided state. It is attacked by hot, concentrated acids and by fluorine or chlorine at high temperatures. Alloys of palladium and gold are useful as platinum substitutes and, because of their resistance to atmospheric corrosion, are used for astronomical and dental purposes and for coating the reflectors of searchlights. Palladium salts are used in photography. Palladium functions as a di-, tri-, and tetravalent element. $PdCl_2$, K_2PdCl_4, $PdCl_3$, PdO, $Pd_2O_3 \cdot xH_2O$, and $PdO_2 \cdot xH_2O$ are typical palladium compounds. The metal sells for about $24 per troy ounce (77¢ per gram).

PHOSPHORUS (Gr. *phosphoros*, light-bringer) Ger. *Phosphor*. Fr. *phosphore*. Phosphorus is a non-metallic element occurring in several different forms. White or colorless phosphorus, the ordinary form, turns yellow on exposure to light. Red phosphorus can be made by heating the white variety or exposing it to a bright light. When a solution of yellow phosphorus in phosphorous tribromide is held at 180°, a bright red precipitate separates. This is called scarlet phosphorus. Metallic or violet phosphorus is obtained by heating the red variety in contact with lead for ten hours at about 500° C., the phosphorus dissolves in the lead and, on cooling, separates in this crystalline modification. Only the red and yellow forms are commercially available. When pure, the red form is not poisonous whereas the yellow variety is extremely toxic. Many of the compounds of phosphorus are harmless. Phosphorus, first isolated from urine by H. Brandt in 1669, is the first element whose discoverer is known. Phosphorus does not occur native but its compounds are widely distributed. The chief source of the element is phosphate rock, generally $Ca_3(PO_4)_2$, which is treated with sulfuric acid to convert it to phosphoric acid which is then heated with carbon, the crude phosphorus being removed by distillation. It occurs in all fertile soils, being a necessary factor in plant and animal economy. It is an essential constituent in protoplasm, nervous tissue and bones, occurring in the latter as calcium phosphate. Phosphorus is used in making bronzes, in gas analysis, in medicine, in making matches, and as a "getter" in incandescent lamp manufacture. PH_3, PCl_3, PCl_5, $POCl_3$, Na_3PO_4, P_2O_3, and P_2O_5 are typical compounds. In large quantities the red and the yellow varieties sell for 33¢ and 25¢ per pound (77¢ and 55¢ per kilogram) respectively.

PLATINUM (Spanish *plata*, silver) Ger. *Platin*. Fr. *platine*. Platinum is a tin-white metal, malleable, ductile, and harder than silver; it does not tarnish in air or dissolve in any single acid. It was first brought to Europe from South America in 1735. The metal occurs native, either in a fairly pure state or alloyed with other metals and nuggets weighing up to 21 pounds have been found. Platinum makes up about $2 \times 10^{-5}\%$ of the earth's crust. In refining crude platinum, the metal is precipitated as $(NH_4)_2PtCl_6$ which on being heated yields spongy platinum. This is then rolled or hammered into the desired condition. Platinum is a very noble metal being dissolved only by aqua regia, but it is corroded by the halogens and caustic alkalies. Like all the metals in this group, platinum possesses considerable catalytic activity, a property most pronounced when the metal is in a finely divided state Platinum black, in which form it is generally used as a catalyst, is a fine, soft, black powder which is thought to be $PtO \cdot H_2O$. A platinum catalyst is used in the contact process for manufacturing sulfuric acid and other commercial reactions. Platinum is used for jewelry, and for electrical and dental purposes, as well as making crucibles, tongs, pyrometers, electrical contact points, pins, foil and plate. Another use in recent years is in decorating glassware, in which a platinum resin is applied and fired, leaving a bright and very thin coating of platinum. Very fine platinum nozzles, called spinnerets, are used to produce rayon, spun glass and other synthetic fibers. The chemical industry uses about 13% of the platinum produced. The most important war use is in the catalytic production of nitric acid which is so essential in explosives manufacture. The principal sources of the metal are Canada, U. S. S. R. of Russia, South Africa, and Colombia. $PtCl_2$, H_2PtCl_4, $PtCl_4$, K_2PtCl_6, and $PtO \cdot 2H_2O$ are typical platinum compounds. The price of the metal is about $62 per troy ounce ($2 per gram).

PLUTONIUM (being the second trans-uranium element, it was named for Pluto, the second trans-Uranus planet) This element, No. 94, was discovered by workers in the Radiation Laboratory in Berkeley, California. An isotope of atomic weight 238 was first detected by McMillan, Kennedy, Seaborg, and Wahl in 1940-41. The most important isotope, atomic weight 239 and half-life of 24,100 years, was found by Kennedy, Seaborg, Segre, and Wahl. This isotope was prepared in large quantities by neutron capture in the uranium pile. Like U-235 it is able to sustain a nuclear chain reaction and was the material used in the atom bomb. Plutonium is very similar chemically to uranium and neptunium. In fact, the elements from numbers 89 through 96 are considered as forming the actinide series of elements similar to the lanthanide or rare earth series. All four valence states of plutonium, namely 3, 4, 5 and 6, can coexist in equilibrium in the same solution but the trivalent form is more stable than in the cases of uranium and neptunium.

POLONIUM (named for Poland, the native country of its discoverer) This radioactive element was discovered by Mme. Curie in 1898 and was obtained by separation with bismuth from pitchblende. It is also known as *radium F* and is similar to the *dvitellurium* predicted by Mendeleev in 1891. This element, No. 84, is extremely scarce and none of its salts has been isolated.

POTASSIUM (Eng. *potash*. Symbol K from *kalium*) Ger. *Kalium*. Fr. *potassium*. Potassium is a light, silver-white alkali metal, first isolated in 1807 by H. Davy. It is found in nature in large quantities, but only in the combined form. It occurs in sylvite (KCl), saltpeter (KNO_3), and many other minerals. Potassium salts are necessary to plant life, and are therefore found in all fertile soils. Plants preferentially absorb these salts which are then found in the ash they leave on ignition. The metal is produced by the electrolysis of fused potassium hydroxide but it is seldom made as it has few uses. Like all of the alkali metals it tarnishes in air, combines with water at ordinary temperatures, and hence must be preserved under kerosene. An alloy of sodium and potassium which is a liquid at ordinary temperatures is used in high reading thermometers. Potassium is used in certain photoelectric cells, and in analysis for the determination of oxygen. Potassium has a valence of one in all of its compounds. KOH, KCN, KCl, KBr, KI, K_2SO_4, KNO_3, K_2SiO_3, K_2CO_3, K_2CrO_4, and $K_2Cr_2O_7$ are some of the more important potassium compounds. The metal retails for about $12.50 per pound ($27.50 per kilogram), but many of its salts are comparatively cheap.

PRASEODYMIUM (Gr. *praseos*, leek-green, and *didymos*, a twin) Ger. *Praseodym*. Fr. *praséodyme*. Praseodymium is a rare earth metal that has a yellow tinge and is strongly paramagnetic. It was discovered in 1885 by C. A. von Welsbach. The element is widely distributed but in rather small amounts being present to the extent of about $2.5 \times 10^{-4}\%$ in the earth's crust. A mixture of praseodymium and neodymium was for a long time considered to be an element, and was called *didymium*. The ratio of praseodymium to neodymium in most minerals is about 1 to 2, both metals being found in cerite and other rare earth minerals. A little didymia is used to impart a brown color to printed matter on gas mantles. Praseodymium salts are leek-green in color. Compounds of this metal are Pr_2O_3, PrO_2, $PrCl_3$, $Pr_2(SO_4)_3$.

PROMETHIUM (named for Prometheus, the fire-bringer of Greek mythology). This name for element No. 61 was proposed by Coryell, Marinsky and Glendenin of the Clinton Laboratories at Oak Ridge, Tenn. This group was the first to make a quantitative investigation of the element. Milligram quantities of the yellow chloride and the rose nitrate have been prepared. See also *cyclonium*, *florentium* and *illinium*.

PROTACTINIUM (Gr. *protos*, first) Ger. *Protaktinium*. Fr. *protactinium*. Protactinium is one of the four radioactive atomic species representing element 91 and is the only one that can be isolated in weighable quantities. The first isotope, UX_2 or brevium (half life 1.14 minutes), was discovered by Fajans in 1913. Protactinium itself was discovered in 1917 by Hahn and Meitner and independently and at about the same time by Soddy and Cranston. It is the mother substance of actinium and its series of natural radioactive elements, being itself derived from an isotope of uranium (actino-uranium). One ton of uranium in any natural ore contains about 0.27 grams protactinium. The oxide Pa_2O_5 was first isolated in 1927, the metal itself in 1934. The atomic weight of the element was listed for the first time in the International Atomic Weight Table of 1936. The half life of protactinium is about 3.2×10^4 years.

RADIUM (L. *radius*, ray) Ger. *Radium*. Fr. *radium*. Radium is a radioactive element. It has been prepared as a white metal which immediately becomes black on exposure to air. The metal will decompose water in the cold, and blackens organic matter such as paper on contact. It was discovered in 1898 by P. Curie and his wife, M. S. Curie. Radium is a decomposition product of uranium, and is always found with that metal, generally to the extent of about one part in three million. The most important source is the pitchblende found at Great Bear Lake in northern Canada, where more than 100 grams of radium are extracted annually. Another important source of radium is the carnotite sand of Colorado. The element is constantly giving off heat, the temperature of radium and its salts being about a degree and a half higher than that of its surroundings. During its 2300 years of life a gram of radium gives off 250,000 times as much energy as the burning of a gram of coal. Each gram of radium produces about a tenth of a cubic millimeter of emanation each day. This gas is pumped off and sealed in tiny tubes which are applied to the diseased tissue when radium is used to combat cancerous growths and skin diseases. Radium and its salts are extremely poisonous to all life; the unskillful application of the radiation is very dangerous. The radium of commerce is generally in the form of the chloride or bromide. The final decomposition product of radium is an isotope of lead. The carbonate and sulfate are used in luminous paints. The price of radium was about $20,000 per gram in 1938 but it is no longer quoted on the open market.

RADON, NITON or RADIUM EMANATION (The name *radon* was chosen because it comes from radium. The name *niton* is from L. *nitens*, shining). Ger. *Niton*. Fr. *niton*. Radon is a gaseous substance emanating from radium and having radioactive properties of its own. It was discovered in 1900 by Dorn but was observed at about the same time by the Curies, Gray, Rutherford and Ramsay. The gas appears to be inert and a member of the argon family and has been liquefied and solidified by Rutherford, Ramsay and others. It decomposes into a radioactive solid and alpha particles, each of which is an atom of helium carrying two unit positive charges. The half life of radon is 3.83 days. For the method of using radon, see *radium*.

RHENIUM (named from the Rhine province belonging to Germany) Ger. *Rhenium*. Rhenium is a member of the manganese family of metals, and was once called dwimanganese. It was discovered by Noddack, Tacke, and Berg in 1924, at the same time that they discovered masurium or ekamanganese. Both of these metals are found in the combined state in platinum ores, gadolinite, molybdenite, and sperryite. Rhenium is a rare element making up only about $1 \times 10^{-7}\%$ of the earth's crust. The metal is stable in air and possesses a very high melting point and boiling point. The most stable rhenium compounds are those in which the element has a valence of six or seven. Re_2O_7, $HReO_4$ (a strong acid), $KReO_4$, $ReCl_6$, Re_2S_7, ReS_3, ReS_2, ReO_2, and ReO_3 are known. The metal is being prepared in Germany to the extent of about 150 kilograms a year. Platinum-rhenium thermocouples have been made, and the metal may find some use as a catalyst. The price is about \$4 per gram.

RHODIUM (Gr. *rhodon*, a rose, from the color of the aqueous solutions of its salts) Ger. *Rhodium*. Fr. *rhodium*. Rhodium, a silvery white metal of the platinum family, was discovered in 1804 by Wollaston. It occurs as an alloy in platinum ores, in osmiridium, and in the gold-rhodium alloys known as rhodite, which are from 30 to 43% rhodium. It is considered a rare element being present to the extent of about $1 \times 10^{-6}\%$ of the earth's crust. The metal is insoluble in acids or aqua regia but when fused with potassium acid sulfate it yields the sulfate. An alloy of 95% platinum and 5% rhodium is superior to platinum for making crucibles and other laboratory equipment. Pure rhodium is attacked by chlorine or sulfur more readily than is any other metal in the platinum group. Rhodium is superior to chromium when used in searchlight and projection reflectors. The presence of rhodium adds hardness to platinum or palladium. For this reason it is used in the spinnerets for making rayon and glass fibers. Rhodium is used in conjunction with platinum to make thermocouples. Rhodium black, a finely divided substance containing some oxide or hydride, is used as a catalyst and for producing a black color in decorating porcelain. A new use for rhodium is in plating standard weights. $RhCl_2$, $RhCl_3 \cdot xH_2O$, $Na_3RhCl_6 \cdot 18H_2O$, Rh_2O_3, RhO_2, Na_2RhO_4 are typical compounds. The price is about \$125 per troy ounce (\$4 per gram).

RUBIDIUM (L. *rubidus*, red) Ger. *Rubidium*. Fr. *rubidium*. Rubidium is a silvery-white alkali metal resembling potassium. It inflames spontaneously in air, and must be preserved out of contact with air and water. Rubidium is the second most electropositive metal, being exceeded only by cesium in this respect. It was discovered spectroscopically in 1860 by Bunson and Kirchhoff and is present in several rare minerals, the chief source being the mother-liquors from carnotite refineries. There are no rich deposits but the element is widely distributed making up about $3 \times 10^{-4}\%$ of the earth's crust. Its salts impart to the non-luminous flame a very brilliant red color. The metal is softer than any metal except cesium and forms a series of salts such as $RbCl$, $RbNO_3$, Rb_2SO_4, Rb_2O, etc. Rubidium and its salts have no important uses, although the metal has been used in photoelectric cells. The price is about \$15 a gram.

RUTHENIUM (*Ruthenia*, Russia) Ger. *Ruthenium*. Fr. *ruthénium*. Ruthenium is a hard, brittle metal of the platinum family, resembling platinum in luster and appearance. The element was named by Osann who discovered it in 1828. It was first made in the pure state by Klaus in 1845. Ruthenium is very scarce being present in the earth's crust in the amount of about $5 \times 10^{-6}\%$. It occurs in the rare mineral laurite, Ru_2S_3, but it is obtained from osmiridium, in which it occurs as an impurity to the extent of 6% or less. Ruthenium has several different valencies in its various compounds, $RuCl_2$, $RuCl_3$, K_2RuCl_5, K_2RuCl_6, Ru_2O_3, RuO_2, and $K_2RuO_4 \cdot H_2O$ being typical ruthenium salts. The metal occludes gases, and is sometimes used to catalyze oxidation reactions. Ruthenium is of little commercial importance although it is sometimes used as an alloy with other platinum group metals. It costs about \$35 per troy ounce (\$1.13 per gram).

SAMARIUM (named after *Samarski*, a Russian engineer) Ger. *Samarium*. Fr. *samarium*. Samarium is a hard, brittle, yellowish-gray, lustrous metal which quickly tarnishes in air. It was discovered in 1879 by Lecoq de Boisbaudran and, like the other rare earths, is found in small quantities in such minerals as cerite, gadolinite, samarskite and others. It is present in the earth's crust to the extent of about $3.5 \times 10^{-4}\%$. It may be separated from lanthanum, praseodymium, and neodymium by converting the mixed oxides to the anhydrous chlorides and passing in a stream of dry hydrogen at a red heat, thus converting the samarium to $SmCl_2$. This is insoluble in alcohol, whereas the chlorides of the others are soluble. Samarium salts are pale yellow in color and, like the metal, are unimportant commercially. The usual compounds of samarium have been prepared, including Sm_2O_3 or samaria, Sm_2S_3, $Sm_2(SO_4)_3$, $SmCl_3$, $Sm(NO_3)_3 \cdot 6H_2O$ and others.

SCANDIUM (Named after the Scandinavian peninsula by its Swedish discoverer) Ger. *Scandium.* Fr. *scandium.* Scandium itself has not been isolated, but the properties of its salts prove it to be identical with the ekaboron predicted by Mendeleev. It was discovered in 1879 by L. F. Nilson and is found in a few rare minerals such as wolframite, wiikite and euxenite to the extent of one or two percent Sc_2O_3. The element makes up about $6 \times 10^{-4}\%$ of the earth's crust. $ScCl_3$, $ScBr_3 \cdot 6H_2O$, Sc_2O_3 or scandia, Sc_2S_3, $Sc(OH)_3$, $Sc_2(SO_4)_3$ and many other scandium compounds have been prepared.

SELENIUM (Gr. *selene*, the moon) Ger. *Selen.* Fr. *sélénium.* Selenium is a non-metallic element which exists in several allotropic forms. It was discovered in 1817 by J. J. Berzelius and J. G. Gahn. Selenium is found in many sulfide ores generally in the form of selenides but sometimes native. The most common ore is clausthalite, PbSe, but the element is usually obtained from the flue dust of pyrites burners. It is a rather scarce element, the earth's crust being composed of only about $8 \times 10^{-5}\%$ selenium. The element is said to be contained in teeth and bones and in most vegetables, especially spinach. It is precipitated from its solutions by sulfur dioxide, which is the method generally used to obtain the element from its refined ores. Selenium exists as red amorphous, red crystalline, gray metallic, and black selenium, the black form being thought by some to be the metallic variety in the finely divided condition. The property of its electrical resistance decreasing while the element is being exposed to light, furnishes the basis for its use in photoelectric cells. These cells are of rapidly increasing importance in controlling automatic equipment of many kinds. A recent application of the element is in rectifiers, which exhibit remarkable stability under high overloads. Selenium is used in preparing a scarlet-red color for glass, glazes and enamels; for making flame-proof insulated wires and paper; in the colloidal form as a gemicide and fungicide. Selenium itself is not poisonous but the alkali selenites and selenates are very toxic. When warmed, selenium emits an odor resembling that of rotten radishes. Selenium and its compounds impart a blue color to the Bunsen flame. The element resembles sulfur and has valencies of 2, 4, and 6. SeO_2, Na_2SeO_3, Na_2SeO_4, and Na_2Se are typical selenium compounds. It is sometimes used to replace sulfur in special vulcanizing applications, particularly in connection with synthetic rubbers. It has wide use as an alloying ingredient in stainless steel, copper alloys and invar. The United States and Canada are the best sources. The price is about $2 per pound ($4.40 per kilogram).

SILICON (L. *silex*, flint) Ger. *Silicium.* Fr. *silicium.* Silicon is a non-metallic element which is dark steel-gray when crystalline, and a dark brown mass when amorphous. It was first isolated in 1823 by J. J. Berzelius. Silicon is never found native, but its compounds are so common that silicon ranks second only to oxygen in abundance, composing 25.8% of the known land, sea and air. It occurs in all silicate minerals as well as in quartz (SiO_2), sandstone, and others. The silicates include clay, granite, feldspar, mica, and many other very common minerals. Silicon is made by reducing SiO_2 with magnesium or sodium. It is employed as a deoxidizer in metallurgy, where many silicon alloys are used, the silicon being added as a rule in the form of ferrosilicon. High silicon alloys are very hard and chemically resistant, but are so brittle they cannot be machined. Silica, or SiO_2, is used in making glass, mortar, and Portland cement; and sodium silicate under the name of waterglass is used as a medium for preserving eggs and as an adhesive. Silicon is very resistant to acid corrosion, a property which is also manifested by the high silicon alloys. A very interesting series of compounds known as silicones are made by dehydration and polymerization of $(CH_3)_2Si(OH)_2$ and similar compounds. These substances, some of which resemble rubber, have remarkable heat-resistant qualities. SiO_2, SiH_4, Na_2SiO_3 and K_2SiO_3 are well known silicon compounds. The price of silicon is about 17¢ per pound (37¢ per kilogram).

SILVER (Assyrian, *sarpu*. Anglo-Saxon *soelfor*. Symbol Ag from L. *argentum*) Ger. *Silber*. Fr. *argent*. Silver is the whitest of metals, and the best conductor of heat and electricity. It is strong and is excelled only by gold in malleability and ductility. Silver is sometimes found free in nature and has been known from the earliest times. Most silver ores contain only about one per cent of silver, but such ores are fairly common. Mexico and the United States produce most of the world's silver, a great deal being a by-product in the refining of lead and copper. It is a scarce metal being present to the extent of about $4 \times 10^{-6}\%$ in the earth's crust. The silver ion is very poisonous, and like lead is cumulative in action. Silver is stable in air and water but blackens on exposure to vapors of sulfur compounds especially hydrogen sulfide which form the sulfide, Ag_2S. The metal is used in making table ware, coinage, jewelry, and in silvering mirrors. Certain of its salts, particularly the halides, are sensitive to light and are much used in photography. Silver nitrate is used in analytical chemistry, in medicine, and, with the cyanide, in plating. In recent years steels containing silver have been widely used in making pistons for gasoline engines. Silver solder is used in low temperature brazing. Large quantities of silver, mostly as bus bars, were used in the atom bomb project, and it was used to plate some of the equipment for the manufacture of penicillin. Perhaps the most important use of silver in the war was as a substitute metal. Used in place of copper, nickel, chromium, aluminum and tin, it released thousands of tons of these metals for vital war use. The price of silver is about 75¢ per troy ounce (2¢ per gram).

SODIUM (Eng. *soda*) Ger. *Natrium*. Fr. *sodium*. Sodium is a waxy, silvery white alkali metal. It was first isolated in 1807 by H. Davy. Sodium always occurs in the combined form, and is present as the chloride in vast quantities in sea water and rock salt deposits. In Chile and Peru there are deposits of $NaNO_3$, and on the sites of dried-up lakes there are found carbonates, sulfates, and borates of sodium. Sodium salts are present in nearly all brines, in animal fluids, and in most plants. Metallic sodium is attacked by air and water, hence it is usually preserved under kerosene or imbedded in petrolatum. It is prepared commercially by the electrolysis of fused sodium hydroxide and is used in making the peroxide and cyanide, as well as in the manufacture of some aniline dyes and a number of other organic compounds where a very strong reducing agent is required. It is sometimes used in the preparation of other metals. Large quantities of sodium are now used in the manufacture of tetraethyl lead, as a heat transfer medium in the valves of internal combustion engines, and as a scavenger and alloying ingredient in metallurgy. Sodium and its salts impart a brilliant yellow color to the flame. Many sodium compounds are extremely important, often being sold by the carload. A few of the most important are the chloride, NaCl, which is a necessary constituent of animal diets; caustic soda, NaOH; soaps, which are sodium or potassium salts of one or more fatty acids such as stearic, oleic or palmitic; borax, $Na_2B_4O_7 \cdot 10H_2O$; trisodium phosphate, $Na_3PO_4 \cdot 12H_2O$; hypo, $Na_2S_2O_3 \cdot 5H_2O$; soda ash, Na_2CO_3, and sal soda, $Na_2CO_3 \cdot 10H_2O$; Glauber's salt, $Na_2SO_4 \cdot 10H_2O$; baking soda, $NaHCO_3$; $NaNO_3$; $NaNO_2$; Na_2O_2; the various silicates which are different ratios of Na_2O, SiO_2 and H_2O; and the sulfite Na_2SO_3. The wholesale price of metallic sodium is about 15¢ per pound (33¢ per kilogram).

STRONTIUM (Named from the town of Strontian, Scotland) Ger. *Strontium*. Fr. *strontium*. Strontium is a silvery white metal but appears yellow when contaminated with nitride or silicide. This metal of the alkaline earth group was first isolated in 1808 by H. Davy although the oxide was known to Crawford in 1790. It is never found native, occurring chiefly as strontianite ($SrCO_3$), and celestite ($SrSO_4$). Strontium metal has no commercial uses but, like the other alkaline earth metals, it can be prepared by the electrolysis of the fused chlorides. Strontium salts impart a brilliant red color to a flame, and are used in fireworks, red signal flares, and on tracer bullets. Strontia (SrO) is used in the recovery of sugar from beet-sugar molasses. A mixture of calcium, barium and strontium carbonates are used to emit electrons in fluorescent lamps. Some strontium compounds have limited uses in medicine. Strontium has a valence 2 and forms compounds such as $SrCl_2$, $SrBr_2$, and $Sr(NO_3)_2$. The metal retails for about $5 per ounce (18¢ per gram), but crude celestite can be bought for as little as 20¢ per pound (44¢ per kilogram).

SULFUR (Sanskrit, *solvere*. L. *sulphurum*) Ger. *Schwefel*. Fr. *soufre*. Sulfur, a non-metallic element that is found native as well as combined, has been known from very early times. It exists in several allotropic forms, of which the most common is rhombic sulfur, the variety which is found native and is mined in vast quantities in Texas, Louisiana and Sicily. Sulfur compounds such as the metallic sulfides and sulfates are also very common. Rhombic sulfur is a yellow powder which changes in shade with different temperatures. When molten sulfur is allowed to cool slowly, wax-yellow needles of monoclinic sulfur are formed and these change to rhombic sulfur at ordinary temperatures. Another form sometimes encountered is nacreous sulfur which forms yellowish-white needles with a pearly luster. There are also other less common metastable varieties known, as well as certain amorphous types. Flowers of sulfur is the name given to a finely divided form prepared by sublimation. In the United States, sulfur is mined by the very unusual method of drilling to the sulfur stratum and sinking three concentric pipes down to the deposit. Superheated steam is then forced down the outside pipe and melts the sulfur; hot water is pumped down the other outside pipe at high pressure, whereby the molten sulfur is forced up through the middle pipe and is collected at the surface. Sulfur is used in the manufacture of matches, gunpowder, and pharmaceutical preparations, as well as in the vulcanization of rubber, and as a fungicide. Most of the sulfur produced is burned to sulfur dioxide, which is the intermediate in the preparation of sulfuric acid, sodium thiosulfate, calcium bisulfite, and other sulfur compounds. Sulfur is one of the elements essential to plant and animal life. It is a constituent of some proteins. An important sulfur compound is hydrogen sulfide, a common laboratory precipitant which is very poisonous. Sulfur has valencies of 2, 4, and 6. FeS, $BaSO_4$, $CaSO_3$, BaS, SO_2, SO_3, S_2Cl_2, and $Na_2S_2O_3 \cdot 5H_2O$ are typical sulfur compounds. Crude sulfur in bulk sells for about $18 per long ton ($18 per metric ton) but the flowers sell for about 3½¢ per pound (8¢ per kilogram), and the commercial flour for about 2¢ per pound (4½¢ per kilogram).

TANTALUM (Gr. myth. *Tantalus*, because the metal was hard to isolate, therefore tantalizing) Ger. *Tantal*. Fr. *tantale*. Tantalum is a bluish gray metal with a bright luster and which is not affected by exposure to air. The element was discovered in 1802 by A. G. Ekeberg. It is never found in the free state but occurs with columbium as the tantalates and columbates of iron, calcium, manganese, uranium, and the rare earths. It is a rare element making up only about $1.2 \times 10^{-6}\%$ of the rocky crust of the earth. Tantalum is impervious to any single acid except hydrofluoric being unaffected by aqua regia, but it will dissolve in the fused alkalies or in a mixture of nitric and hydrofluoric acids. Tantalum has high melting and boiling points, is malleable and very ductile, and was once used in making filaments for incandescent lamps but in this capacity it has been replaced by tungsten. Its main use is for chemical equipment especially for the production and handling of hydrochloric acid. It is also used in vacuum tubes and in surgery where, among other uses, it is made into skull plates. Tantalum is used to make pen nibs, dental and laboratory equipment, normal weights, and parts for delicate instruments which are subjected to the action of corrosive gases. It is also used as a rectifier for alternating current since a tantalum electrode in a single cell will permit the current to flow only in one direction, thus changing an alternating current to a pulsating direct current. Tantalum usually has a valence of five. Ta_2O_5, TaO_2, $FeTa_2O_6$, $TaCl_3$, $TaOF_3$, $CaTa_2O_6$, $TaCl_5$, and K_2TaF_7 are typical tantalum compounds. The metal costs about $50 per pound ($110 per kilogram).

TECHNETIUM (Gr. *technikos*, an art, as this was the first element to be made artificially) It was discovered in 1937 by Perrier and Segre in molybdenum bombarded in the Berkeley cyclotron with deuterons or neutrons. In its chemical properties it resembles manganese and, even more closely, rhenium. It forms pertechnetates which are similar to the permanganates and perrhenates, and forms an acid-insoluble sulfide as does rhenium. The metal is insoluble in H_2O_2 or HCl. Several radioactive isotopes are known, the most stable of which has a half-life of 1×10^6 years. Some of the isotopes have been found among the fission products of uranium. Technetium is element No. 43 and is known also as *masurium*, which see.

TELLURIUM (L. *tellus*, the earth) Ger. *Tellurium*. Fr. *tellure*. Tellurium is a non-metallic element of the sulfur selenium family. It was discovered in 1782 by F. J. Müller (Baron von Reichenstein) and later confirmed by M. H. Klaproth who actually isolated the new element. When cooled from the molten state, tellurium is a tin-white crystalline mass which is brittle and easily powdered, and has a metallic luster. It also exists as a brownish-black amorphous powder. Tellurium is the least abundant of the sulfur family, rarely occurring native but usually as telluride and in a few oxidized ores. It is slightly more abundant than gold making up about $1 \times 10^{-6}\%$ of the earth's crust. Tellurium is used in the glass industry, in the manufacture of electrical equipment, and in making dyestuffs. Some of its alloys have valuable properties, that with tin being very hard and of high tensile strength, while its alloy with aluminum is very ductile. Colloidal tellurium is used as an insecticide, germicide, and wood preservative. Certain tellurium salts are used in staining metals, while one tellurium compound has been found to possess anti-knock properties when used as a component of motor fuels. Tellurium is poisonous and is readily absorbed from gold-tellurium dental fillings. The very offensive "tellurium breath" is caused by the inhalation of the vapors of tellurium, or by the absorption of the element in the body by other means. The element has valencies of 2, 4, and 6. H_2Te, H_2TeO_4, H_2TeO_3, $AuTe_2$, TeO_2, and $BaTeO_4$ are typical tellurium compounds. The wholesale price is about $2 per pound ($4.40 per kilogram).

TERBIUM (from *Ytterby*, a town in Sweden) Ger. *Terbium*. Fr. *terbium*. Terbium is a rare earth metal which has not yet been isolated. It was discovered in 1843 by C. G. Mosander and is one of the least abundant of the rare earths, being found in small quantities in gadolinite, cerite, and other rare earth minerals. The element is present in the earth's crust to the extent of about $5 \times 10^{-5}\%$. Terbium salts are colorless or white and have no important uses. Tb_2O_3 or terbia, Tb_4O_7, $TbCl_3$, $Tb_2(SO_4)_3$, $Tb(NO_3)_3 \cdot 6H_2O$, and a few other terbium salts have been prepared.

THALLIUM (L. *thallus*, a budding twig) Ger. *Thallium*. Fr. *thallium*. Thallium is a gray metal, softer than lead, and having high malleability and low tenacity. In 1861 Crookes discovered a new green line in the spectrum which he attributed to a new element which he called thallium. The metal was first isolated in 1862 by A. Lamy. The ores of thallium are so scarce that it is easier to obtain the metal from the mud of the lead chambers or the flue dust of sulfuric acid works. Thallium makes up about $1 \times 10^{-5}\%$ of the earth's crust. Thallium salts are poisonous and color the non-luminous flame a bright green. Thallium acetate, which is poisonous, when taken internally causes a falling out of the hair. Depilatory preparations containing up to 5½% have been prepared and sold but their use is attended by considerable danger. Thallium itself has no important uses, but its salts, especially the sulfate, are widely used in rat poisons, in a few medicinal preparations, in analytical chemistry, and in making green signal lights. The element has valencies of 1 and 3. Tl_2O, Tl_2O_3, $TlOH$, $TlCl$, $TlO(OH)$, and Tl_2S are typical compounds. Thallium costs about $5 per pound ($11 per kilogram).

THORIUM (Scandinavian myth. *Thor.*) Ger. *Thorium.* Fr. *thorium.* Thorium is a metal resembling platinum in color, and having a high specific gravity and melting point. It was discovered in 1819 by J. J. Berzelius. Thorium is widely distributed but in small quantities, thorite, orangite, and thorianite containing from 50 to 78% ThO_2. The chief ore is monazite sand in which thorium is present to the extent of about 5 to 7% in the concentrated ore. The earth's crust contains about $2.5 \times 10^{-4}\%$ thorium. The most important use of thorium is as the nitrate which is combined with about one per cent of cerium nitrate to make Welsbach gas mantles. These nitrates are burned to oxides the first time the mantles are used; beryllium and magnesium nitrates are also present to strengthen the ash skeleton. Certain thorium salts have some small use in medicine, analysis, and roentgenography. Thorium metal is used in the electronic industries for its thermionic emission properties, low work function, and action as a "getter." It is a very soft, ductile metal. Thorium is radioactive, its half-life being 1.4×10^{10} years. It is a member of the tin group, and has a valence of four. ThO_2, $ThCl_4$, $Th(NO_3)_4$, $Th(OH)_4$, are typical compounds. Thorium undergoes fission when bombarded with high-speed neutrons, and was considered for use in the atom bomb. The price of the metal is about 40¢ per gram but the nitrate costs as little as $2.25 per pound ($4.95 per kilogram).

THULIUM (L. *Thule*, the most northerly part of the habitable world) Ger. *Thulium.* Fr. *thulium.* Thulium is a rare earth metal of the erbium group and has never been isolated. It was discovered in 1879 by P. T. Cleve and is found in small amounts in euxenite, gadolinite, blomstrandine, and other rare earth minerals. Thulium makes up about $5 \times 10^{-5}\%$ of the earth's crust. It is very difficult to separate thulium from the other metals of its group, especially erbium. Thulium salts are pale green in color. Tm_2O_3 or thulia, $TmCl_3 \cdot 7H_2O$, $Tm(NO_3)_3 \cdot 4H_2O$, $Tm_2(SO_4)_3$ and other thulium salts have been prepared.

TIN (Anglo-Saxon, Danish, and Icelandic, *tin.* Actual origin unknown) Ger. *Zinn.* Fr. *étain.* Tin is a white metal with a slight bluish tinge. Below 18° C. the stable form is *gray tin*, which is a powdery material and long exposure to cold will cause metallic tin to change to the gray form. When tin is so affected it is said to have the tin disease. When a piece of tin is bent it emits a high-pitched crackling noise known as the "cry" of tin. The metal was known in ancient times, for, although the ancients did not find it native, the smelting of tin is a comparatively simple process. Tin, though a common metal, is quite scarce, few workable deposits being known. It is present to the extent of about $6 \times 10^{-4}\%$ in the earth's crust, being less common than cerium, vanadium, tungsten, zirconium and other metals that are usually considered rare. The most important ore is cassiterite, SnO_2. The ore is first concentrated, then roasted, and then impurities such as tungsten and iron are removed chemically. The best tin mines are in the Malayan peninsula but during the war these deposits were in the hands of the Japanese and this made Bolivia the next best source. It is widely used in lining vessels for domestic and industrial use, but tin foil has been almost completely replaced by aluminum foil in the wrapping of tobacco, candy, etc. Tin forms a part of many valuable alloys such as brass, bronze, pewter, solder, and white bearing metal. The so-called "tin" cans are made of sheet iron coated with a thin layer of tin. The metal is also used as a reducing agent. Tin oxide (SnO_2) is used as a polishing powder and as an opacifying agent in glasses, glazes, and enamels. Tin sulfide is used as a bronzing powder and the two chlorides, $SnCl_2$ and $SnCl_4$, are used as mordants, in weighting silk, and in dyeing. Tin has valencies of two and four, and forms compounds such as SnO, SnO_2, $Sn(OH)_2$, H_2SnO_3, and $SnSO_4$. The price of tin is about 80¢ per pound ($1.75 per kilogram).

TITANIUM (L. myth. *Titans*, the first sons of the earth) Ger. *Titanium*. Fr. *titane*. Titanium is a metal of the tin group which resembles iron and takes a high polish. It was discovered in 1791 by W. Gregor, and rediscovered in 1794 by M. H. Klaproth who named it titanium. The metal does not occur free in nature and its compounds are not found in very concentrated form, yet it is more abundant than copper, lead, and zinc. Its most important ores are rutile, TiO_2, and ilmenite, $FeTiO_3$. The chief source is India where it occurs mostly as ilmenite but there are good deposits in the Adirondack region of New York. The use of titanium as a structural metal has been retarded by the difficulty of freeing it from oxygen and nitrogen. The best method appears to be the chlorination of the oxide with subsequent decomposition by means of magnesium in an atmosphere of helium. The metal is hard, and so brittle that in the cold it can be powdered in an agate mortar, but at a red heat it can be forged. It burns in oxygen at 610° C. to form the oxide, TiO_2, and in nitrogen at 800° C. to form the nitride, TiN. This is the only known vigorous combustion in nitrogen gas. Titanium is chiefly used in metallurgy as a deoxidizer and denitrogenizer, and to add desirable qualities such as toughness to alloys. The oxide (TiO_2) is a brilliant, white pigment that is used in the ceramic, rubber and other industries. Certain titanium compounds are used as incandescent media in illumination, while others are used as dyes and mordants for wool, cotton, and paper. During the war the tetrachloride was used to produce a white smoke, and the oxychloride was blown into ships' fireboxes in powdered form to produce dense clouds of black smoke. The tetrachloride mixed with ammonia is used in sky writing. Other than those previously mentioned, Ti_2O_3, TiF_4, $TiCl_4$, and K_2TiF_6 are the most common titanium compounds. The price of the metal is about $5.00 per pound ($11.00 per kilogram) but the more easily produced TiO_2 costs only about 16½¢ per pound (36¢ per kilogram).

TUNGSTEN (Danish *tung sten*, heavy stone) Ger. *Wolfram*. Fr. *tungstène*. Symbol W (Wolframium). Tungsten is a metal of the chromium group. It is steel-gray in color, with a high metallic luster and good tensile strength, and has the highest melting point of any metal. It was discovered by Scheele in 1783 with the assistance of two laboratory helpers, the Spanish brothers J. J. and Don F. de Elhuyar. Many historians credit the de Elhuyars with the discovery of the metal. Tungsten does not occur native and its compounds are rather rare, the element making up about $5 \times 10^{-4}\%$ of the earth's crust. The most important ores are the wolfram group (the iron and manganese tungstates) and the scheelite group (the calcium tungstates). Newly discovered tungsten deposits have made the United States nearly independent of foreign supplies but some is still imported from China (formerly our chief source), Malaya, Bolivia, Portugal and other countries. Russia has large unworked deposits of tungsten. The ores are first refined to a content of about 65% WO_3 and are then given different chemical treatments depending on whether the oxide, the tungstates or the metal are wanted. Tungsten filaments are used in nearly all incandescent lamps, as well as in the wiring of electric furnaces; the metal is also used for targets in X-ray tubes, in contact points, and in phonograph needles. Tungsten alloys are used in tool steel and in other places where great strength and high heat-resisting qualities are needed. When tungsten is combined with carbon in the alloy *Carbaloy*, it forms a very hard material that holds a cutting edge under very severe conditions. Magnesium tungstate is used as a phosphor in fluorescent lamps. Tungsten exhibits valencies of from two to six, but its most stable derivatives are those containing hexavalent tungsten. Some of its better known compounds are WO_3, WF_6, WCl_4, $WOCl_4$, H_2WO_4, $CaWO_4$, and Na_2WO_4. The price varies from about $2 per pound ($4.40 per kilogram) for the 98% material to $5 per pound ($11 per kilogram) for tungsten of 99.9% purity.

URANIUM (Named from the planet Uranus) Ger. *Uranium*. Fr. *uranium*. Uranium is a radioactive metal of the chromium series and was discovered in 1789 by M. H. Klaproth in the mineral pitchblende. It occurs as a constituent in several ores such as carnotite, pitchblende, and cleveite; the most important deposits being the pitchblende deposits at Great Bear Lake in Canada, and the carnotite mines in Colorado and Utah. Good deposits are found in Czechoslovakia and in the Belgian Congo. It is present in the earth's crust to the extent of about $5 \times 10^{-4}\%$. Uranium is a radioactive element with a half-life of 4.51×10^9 years. It is constantly breaking down, first to uranium X_1, then to uranium X_2, uranium II, ionium, and finally to radium. Radium is, therefore, always associated with uranium, and before the war was the reason behind the treatment of uranium ores, uranium being obtained as a by-product in radium production. Uranium is a lustrous, white metal, malleable and ductile and capable of taking a high polish. It is not hard enough to scratch glass, and has a density of 18.90 at 25° C. The metal burns briskly in air at 170° C. to form UO_2. It displaces hydrogen from mineral acids, and displaces mercury, silver, copper, tin, platinum, and gold from solutions of their salts. Uranium salts are poisonous to the animal system. Uranium has a valence of six or four. UO_3, UO_2, UCl_6, $UO_2(IO_3)_2$, and UO_2Cl_2 are a few typical uranium compounds. The last two mentioned are *uranyl* compounds. Uranium is sometimes used to harden and strengthen steel, while some uranium compounds are widely employed in ceramics, analytical chemistry and photography. Since the discovery of uranium fission in 1939 uranium has become one of the most important elements. It was found that U-235, an isotope present to the extent of one part in 140 parts of U-238, would undergo nuclear decomposition when bombarded with neutrons. In the enriched piles, the U-235 was first separated from the U-238 (usually by diffusion of the gaseous UF_6) and the two uraniums arranged in a geometrical lattice imbedded in graphite. The reaction is controlled by cadmium strips which can be withdrawn at will. As the chain reaction proceeds, the U-235 emits neutrons which are captured by the U-238 thus forming U-239, each atom of which emits a beta particle becoming neptunium (Np-239). This emits another beta particle and breaks down to plutonium (Pu-239). This is comparatively stable and like U-235 can support a chain reaction but, being a different element, can be separated from uranium by chemical means. Plutonium was produced in large quantities at Hanford, Washington, and was used in the atom bomb. These reactions follow the Einstein law which states that mass can be converted into energy and that one pound equals 11,400,000,000 kilowatt-hours. Since each pound of U-235 breaks down to 0.999 pounds of products, each pound undergoing fission produces 11,400,000 kilowatt-hours of energy. Work is being carried out in efforts to utilize this energy for peaceful purposes such as the generation of electricity. The price of uranium is about $20 per pound ($44 per kilogram).

VANADIUM (Scand. myth. goddess, *Vanadin*) Ger. *Vanadin*. Fr. *vanadium*. Vanadium is a steel-gray metal capable of taking a very high polish and is the hardest of all metals. It was discovered in 1830 by N. G. Sefstrom in iron ores found near Taberg, Sweden. It does not occur free in nature, but is quite common in the combined form, being more abundant than zinc, lead, nickel, nitrogen, or copper. The metal occurs in sufficient concentration to be extracted commercially in several different forms. It has been obtained commercially from the ash of oil burning furnaces. It is usually associated with other ores such as titaniferous magnetites, gold tellurides, and in patronite found in Peru. The United States is the best source of vanadium followed by Africa and Peru. The extraction varies with the type of ore used, but the separation is usually a chemical one. It is very difficult to obtain the metal pure, but fairly easy to make alloys such as ferrovanadium and nickelvanadium. Vanadium is used, frequently with chromium, in the making of special alloy steels, its presence increasing the toughness of the alloy and adding to the resistance to shock. The metal is also used as a contact catalyst in the manufacture of SO_3, as a reducing agent, as a dryer for linseed oil paints, and as a photographic developer and sensitizer. Vanadium compounds are poisonous when taken internally. Vanadium has valencies of from two to five, and forms four oxides, VO, V_2O_3, VO_2, and V_2O_5. Other common vanadium compounds are V_2S_5, $VOCl_3$, VCl_2, and NH_4VO_3. Ferrovanadium having a 45 to 55% vanadium content can be bought for about $2.90 per pound ($6.38 per kilogram) of contained vanadium.

VIRGINIUM (State of Virginia). Virginium (ekacesium) is the alkali metal below cesium in the periodic table. It was discovered in 1929 by Allison and Murphy who examined specimens of lepidolite, a lithium ore, and pollucite, a cesium mineral, with their magneto-optic method of analysis. They consistently found minima on their arbitrary scale corresponding to those predicted for ekacesium. (Cf. *Physical Review* 35, 285.) The chloride, nitrate, sulfate and hydroxide all gave minima at the proper points. In 1931, Papish and Wainer found spectroscopic evidence of the existence of this element in the least soluble alums prepared from a sample of samarskite which was rich in uranium and its disintegration products, and which also contained rubidium and cesium. They were, however, unable to verify the magneto-optic observations of Allison and Murphy. See also *francium.*

XENON (Gr. *xenos,* a stranger) Ger. *Xenon.* Fr. *xénon.* Xenon is a rare, inert, atmospheric gas. It was isolated in 1898 by W. Ramsay and M. W. Travers by distilling liquid argon which also contained the other inert gases. Xenon is the rarest atmospheric gas. It is the least volatile constituent in liquid air, and is one of the heaviest gases known. One liter of xenon weighs 5.842 grams, and its vapor density is 65 compared to oxygen as 16. Liquid xenon at −109° C. has a specific gravity of 3.06. Like the other elements in the zero group, it forms no compounds. The gas is seldom prepared pure. The cost in glass of 100 cc at normal pressure is about $20.

YTTERBIUM (From *Ytterby,* a town in Sweden) Ger. *Ytterbium.* Fr. *ytterbium.* Ytterbium is a rare earth metal which has not been isolated. It was discovered in 1905 by G. Urbain as a constituent of Marignac's ytterbium which was found to contain two elements that were called lutecium and neo-ytterbium. The latter name has since been shortened to ytterbium. It is found in very small amounts in minerals which contain other rare earths, particularly yttrium. These minerals include gadolinite, polycrase, blomstrandine and others. In the earth's crust, ytterbium is present in the amount of about $3.5 \times 10^{-4}\%$. A few ytterbium compounds are known among them being Yb_2O_3 or ytterbia, and $Yb_2(SO_4)_3 \cdot 8H_2O$.

YTTRIUM (From *Ytterby,* a town in Sweden) Ger. *Yttrium.* Fr. *yttrium.* Yttrium, a metal of the rare earth group, has not yet been prepared in massive form, but has been isolated as a gray, metallic powder. It was first separated in the form of yttria by Mosânder in 1843, and was named by Ekeberg. It has the lowest molecular weight of the rare earths, and, being Element 39, is sometimes considered "out of place" in the periodic table, the other rare earths being numbers 57 to 71 inclusive. Yttrium is one of the most abundant of the rare earths making up about $5 \times 10^{-4}\%$ of the rocky crust of the earth. It is found in company with the other rare earths in monazite sand, gadolinite, blomstrandine, samarskite, xenotime, euxenite and polycrase. The salts of yttrium are colorless. Y_2O_3, or yttria, YCl_3, $Y(OH)_3$, $Y_2(SO_4)_3$, $Y(NO_3)_3 \cdot 6H_2O$ and others have been prepared. There is a small demand for yttria in the manufacture of Nernst lamps.

ZINC (Ger. *Zink*, akin to *Zinn*, tin) Ger. *Zink*. Fr. *zinc*. Zinc is a bluish-white metal which when pure is malleable and ductile at ordinary temperatures. Commercial zinc must be heated to certain temperatures before it may be worked. Zinc and its compounds have been known since the middle ages especially in India and China. It has had dozens of different names, one of them, *spelter*, being applied today to commercial zinc. Paracelsus, an alchemist of about 1570, seems to have been the first to call it "zinckum." Zinc is never found native, its chief ore being sphalerite or ZnS. It is also found as the oxide, zincite, and the carbonate, smithsonite. The metal is generally prepared by roasting the ore and then reducing it with carbon in a distillation furnace above 907° C., the boiling point of zinc. It is present in the earth's crust to the extent of about $1 \times 10^{-4}\%$, being many times more abundant than cadmium with which it is nearly always associated. It is widely used in making galvanized iron, which is sheet iron covered with a thin film of zinc. Another important use is as the negative plate in the so-called dry cells. The metal is also used as a precipitant in the cyanide process of refining gold and silver. Impure zinc generally contaminated with arsenic is often used to prepare hydrogen in the laboratory. Large amounts of zinc are used annually in making brass and other alloys. In the pure form it is widely used as a reducing agent in analytical chemistry. Precipitated zinc sulfide is the only white sulfide. This material, suitably prepared and activated, is used in radar and television phosphors. Zinc has a valence of two, forming compounds like ZnO, ZnS, $ZnSO_4$, $ZnCl_2$, and $Zn(NO_3)_2$, as well as the zincates like Na_2ZnO_2, and K_2ZnO_2. The wholesale price of zinc is about 11¢ per pound (24¢ per kilogram).

ZIRCONIUM (Arabian *Zerk*, a precious stone) Ger. *Zirkonium*. Fr. *zirconium*. Zirconium exists in two forms, one of which is crystalline, white, metallic, and takes a high luster like nickel, while the other is a bluish-black amorphous powder. The oxide was discovered in 1789 by M. H. Klaproth, and the metal was first isolated by J. J. Berzelius in 1824. Zirconium does not occur free in nature, being commonly found as the silicate or oxide. It is widely distributed but large, workable deposits are rare. The metal is prepared as a powder by reduction of the oxide, fluoride, or chloride with the alkali or alkaline earth metals. It can also be prepared by the action of sodium on K_2ZrF_6 or by reduction of the tetrachloride with magnesium in an atmosphere of helium. Solid metal is obtained from the powder by pressing and heat-treating compacts in vacuo. The crystalline metal is stable in air and has a bright, silvery luster. Cold workable wire and sheet are produced by the thermal decomposition of zirconium iodide on a heated wire. In the powder form zirconium has a low ignition temperature and it is very explosive when mixed with oxidizing agents. It is employed in this manner in photoflash primers, flares, and blasting caps. Zirconium is used in the electronic industries because of its superior "gettering" properties. It has been used as a scavenger in steel and as an alloying element with steel, copper, and nickel. The oxide has been used to replace lime in carbide lamps, to make highly refractory ware such as crucibles and muffles, and as an opacifying agent in glazes. The silicate, zircon, has been used for balance knife-edges and planes because of its hardness; in powdered form it is used in making white basing cements for certain incandescent lamps. Zirconium has a valence of four in all of its compounds. ZrO_2, ZrF_4, ZrS_2, $ZrCl_4$, and H_2ZrO_3 are some typical compounds. The price of the crude, powdered metal is about $7 per pound ($15 per kilogram) but powdered zircon, $ZrSiO_4$, can be purchased for as little as 8¢ per pound (18¢ per kilogram).

CHANGES IN ATOMIC WEIGHTS 1894 TO 1941

The Dates Below Are Inclusive

Aluminum 27 (*1894-1895*); 27.11 (*1896-1899*); 27.1 (*1900-1921*); 27.0 (*1922*); 26.97 (*1925-1941*).

Antimony 120 (*1894-1895*); 120.43 (*1896-1899*); 120.4 (*1900-1902*); 120.2 (*1903-1922*); 121.77 (*1925*); 121.76 (*1931-1941*).

Argon 39.96 (*1902*); 39.9 (*1903-1910*); 39.88 (*1911-1917*); 39.9 (*1920-1922*); 39.91 (*1925*); 39.944 (*1931-1941*).

Arsenic 75 (*1894-1895*); 75.09 (*1896*); 75.01 (*1897-1899*); 75.0 (*1900-1909*); 74.96 (*1910-1925*); 74.93 (*1931-1933*); 74.91 (*1934-1941*).

Barium 137.43 (*1894-1899*); 137.40 (*1900-1902*); 137.4 (*1903-1908*); 137.37 (*1909-1925*); 137.36 (*1931-1941*).

Beryllium (**glucinum**) 9 (*1894-1895*); 9.08 (*1896-1899*); 9.1 (*1900-1922*); 9.02 (*1925-1941*).

Bismuth 208.9 (*1894*); 208 (*1895*); 208.11 (*1896-1899*); 208.1 (*1900-1902*); 208.5 (*1903-1906*); 208.0 (*1907-1921*); 209.00 (*1921-1941*).

Boron 11 (*1894-1895*); 10.95 (*1896-1899*); 11.0 (*1900*); 11 (*1901-1902*); 11.0 (*1903-1905*); 11 (*1906*); 11.0 (*1907-1917*); 10.9 (*1920-1922*); 10.82 (*1925-1941*).

Bromine 79.95 (*1894-1902*); 79.96 (*1903-1908*); 79.92 (*1909-1922*); 79.916 (*1925-1941*).

Cadmium 112 (*1894-1895*); 111.93 (*1896*); 111.95 (*1897-1898*); 112.38 (*1899*); 112.4 (*1900-1908*); 112.40 (*1909-1922*); 112.41 (*1925-1941*).

Calcium 40 (*1894-1895*); 40.08 (*1896*); 40.07 (*1897-1899*); 40.1 (*1900-1908*); 40.09 (*1909-1911*); 40.07 (*1912-1925*); 40.08 (*1931-1941*).

Carbon 12 (*1894-1895*); 12.01 (*1896-1897*); 12.00 (*1898-1899*); 12.0 (*1900-1902*); 12.00 (*1903-1915*); 12.005 (*1916-1922*); 12.000 (*1925*); 12.00 (*1931-1936*); 12.01 (*1937*); 12.010 (*1938-1941*).

Cerium 140.2 (*1894-1896*); 140.20 (*1897*); 139.35 (*1898-1899*); 139.0 (*1900-1901*); 139 (*1902*); 140 (*1903*); 140.25 (*1904-1925*); 140.13 (*1931-1941*).

Cesium 132.9 (*1894-1895*); 132.89 (*1896-1899*); 132.9 (*1900-1902*); 133 (*1903*); 132.9 (*1904-1908*); 132.81 (*1909-1933*); 132.91 (*1934-1941*).

Chlorine 35.45 (*1894-1908*); 35.46 (*1909-1922*); 35.457 (*1925-1941*).

Chromium 52.1 (*1894-1895*); 52.14 (*1896-1899*); 52.1 (*1900-1909*); 52.0 (*1910-1922*); 52.01 (*1925-1941*).

Cobalt 59 (*1894*); 59.5 (*1895*); 58.93 (*1896-1897*); 58.99 (*1898-1899*); 59.00 (*1900-1902*); 59.0 (*1903-1908*); 58.97 (*1909-1922*); 58.94 (*1925-1941*).

Columbium (**niobium**) 94 (*1894-1895*); 94.0 (*1896*); 93.73 (*1897-1899*); 93.7 (*1900-1902*); 94 (*1903-1908*); 93.5 (*1909-1916*); 93.1 (*1917-1925*); 93.3 (*1931-1934*); 92.91 (*1935-1941*).

Copper 63.6 (*1894-1895*); 63.60 (*1896-1899*); 63.6 (*1900-1901*); 63.60 (*1902*); 63.6 (*1903-1908*); 63.57 (*1909-1941*).

Dysprosium 162.5 (*1908-1922*); 162.52 (*1925*); 162.46 (*1931-1941*).

Erbium 166.3 (*1894-1896*); 166.32 (*1897-1899*); 166.0 (*1900*); 166 (*1901-1908*); 167.4 (*1909-1911*); 167.7 (*1912-1925*); 167.64 (*1931-1933*); 165.20 (*1934*); 167.64 (*1935-1937*); 167.2 (*1938-1941*).

Europium 152.0 (*1907*); 152 (*1908*); 152.0 (*1909-1941*).

Fluorine 19 (*1894-1895*); 19.03 (*1896*); 19.06 (*1897-1899*); 19.05 (*1900-1902*); 19 (*1903-1906*); 19.0 (*1907-1922*); 19.00 (*1925-1935*); 19.00 (*1936-1941*).

Gadolinium 156.1 (*1894-1896*); 156.76 (*1897-1899*); 157.0 (*1900-1901*); 156.4 (*1902*); 156 (*1903-1908*); 157.3 (*1909-1922*); 157.26 (*1925*); 157.3 (*1931-1936*); 156.9 (*1941*).

Gallium 69 (*1894-1895*); 69.0 (*1896*); 69.91 (*1897-1899*); 70.0 (*1900*); 70 (*1901-1906*); 70.0 (*1907-1908*); 69.9 (*1909-1917*); 70.1 (*1920-1922*); 69.72 (*1925-1941*).

Germanium 72.3 (*1894-1896*); 72.48 (*1897-1899*); 72.5 (*1900-1922*); 72.60 (*1925-1941*).

Gold 197.3 (*1894-1895*); 197.24 (*1896*); 197.23 (*1897-1899*); 197.2 (*1900-1941*).

Hafnium 178.6 (*1931-1941*).

Helium 3.96 (*1902*); 4 (*1903-1906*); 4.0 (*1907-1910*); 3.99 (*1911-1915*); 4.00 (*1916-1925*); 4.002 (*1931-1937*); 4.003 (*1938-1941*).

Holmium 163.5 (*1913-1922*); 163.4 (*1925*); 163.5 (*1931-1940*); 164.94 (*1941*).

Hydrogen 1.008 (*1894-1925*); 1.0078 (*1931-1937*); 1.0081 (*1938-1939*); 1.0080 (*1940-1941*).

Indium 113.7 (*1894-1896*); 113.85 (*1897-1899*); 114.0 (*1900-1902*); 114 (*1903-1904*); 115 (*1905-1908*); 114.8 (*1909-1933*); 114.76 (*1934-1941*).

Iodine 126.85 (*1894-1904*); 126.97 (*1905-1908*); 126.92 (*1909-1922*); 126.932 (*1925-1931*); 126.92 (*1933-1941*).

Iridium 193.1 (*1894-1895*); 193.12 (*1896-1899*); 193.1 (*1900-1902*); 193.0 (*1903-1908*); 193.1 (*1909-1941*).

Iron 56 (*1894-1895*); 56.02 (*1896-1899*); 56.0 (*1900*); 55.91 (*1901-1908*); 55.85 (*1909-1911*); 55.84 (*1912-1939*); 55.85 (*1940-1941*).

Krypton 81.76 (*1902*); 81.8 (*1903-1909*); 83.0 (*1910*); 82.92 (*1911-1922*); 82.9 (*1925-1931*); 83.7 (*1933-1941*).

Lanthanum 138.2 (*1894-1895*); 138.6 (*1896*); 138.64 (*1897-1899*); 138.6 (*1900-1902*); 138.9 (*1903-1908*); 139.0 (*1909-1922*); 138.90 (*1925-1931*); 138.92 (*1933-1941*).

Lead 206.95 (*1894-1895*); 206.92 (*1896-1902*); 206.9 (*1903-1908*); 207.10 (*1909-1915*); 207.20 (*1916-1925*); 207.22 (*1931-1936*); 207.21 (*1939-1941*).

Lithium 7.02 (*1894-1895*); 7.03 (*1896-1908*); 7.00 (*1909-1910*); 6.94 (*1911-1922*); 6.940 (*1925-1941*).

Lutecium (cassiopeium) 174.0 (*1909-1915*); 175.0 (*1916-1939*); 174.99 (*1940-1941*).

Magnesium 24.3 (*1894-1895*); 24.29 (*1896*); 24.28 (*1897-1899*); 24.3 (*1900-1902*); 24.36 (*1903-1908*); 24.32 (*1909-1941*).

Manganese 55 (*1894-1895*); 54.99 (*1896-1899*); 55.0 (*1900-1908*); 54.93 (*1909-1941*).

Mercury 200 (*1894-1895*); 200.0 (*1896*); 200.00 (*1897-1898*); 200.0 (*1899-1911*); 200.6 (*1912-1922*); 200.61 (*1925-1941*).

Molybdenum 96 (*1894-1895*); 95.98 (*1896*); 95.99 (*1897-1899*); 96.0 (*1900-1902*); 96 (*1903*); 96.0 (*1904-1937*); 95.95 (*1938-1941*).

Neodymium 140.5 (*1894-1896*); 140.80 (*1897-1898*); 143.60 (*1899*); 143.6 (*1900-1908*); 144.3 (*1909-1922*); 144.27 (*1925-1941*).

Neon 19.94 (*1902*); 20 (*1903-1908*); 20.0 (*1909*); 20.2 (*1910-1925*); 20.183 (*1931-1941*).

Nickel 58.7 (*1894-1895*); 58.69 (*1896-1899*); 58.70 (*1900-1902*); 58.7 (*1903-1908*); 58.68 (*1909-1922*); 58.69 (*1925-1941*).

Nitrogen 14.03 (*1894-1895*); 14.04 (*1896-1906*); 14.01 (*1907-1917*); 14.008 (*1920-1941*).

Osmium 190.8 (*1894-1895*); 190.99 (*1896-1899*); 191.0 (*1900-1903*); 191 (*1904-1905*); 191.0 (*1906-1908*); 190.9 (*1909-1922*); 190.8 (*1925-1933*); 191.5 (*1934-1937*); 190.2 (*1938-1941*).

Oxygen 16.0 (*1894*); 16 (*1895*); 16.00 (*1896-1899*); 16.000 (*1900-1902*); 16.00 (*1903-1922*); 16.000 (*1925*); 16.0000 (*1931-1941*).

Palladium 106.6 (*1894*); 106.5 (*1895*); 106.36 (*1896-1899*); 107.0 (*1900-1902*); 106.5 (*1903-1908*); 106.7 (*1909-1941*).

Phosphorus 31 (*1894-1895*); 31.02 (*1896-1899*); 31.0 (*1900-1910*); 31.04 (*1911-1922*); 32.027 (*1925*); 31.02 (*1931-1938*); 30.98 (*1939-1941*).

Platinum 195 (*1894-1895*); 194.89 (*1896-1899*); 194.9 (*1900-1902*); 194.8 (*1903-1908*); 195.0 (*1909-1910*); 195.2 (*1911-1922*); 195.23 (*1925-1941*).

Potassium 39.11 (*1894-1902*); 39.15 (*1903-1908*); 39.10 (*1909-1922*); 39.096 (*1925*); 39.10 (*1931-1933*); 39.096 (*1934-1941*).

Praseodymium 143.5 (*1894-1896*); 143.60 (*1897-1898*); 140.46 (*1899*); 140.5 (*1900-1908*); 140.6 (*1909-1915*); 140.9 (*1916-1922*); 140.92 (*1925-1941*).

Protactinium 231 (*1936-1941*).

Radium 225 (*1903-1905*); 225.0 (*1906-1907*); 225 (*1908*); 226.4 (*1909-1915*); 226.0 (*1916-1922*); 225.95 (*1925*); 225.97 (*1931-1935*); 226.05 (*1936-1941*).

Radon (niton) 222.4 (*1912-1922*); 222 (*1925-1941*).

Rhenium 186.31 (*1931-1941*).

Rhodium 103 (*1894-1895*); 103.01 (*1896-1899*); 103.0 (*1900-1908*); 102.9 (*1909-1922*); 102.91 (*1925-1941*).

Rubidium 85.5 (*1894-1895*); 85.43 (*1896-1899*); 85.4 (*1900-1904*); 85.5 (*1905-1908*), 85.45 (*1909-1922*); 85.44 (*1925-1936*); 85.48 (*1937-1941*).

Ruthenium 101.6 (*1894-1895*); 101.68 (*1896-1899*); 101.7 (*1900-1941*).

Samarium 150 (*1894-1895*); 150.0 (*1896*); 150.26 (*1897-1899*); 150.3 (*1900-1901*); 150.3 ? (*1902*); 150 (*1903-1904*); 150.3 (*1905-1908*); 150.4 (*1909-1922*); 150.43 (*1900-1941*).

Scandium 44 (*1894-1895*); 44.0 (*1896*); 44.12 (*1897-1899*); 44.1 (*1900-1920*); 45.1 (*1921-1922*); 45.10 (*1925-1941*).

Selenium 79 (*1894-1895*); 79.0 (*1896*); 79.02 (*1897-1898*); 79.17 (*1899*); 79.2 (*1900-1933*); 78.96 (*1934-1941*).

Silicon 28.4 (*1894-1895*); 28.40 (*1896-1899*); 28.4 (*1900-1908*); 28.3 (*1909-1921*); 28.1 (*1922*); 28.06 (*1925-1941*).

Silver 107.92 (*1894-1902*); 107.93 (*1903-1908*); 107.88 (*1909-1922*); 107.880 (*1925-1941*).

Sodium 23.05 (*1894-1908*); 23.00 (*1909-1922*); 22.997 (*1925-1941*).

Strontium 87.60 (*1894*); 87.66 (*1895*); 87.61 (*1896-1899*); 87.60 (*1900-1902*); 87.6 (*1903-1908*); 87.62 (*1909-1910*); 87.63 (*1911-1941*).

Sulfur 32.06 (*1894-1895*); 32.07 (*1896-1902*); 32.06 (*1903-1908*); 32.07 (*1909-1915*); 32.06 (*1916-1922*); 32.064 (*1925*); 32.06 (*1931-1941*).

Tantalum 182.6 (*1894-1896*); 182.84 (*1897-1899*); 182.8 (*1900-1902*); 183 (*1903-1906*); 181 (*1907-1908*); 181.0 (*1909-1911*); 181.5 (*1912-1925*); 181.4 (*1931-1935*); 180.88 (*1936-1941*).

Tellurium 125 (*1894-1895*); 127.0 ? (*1896*); 127.49 (*1897-1899*); 127.5 (*1900*); 127.5 ? (*1901*); 127.7 (*1902*); 127.6 (*1903-1908*); 127.5 (*1909-1933*); 127.61 (*1934-1941*).

Terbium 160 (*1894-1895*); 160.0 (*1896*); 160.00 (*1897-1899*); 160 (*1900-1906*); 159.2 (*1907-1941*).

Thallium 204.18 (*1894-1895*); 204.15 (*1896-1902*); 204.1 (*1903-1908*); 204.0 (*1909-1922*); 204.39 (*1925-1941*).

Thorium 232.6 (*1894-1895*); 232.63 (*1896-1899*); 232.6 (*1900-1901*); 232.6 ? (*1902*); 232.5 (*1903-1908*); 232.42 (*1909-1910*); 232.4 (*1911-1917*); 232.15 (*1920-1925*); 232.12 (*1933-1941*).

Thulium 170.7 (*1894-1896*); 170.70 (*1897-1899*); 170.7 (*1900-1902*); 171 (*1903-1908*); 168.5 (*1909-1921*); 169.9 (*1922*); 169.4 (*1925-1941*).

Tin 119 (*1894-1895*); 119.05 (*1896-1899*); 119.0 (*1900-1915*); 118.7 (*1916-1922*); 118.70 (*1925-1941*).

Titanium 48 (*1894-1895*); 48.15 (*1896-1902*); 48.1 (*1903-1925*); 47.90 (*1931-1941*).

Tungsten 184 (*1894*); 184.9 (*1895*); 184.84 (*1896*); 184.83 (*1897-1899*); 184 (*1900-1906*); 184.0 (*1907-1937*); 183.92 (*1938-1941*).

Uranium 239.6 (*1894-1895*); 239.59 (*1896-1899*); 239.6 (*1900-1902*); 238.5 (*1903-1915*); 238.2 (*1916-1922*); 238.17 (*1925*); 238.14 (*1931-1936*); 238.07 (*1937-1941*).

Vanadium 51.4 (*1894-1895*); 51.38 (*1896-1899*); 51.4 (*1900-1902*); 51.2 (*1903-1910*); 51.06 (*1911*); 51.0 (*1912-1922*); 50.96 (*1925*); 50.95 (*1931-1941*).

Xenon 128.0 (*1902*); 128 (*1903-1908*); 128.0 (*1909*); 130.1 (*1910*); 130.2 (*1911-1932*); 131.3 (*1933-1941*).

Ytterbium 173 (*1894-1895*); 173.0 (*1896*); 173.19 (*1897-1899*); 173.2 (*1900-1902*); 173 (*1903-1904*); 173.0 (*1905-1908*); 172.0 (*1909-1915*); 173.5 (*1916-1922*); 173.6 (*1925*); 173.5 (*1931-1933*); 173.04 (*1934-1941*).

Yttrium 89.1 (*1894-1895*); 88.95 (*1896*); 89.02 (*1897-1899*); 89.0 (*1900-1915*); 88.7 (*1916-1917*); 89.33 (*1920-1922*); 88.9 (*1925*); 88.92 (*1931-1941*).

Zinc 65.3 (*1894-1895*); 65.41 (*1896-1899*); 65.4 (*1900-1908*); 65.7 (*1909*); 65.37 (*1910-1922*); 65.38 (*1925-1941*).

Zirconium 90.6 (*1894-1896*); 90.40 (*1897-1899*); 90.4 (*1900-1902*); 90.6 (*1903-1922*); 91 (*1925*); 91.22 (*1931-1941*).

The references for this table are given below in which the date is preceded by the volume number and then the page number of the Journal of the American Chemical Society: 16, 192 (1894); 17, 212 (1895); 18, 213 (1896); 19, 368 (1897); 20, 171 (1898); 21, 213 (1899); 22, 79 (1900); 23, 94 (1901); 24, 213 (1902); 25, 1 (1903); 26, 1 (1904); 27, 1 (1905); 28, 1 (1906); 29, 107 (1907); 30, 1 (1908); 31, 1 (1909); 32, 1 (1910); 33, 1639 (1911); 34, 1437 (1912); 35, 1807 (1913); 36, 1585 (1914); 37, 2449 (1915); 38, 2219 (1916); 39, 2517 (1917); 41, 1881 (1919); 42, 1761 (1920); 43, 1751 (1921); 47, 600 (1925); 53, 1637 (1931); 55, 451 (1933); 56, 763 (1934); 57, 793 (1935); 58, 547 (1936); 59, 225 (1937); 60, 744 (1938); 61, 227 (1939); 62, 672 (1940); 63, 850 (1941).

TABLE OF ISOTOPES

The information in this table has been taken from a CHART OF THE ISOTOPES prepared in the General Electric Research Laboratory by Dr. G. Friedlander and Dr. M. L. Perlman, copyrighted in 1948 by General Electric Company, and reproduced here by permission.

COLUMN HEADINGS

At. No. The *atomic number* gives the number of protons in the nucleus, a value often indicated by the symbol Z.

Mass No. The *mass number* gives the sum of the number of protons and neutrons in the nucleus, a value often indicated by the symbol A.

For any isotope, the number of neutrons is equal to the difference between the mass number and the atomic number; i.e., $A - Z$. Nuclides with the same mass number are called *isobars;* e.g., calcium-40 (with 20 protons and 20 neutrons) has the same mass number as argon-40 (which has 18 protons and 22 neutrons).

Type. The isotopes in the following table are classified into those which are (*a*) stable and occur naturally (*S*); (*b*) radioactive and occur naturally; and (*c*) radioactive and produced artificially (*AR*).

Abundance in %. Here are given the percentages of stable isotopes present in naturally occurring elements.

Isotopic Mass. These values show the mass of the isotope in terms of the most abundant isotope of oxygen as 16.

In the column headed **C** are given some indications of the accuracy with which the data for the artificially-radioactive elements are known.

Half-Life. For radioactive elements, this is the period of time required for half of the nuclei to undergo disintegration.

Radiation Decay. Data in this column show the mode of decay and the radiation given off.

Abbreviations and symbols used in the table

TYPE

S	stable and naturally occurring
R	radioactive and naturally occurring
AR	radioactive and produced artificially

CLASSIFICATION

a	mass number and element certain
b	mass number probable, element certain
c	one of a few mass numbers, element certain
d	element certain
e	element probable
f	insufficient evidence

RADIATION DECAY

α	alpha particle
β^-	negative beta particle
β^+	positive beta particle
γ	gamma ray
X	X-ray
n	neutron
e^-	internal conversion electron
K	electron capture
IT	isomeric transition

TIME

μs	microsecond
s	second
m	minute
h	hour
d	day
y	year

TABLE OF ISOTOPES

At. No. (Z)	Symbol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
0	n	1	AR	....	1.008941	a	~20 m	....
1	H	1	S	99.98	1.008130	....	....	....
	D	2	S	0.02	2.014708	....	....	....
	T	3	AR	....	....	a	12 y	β^-
2	He	3	S	1.1×10^{-4}	3.01700	....	....	....
	He	4	S	100	4.00390	....	....	....
	He	6	AR	....	....	a	0.8 s	β^-
3	Li	6	S	7.5	6.01697	....	....	....
	Li	7	S	92.5	7.01822	....	....	....
	Li	8	AR	....	....	a	0.88 s	β^-, α
4	Be	7	AR	....	....	a	43 d	K, γ
	Be	9	S	100	9.01503	....	....	....
	Be	10	AR	....	....	a	2.5×10^6 y	β^-
5	B	10	S	18.83	10.01618	....	....	....
	B	11	S	81.17	11.01284	....	....	....
	B	12	AR	....	....	a	0.022 s	β^-
6	C	10	AR	....	....	a	8.8 s	β^+
	C	11	AR	....	....	a	20.5 m	β^+
	C	12	S	98.9	12.00382	....	....	....
	C	13	S	1.1	13.007581	....	....	....
	C	14	AR	....	....	a	5100 y	β^-
7	N	13	AR	....	....	a	10.1 m	β^+
	N	14	S	99.62	14.00751	....	....	....
	N	15	S	0.38	15.004934	....	....	....
	N	16	AR	....	....	a	7.35 s	β^-, γ
	N	17	AR	....	....	a	4.14 s	β^-
8	O	15	AR	....	....	a	126 s	β^+
	O	16	S	99.757	16.00000	....	....	....
	O	17	S	0.039	17.00450	....	....	....
	O	18	S	0.204	18.00490	....	....	....
	O	19	AR	....	....	a	27 s	β^-, γ
9	F	17	AR	....	....	a	70 s	β^+
	F	18	AR	....	....	a	112 m	β^+
	F	19	S	100	19.00450	....	....	....
	F	20	AR	....	....	a	12 s	β^-, γ
10	Ne	19	AR	....	....	a	20.3 s	β^+
	Ne	20	S	90.00	19.99877	....	....	....
	Ne	21	S	0.27	20.999	....	....	....
	Ne	22	S	9.73	21.99844	....	....	....
	Ne	23	AR	....	....	a	40 s	β^-
11	Na	21	AR	....	....	b	23 s	....
	Na	22	AR	....	....	a	3.0 y	β^+, γ
	Na	23	S	100	22.99618	....	....	....
	Na	24	AR	....	....	a	14.8 h	β^-, γ
	Na	25	AR	....	....	b	62 s	β^-, γ
12	Mg	23	AR	....	....	a	11.6 s	β^+
	Mg	24	S	77.4	23.9924	....	....	....
	Mg	25	S	11.5	24.9938	....	....	....
	Mg	26	S	11.1	25.9898	....	....	....
	Mg	27	AR	....	....	a	10.2 m	β^-, γ
13	Al	26	AR	....	....	a	7.0 s	β^+
	Al	27	S	100	26.9899	....	....	....
	Al	28	AR	....	....	a	2.4 m	β^-, γ

TABLE OF ISOTOPES

At. No. (Z)	Symbol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Al	29	AR	....	....	a	6.7 m	β^-
14	Si	27	AR	....	....	a	4.9 s	β^+
	Si	28	S	92.28	27.9866	....	....	....
	Si	29	S	4.67	28.9866	....	....	....
	Si	30	S	3.05	29.9832	....	....	....
	Si	31	AR	....	....	a	170 m	β^-, no γ
15	P	29	AR	....	....	a	4.6 s	β^+
	P	30	AR	....	....	a	2.55 m	β^+
	P	31	S	100	30.9843	....	....	....
	P	32	AR	....	....	a	14.30 d	β^-, no γ
	P	34	AR	....	....	a	12.4 s	β^-, γ
16	S	31	AR	....	....	a	3.2 s	β^+
	S	32	S	95.1	31.98089	....	....	....
	S	33	S	0.74	32.9800	....	....	....
	S	34	S	4.2	33.97710	....	....	....
	S	35	AR	....	....	a	87.1 d	β^-
	S	36	S	0.016	35.978	....	....	....
	S	37	AR	....	....	b	5 m	β^-, γ
17	Cl	33	AR	....	....	a	2.4 s	β^+
	Cl	34	AR	....	....	a	33 m	β^+, γ
	Cl	35	S	75.4	34.97867	....	....	....
	Cl	36	AR	....	....	a	10^6 y	β^-, β^+, K
	Cl	37	S	24.6	36.97750	....	....	....
	Cl	38	AR	....	....	a	38.5 m	β^-, γ
18	A	35	AR	....	....	a	1.88 s	β^+
	A	36	S	0.307	35.9780	....	....	....
	A	37	AR	....	....	a	34.1 d	K
	A	38	S	0.061	37.974	....	....	....
	A	40	S	99.632	39.9756	....	....	....
	A	41	AR	....	....	a	110 m	β^-, γ
19	K	38	AR	....	....	a	7.5 m	β^+, γ
	K	39	S	93.38	38.9747	....	....	....
	K	40	R	0.012	....	....	2.4×10^8 y	β^-, β^+, K, γ
	K	41	S	6.61	....	....	....	....
	K	42	AR	....	....	a	12.4 h	β^-, γ
	K	43, 44	AR	....	....	c	18 m	β^-
20	Ca	39	AR	....	....	e	1.06 s	β^+
	Ca	40	S	96.96	39.9753	....	....	....
	Ca	41	AR	....	....	$<<1$ d or >1 y	....	....
	Ca	42	S	0.64	41.9711	....	....	....
	Ca	43	S	0.15	42.9723	....	....	....
	Ca	44	S	2.06	....	....	....	....
	Ca	45	AR	....	....	a	180 d	β^-, no γ
	Ca	46	S	0.0033	....	....	....	....
	Ca	48	S	0.19	....	....	....	....
	Ca	49	AR	....	....	a	2.5 h	β^-, γ
						b	30 m	β^-
21	Sc	41	AR	....	....	a	87 s	β^+
	Sc	43	AR	....	....	a	3.92 h	β^+, γ
	Sc	44	AR	....	....	a	2.44 d	IT, e^-, γ
						a	3.92 h	β^+, γ
	Sc	45	S	100	44.9669	....	....	....
	Sc	46	AR	....	....	a	85 d	β^-, γ, no K

TABLE OF ISOTOPES

At. No. (Z)	Sym-bol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Sc	47	AR	...	...	b	3.4 d	β^-
	Sc	48	AR	...	...	a	44 h	β^-, γ
	Sc	49	AR	...	...	a	57 m	β^-, no γ
22	Ti	45	AR	...	...	a	3.08 h	β^+
						d	21 d	...
	Ti	46	S	7.95	45.9661	...	...	...
	Ti	47	S	7.75	46.9647	...	...	...
	Ti	48	S	73.45	47.9631	...	...	...
	Ti	49	S	5.51	48.9646	...	...	...
	Ti	50	S	5.34	49.9621	...	...	...
	Ti	51	AR	...	...	a	6 m	β^-, γ
						a	72 d	β^-, γ
23	V	48	AR	...	...	a	16 d	β^-, K, γ
	V	49	AR	...	...	b	33 m	β^-
	V	50	AR	...	...	c	600 d	K, no β^+, no γ, no e^-
	V	51	S	100	50.9577	...	...	...
	V	52	AR	...	...	a	3.9 m	β^-, γ
24	Cr	49	AR	...	...	a	42 m	β^+, γ
	Cr	50	S	4.49	...	...	...	...
	Cr	51	AR	...	...	b	26.5 d	K, e^-, γ, no β^+
	Cr	52	S	83.78	51.956	...	...	...
	Cr	53	S	9.43	52.956	...	...	...
	Cr	54	S	2.30	...	...	...	...
	Cr	55	AR	...	...	b	1.3–2.3 h	β^+
25	Mn	51	AR	...	...	a	46 m	β^+
	Mn	52	AR	...	...	a	21 m	β^+, IT, e^-, γ
						a	6.5 d	β^-, K, γ
	Mn	54	AR	...	...	a	310 d	K, γ
	Mn	55	S	100	54.957	...	...	...
	Mn	56	AR	...	...	a	2.59 h	β^-, γ
26	Fe	52	AR	...	...	a	7.8 h	β^+
	Fe	53	AR	...	...	a	8.9 m	β^+
	Fe	54	S	6.04	53.957	...	...	...
	Fe	55	AR	...	...	a	~4 y	K, e^-, γ, X
	Fe	56	S	91.57	55.9568	...	...	...
	Fe	57	S	2.11	56.957	...	...	...
	Fe	58	S	0.28	...	...	...	...
	Fe	59	AR	...	...	a	47 d	β^-, γ
27	Co	55	AR	...	...	a	18.2 h	β^+, γ
	Co	56	AR	...	...	a	72 d	β^+, K, e^-, γ
	Co	57	AR	...	...	a	270 d	β^+, K, e^-, γ
	Co	58	AR	...	...	a	72 d	β^+, K, γ
	Co	59	S	100	...	...	...	...
	Co	60	AR	...	...	a	10.7 m	IT, e^-, β^-, γ
						a	5.3 y	β^-, γ
	Co	61	AR	...	...	a	1.75 h	β^-
28	Ni	57	AR	...	...	a	36 h	β^+
	Ni	58	S	67.4	...	...	...	...
	Ni	59	AR	...	...	a	15 y	β^+
	Ni	60	S	26.7	59.959	...	...	...
	Ni	61	S	1.2	...	...	...	...
	Ni	62	S	3.8	...	...	...	...
	Ni	63	AR	...	...	a	long	...

TABLE OF ISOTOPES

At. No. (Z)	Symbol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Ni	64	S	0.88	....	....	....	....
	Ni	65	AR	....	....	a	2.6 h	β^-, γ
29	Cu	58	AR	....	....	b	10 m	β^+
	Cu	59	AR	....	....	b	81 s	β^+
	Cu	60	AR	....	....	a	24.6 m	β^+, γ
	Cu	61	AR	....	....	a	3.4 h	β^+, K, no γ
	Cu	62	AR	....	....	a	10.1 m	β^+
	Cu	63	S	70.13	62.956	....	....	....
	Cu	64	AR	....	....	a	12.8 h	β^-, β^-, K, γ
	Cu	65	S	29.87	64.955	....	....	....
	Cu	66	AR	....	....	a	5 m	β^-, γ
30	Zn	63	AR	....	....	a	38.3 m	β^+, K, γ
	Zn	64	S	50.9	63.956	....	....	....
	Zn	65	AR	....	....	a	250 d	β^+, K, e^-, γ
	Zn	66	S	27.3	65.952	....	....	....
	Zn	67	S	3.9	....	....	....	....
	Zn	68	S	17.4	67.956	....	....	....
	Zn	69	AR	....	....	a	13.8 h	IT, γ
						a	57 m	β^-, no γ
	Zn	70	S	0.5	69.954	....	....	....
	Zn	72	AR	....	....	a	49 h	β^-, γ
	Zn	73	AR	....	....	b	<2 m	β^-
31	Ga	64	AR	....	....	b	48 m	β^+
	Ga	65	AR	....	....	a	15 m	K, e^-, γ
	Ga	66	AR	....	....	a	9.4 h	β^+
	Ga	67	AR	....	....	a	83 h	K, e^-, γ
	Ga	68	AR	....	....	a	68 m	β^+
	Ga	69	S	61.2	68.955	....	....	....
	Ga	70	AR	....	....	a	20 m	β^-, γ
	Ga	71	S	38.8	70.953	....	....	....
	Ga	72	AR	....	....	a	14.1 h	β^-, e^-, γ
	Ga	73	AR	....	....	b	5 h	β^-, no γ
	Ga	74	AR	....	....	d	9 d	β^-
32	Ge	69	AR	....	....	e	~195 d	....
	Ge	70	S	21.2	....	....	....	....
	Ge	71	AR	....	....	a	11 d	β^+, K (?), γ
						a	40 h	β^+
	Ge	72	S	27.3	....	a	....	....
			AR	....	....	....	0.5 μs	e^-
	Ge	73	S	7.9	....	....	....	....
	Ge	74	S	37.1	....	....	....	....
	Ge	75	AR	....	....	a	89 m	β^-, γ
	Ge	76	S	6.5	....	....	....	....
	Ge	77	AR	....	....	a	59 s	β^-
						a	12 h	β^-, γ
	Ge	78	AR	....	....	c	2.1 h	β^-, γ
33	As	72	AR	....	....	b	26 h	β^+, γ
	As	73	AR	....	....	d	90 h	K, e^-, γ
						d	50 h	β^+
	As	74	AR	....	....	a	16 d	β^-, β^+, γ
	As	75	S	100	....	....	....	....
	As	76	AR	....	....	a	26.8 h	β^-, γ
	As	77	AR	....	....	b	40 h	β^-
	As	78	AR	....	....	a	65-80 m	β^-, γ

TABLE OF ISOTOPES

At. No. (Z)	Sym-bol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	As	81	AR	...	...	b	<10 m	β^-
34	Se	73	AR	...	...	b	7.0 h	β^+, K, X
	Se	74	S	0.9	...	...	...	...
	Se	75	AR	...	...	a	127 d	K, e^-, γ, X
	Se	76	S	9.5	...	...	...	...
	Se	77	S	8.3	...	...	...	...
	Se	78	S	24.0	...	...	...	...
	Se	79	AR	...	...	b	<10 m or >7 × 10^6 y	β^-
	Se	80	S	48.0	...	...	...	...
	Se	81	AR	...	...	b	58 m	IT, e^-, γ
						b	18 m	β^-, no γ
	Se	82	S	9.3	...	...	...	...
	Se	83	AR	...	...	a	67 s	β^-
						a	25 m	β^-, γ
	Se	84	AR	...	...	a	~2 m	β^-
	Se	...	AR	...	...	e	17.5 s	γ
35	Br	78	AR	...	...	a	6.4 m	β^+, e^-, γ
	Br	79	S	50.6	...	...	...	...
	Br	80	AR	...	...	a	4.4 h	IT, e^-, γ
						a	18 m	β^-, β^+, γ
	Br	81	S	49.4	...	...	...	...
	Br	82	AR	...	...	a	34 h	β^-, γ
	Br	83	AR	...	...	a	2.4 h	β^-, no γ
	Br	84	AR	...	...	a	33 m	β^-, γ
	Br	85	AR	...	...	a	3.0 m	β^-
	Br	87	AR	...	...	a	50 s	β^-
36	Kr	78	S	0.342	77.945	...	...	...
	Kr	79, 81	AR	...	...	c	13 s	IT (?), e^-, γ, no β^+
						c	55 s	IT (?), e^-, γ, no β^+
	Kr	80	S	2.23	...	...	...	...
	Kr	79, 81	AR	...	...	c	34 h	β^+
	Kr	82	S	11.50	81.939	...	...	...
	Kr	83	S	11.48	...	...	...	...
			AR	...	...	...	113 m	IT, e^-, X
	Kr	84	S	57.02	83.938	...	...	...
	Kr	85	AR	...	...	a	4.5 h	β^-, γ
						a	~10 y	β^-, no γ
	Kr	86	S	17.43	85.939	...	...	...
	Kr	87	AR	...	...	a	74 m	β^-
	Kr	88	AR	...	...	a	3 h	β^-
	Kr	89	AR	...	...	a	2.6 m	β^-
	Kr	90	AR	...	...	a	~33 s	β^-
	Kr	91	AR	...	...	a	6–10 s	β^-
	Kr	92	AR	...	...	c	3 s	β^-
	Kr	93	AR	...	...	c	2 s	β^-
	Kr	94	AR	...	...	c	1.4 s	β^-
	Kr	97	AR	...	...	a	short	β^-
37	Rb	82	AR	...	...	b	20 m	...
	Rb	84	AR	...	...	b	6.5 h	...
	Rb	85	S	72.8	...	...	...	...
	Rb	86	AR	...	...	a	19.5 d	β^-, γ

TABLE OF ISOTOPES

At. No. (Z)	Sym-bol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Rb	87	R	27.2	....	....	6.3×10^{10} y	β^-, γ
	Rb	88	AR	....	....	a	17.8 m	β^-
	Rb	89	AR	....	....	a	15.4 m	β^-
	Rb	90	AR	....	....	a	short	β^-
	Rb	91	AR	....	....	a	short	β^-
	Rb	92	AR	....	....	c	short	β^-
	Rb	93	AR	....	....	c	short	β^-
	Rb	94	AR	....	....	c	short	β^-
	Rb	97	AR	....	....	a	short	β^-
	Rb	....	AR	....	....	d	80 s	β^-
38	Sr	84	S	0.56	....	....	....	....
	Sr	85	AR	....	....	a	70 m	IT, e^-, γ
						a	65 d	K, γ
	Sr	86	S	9.86	....	....	....	....
	Sr	87	S	7.02	....	a	....	....
			AR	....	....	....	2.7 h	IT, e^-, γ
	Sr	88	S	82.56	....	....	....	....
	Sr	89	AR	....	....	a	54 d	β^-, no γ
	Sr	90	AR	....	....	a	25 y	β^-, no γ
	Sr	91	AR	....	....	a	9.7 h	β^-, γ
	Sr	92	AR	....	....	c	2.7 h	β^-
	Sr	93	AR	....	....	c	7 m	β^-
	Sr	94	AR	....	....	c	~2 m	β^-
	Sr	97	AR	....	....	a	short	β^-
39	Y	86	AR	....	....	b	105 d	K, γ
	Y	87	AR	....	....	b	14 h	IT, e^-, γ
						a	80 h	K, no γ
	Y	88	AR	....	....	a	2.0 h	β^+
	Y	89	S	100	....	....	....	....
	Y	90	AR	....	....	a	62 h	β^-, no γ
	Y	91	AR	....	....	a	51 m	IT, e^-, γ
						a	57 d	β^-, no γ
	Y	92	AR	....	....	c	3.5 h	β^-, γ
	Y	93	AR	....	....	c	11 h	β^-, γ
	Y	94	AR	....	....	c	20 m	β^-, γ
	Y	95	AR	....	....	a	<3 h	β^-
	Y	97	AR	....	....	a	short	β^-
40	Zr	89	AR	....	....	a	4.5 m	IT or K, e^-, γ
						a	78 h	β^+, no γ
	Zr	90	S	48.0	....	....	....	....
	Zr	91	S	11.5	....	....	....	....
	Zr	92	S	22.0	....	....	....	....
	Zr	93	AR	....	....	f	2.5 m	β^- (?)
	Zr	94	S	17.0	....	....	....	....
	Zr	95	AR	....	....	a	65 d	β^-, e^-, γ
	Zr	96	S	1.5	....	....	....	....
	Zr	97	AR	....	....	a	17.0 h	β^-, γ
	Zr	....	AR	....	....	e	70 h	β^-
	Zr	....	AR	....	....	e	18 m	β^-
	Zr	....	AR	....	....	e	6 m	β^-
41	Cb	90	AR	....	....	b	21 h	β^+
	Cb	91	AR	....	....	b	~55 d	K, e^-, γ
	Cb	92	AR	....	....	a	10.1 d	β^-, γ, X
						c	21.6 h	β^-, γ

TABLE OF ISOTOPES

At. No. (Z)	Symbol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Cb	93	S	100	....	....	....	....
	Cb	94	AR	....	....	a	6.6 m	IT, β^-, X
						a	>100 y	....
	Cb	95	AR	....	....	a	90 h	IT, e^-, X
						a	35 d	β^-, e^-, γ
	Cb	96	AR	....	....	e	96 h	....
	Cb	97	AR	....	....	a	75 m	β^-, γ
	Cb	....	AR	....	....	e	38 m	....
	Cb	....	AR	....	....	e	12 m	....
	Cb	....	AR	....	....	e	4 m	....
42	Mo	92	S	14.9	....	....	....	....
	Mo	93	AR	....	....	c	17 m	β^+
						b	6.7 h	β^+, γ, no K
	Mo	94	S	9.4	....	....	....	....
	Mo	95	S	16.1	....	....	....	....
	Mo	96	S	16.6	....	....	....	....
	Mo	97	S	9.65	....	....	....	....
	Mo	98	S	24.1	....	....	....	....
	Mo	99	AR	....	....	a	67 h	β^-, γ, X
	Mo	100	S	9.25	....	....	....	....
	Mo	101	AR	....	....	a	14.6 m	β^-, γ
	Mo	102	AR	....	....	c	12 m	β^-
	Mo	105	AR	....	....	a	short	β^-
43	Tc	....	AR	....	....	e	18 s	β^-
	Tc	....	AR	....	....	e	36.5 h	β^-
	Tc	....	AR	....	....	d	~2 d	K
	Tc	....	AR	....	....	d	52 d	K, γ, X
	Tc	....	AR	....	....	e	53 m	β^+, K, γ
	Tc	96	AR	....	....	a	4.2 d	K, e^-, γ
						b	2.7 h	β^+ (?)
	Tc	99	AR	....	....	a	5.9 h	IT, e^-, X, γ
						a	1×10^6 y	β^-
	Tc	101	AR	....	....	a	14.0 m	β^-, γ
	Tc	102	AR	....	....	c	<1 m	β^-
	Tc	105	AR	....	....	a	short	β^-
	Tc	107	AR	....	....	c	<1.5 m	β^-
44	Ru	....	AR	....	....	e	90 m	....
	Ru	....	AR	....	....	f	20 m	....
	Ru	96	S	5.68	....	....	....	....
	Ru	97	AR	....	....	b	2.8 d	K, e^-, γ, X
	Ru	98	S	2.22	....	....	....	....
	Ru	99	S	12.81	....	....	....	....
	Ru	100	S	12.70	....	....	....	....
	Ru	101	S	16.98	....	....	....	....
	Ru	102	S	31.34	....	....	....	....
	Ru	103	AR	....	....	a	43 d	β^-, γ
	Ru	104	S	18.27	....	....	....	....
	Ru	105	AR	....	....	a	4.4 h	β^-, γ
	Ru	106	AR	....	....	a	1.0 y	β^-, no γ
	Ru	107	AR	....	....	c	4 m	β^-
	Ru	....	AR	....	....	d	60 d	β^-
	Ru	....	AR	....	....	f	30–60 m	β^-
	Ru	....	AR	....	....	f	1–2 h	β^-
45	Rh	102	AR	....	....	b	210 d	β^-, β^+, γ

TABLE OF ISOTOPES

At. No. (*Z*)	Symbol	Mass No. (*A*)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Rh	103	S	100	....	a	....	....
			AR	....	....	.....	52 m	IT, e^-, X
	Rh	104	AR	....	....	a	4.2 m	IT, e^-, γ
						a	44 s	β^-, γ
	Rh	105	AR	....	....	a	37 h	β^-, e^-, γ
	Rh	106	AR	....	....	a	30 s	β^-, γ
	Rh	107	AR	....	....	c	25 m	β^-
	Rh	109	AR	....	....	a	<1 h	β^-
	Rh	....	AR	....	....	f	30 d	β^-
	Rh	....	AR	....	....	f	4–5 d	β^-
	Rh	....	AR	....	....	f	9 h	β^-, γ
46	Pd	102	S	0.8	....	....	....	....
	Pd	103	AR	....	....	f	17 d	....
	Pd	104	S	9.3	....	....	....	....
	Pd	105	S	22.6	....	....	....	....
	Pd	106	S	27.2	....	....	....	....
	Pd	107	AR	....	....	a	short, $>10^8$ y	β^-
	Pd	108	S	26.8	....	....	....	....
	Pd	109	AR	....	....	a	13 h	β^-, no γ
	Pd	110	S	13.5	....	....	....	....
	Pd	111	AR	....	....	a	26 m	β^-
	Pd	112	AR	....	....	a	21 h	β^-, no γ
47	Ag	....	AR	....	....	e	16.3 m	....
	Ag	....	AR	....	....	e	73 m	....
	Ag	105	AR	....	....	b	45 d	K, γ
	Ag	106	AR	....	....	a	24.5 m	β^+, no γ
						a	8.2 d	K, e^-, γ
	Ag	107	S	51.9	....	a	....	....
			AR	....	....	....	44.3 s	IT, e^-, γ
	Ag	108	AR	....	....	a	2.3 m	β^-
	Ag	109	S	48.1	....	a	....	....
			AR	....	....	.....	40.5 s	IT, e^-, γ, X
	Ag	110	AR	....	....	a	22 s	β^-, γ
						a	225 d	β^-, γ
	Ag	111	AR	....	....	a	7.5 d	β^-
	Ag	112	AR	....	....	a	3.2 h	β^-, γ
48	Cd	....	S	....	....	d	....	....
			AR	....	....	....	48.7 m	IT, e^-, γ
	Cd	....	AR	....	....	e	33 m	β^+
	Cd	106	S	1.4	....	....	....	....
	Cd	107	AR	....	....	a	6.7 h	β^+, K, γ
	Cd	108	S	1.0	....	....	....	....
	Cd	109	AR	....	....	a	158 d	K
	Cd	110	S	12.8	....	....	....	....
	Cd	111	S	13.0	....	....	....	....
	Cd	112	S	24.2	....	....	....	....
	Cd	113	S	12.3	....	....	....	....
	Cd	114	S	28.0	....	....	....	....
	Cd	115	AR	....	....	a	44 d	β^-, γ
						a	2.33 d	β^-, γ
	Cd	116	S	7.3	....	....	....	....
	Cd	117	AR	....	....	a	2.8 h	β^-
49	In	108	AR	....	....	e	5 h	γ, no β^+
	In	109	AR	....	....	c	5.2 h	β^+, K, γ

TABLE OF ISOTOPES

At. No. (Z)	Symbol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	In	110	AR	....	....	b	65 m	β^+
	In	111	AR	....	....	b	2.7 d	K, e^-, γ
	In	112	AR	....	....	a	23 m	IT, e^-, γ, X
						a	9 m	β^-, β^+, X
	In	113	S	4.5	....	a	....	....
			AR	....	....	....	105 m	IT, e^-, γ
	In	114	AR	....	....	a	48 d	IT, e^-
						a	72 s	β^-
	In	115	S	95.5	....	a	....	....
			AR	....	....	....	4.53 h	IT, e^-, γ
	In	116	AR	....	....	a	13 s	β^-, no γ
						a	54 m	β^-, γ
	In	117	AR	....	....	a	117 m	β^-
50	Sn	<119	AR	....	....	e	13 d	β^-
	Sn	<119	AR	....	....	e	3 h	β^-
	Sn	<119	AR	....	....	e	25 m	β^-
	Sn	<126	AR	....	....	d	40 m	β^-
	Sn	<126	AR	....	....	d	26 h	β^-, X
	Sn	112	S	1.1	....	....	....	....
	Sn	113	AR	....	....	a	105 d	K, e^-, X
	Sn	114	S	0.8	....	....	....	....
	Sn	115	S	0.4	....	....	....	....
	Sn	116	S	15.5	115.942	....	....	....
	Sn	117	S	9.1	....	....	....	....
	Sn	118	S	22.5	117.939	....	....	....
	Sn	119	S	9.8	118.938	....	....	....
	Sn	120	S	28.5	119.930	....	....	....
	Sn	121, 123	AR	....	....	c	60 h	β^-, no γ
	Sn	122	S	5.5	121.944	....	....	....
	Sn	121, 123	AR	....	....	c	130 d	β^-, no γ
						c	10 d	β^-, X, γ
	Sn	124	S	6.8	123.943	....	....	....
	Sn	125	AR	....	....	b	9 m	β^-
	Sn	126	AR	....	....	c	70 m	β^-
	Sn	>125	AR	....	....	d	~20 m	β^-
	Sn	<126	AR	....	....	d	400 d	....
51	Sb	<125	AR	....	....	e	3.5 m	β^-
	Sb	<126	AR	....	....	d	3 h	β^-
	Sb	116, 118	AR	....	....	c	3.6 m	β^+
	Sb	117, 119	AR	....	....	c	2.8 h	K, X
	Sb	118, 116	AR	....	....	c	5.1 h	K, e^-, γ, X
	Sb	119, 117	AR	....	....	c	39 h	K, X
	Sb	120	AR	....	....	a	17 m	β^+
	Sb	121	S	56	....	....	....	....
	Sb	122	AR	....	....	a	3.5 m	IT, e^-, X
						a	2.8 d	β^-, e^-, γ
	Sb	123	S	44	....	....	....	....
	Sb	124	AR	....	....	a	1.3 m	β^-, γ
						a	21 m	IT, β^-, e^-
						a	60 d	β^-, γ
	Sb	125	AR	....	....	b	2.7 y	β^-, γ, X
	Sb	126	AR	....	....	c	60 m	β^-
	Sb	127	AR	....	....	a	93 h	β^-, γ
	Sb	129	AR	....	....	a	4.2 h	β^-

TABLE OF ISOTOPES

At. No. (Z)	Symbol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Sb	132	AR	......	......	c	~5 m	β^-
	Sb	133	AR	......	......	a	<10 m	β^-
	Sb	134	AR	......	......	c	<10 m	β^-
52	Te	120	S	0.088	......	......	......	......
	Te	121	AR	......	......	b	143 d	IT, e^-, γ
						b	17 d	K, γ, X
	Te	122	S	2.43	......	......	......	......
	Te	123	S	0.85	......	......	......	......
	Te	124	S	4.59	......	a	......	......
			AR	......	......	......	0.0012 s	IT, e^-
	Te	125	S	6.93	......	......	......	......
	Te	126	S	18.71	......	......	......	......
	Te	127	AR	......	......	a	90 d	IT, e^-, X
						a	9.3 h	β^-, no γ
	Te	128	S	31.86	......	......	......	......
	Te	129	AR	......	......	a	32 d	IT, e^-, X
						a	70 m	β^-, γ, X
	Te	130	S	34.52	......	......	......	......
	Te	131	AR	......	......	a	30 h	IT, e^-
						a	25 m	β^-
	Te	132	AR	......	......	c	70 h	β^-, e^-, γ, X
	Te	133	AR	......	......	a	60 m	β^-
	Te	134	AR	......	......	c	43 m	β^-
	Te	135	AR	......	......	a	<2 m	β^-
	Te	......	AR	......	......	d	~1 m	β^-
53	I	124	AR	......	......	a	4.0 d	β^+
	I	125	AR	......	......	b	56 d	K, X, no β, no γ
	I	126	AR	......	......	a	13.0 d	β^-, K, γ
	I	127	S	100	126.932	......	......	......
	I	128	AR	......	......	a	25.0 m	β^-, γ
	I	129	AR	......	......	a	$>10^8$ y	β^-
	I	130	AR	......	......	a	12.6 h	β^-, γ
	I	131	AR	......	......	a	8.0 d	β^-, e^-, γ
	I	132	AR	......	......	c	2.4 h	β^-, γ
	I	133	AR	......	......	a	22 h	β^-, γ
	I	134	AR	......	......	c	54 m	β^-, γ
	I	135	AR	......	......	a	6.7 h	β^-, γ
	I	136	AR	......	......	c	1.8 m	β^-
	I	137	AR	......	......	b	23 s	β^-, n
54	Xe	......	AR	......	......	d	68 m	IT (?)
	Xe	124	S	0.094	......	......	......	......
	Xe	126	S	0.088	......	......	......	......
	Xe	127	AR	......	......	b	75 s	IT, e^-, γ
						b	34 d	e^-, γ
	Xe	128	S	1.92	......	......	......	......
	Xe	129	S	26.23	128.946	......	......	......
	Xe	130	S	4.05	......	......	......	......
	Xe	131	S	21.24	......	......	......	......
	Xe	132	S	26.93	131.946	......	......	......
	Xe	133	AR	......	......	a	5.4 d	β^-, e^-, γ, X
	Xe	134	S	10.52	......	......	......	......
	Xe	135	AR	......	......	a	13 m	IT, e^-, γ
						a	9.2 h	β^-, γ

TABLE OF ISOTOPES

At. No. (Z)	Symbol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Xe	136	S	8.93	....	....	....	....
	Xe	137	AR	....	....	b	3.4 m	β^-
	Xe	138	AR	....	....	b	17 m	β^-
	Xe	139	AR	....	....	a	41 s	β^-
	Xe	140	AR	....	....	a	10–16 s	β^-
	Xe	141	AR	....	....	a	1.7–3 s	β^-
	Xe	143	AR	....	....	a	1 s	β^-
	Xe	144	AR	....	....	a	short	β^-
	Xe	145	AR	....	....	c	0.8 s	β^-
55	Cs	130	AR	....	....	b	30 m	....
	Cs	131	AR	....	....	b	10.2 d	K, X, no β^+
	Cs	132	AR	....	....	b	7.1 d	K, e^-, γ
	Cs	133	S	100	....	....	....	....
	Cs	134	AR	....	....	a	3 h	β^-
						a	1.7 y	β^-, γ
	Cs	135	AR	....	....	a	$>2.5 \times 10^4$ y	β^-
	Cs	136	AR	....	....	c	13 d	β^-, γ
	Cs	137	AR	....	....	a	33 y	β^-, γ
	Cs	138	AR	....	....	b	33 m	β^-, γ
	Cs	139	AR	....	....	a	7–10 m	β^-
	Cs	140	AR	....	....	d	40 s	β^-
						a	short	β^-
	Cs	141	AR	....	....	a	short	β^-
	Cs	142	AR	....	....	d	1–2 m	β^-
	Cs	143	AR	....	....	a	short	β^-
	Cs	144	AR	....	....	a	short	β^-
	Cs	145	AR	....	....	c	short	β^-
56	Ba	....	AR	....	....	d	3 m	....
	Ba	130	S	0.101	....	....	....	....
	Ba	131	AR	....	....	b	12.0 d	K, e^-, γ
	Ba	132	S	0.097	....	....	....	....
	Ba	133	AR	....	....	a	38.8 h	IT, e^-, γ
						a	>20 y	K, γ, e^-, X, no β^+
	Ba	134	S	2.42	....	....	....	....
	Ba	135	S	6.59	....	....	....	....
	Ba	136	S	7.81	....	....	....	....
	Ba	137	S	11.32	....	....	....	....
	Ba	138	S	71.66	....	....	....	....
	Ba	139	AR	....	....	a	85 m	β^-, γ
	Ba	140	AR	....	....	a	12.8 d	β^-, e^-, γ
	Ba	141	AR	....	....	b	18 m	β^-, γ
	Ba	142	AR	....	....	c	6 m	β^-
	Ba	143	AR	....	....	a	<0.5 m	β^-
	Ba	144	AR	....	....	a	short	β^-
	Ba	145	AR	....	....	c	short	β^-
57	La	137	AR	....	....	b	17.5 h	K, γ
	La	138	S	0.089	....	f	....	....
			AR	....	....	....	2.2 h	....
	La	139	S	99.911	138.955	....	....	....
	La	140	AR	....	....	a	40.2 h	β^-, γ
	La	141	AR	....	....	b	3.6 h	β^-
	La	142	AR	....	....	c	77 m	β^-, γ
	La	143	AR	....	....	a	20 m	β^-

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At. No. (Z)	Sym-bol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	La	144	AR	...	...	a	short	β^-
	La	145	AR	...	...	c	short	β^-
58	Ce	136	S	0.193	...	...	...	...
	Ce	138	S	0.250	...	...	...	...
	Ce	140	S	88.48	...	b	...	...
			AR	...	...	...	140 d	IT, γ
	Ce	141	AR	...	...	a	29 d	β^-, e^-, γ
	Ce	142	S	11.07	...	...	...	...
	Ce	143	AR	...	...	a	33 h	β^-, γ
	Ce	144	AR	...	...	a	275 d	β^-, no γ
	Ce	145	AR	...	...	c	1.8 h	β^-
	Ce	146	AR	...	...	c	14.6 m	β^-
59	Pr	140	AR	...	...	a	3.5 m	β^+
	Pr	141	S	100	...	a	...	...
			AR	...	...	...	70 μs	IT, e^-
	Pr	142	AR	...	...	a	19.3 h	β^-, γ
	Pr	143	AR	...	...	a	13.9 d	β^-, no γ
	Pr	144	AR	...	...	a	17.5 m	β^-, e^-, γ
	Pr	145	AR	...	...	c	4.6 h	β^-, no γ
	Pr	146	AR	...	...	c	24.6 m	β^-, γ
60	Nd	141	AR	...	...	a	2.5 h	β^+
	Nd	142	S	25.95	...	...	...	...
	Nd	143	S	13.0	...	...	...	...
	Nd	144	S	22.6	...	...	...	...
	Nd	145	S	9.2	...	...	...	...
	Nd	146	S	16.5	145.960	...	...	...
	Nd	147	AR	...	...	a	11.0 d	β^-, e^-, γ, X
	Nd	148	S	6.8	147.961	...	...	...
	Nd	149	AR	...	...	b	1.7 h	β^-, γ or X
	Nd	150	S	5.95	149.967	...	...	...
	Nd	151	AR	...	...	f	short	β^-
	Nd	...	AR	...	...	o	47 h	β
	Nd	...	AR	...	...	o	21 m	β
61	Pm	...	AR	...	...	o	16 d	β^-, γ
	Pm	...	AR	...	...	o	2.7 h	β^-, γ
	Pm	...	AR	...	...	f	12.5 h	β^-
	Pm	...	AR	...	...	o	$\sim$200 d	K or IT, γ
	Pm	147	AR	...	...	a	3.7 y	β^-, no γ
	Pm	148	AR	...	...	a	5.3 d	β^-, γ
	Pm	149	AR	...	...	a	47 h	β^-, γ
	Pm	151	AR	...	...	o	12 m	β
	Pm	153	AR		...	a	$<$5 m	β
	Pm	156	AR	...	...	b	$<$5 m	β
62	Sm	144	S	3.16	...		...	...
	Sm	145	AR	...	...	a	$>$72 d	β^+ or K
	Sm	147	S	15.07	...	...	...	
	Sm	148	R	11.27	...		1.4×10^{11} y	α
	Sm	149	S	13.84	...	...	...	...
	Sm	150	S	7.47	...	...	...	...
	Sm	151	AR	...	...	a	$\sim$20 y	...
	Sm	152	S	26.63	...	...	...	
	Sm	153	AR	...	...	a	46 h	IT (?), β^-, γ
	Sm	154	S	22.53	...	...	...	...
	Sm	155	AR	...		b	25 m	β^-, γ

TABLE OF ISOTOPES

At. No. (*Z*)	Sym-bol	Mass No. (*A*)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Sm	156	AR	....	....	b	~10 h	β^-
63	Eu	....	AR	....	....	e	40 d	....
	Eu	150	AR	....	....	e	27 h	β^+
	Eu	151	S	49.1	....	....	....	....
	Eu	152	AR	....	....	a	9.2 h	β^-, e^-, K (?), γ
						a	~5 y	....
	Eu	153	S	50.9	....	....	....	....
	Eu	154	AR	....	....	a	7 y	β^-, e^-, γ
	Eu	155	AR	....	....	a	2 y	β^-, γ
	Eu	156	AR	....	....	a	15.4 d	β^-, γ
	Eu	157	AR	....	....	b	15.4 h	β^-, γ
	Eu	158	AR	....	....	d	60 m	β^-
64	Gd	....	AR	....	....	f	155–170 d	β^-, γ
	Gd	152	S	0.2	....	....	....	....
	Gd	153	AR	....	....	a	>72 d	....
	Gd	154	S	2.86	....	....	....	....
	Gd	155	S	15.1	154.977	....	....	....
	Gd	156	S	20.59	155.976	....	....	....
	Gd	157	S	16.42	156.976	....	....	....
	Gd	158	S	23.45	....	....	....	....
	Gd	159, 161	AR	....	....	e	8 h	....
	Gd	160	S	20.87	....	....	....	....
65	Tb	159	S	100	....	....	....	....
	Tb	160	AR	....	....	a	3.9 h	β^-
						a	72 d	β^-, e^-, γ
66	Dy	....	AR	....	....	f	2.2 m	β^+
	Dy	158	S	>0.1	....	....	....	....
	Dy	160	S	0.1	....	....	....	....
	Dy	161	S	21.1	....	....	....	....
	Dy	162	S	26.6	....	....	....	....
	Dy	163	S	24.8	....	....	....	....
	Dy	164	S	27.3	....	....	....	....
	Dy	165	AR	....	....	a	1.25 m	IT, e^-
						a	2.33 h	β^-, e^-, γ
67	Ho	164	AR	....	....	f	47 m	β^-
	Ho	165	S	100	....	....	....	....
	Ho	166	AR	....	....	a	27.5 h	β^-
68	Er	162	S	0.1	....	....	....	....
	Er	164	S	1.5	....	....	....	....
	Er	....	AR	....	....	f	1.1 m	β^+
	Er	166	S	32.9	....	....	....	....
	Er	167	S	24.4	....	....	....	....
	Er	168	S	26.9	....	....	....	....
	Er	169	AR	....	....	c	6 m	β^-
						b	9.4 d	β^-, no γ
	Er	170	S	14.2	....	....	....	....
	Er	171	AR	....	....	e	20 h	β^-, γ
						b	7.5 h	β^-, γ
69	Tm	169	S	100	....	b	....	....
			AR	....	....	....	1 μs	e^-
	Tm	170	AR	....	....	a	127 d	β^-, no γ
	Tm	171	AR	....	....	b	2.5 μs	e^-, γ
						b	700 d	....
70	Yb	168	S	0.06	....	....	....	....

TABLE OF ISOTOPES

At. No. (*Z*)	Sym-bol	Mass No. (*A*)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Yb	169	AR	....	....	b	33 d	K, γ, X
	Yb	170	S	4.21	....	....	....	....
	Yb	171	S	14.26	....	....	....	....
	Yb	172	S	21.49	....	....	....	....
	Yb	173	S	17.02	....	....	....	....
	Yb	174	S	29.58	....	....	....	....
	Yb	175	AR	....	....	a	99 h	β^-, γ, X
						e	45 d	β^-
	Yb	176	S	13.38	....	....	....	....
	Yb	177	AR	....	....	a	2.1 h	β^-
71	Lu	175	S	97.5	....	....	....	....
	Lu	176	R	2.5	....	a	2.4×10^{10} y	β^-, K, γ
			AR	....	....	....	3.4 h	β^-, no γ
	Lu	177	AR	....	....	a	6.6 d	β^-
72	Hf	177, 179	S	....	....	d	....	....
			AR	....	....	....	19 s	IT
	Hf	174	S	0.18	....	....	....	....
	Hf	176	S	5.30	....	....	....	....
	Hf	177	S	18.47	....	....	....	....
	Hf	178	S	27.10	....	....	....	....
	Hf	179	S	13.85	....	....	....	....
	Hf	180	S	35.11	....	....	....	....
	Hf	181	AR	....	....	a	46 d	β^-, γ
73	Ta	180	AR	....	....	a	14–21 m	....
						a	8.2 h	K, e^-, β^- (?), γ
	Ta	181	S	100	....	a	....	....
			AR	....	....	....	22 μs	IT, e^-
	Ta	182	AR	....	....	a	120 d	β^-, γ
						b	16.2 m	β^-, γ
74	W	....	AR	....	....	e	21 m	....
	W	....	AR	....	....	e	3.9 h	....
	W	180	S	0.122	....	....	....	....
	W	181	AR	....	....	c	140 d	K, e^-, γ, X, no β^{+-}
	W	182	S	25.80	....	....	....	....
	W	183	S	14.26	....	....	....	....
	W	184	S	30.74	....	....	....	....
	W	185	AR	....	....	b	77 d	β
	W	186	S	29.22	....	....	....	....
	W	187	AR	....	....	b	24.1 h	β^-, γ
75	Re	....	AR	....	....	e	13 m	....
	Re	....	AR	....	....	e	30–55 m	β^+
	Re	184	AR	....	....	b	52 d	K, γ
	Re	185	S	38.2	....	....	....	....
	Re	186	AR	....	....	a	92.8 h	β^-, no γ
	Re	187	R	61.8	....	a	3×10^{12} y	β
			AR	....	....	....	1 μs	e, γ
	Re	188	AR	....	....	a	18.9 h	β, γ
76	Os	184	S	0.018	....	....	....	....
	Os	185	AR	....	....	b	94.7 d	K (?), γ
	Os	186	S	1.59	....	....	....	....
	Os	187	S	1.64	....	....	....	....
	Os	188	S	13.3	....	....	....	....
	Os	189	S	16.1	....	....	....	....

TABLE OF ISOTOPES

At. No. (*Z*)	Symbol	Mass No. (*A*)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Os	190	S	26.4	190.038	....	....	....
	Os	191, 193	AR	....	....	c	17 d	β^-, γ
	Os	192	S	41.0	192.038	....	....	....
	Os	193, 191	AR	....	....	c	32 h	β^-, γ
77	Ir	190	AR	....	....	a	10.7 d	K (?), e^-, γ
	Ir	191	S	38.5	191.040	....	....	....
	Ir	192	AR	....	....	c	1.5 m	IT, e^-, γ, X
						a	75 d	β^-, γ
	Ir	193	S	61.5	193.041	....	....	....
	Ir	194	AR	....	....	a	19.0 h	β^-, γ
78	Pt	190	AR	....	....	b	long	....
	Pt	191	AR	....	....	b	3.00 d	e^-, X, γ
	Pt	192	S	0.8	....	....	....	....
	Pt	193	AR	....	....	b	4.33 d	e^-, X, γ
	Pt	194	S	30.2	194.040	....	....	....
	Pt	195	S	35.3	195.040	....	....	....
	Pt	196	S	26.6	....	d	....	....
			AR	....	....	....	80 m	IT, e^-
	Pt	197	AR	....	....	b	18 h	β^-
						b	3.3 d	β^-, γ
	Pt	198	S	7.2	198.044	....	....	....
	Pt	199	AR	....	....	a	31 m	β^-
79	Au	191	AR	....	....	d	1 d	....
	Au	192	AR	....	....	c	4.7 h	e^-, γ, X
	Au	193	AR	....	....	b	15.8 h	e^-, X
	Au	194	AR	....	....	c	39.5 h	e^-, γ, X
	Au	195	AR	....	....	c	195 d	e^-, γ, X, no β^+
	Au	196	AR	....	....	a	14 h	X
						a	5.55 d	β^-, e^-, γ, X
	Au	197	S	100	197.039	a	....	....
			AR	....	....	....	7.5 s	IT, e^-
	Au	198	AR	....	....	a	2.76 d	β^-, e^-, γ
	Au	199	AR	....	....	a	3.3 d	β^-, γ
	Au	200, 202	AR	....	....	c	48 m	β^-
80	Hg	199, 200, 204	S	....	....	c	....	....
			AR	....	....	....	43 m	IT, e^-, γ
	Hg	196	S	0.15	....	....	....	....
	Hg	197	AR	....	....	a	23 h	K, e^-, γ
						a	64 h	K, e^-, γ
	Hg	198	S	10.1	....	....	....	....
	Hg	199	S	17.0	....	....	....	....
	Hg	200	S	23.3	....	....	....	....
	Hg	201	S	13.2	....	....	....	....
	Hg	202	S	29.6	....	....	....	....
	Hg	203, 205	AR	....	....	c	51.5 d	β^-, γ
	Hg	204	S	6.7	....	....	....	....
	Hg	205	AR	....	....	a	5.5 m	β
81	Tl	....	AR	....	....	d	10.5 h	K (?), e^-, γ
	Tl	200	AR	....	....	f	4 m	....
						f	3.8 h	....
	Tl	....	AR	....	....	d	44 h	K (?), e^-
	Tl	202	AR	....	....	b	11.8 h	K (?), e^-, γ
	Tl	203	S	29.1	203.057	....	....	....

TABLE OF ISOTOPES

At. No. (Z)	Symbol	Mass No. (A)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Tl	204	AR	....	....	b	3.5 y	β^-, no γ
	Tl	205	S	70.9	205.057	....	....	....
	Tl	206	R	....	(Ra E″)	....	4.23 m	β^-, no γ
	Tl	207	R	....	(Ac C″)	....	4.76 m	β^-, γ
	Tl	208	R	....	(Th C″)	....	3.1 m	β^-, γ
	Tl	209	AR	....	....	a	<1 h	β^-
	Tl	210	AR	....	(Ra C″)	....	1.32 m	β^-
82	Pb	203	AR	....	....	b	52 h	K, e^-, γ
	Pb	204	S	1.5	204.058	b	....	....
			AR	....	....	....	68 m	IT, e^-, γ
	Pb	205, 203	AR	....	....	f	10.25 m	β^-
	Pb	206	S	23.59	....	....	....	....
	Pb	207	S	22.64	....	....	....	....
	Pb	208	S	52.29	208.057	....	....	....
	Pb	209	AR	....	....	a	3.3 h	β^-
	Pb	210	R	....	(Ra D)	....	22 y	β^-, γ
	Pb	211	R	....	(Ac B)	....	36.1 m	β^-, γ
	Pb	212	R	....	(Th B)	....	10.6 h	β^-, γ
	Pb	214	R	....	(Ra B)	....	26.8 m	β^-, γ
83	Bi	204	AR	....	....	b	12 h	K, e^-
	Bi	206	AR	....	....	a	6.4 d	K, e^-, γ, X
	Bi	208	AR	....	....	b	long	e^-, γ
	Bi	209	S	100	209.055	....	....	....
	Bi	210	R	....	(Ra E)	....	5.0 d	β^-, α
	Bi	211	R	....	(Ac C)	....	2.16 m	α, β^-, γ
	Bi	212	R	....	(Th C)	....	60.5 m	β^-, α, γ
	Bi	213	AR	....	....	a	47 m	β^-, α
	Bi	214	R	....	(Ra C)	....	19.7 m	β^-, α, γ
84	Po	206	AR	....	....	b	9 d	K, e^-, α, γ, X
	Po	207	AR	....	....	b	5.7 h	K, e^-, α, γ
	Po	208	AR	....	....	b	3 y	α
	Po	210	R	....	(Ra F)	....	140 d	α, γ
	Po	211	R	....	(Ac C′)	....	5×10^{-3} s	α
	Po	212	R	....	(Th C′)	....	0.3 μs	α
	Po	213	AR	....	....	a	3.2 μs	α
	Po	214	R	....	(Ra C′)	....	150 μs	α
	Po	215	R	....	(Ac A)	....	1.83×10^{-3} s	α
	Po	216	R	....	(Th A)	....	0.158 s	α, β
	Po	218	R	....	(Ra A)	....	3.05 m	α, β
85	At	211	AR	....	....	a	7.5 h	α, K
	At	216	R	....	....	....	<1 m	α
	At	217	AR	....	....	a	0.020 s	α
	At	218	R	....	....	....	few s	α
86	Rn	219	R	....	(An)	....	3.92 s	α
	Rn	220	R	....	(Tn)	....	54.5 s	α
	Rn	222	R	....	....	....	3.825 d	α
87	Fr	221	AR	....	....	a	4.8 m	α
	Fr	223	AR	....	(Ac K)	....	21 m	β^-, γ
88	Ra	223	R	....	(Ac X)	....	11.2 d	α, γ
	Ra	224	R	....	(Th X)	....	3.64 d	α
	Ra	225	AR	....	....	a	14.8 d	β^-
	Ra	226	R	....	....	....	1590 y	α, γ
	Ra	228	R	....	(Ms Th_1)	....	6.7 y	β
89	Ac	225	AR	....	....	a	10.0 d	α

TABLE OF ISOTOPES

At. No. (*Z*)	Symbol	Mass No. (*A*)	Type	Abundance in %	Isotopic Mass	C	Half-Life	Radiation Decay
	Ac	227	R	....	....	....	13.5 y	β^-, α, no γ
	Ac	228	R	....	(Ms Th_2)	....	6.13 h	β^-, α, γ
90	Th	227	R	....	(Rd Ac)	....	18.9 d	α, γ
	Th	228	R	....	(Rd Th)	....	1.90 y	α, γ
	Th	229	AR	....	....	a	7×10^3 y	α
	Th	230	R	....	(Io)	....	8.3×10^4 y	α, γ
	Th	231	R	....	(UY)	....	24.6 h	β^-
	Th	232	R	100	....	....	1.39×10^{10} y	α
	Th	233	AR	....	....	a	23 m	β^-, no γ
	Th	234	R	....	(UX_1)	....	24.5 d	β^-, γ
91	Pa	231	R	....	....	....	3.2×10^4 y	α, γ
	Pa	233	AR	....	....	a	27.4 d	β^-, e^-, γ
	Pa	234	R	....	(UX_2)	....	1.14 m	IT, β^-, γ
			R	....	(UZ)	....	6.7 h	β^-, γ
92	U	233	AR	....	....	a	1.63×10^5 y	α
	U	234	R	0.00518	....	....	2.33×10^5 y	α
	U	235	R	0.719	....	....	7.07×10^8 y	α
	U	237	AR	....	....	a	6.8 d	β^-, γ
	U	238	R	99.274	....	....	4.51×10^9 y	α
	U	239	AR	....	....	a	23 m	β^-, γ
93	Np	234	AR	....	....	a	4.4 d	K, γ
	Np	235	AR	....	....	a	240 d	K
	Np	236	AR	....	....	a	20 h	β^-
	Np	237	AR	....	....	a	2.25×10^6 y	α
	Np	238	AR	....	....	a	2.0 d	β^-
	Np	239	AR	....	....	a	2.3 d	β^-, γ
94	Pu	238	AR	....	....	a	50 y	α
	Pu	239	AR	....	....	a	24,100 y	α
	Pu	241	AR	....	....	a	long	β^-
95	Am	241	AR	....	....	a	500 y	α
	Am	242	AR	....	....	a	18 h	β^-
96	Cm	240	AR	....	....	a	30 d	α
	Cm	242	AR	....	....	a	150 d	α

ABUNDANCE OF THE ELEMENTS

See also another table for elements in *Sea Water*.

IN THE EARTH'S CRUST

Element	%
Oxygen	46.43
Silicon	27.77
Aluminum	8.13
Iron	5.12
Calcium	3.63
Sodium	2.85
Potassium	2.60
Magnesium	2.09
Titanium	0.629
Phosphorus	0.130
Hydrogen	0.127
Manganese	0.096
Fluorine	0.077
Chlorine	0.055
Sulfur	0.052
Barium	0.048
Chromium	0.037
Zirconium	0.028
Carbon	0.027
Vanadium	0.021
Nickel	0.019
Strontium	0.018
Lithium	0.003
Copper	0.002
Cerium	0.0015
Other rare earths	0.0034
Beryllium	0.001
Cobalt	0.001
All others	0.0041

IN DRY AIR

Component	% by volume	% by weight
Nitrogen	78.06	75.50
Oxygen (O_2)	20.99	23.15
Argon	0.9323	1.292
Carbon dioxide	0.03	0.05
Hydrogen	0.01	0.0007
Neon	0.0018	0.0014
Helium	0.0005	0.000065
Krypton	0.0001	0.0003
Ozone (O_3)	0.00006	0.0001
Xenon	0.000009	0.00004

IN THE HUMAN BODY

Element	%
Oxygen	65.0
Carbon	18.0
Hydrogen	10.0
Nitrogen	3.0
Calcium	2.0
Phosphorus	1.0
Potassium	0.35
Sulfur	0.25
Sodium	0.15
Chlorine	0.15
Magnesium	0.05
Iron	0.004
Iodine	trace
Fluorine	trace
Silicon	trace

Aldebaranium—ytterbium.
Argentum—silver.
Aurum—gold.
Austrium—impure gallium.
Cassiopeium—lutecium.
Celtium—lutecium.
Demonium—dysprosium.
Didymium—neodymium and praseodymium.
Dwi-manganese—rhenium.
Eka-aluminum—gallium.
Eka-boron—scandium.
Eka-cesium—virginium; francium.
Eka-iodine—alabamine; astatine.
Eka-manganese—masurium.
Eka-silicon—germanium.
Eka-tantalum—protoactinium.
Erythronium—vanadium.
Ferrum—iron.
Florentium—illinium; cyclonium; promethium.
Glucinum—beryllium.
Hydrargyrum—mercury.
Kalium—potassium.
Natrium—sodium.
Neoytterbium—ytterbium.
Niobium—columbium.
Niton—radon.
Plumbum—lead.
Radium emanation—radon.
Stannum—tin.
Stibium—antimony.
Wolframium—tungsten.

EFFECTIVE RADII OF ATOMS AND IONS

Compiled by Charles W. Stillwell, Ph. D.

The values are given in angstrom units. The atomic radii are from Neuburger, *Zeit. Krist. 93, 1 (1936)*. To give some idea of the degree of accuracy with which values for ionic radii are known, three sets of values are given; viz., **G**, empirical data from crystal structure by Goldschmidt, *Ber. 60, 1263 (1927)*; and calculated values **P** and **Z** by Pauling, *J. Am. Chem. Soc. 49, 765 (1927)*, and Zachariasen, *Zeit. Krist. 80, 137 (1931)*.

Element	Atomic Radius	Ion	Ionic Radii G	Ionic Radii P	Ionic Radii Z	Interatomic Distances
H	0.37	H^-	1.27	2.08	1.36	....
Ne	1.60	....	....	....	....	....
A	1.91	....	....	....	....	....
Kr	2.0	....	....	....	....	....
Xe	2.2	....	....	....	....	....
Li	1.50	Li^+	0.78	0.60	0.68	....
Be	1.1112	Be^{2+}	0.34	0.31	0.39	....
B	(*ca.* 0.7)	B^{3+}	....	0.20	0.24	....
C	0.77	C-O (CO_3)	....	....	....	1.31*
N	0.53	N-O (NO_3)	....	....	....	1.23*
		N^{3-}	....	1.71	....	....
O	.....	O^{2-}	1.32	1.40	1.40	....
		O^{6+}	....	0.09	....	....
F	0.68	F^{7+}	....	0.07	....	....
		F^-	1.33	1.36	1.33	....
Na	1.86	Na^+	0.98	0.95	0.98	....
Mg	1.595	Mg^{2+}	0.78	0.65	0.71	....
Al	1.48	Al^{3+}	0.57	0.50	0.55	....
Si	1.172	Si^{4+}	0.39	0.41	0.44	....
		Si-O (SiO_3)	....	....	....	1.63†

* Zachariasen, *J. Am. Chem. Soc. 53, 2123 (1931)*.

† Zachariasen, private communication.

EFFECTIVE RADII OF ATOMS AND IONS

Element	Atomic Radius	Ion	Ionic Radii			Interatomic Distances
			G	P	Z	
P (black)	1.08	P-O (PO_4)	....	....	....	1.56†
		P^{3-}	....	2.12	....	....
S (rhombic)	1.06	S-O (SO_4)	....	....	....	1.49†
		S^{2-}	1.74	1.84	1.85	....
Cl	0.97	Cl-O (ClO_3)	....	....	....	1.45†
		Cl^-	1.81	1.81	1.81	....
K	2.27	K^+	1.33	1.33	1.33	....
Ca	1.97	Ca^{2+}	1.06	0.99	0.98	....
Sc	.....	Sc^{3+}	0.83	0.81	0.78	....
Ti	1.45	Ti^{4+}	0.64	0.68	0.62	....
V	1.313	V^{4+}	0.61	....	....	....
		V^{5+}	....	0.59	....	....
Cr (α)	1.246	Cr^{3+}	0.65	....	....	....
(β)	1.35	Cr^{6+}	....	0.52	....	....
Mn (α)	1.24	Mn^{2+}	0.91	....	....	....
(β)	1.26	Mn^{4+}	0.52	....	....	....
(γ)	1.29	Mn^{7+}	....	0.46	....	....
Fe (α)	1.238	Fe^{2+}	0.83	....	....	....
(β)	1.26	Fe^{3+}	0.67	....	....	....
Co	1.25	Co^{2+}	0.82	....	....	....
Ni	1.243	Ni^{2+}	0.78	....	....	....
Cu	1.275	Cu^+	(*ca.* 1.0)	0.96	....	....
Zn	1.329	Zn^{2+}	0.83	0.74	....	....
Ga	1.22	Ga^{3+}	0.62	0.62	....	....
Ge	1.22	Ge^{4+}	0.44	0.53	....	....
As	1.25	As^{5+}	....	0.47	....	....
		As-O (AsO_3)	....	....	....	2.01*
		As^{3-}	....	2.22	....	....
Se	1.16	Se^{6+}	0.3 to .4	0.42	....	....
		Se^{2-}	1.91	1.98	1.96	....
Br	1.13	Br-O (BrO_3)	....	....	....	1.68*
		Br^-	1.96	1.95	1.96	....
Rb	2.43	Rb^+	1.49	1.48	1.48	....
Sr	2.14	Sr^{2+}	1.27	1.13	1.15	....
Zr	1.58	Zr^{4+}	0.87	0.80	0.79	....
Mo	1.36	Mo^{4+}	0.68	....	....	....
		Mo^{6+}	....	0.62	....	....
Ru	1.322	Ru^{4+}	0.65	....	....	....
Rh	1.342	Rh^{3+}	0.69	....	....	....
Pd	1.372	....	....	....	....	....
Ag	1.441	Ag^+	1.13	1.26	....	....
Cd	1.486	Cd^{2+}	1.03	0.97	....	....
Sn (white)	1.508	Sn^{4+}	0.74	0.71	....	....
Sb	1.439	Sb^{5+}	....	0.62	....	....
		Sb-O (SbO_3)	....	....	....	2.22*
		Sb^{3-}	....	2.45	....	....
Te	1.44	Te^{4+}	0.89	....	....	....
		Te^{6+}	....	0.56	....	....
		Te^{2-}	2.11	2.21	2.18	....
I	1.35	I^{7+}	....	0.50	....	....
		I^-	2.20	2.16	2.19	....
Cs	2.62	Cs^+	1.65	1.69	1.67	....
Ba	2.17	Ba^{2+}	1.43	1.35	1.31	....
La	1.86	La^{3+}	1.22	1.15	1.06	....
Ce	1.81	Ce^{4+}	1.02	1.01	0.89	....

PHYSICAL CONSTANTS

In this table the density of gases is given as the weight in grams of one liter of the gas at 760 mm of mercury pressure (one atmosphere) and 0° C.; densities of liquids and solids are expressed in grams per one cubic centimeter; values in parentheses are estimated values.

Name	Symbol	Form and Color at Room Temp.	Density	Melting Point °C.	Boiling Point °C.	Specific Heat g-cal/g atom
Alabamine	Ab	Element No.	85; atomic weight	(221); mel	ting point (	470°).
Aluminum	Al	silv. met.	(l) $2.4^{658°}$	....	1800	(l) $6.76^{60°}$
			(s) $2.702^{20°}$	660	....	(s) $5.78^{20°}$
Antimony	Sb	silv. met.	(l) $6.55^{631°}$	....	1380	$6.7^{630°}$
			(s) $6.684^{25°}$	630.5	....	$6.0^{20°}$
Argon	A	colorl. gas	(g) 1.7824	....	....	$4.83^{15°}$
			(l) $1.402^{-185.7°}$	....	−185.7	$5.35^{-100°}$
			(s) $1.65^{-223°}$	−189.2	....	$6.19^{-223°}$
Arsenic	As	gray met.	(s) 5.7	$814^{36 at.}$	subl. 615	$6.16^{0-100°}$
		black	(s) $4.7^{20°}$	....	....	$6.45^{0-100°}$
		yel.	(s) $2.0^{20°}$	....	....	....
Barium	Ba	yel. met.	(s) $3.5^{20°}$	850	1140	....
Beryllium	Be	gray met.	(s) $1.8^{20°}$	1350	(1500)	$3.85^{0-100°}$
Bismuth	Bi	wh. met.	(l) $10.1^{270°}$	....	1450	(l) $7.41^{400°}$
			(s) $9.8^{20°}$	271	....	(s) $6.12^{20°}$
Boron	B	gray	2.5	2300	2550	$3.3^{0-100°}$
Bromine	Br	red liq.	(l) $3.119^{20°}$	....	58.78	(l) $8.6^{13-45°}$
			(s) (3.4)	−7.2	....	(s) $5.62^{-192 \text{ to} -108°}$
Cadmium	Cd	silv. met.	(l) $8.0^{320°}$	....	767	(l) $8.6^{261°}$
			(s) $8.6^{20°}$	320.9	....	(s) $6.17^{20°}$
Calcium	Ca	silv. met.	(s) $1.55^{20°}$	810	1200 ± 30	$6.21^{20°}$
Carbon	C	diamond	(s) $3.51^{20°}$	....	4200	$1.5^{20°}$
		graphite	(s) $2.26^{20°}$	3500	....	$2.0^{20°}$
Cerium	Ce	gray met.	6.90 (6.7)	640	1400	....
Cesium	Cs	silv. yel. met.	(l) $1.84^{26°}$	....	670	....
			(s) $1.90^{20°}$	26	....	$6.9^{20°}$
Chlorine	Cl	yel.-grn. gas	(g) 3.214	....	....	(g) 4.11
			(l) $1.557^{-33.6°}$	....	−34 6	(l) 8.0
			(s) (1.9)	−101.6	....	(s) $6.7^{-113°}$
Chromium	Cr	gray	(s) 7.1	1615	2200	$5.5^{20°}$
Cobalt	Co	silv. met.	(s) $8.9^{20°}$	1480	2900	$5.93^{20°}$
Columbium	Cb	platinum wh.	(s) $8.57^{20°}$	2415	(>3300)	$6.01^{20°}$
Copper	Cu	red met.	(l) $8.3^{1083°}$	1083	....	(l) $6.5^{1084°}$
			(s) $8.92^{20°}$	....	2300	(s) $5.85^{20°}$
Dysprosium	Dy	....	....	....	....	....
Erbium	Er	....	....	1250(?)	....	....
Europium	Eu	....	....	1150 ± 50	....	....
Fluorine	F	pa. yel. gas	(g) 1.695	....	....	....
			(l) $1.11^{-187°}$	....	−187	....
			(s) 1.3	−223	....	....
Gadolinium	Gd	....	....	....	....	....
Gallium	Ga	gray-wh. met.	(l) $6.095^{29.7°}$	....	>1600	$5.5^{119°}$
			(s) $5.91^{20°}$	29.75	....	$5.5^{12-23°}$
Germanium	Ge	gray-wh. met.	$5.36^{20°}$	958.5	2700	$5.33^{0-100°}$
Gold	Au	yel. met.	(l) $17^{1063°}$	....	2600	(l) $6.5^{1100°}$
			(s) $19.3^{20°}$	1063.0	....	(s) $6.14^{18°}$
Hafnium	Hf	....	....	(1700)	(>3200)	....
Helium	He	colorl. gas	(g) 0.1785	....	....	(g) 4.99
			(l) $0.126^{-268.9°}$	< −272.2	−268.9	....
Holmium	Ho	....	....	....	....	....

OF THE ELEMENTS

The following abbreviations are employed:—at., atmosphere; bl., blue; c., cubic; colorl., colorless; g., gas; grn., green; h., hexagonal; l., liq., liquid; m., monoclinic; met., metal or metallic; pa., pale; powd., powder; r., rhombic; s., solid; silv., silvery; subl., sublimes; t., tetragonal; tr., trigonal; wh., white; yel., yellow or yellowish.

Symbol	Latent Heat of (in kg-cal/g atom)		Resistivity ohm-cm= R×10⁻⁶	Surface Tension dyne/cm	Thermal Expansion E×10⁻⁶	Solid Cryst form
	Vaporization at B. P.	Fusion	R		E	
Ab	....	....	....	....	....	....
Al	53.8	....	....	520^{750°	....	....
	....	2.55	2.62^{20°	....	23.03^{20°	c
Sb	45.4	....	(l) 12^{860°	....	....	....
	....	4.77	(s) 39^{20°	....	11.4^{20°	h
A	....	....	....	....	....	....
	1.5	....	....	....	....	....
	....	0.268	....	....	....	c
As	subl. 33.2	1.65	35^{0°	....	4.7^{20°	h
	....	....	....	....	....	....
	....	....	....	....	....	c
Ba	86.3	1.40	....	....	....	....
Be	....	2.9	18.5^{20°	....	....	h
Bi	46.1	2.50	....	376^{300°	....	....
	....	2.60	115^{20°	....	....	h
B	....	....	1.8×10^{12}, 0°	....	....	m(?)
Br	3.58	....	....	$36^{58.6^\circ}$	1100^{0-30°	r
	....	1.3	(s) $>10^{14}$	....	....	....
Cd	25.6	1.45	....	628^{350°	....	....
	....	....	7.5^{20°	....	29.8^{20°	h
Ca	95.3	2.23	4.6^{20°	....	25^{0-21°	c
C	143	....	5×10^{20}, 15°	....	0.9^{20°	c
	....	....	1400, 20°	....	3^{20°	c
Ce	....	....	78^{20°	....	....	c(h)
Cs	17	....	....	....	....	....
	....	0.50	20^{20°	....	97^{0-26°	....
Cl	....	....	....	....	....	....
	2.39	....	$>10 \times 10^{15}$, -70°	$27^{-34.5^\circ}$	1500^{-34°	r
	....	0.812	....	....	....	....
Cr	76.5	3.93	2.6^{0°	....	8.2^{20°	c
Co	90.8	3.67	9.7^{20°	....	12.3^{20°	c
Cb	....	....	12.4^{20°	....	6.5^{20°	c
Cu	112	....	....	....	(l) 190^{1083°	....
	....	3.11	1.69^{20°	....	(s) 16.6^{20°	c
Dy	....	....	....	....	....	....
Er	....	....	....	....	....	....
Eu	....	....	....	....	....	....
F	....	....	....	....	....	....
	1.4	....	....	....	(l) 3000^{-200°	....
	....	0.19	....	....	....	....
Gd	....	....	....	....	....	....
Ga	....	....	(l) 27×10^{-6}, 30°	358^{30°	....	....
	....	1.33	(s) 53^{0°	....	18^{0-30°	t
Ge	119	....	89×10^{3}, 0°	....	....	c
Au	87.9	....	(l) 30.8×10^{-6}, 1063°	....	....	....
	....	3.03	(s) 2.4^{20°	....	14.2^{20°	c
Hf	....	....	....	....	....	....
He	....	....	....	....	....	....
	0.024	....	....	....	....	....
Ho	....	....	....	....	....	....

Name	Symbol	Form and Color at Room Temp.	Density	Melting Point °C	Boiling Point °C	Specific Heat g-cal/g atom
Hydrogen	H	colorl. gas	(g) 0.08987	....	....	(g) 3.477
			(l) $0.0709^{-252.7^\circ}$	....	−252.7	(l) 0.233^{-252°
			(s) 0.0808^{-262°	−259.14	....	(s) $0.57^{-260.6^\circ}$
Indium	In	silv. met.	7.3^{20°	155	>1450	6.5^{20-100°
Iodine	I	blk. solid	(l) 4.00^{107°	....	184.35	(l) $1.91^{114-185^\circ}$
			(s) 4.93^{20°	113.5	....	(s) 6.64^{20°
Iridium	Ir	silv. met.	22.4^{20°	2350	(>4800)	6.24^{0-100°
Iron	Fe	silv. met.	(l) 6.9^{1530°	....	3000	....
			(s) 7.86^{20°	1535	....	5.95^{20°
Krypton	Kr	colorl. gas	(g) 3.708	....	....	....
			(l) 2.6^{-146°	....	−151.8	....
			(s) (2)	−169	....	....
Lanthanum	La	silv. met.	(s) 6.15^{20°	826	1800	6.2^{0-100°
Lead	Pb	silv. met.	(l) 10.3^{327°	....	1620	....
			(s) 11.34^{20°	327.5	....	4.61^{20°
Lithium	Li	silv. met.	0.53^{20°	186	1336 ± 5	5.5^{0°; 9.5^{190°
Lutecium	Lu	....	....	....	....	....
Magnesium	Mg	silv. met.	(l) 1.57^{650°	....	1110	....
			(s) 1.74^{20°	651	....	6.0^{20°
Manganese	Mn	silv. met.	7.2^{20°	1260	1900	5.88^{0°
Masurium	Ma	....	....	(2300)	....	....
Mercury	Hg	silv. liq.	(l) 13.546^{20°	....	356.90	(l) 6.67^{20°
			(s) $14.19^{-38.9^\circ}$	−38.87	....	(s) 6.69^{-40°
Molybdenum	Mo	silv. met.	10.2	2625	3700	6.2^{20-100°
Neodymium	Nd	silv. met.	6.9^{20°	840	....	6.5^{0-100°
Neon	Ne	colorl. gas	(g) 0.9002	....	....	....
			(l) $1.204^{-245.9^\circ}$	....	−245.9	....
			(s) (1.0)	−248.67	....	....
Nickel	Ni	silv. met.	8.90^{20°	1452	2900	(l) 7.9^{1452°
			....	....	....	(s) 6.16^{20°
Nitrogen	N	colorl. gas	(g) 1.2506	....	....	(g) 3.479
			(l) $0.808^{-195.8^\circ}$	....	−195.8	(l) 6.64^{-200°
			(s) $1.026^{-252.5^\circ}$	−209.86	....	(s) 5.5^{-212°
Osmium	Os	bl.-wh. met.	22.48^{20°	2700	(>5300)	6.0^{20-100°
Oxygen	O	colorl. gas	(g) 1.4290	....	....	(g) 3.489
			(l) 1.14^{-183°	....	−183.0	(l) 6.31^{-200°
			(s) $1.426^{-252.5^\circ}$	−218.4	....	(s) $5.37^{-221.8}$
Ozone	O_3	colorl. gas	(g) 3.03^{-80°	....	....	....
			(l) 1.71^{-183°	−251	−112	....
Palladium	Pd	silv. met.	(l) 11^{1550°	....	2200	....
			(s) 12^{20°	1555	....	6.26^{18°
Phosphorus	P	yel. solid	(s) 1.82^{20°	44.1	....	5.5
		red solid	(s) 2.20^{20°	$590^{43\,\text{at.}}$	....	5.7^{-21} to $^{+7^\circ}$
			(l) $1.745^{44.5^\circ}$	....	280	....
Platinum	Pt	silv. met.	(s) 21.45^{20°	1755	....	6.33^{20°
			(l) 19^{1755°	....	4300	....
Polonium	Po	....	....	(1800)	....	....
Potassium	K	silv. met.	(l) 0.83^{62°	....	760	(l) 7.2^{63°
			(s) 0.86^{20°	62.3	....	(s) 6.9^{14°
Praseodymium	Pr	met.	6.5^{20°	940	....	6.5^{0-100°
Radium	Ra	silv. met.	(5)	960	1140	....
Radon	Rn	colorl. gas	(g) 9.73	....	....	....
			(l) 4.4^{-62°	....	−61.8	....
			(s) (4)	−71	....	....

Symbol	Latent heat of (in kg-cal/g atom)		Resistivity ohm-cm= $R \times 10^{-6}$	Surface Tension dyne/cm	Thermal Expansion $E \times 10^{-6}$	Solid Cryst form
	Vaporization at B. P.	Fusion	R		E	
H	....	....	....	....	....	....
	0.108	....	....	$1.91^{-252.7°}$	$1300^{-255°}$	....
	....	0.014	....	....	....	o
In	....	....	(l) 29×10^{-6}, 155°	....	....	....
			(s) $9^{20°}$	....	$33^{20°}$	t
I	5.26	....	(l) 78×10^{6}, 110.5°	....	(l) $800^{107-150°}$	....
	....	2.00	(s) 1.3×10^{15}, 20°	....	(s) $93^{20-100°}$	r
Ir	....	5.04	$6^{20°}$	....	$6.5^{20°}$	o
Fe	90.8	....	....	....	....	....
	....	2.68	$10.0^{20°}$	....	$11.7^{20°}$	o
Kr	....	....	....	....	....	....
	2.2	....	....	....	....	....
	....	0.36	....	....	....	....
La	....	....	$59^{18°}$	....	....	....
Pb	46.12	....	(l) 98×10^{-6}, 400°	$442^{350°}$	(l) $120^{327-825°}$	....
	....	1.24	(s) $21.9^{20°}$	....	(s) $29.1^{20°}$	c
Li	35.4	0.23	(s) $9.3^{20°}$	....	(s) $56^{20°}$	....
			(l) 45×10^{-6}, 230°	....	(l) $180^{186-230°}$	o
Lu	....	....	....	....	....	....
Mg	62.6	....	....	....	(l) $380^{650-800°}$	....
	....	2.16	$4.46^{20°}$	....	(s) $25.6^{20°}$	h
Mn	57.3	3.45	5	....	$23^{20°}$	....
Ma	....	....	....	....	....	....
Hg	14.2	....	(l) 95.8×10^{-6}, 20°	....	(l) $182^{20°}$	
	....	0.557	(s) $21.3^{-80°}$	$476^{20°}$	(s) 90^{-190} to $^{-40°}$	h(?)
Mo	170	6.66	$4.77^{20°}$	....	$4^{20°}$	c
Nd	....	....	$79^{20°}$	....	....	....
Ne	....	....	....	....	....	....
	0.416	....	....	....	....	....
	....	0.057	....	....	....	....
Ni	90.8	4.20	....	....	....	....
	....	....	$6.9^{20°}$	....	$12.8^{20°}$	o
N	....	....	....	....	....	....
	0.669	....	....	$8.85^{-195.8°}$	$600^{-195°}$	....
	....	0.0851	....	....	....	c
Os	....	....	$9^{20°}$	....	$6.1^{20°}$	h
O	....	....	....	....	....	....
	0.8179	....	....	$13.2^{-183°}$	$4100^{-195°}$	....
	....	0.053	....	....	....	h
O_3	....	....	....	....	$2000^{-183°}$	....
	0.960	....	....	....	....	....
Pd	....	....	....	....	....	....
	....	4.12	$10.8^{20°}$	....	$11.8^{20°}$	c
P	....	0.156	10^{17}, 11°	....	(s) $125^{0-40°}$	h
	....	....	....	....	....	c
	3.130	....	(l) 2.3×10^{6}, 25°	....	(l) $520^{50-60°}$	....
Pt	....	4.70	$10.5^{20°}$	....	$8.9^{20°}$	c
	124	....	....	....	....	....
Po	....	....	....	....	....	....
K	20	....	(l) 13×10^{-6}, 62°	....	(l) $290^{62-150°}$	....
	....	0.574	(s) $7.0^{20°}$	....	(s) $83^{20°}$	o
Pr	....	....	$88^{18°}$	....	....	....
Ra	....	....	....	....	....	....
Rn	....	....	....	....	....	....
	4.32	....	....	....	....	....
	....	0.777	....	....	....	....

Name	Symbol	Form and Color at Room Temp.	Density	Melting Point °C	Boiling Point °C	Specific Heat g-cal/g atom
Rhenium	Re	hard, silv. met.	21.40	3440 ± 60	....	6.44
Rhodium	Rh	silv. met.	12.5^{20°	1955	(>2500)	60^{0-100°
Rubidium	Rb	silv. met.	(l) $1.475^{38.5^\circ}$	....	700	(l) 7.65^{50°
			(s) 1.53^{20°	38.5	....	(s) 6.86^{0°
Ruthenium	Ru	gray met.	12.2^{20°	2450	(>2700)	6.2^{0-100°
Samarium	Sa	met.	7.7	1350	....	....
Scandium	Sc	....	(2.5)	1200	(2400)	....
Selenium	Se	gray solid	4.80^{25°	220	688	6.7^{0-41°
		red solid	4.50^{25°	....	....	....
Silicon	Si	black solid	2.4^{20°	1420	2600	4.95^{20°
Silver	Ag	silv. met.	(l) 9.4^{960°	....	1950	(l) $33.8^{907-1100^\circ}$
			(s) 10.5^{20°	960.5	....	(s) 6.16^{20°
Sodium	Na	silv. met.	(l) $0.93^{97.5^\circ}$	....	880	(l) 7.65^{100°
			(s) 0.97^{20°	97.5	....	(s) 6.79^{20°
Strontium	Sr	yel. met.	2.6	800	1150	....
Sulfur	S	yel. solid	(l) 1.808^{115°	....	444.6	(l) 7.26^{100°
			(s) 2.07^{20°	112.8	....	(s) 5.5^{0-30°
			(s) 1.96^{20°	119.0	....	(s) 5.7^{0-30°
Tantalum	Ta	blue gray	16.6	2996	(>4100)	6.51^{20°
Tellurium	Te	gray-wh. powd.	(s) (α) 6.24^{20°	452	1390	6.0^{20°
			(s) (β) 6.00^{20°	....	....	....
Terbium	Tb	....	....	....	....	....
Thallium	Tl	silv. met.	(l) 11.0^{300°	....	1650	....
			(s) 11.85^{20°	303.5	....	6.36^{20°
Thorium	Th	met.	11.4	1845	(>3000)	6.40^{0-100°
Thulium	Tm	....	....	....	....	....
Tin	Sn	silv. met.	(l) 6.98^{232°	....	2260	(l) 7.4^{232°
		wh.	(s) 7.31^{20°	231.85	....	(s) 6.43^{18°
		gray	(s) 5.750^{20°	....	....	(s) 6.12^{20°
Titanium	Ti	silv. met.	4.5^{20°	1800	(>3000)	6.9^{0-100°
Tungsten	W	met.	19.3	3370	5900	6.2^{20-100°
Uranium	U	wh. met.	18.90^{25°	<1850	....	6.7^{0-100°
Vanadium	V	gray met.	5.96	1710	(3000)	5.88^{0-100°
Virginium	Vi	....	....	(23)	Element	No. 87.
Xenon	Xe	colorl. gas	(g) 5.851	....	....	....
			(l) $3.06^{-109.1^\circ}$	....	−109.1	....
			(s) (2.7)	−140	....	....
Ytterbium	Yb	....	....	ca. 1800	....	....
Yttrium	Y	gray met.	5.51	1490	(2500)	....
Zinc	Zn	bl.-wh. met.	(l) 6.74^{63°	....	907	....
			(s) 7.140^{20°	419.43	....	6.05^{20°
Zirconium	Zr	gray met.	(s) 6.4^{20°	1700	(>2900)	6.02^{0-100°

Symbol	Latent Heat of (in kg-cal/g atom)		Resistivity ohm-cm= $R \times 10^{-6}$	Surface Tension dyne/cm	Thermal Expansion $E \times 10^{-6}$	Solid Cryst form
	Vaporization at B. P.	Fusion	R		E	
Re	200	....	19.8^{0°	....	12.45*	h
Rh	....	....	5.1^{20°	....	8.4^{20°	c
Rb	18	....	(l) 23.5×10^{-6}, 50°	....	(l) 340^{40-100°	....
	....	0.516	(s) 12.5^{20°	....	(s) 90^{20°	....
Ru	....	....	10^{20°	....	9.1^{20°	h
Sa	....	....	....	....	....	....
Sc	....	....	....	....	....	....
Se	7.4	0.53	12^{20°	72^{217°	37^{40°	tr
	....	....	....	....	....	(h?)
Si	40.6	9.47	85×10^{3}, 20°	....	$2.8\text{-}7.3^{20^\circ}$	c
Ag	59.5	....	(l) 17×10^{-6}, 1000°	....	(l) $110^{960-1200^\circ}$	....
	....	2.70	(s) 1.62^{20°	....	(s) 18.9^{20°	c
Na	25.1	....	(l) 9.7×10^{-6}, 100°	....	(l) $280^{100-200^\circ}$	....
	....	0.633	(s) 4.6^{20°	....	(s) 71^{20°	c
Sr	91.5	2.19	....	....	23^{20°	....
S	2.15	....	....	....	(l) 430^{115°	....
	....	0.300	2×10^{23}, 20°	....	(s) 64^{40°	r
	....	0.333	....	....	....	m
Ta	....	....	13.1^{20°	....	7.1^{20°	c
Te	20	0.9(3.2?)	$[5.8\text{-}33] \times 10^{3}$	....	16.8^{40°	h(?)
	....	....	....	....	....	....
Tb	....	....	....	....	....	....
Tl	28.7(?); 61.2(?).	....	(l) 74×10^{-6}, 300°	....	(l) $140^{300-350^\circ}$	....
	....	1.03	(s) 18.1^{20°	....	(s) 28^{20°	t
Th	....	....	18^{20°	....	....	c
Tm	....	....	....	....	....	....
Sn	77.7	....	(l) 49×10^{-6}, 300°	....	$100^{232-1600^\circ}$	....
	....	1.78	(s) 11.4^{20°	....	20^{20°	t
	....	....	....	....	5^{-163} to $^{-18^\circ}$	c(?)
Ti	....	....	3^{20°	....	....	c
W	217	8.40	5.48^{20°	....	4^{20°	c
U	....	....	60^{20°	....	....	....
V	....	....	....	....	....	c
Vi	....	....	....	....	....	....
Xe	....	....	....	....	....	....
	(3.20)	....	....	....	....	....
	....	(0.490)	....	....	....	....
Yb	....	....	....	....	....	....
Y	....	....	....	....	....	....
Zn	23.7	....	(l) 43×10^{-6}, 440°	....	(l) $150^{419-543^\circ}$	....
	....	1.6	(s) 6^{20°	....	(s) 33^{20°	h
Zr	....	....	....	....	170^{0°	c

*β for 001 cryst. plane; β for 100 cryst. plane = 4.67

PROPERTIES OF MINERALS

Compiled by Clarence E. Miller, M. Sc.

For more detailed information concerning the minerals listed or not listed in these tables, the reader is referred to the following sources which have been freely used in compiling these tables:

DANA, E. S., **Dana's System of Mineralogy.** 6th Edition and Appendices to date.

HINTZE, C., **Handbuch der Mineralogie.** Band I to May 1933; Band II. Published by Walter D. Grüyter and Co., Berlin and Leipzig, Germany.

WINCHELL, A. N., **Elements of Optical Mineralogy.** Part II. 3d Edition, 1933. Published by John Wiley and Sons, New York.

FORD, W. E., **Dana's Textbook of Mineralogy.** 4th Edition, 1932. Published by

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Moh's Scale Of Hardness:

1, talc; 2, gypsum; 3, calcite; 4, fluorite; 5, apatite; 6, orthoclase; 7, quartz; 8, topaz; 9, corundum, 10, diamond.

"Working Scale Of Hardness:"

1, very easily scratched by finger nail, and have greasy feel to the hand; 2, easily scratched by finger nail; 3, scratched by brass pin or copper coin; 4, easily scratched by knife; 5, scratched with difficulty with knife; 6, easily scratched by file; 7, are but little touched by file, but will scratch window glass. All harder than 7 will scratch window glass.

Abbreviations

In compiling the data in Table of Minerals, the following abbreviations have been used:

***—under* Name:**

Ra., radioactive; ?, questioned or doubtful.

***—under* Crystal System:**

C, Isometric; Tet., tetragonal; H, hexagonal; R, orthorhombic; M, monoclinic; Tri., triclinic; Am., amorphous; Crypt., cryptocrystalline; iso., isotropic; ?, doubtful.

***—under* Index of Refraction:**

All values, unless noted, are those of the mean value or β; η, index of refraction for all isotropic minerals, and when used with biaxial or uniaxial minerals denotes that no definite directional value has been determined; ω is the index of refraction value for the ordinary ray and is used in giving the index of uniaxial minerals; α and γ, where used denote, respectively the values of minimum and maximum indices of refraction of biaxial minerals; ϵ is used to denote the value of index of the extraordinary ray in uniaxial minerals.

***—under* Color:**

W, white; R, red; Reds, various shades of red; Bl., blue; Blk., black; Br., brown; O, orange; Y, yellow; Grn., green; Greens, various shades of green; Gr., gray; V, violet; Pr., purple; Pk., pink; — or colorl., colorless; d, deep shade; all of the abbreviations above when in lower case type (as grn. for greenish) indicate the ending of the word with "ish".

TABLE A

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Acanthite	Ag_2S	R	2-2.5	7.2-7.3	....	Bl, Gr
2	Adamite	$Zn_3(AsO_3)_2 \cdot H_2O$	R	3.5	4.3	1.733	Y, R,Gr, colorl.
3	Aeschynite (Ra)	$Ce_2(Ca,Fe)_2(Ti,Th)_8O_{39}$	R	5-6	4.9-5.1	2.20—2.26η	Blk, Br, Y
4	Aguilarite	$Ag_2S \cdot Ag_2Se$	C	2.5	7.586	....	iron Blk.
5	Aikenite	$2PbS \cdot Cu_2S \cdot Bi_2S_5$	R	2-2.5	6.1-6.8	....	lead Gr
6	Alabandite	MnS	C	3.5-4	3.9-4.1	2.70$_{Li}\eta$	iron Blk
7	Allanite	$HCaFe''(Al, Ce, Fe''')_3 Si_3O_{13}$	M	5.5-6	3.0-4.2	1.64-1.80	Blk, Br Blk
8	Allophane	$Al_2SiO_5 \cdot nH_2O$	Am	3	1.85-1.89	1.47-1.49η	Y, Gr, Br, O, Grn, Pk
9	Altaite	PbTe	C	3-3.5	8.16	....	blR

PROPERTIES OF MINERALS

John Wiley and Sons, New York.
LARSEN, E. S., **The Microscopic Determination of the Nonopaque Minerals.** U. S. Geolog. Surv. Bul. 679, 1921; Washington.
SHORT, M. N., **Microscopic Determination of the Ore Minerals.** U. S. Geolog. Surv. Bul. 825, 1931; Washington.
The American Mineralogist. Vols. 1 to 18 (1933). Published by the Mineralogical Society of America.
Mineralogical Magazine and Abstracts. Magazine 1876 to 1933; Abstracts 1920 to 1933. Published by the British Mineralogical Society; London.

Von Kobell's Scale Of Fusibility:

1, stibnite; 2, natrolite; 3, garnet, lime-alumina variety; 4, hornblende; 5, orthoclase; 6, bronzite; 7, infusible.

Penfield's Scale Of Fusibility:

1, stibnite, fuses readily in candle flame; 2, chalcopyrite, fuses in the luminous flame, but with difficulty in closed tube; 3, almandite, fuses readily in the blowpipe; 4, actinolite, edges are readily rounded in the blowpipe flame; 5, edges are fused with difficulty in the blowpipe flame; 6, bronzite, only the thinnest splinters are rounded by fusion in the blowpipe flame; 7, infusible.

—*under* Luster:

M, metallic; V, vitreous; A, adamantine; G, greasy; W, waxy; R, resinous; D, dull; E, earthy; Pl., pearly; Sk., silky; Sn., satiny; Sp., splendent; s, sub.

—*under* Fusibility:

Numbers 1, 2, 3,... 6 degrees of fusibility; see **Scale of Fusibility,** if, infusible; f, fusible; df., difficultly fusible; ef., easily fusible; vol., volatile.

—*under* Solubility:

i., insoluble; s., soluble; sl., slightly or partly; dec., decomposes or decomposed; aq. reg., aqua regia; gel., gelatinizes; turp., turpentine; alc., alcohol; a., acid.

—*under* Special Properties:

Photoluminescence includes phosphorescence or fluorescence caused by X-ray, or ultra violet light, or argon lamp, abbreviated (A), or exposure to radium (R).

Cer., cerium metals; Yttr., yttrium metals; E, rare earths; mole/unit cell, moles per unit cell; B. B., before blow pipe.

—*under* Localities:

Only the important localities of fine specimens, or crystallized material is given in case of the more common minerals.

A., abundant; C., common; Unc., uncommon; R., rare; V. R., very rare.

TABLE A

Luster	Fusibility	Solubility	Special Properties	Locality	
M	1.5	s. HNO_3	sectile; changes (reversibly) to isometric form at 179°C, photoelectric	V.R Bohemia; Mexico; Colorado (?)	1
V	3	s. HCl	may contain Ga	R. Zinc deposits: Greece; Germany; Utah; Nevada; Japan; Chili; France	2
R-sM	if.	i.	19-24 % Cer., 1-3 % Yttr., 16-18 % ThO_2	V.R. Imen Mts.; Urals; Norway	3
M sp.	....	....	sectile; thermoelectric	V.R. Guanajuato, Mexico	4
M	f.	dec. HNO_3	....	R. Urals; Georgia; No. Carolina; Germany; Austria.	5
sM	3	s. HCl	streak-green	R. Asia Minor; Europe; Mexico; Arizona; Colorado.	6
sM, R	2.5	gel. HCl	3.6-51 % Cer., 0-8 % Yttr., 0-3.5 % TnO_2	Unc. E. Greenland; New York; New Jersey; Madagascar; Virginia; Texas	7
W-R	if.	gel. HCl	....	R. Pennsylvania; Thuringia; England.	8
M	f.	s. HNO_3	effervesces with HNO_3	R. Altai Mts., Siberia; Chile; N. Carolina; N. Mexico; Colorado; California.	9

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Aluminite	$Al_2O_3\cdot SO_3\cdot 9H_2O$	R?	1-2	1.66	1.464	W
2	Alunite	$K_2Al_6(OH)_{12}(SO_4)_4$	H	3.5-4	2.58-2.75	1.572ω	W
3	Alugenite	$Al_2(SO_4)_3\cdot 18H_2O$	M or Tri	1.5-2	1.65-1.8	1.474	W
4	Alvite	Silicate Zr, Ce, Y, Ca, Mg, Be, Cu, Zn, H_2O	Tet.	5-6	3.3-4.3	....	y Br
5	Amalgam	Ag_2Hg_3 - $Ag_{36}Hg$	C	3-3.5	13.75-14.1	....	silver W
6	Ambatoarinite	$5SrCO_3\cdot 4E_2CO_3$, E_2O_3 E = Ce, La, Di	R	4.5	3.95	>1.66η	Pk, Blk
7	Amblygonite	$Li(Al,F)PO_4$	Tri	6	3-3.1	1.595	W-grn,bl,y
8	Amethyst	$SiO_2 + Mn$	H	7	2.65-2.66	....	Pr, bV
9	Ammonioborite	$(NH_4)_2B_{10}O_{16}\cdot 5H_2O$	.....	....	....	1.487	....
10	Ammoniojarosite	$(NH_4)_2Fe_6(OH)_{12}(SO_4)_4$	H?	....	....	1.750-1.800	pY
11	Ammonium nitrate	NH_4NO_3	R	1	1.73	....	—, W
12	Ampangabeite (Ra)	Columbate and titanate of Fe, U, rare earths	R	4	3.97-4.29	2.13η	Br R
13	Amphibole Group:	....	.....	....	....	....	....
14	(a) Actinolite	$Ca(Mg, Fe)_3(SiO_3)_4$	M	5-6	3-3.2	1.627	Grn-grGrn
15	(b) Anthophyllite	$(Mg, Fe)SiO_3$	R	5.5-6	2.85-3.2	1.642	br Grn, br Gr
16	(c) Arfvedsonite	$Na_3Fe_4Al(OH)_2Si_8O_{22}$	M	6	3.44-3.45	1.707	pure Blk
17	(d) Hornblende	Complex silicate of Ca, Al, Mg, Fe'', Fe'''	M	5-6	2.9-3.4	1.642-1.673	Bl-W
18	(e) Glaucophane	$Na(Al,Fe)(SiO_3)_2$ with $(Mg,Fe)SiO_3$	M	6-6.5	3-3.15	1.638	azure Bl, BlkBl-gr
19	(f) Riebeckite	$NaFe'''(SiO_3)_2$ with $FeSiO_3$	M	4	3.4	1.695	dBl-Blk
20	(g) Tremolite	$CaMg_3(SiO_3)_4$	M	5-6	2.9-3.2	1.623	W-dGr
21	Analcime	$Al_2O_3\cdot 4SiO_2\cdot Na_2O\cdot 2H_2O$	C	5-5.5	2.2-2.3	1.4874η	W
22	Ancylite	$4Ce(OH)CO_3\cdot 3SrCO_3\cdot 3H_2O$	R	4.5	3.95	1.865$\pm\omega$	y, O, Br, Gr
23	Andalusite	$Al_2O_3\cdot SiO_2$	R	7.5	3.1-3.2	1.639	rBr, V, Gr, R, Grn
24	Anglesite	$PbSO_4$	R	2.8-3	6.3-6.4	1.882	W
25	Anhydrite	$CaSO_4$	R	3-3.5	2.8-3	1.576	W
26	Ankerite	$2CaCO_3\cdot MgCO_3\cdot FeCO_3$	H	3.5-4	2.9-3.2	1.727ω	W, Gr, r
27	Antimony	Sb	H	3-3.5	6.6-6.7	....	tin W
28	Apatite	$(CaF)Ca_4(PO_4)_3 \pm Cl$	H	4.5-5	3.17-3.23	1.632-1.648 ω	sea Grn, blGrn, VGrn, VBl, W
29	Apophyllite	$K_2O\cdot 8CaO\cdot 16SiO_2\cdot 16H_2O$	Tet.	4.5-5	2.3-2.4	1.703	W, gr
30	Aragonite	$CaCO_3$	R	3.5-4	2.93	1.680	W, Gr, V, Y, Grn
31	Argentite	Ag_2S	C	2-2.5	7.2-7.4	....	blk, lead Gr
32	Argyrodite	Ag_8GeS_6	C	2-3	6.1-6.3	....	Blk, Gr
33	Arizonite	$Fe_2O_3\cdot 3TiO_2$	M?	5.5	4.25	2.62_{Li}	d steel Gr

Luster	Fusibility	Solubility	Special Properties	Locality	
E	if.	s. acid	....	R. In clay: Saxony; France; England; Missouri	1
D-V	if.	s. H_2SO_4	decrepitates; photoluminescent	Unc. Europe; Utah	2
V-S	if.	s. H_2O	....	Unc. Bohemia; Italy; Chile; Colorado; Arizona; New Mexico.	3
G	if.	i.	4 % Cer., 22 % Yttr., 4.6 % Hf	V.R. Ytterby, Sweden; Arendal, Norway; No. America.	4
M	vol.	s. HNO_3	....	R. Bavaria; So. America; British Columbia	5
.....	....	s. HCl	....	V.R. Ambatoarina, Madagascar	6
V-G	2	s. H_2SO_4, HCl	thermoluminescent	C. Pegmatites: Europe; Australia; Maine; California	7
V	as quartz		....	C. Urals; India; Ceylon; Madagascar; United States; Canada	8
.....	....	....	....	R. Tuscan lagoons, Italy	9
V	....	s. HCl	....	R. Southern Utah	10
V	....	s. H_2O	deflagrates	R. Tennessee	11
G	f.	s. HCl	....	V.R. Madagascar; Brazil	12
.....	....	....	....	A. World wide in igneous and metamorphic rocks	13
V	4	i. HCl	....	C. Widespread	14
V	df.	i.	....	R. Norway; Greenland; Pennsylvania; No. Carolina	15
V	2	i.	intumesces	R. Greenland; Norway; Red Hill, New Hampshire; Colorado	16
V	3-4	i. a.	....	A. Widespread	17
V	3-3.5	i.a.	....	R. Switzerland; Italy; Japan; California	18
V	3(?)	i.a.	....	R. Socotra Island; Nigeria; Massachusetts; Colorado	19
V	4	i.a.	thermoluminescent, yellow	C. Tremola, Switzerland; widespread	20
V	2.5	gel. HCl	no intumescence	Unc. With zeolites: Europe; New Jersey; Colorado	21
.....	if.	s. a.	46.3 % Ce	V.R. Narsarsuk, Greenland	22
V	if.	i.	sections normal to optic axis are idiophanous; var. Chiastolite shows black and white crosses	C. Ural Mts.; Spain; Germany; Maine; Massachusetts; Pennsylvania; California	23
A-V	1.5	sl. s. HNO_3	decrepitates; very brittle; (A) photoluminescent	C. Common in lead deposits	24
V-Pl	3	s. HCl	diamagnetic; radium changes color	A. Common with gypsum deposits	25
V	if.	s. a.	....	Unc. Austria; Italy; Novia Scotia; New York	26
M	1	s. h. HCl $SbCl_3$ ppt.	....	R. Germany; France; Quebec; California	27
V-sR	4.5-5	s. HCl, HNO_3	(Ra); (A) (C) photoluminescent; thermoelectric; pyro- and piezo- electric	C. Widely distributed; Renfew County, Quebec	28
V-Pl	1.5	dec. HCl	pyroelectric.	C. With zeolites	29
V	if.	s. HCl	(A) photoluminescent	A. Czechoslovakia; Germany; Italy; Sicily; Colorado; Missouri	30
M	f.	s. HNO_3	sectile, X-ray has cubic structure only above 180°C, is orthorhombic below; photoelectric	Unc. Saxony; Harz Mts.; So. America; Montana; Colorado; Nevada	31
M	ef.	dec. HNO_3	6.5 % Ge	V.R. Freiberg, Saxony; Bolivia	32
M-sM	....	dec. h. H_2SO_4	streak-brown	V.R. Mohave County, Arizona	33

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Arrhenite	Silico-tantalate of Y, Ce, Zr, Al, Fe, Ca, Be, etc.	Am.	....	3.68	....	R
2	Arsenic	As	H	3.5	5.7	....	tin W
3	Arsenoferrite	$FeAs_2$	C	5.5	6.42	....	dBr
4	Arsenolite	As_2O_3	C	1.5	3.7-3.86	1.755_η	W, colorl.
5	Arsenopyrite	$FeS_2 \cdot FeAs_2$	R	5.5-6	5.9-6.2	....	silver W
6	Astrophyllite	$(K,Na)_4(Fe,Mn)_4(Si,Ti,Zr)_5O_{16}$	R	3-4	3.3-3.4	1.703	bronze Y, gold Y
7	Atacamite	$CuCl_2 \cdot 3Cu(OH)_2$	R	3-3.5	3.76-3.78	1.861	bright Grn, blk Grn
8	Auerbachite	Impure hydrated $ZrSiO_4$	Tet.	6	4.06	....	brGr
9	Auerlite (Ra)	Silico-phosphate of Th; $3ThO_2(3SiO_2 \cdot P_2O_5)6H_2O$	Tet.	2.5-3	4.1-4.8	1.67_ω	Y, OR
10	Autunite (Ra)	$CaO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O$	R	2-2.5	3.1-3.2	1.575	lemon-sulfur Y
11	Avogadrite	$(K,Cs)BF_4$	R	....	2.62	1.3245	....
12	Axinite	$H(Fe,Mn)Ca_2Al_2BSi_4O_{16}$	Tri.	6.5-7	3.3	1.685	Br, Bl, Y
13	Azurite	$2CuCO_3 \cdot Cu(OH)_2$	M	3.5-4.3	3.4-3.8	1.758	azure Bi
14	Baddeleyite	ZrO_2 plus small amount of hafnium oxide	M	6.5	4.4-6.0	2.19	—, Y, Blk, Br
15	Bagrationite	var. allanite	M	5.5-6	3-4.2	....	Blk
16	Barite	$BaSO_4$	R	2.5-3.5	4.3-4.6	1.637	W
17	Barylite	$Be_2BaSi_2O_7$	R	6-7	4.0	1.70	—, W
18	Bassetite (Ra)	Nearly that of autunite	M	....	3.10	1.574	Y
19	Basnäsite	(Ce, La, Di) FCO_3	H	4-4.5	4.9-5.2	1.717_ω	Y-rBr
20	Bauxite	$Al_2O_3 \cdot 2H_2O$	Am.	soft	2.55	....	W, Br, R
21	Bazzite	Silicate, Sc, rare earths, Fe, Na	H	6.5	2.8	1.626_ω	azure Bl
22	Beckelite	$Ca_3(Ce,La,Di)_4Si_3O_{15}$	C	5	4.15	1.812_η	Y
23	Becquerelite (Ra)	$UO_3 \cdot 2H_2O$	R	....	....	1.87	br Y
24	Befanamite	Similar to thortveite; no Y; high Zr, Al	.....	6-7	3.49	....	....
25	Benitoite	$BaTiSi_3O_9$	H	6.2-6.5	3.6	1.757_ω	Bl-pBl, —
26	Bertrandite	$4BeO \cdot 2SiO_2 \cdot H_2O$	R	6-7	2.59-2.6	1.605	—, pY
27	Beryl	$3BeO \cdot Al_2O_3 \cdot 6SiO_2$	H	7.5-8	2.6-2.8	1.582_ω	Grn, Bl, Y, W
28	Berylonite	$NaBePO_4$	R	5.5-6	2.8	1.558	—, W, pY
29	Berzelianite	Cu_2Se	C	soft	6.71	......	silver W
30	Betafite (Ra)	Hydrous columbate, titanate of U, Ca, etc.	C	5	4	1.92	grnBlk
31	Biotite	See under Mica	.....	....	....	....	....
32	Bismuth	Bi	H	2-2.5	9.7-9.8	....	r silver
33	Bismutatantalite	$Bi_2O_3(Ta,Cb)_2O_5$	R	5	8.15	2.2_η	Blk
34	Bismuthinite	Bi_2S_3	R	2	6.4-6.5	....	lead Gr, tin W
35	Blödite	$Na_2SO_4 \cdot MgSO_4 \cdot 4H_2O$	M	3	2.23	1.488	—, grn, y R
36	Blomstrandine (Ra)	Columbate, titanate of Y, Er, Ce, U ($Nb_2O_5 : TiO_2 = 1:6$)	R	5.5	4.8-4.9	2.142_η	br Blk.

Luster	Fusibility	Solubility	Special Properties	Locality	
.....	....	....	33.2%Yttr.; 2.6%Cer.	V.R. Ytterby, Sweden	1
M	vol.	s. HCl	B. B. garlic odor	R. Saxony; Roumania; Japan; Arizona; Canada	2
.....	....	....	....	R. Switzerland; Czechoslovakia	3
V	1, vol.	sl. s. H_2O	....	R. California; Bohemia; Germany; France	4
M	2	dec. HNO_3	thermoelectric	C. Germany; Switzerland; Norway; New Hampshire; Colorado; Ontario	5
sM-Pl	2.5-3	dec. HCl	....	V.R. Norway; Greenland; French Guinea; Colorado	6
A-V	3-4	v. s. a.	....	Unc. So. America; rare in U.S.A.: Arizona; Wyoming; Utah	7
E	if.	powder s. H_2SO_4	....	V.R. Alexandrovsk, Russia	8
.....	if.	....	69-73% ThO_2	V.R. Henderson County, No. Carolina	9
sA-Pl	2.5	s. HNO_3	(A) photoluminescent	V.R. Saxony; France; Portugal; England; Connecticut; No. Carolina; So. Dakota	10
.....	....	....	....	V.R. As sublimate at Vesuvius	11
V	2	not dec.	ignited, gel. HCl; pyroelectric	Unc. Germany; Switzerland; France; Japan; New Jersey; Pennsylvania; California	12
V-A	3	s.a.	thermoluminescent	C. Siberia; Australia; Bisbee and Morenci, Arizona; New Mexico	13
Sk-G	6	dec. H_2SO_4	1.2%Hf; B. B. glows	V.R. Ceylon; Brazil; Montana	14
R-sM	....	....	....	V.R. Ural Mts.	15
V, R Pl	3	i.	decrepitates; (A) photoluminescent; diamagnetic	C. England; Roumania; Germany; Michigan; Missouri; Colorado; Utah	16
G	if.	i.	....	V.R. Sweden; New Jersey	17
.....	....	....	....	V.R. Cornwall, England	18
V	if.	sl. s. H_2SO_4	64-93%Cer.; 0-10% ThO_2	R. Sweden; Urals; Madagascar; Colorado	19
E	if.	....	nonplastic	C. France; Alabama; Georgia; Arkansas	20
.....	if.	i.	....	V.R. Baveno, Italy	21
.....	if.	s. a.	59.7%Cer.; 2.8%Yttr.	V.R. Ukraine, Russia	22
R	....	....	....	V.R. Belgian Congo	23
.....	....	....	1.0% Hf	V.R. Befanamo, Madagascar	24
A, V.	3	s. HF	....	V.R. San Benito County, California	25
V-Pl	if.	i. a.	pyroelectric	R. Siberia; France; Bohemia; Norway; Maine; Virginia; Colorado	26
V-R	5.5	i.	weakly pyroelectric; paramagnetic	C. Urals; S. W. Africa; Brazil; Colombia; Maine; No. Carolina; Colorado	27
V	3-5	s.a.	decrepitates	R. Maine; Norway	28
M	f.	s. HNO_3	....	V.R. Sweden; Harz Mts.	29
G	....	....	....	V.R. Madagascar	30
.....	....	....	....	....	31
M	v. vol.	s. HNO_3	....	V.R. Saxony; Norway; Sweden; Australia	32
sM	....	i. a.	streak-black; 40% Ta_2O_3; 6.6% Cb_2O_3. No U.	V.R. Pegmatite: Uganda	33
M	1	s. h. HNO_3	sectile, streak-Gr thermo-and photoelectric	R. Saxony; Norway; Bolivia; Connecticut; Montana	34
V	1.5	s. H_2O	....	R. Salsburg; Stassfurt; Russia; Chile; California; New Mexico	35
.....	df.	......	....	V.R. Pegmatite: Norway	36

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Bodenbenderite	Titano-silicate of Y, Al, Mn, etc.	C	6-6.5	3.5	$>1.77_\eta$	flesh R
2	Bodenite	var. allanite (rich in Al, Ca; no Be)	M	....	....	....	....
3	Boracite	$6MgO \cdot MgCl_2 \cdot 8B_2O_3$	C	7	2.9	1.667_η	W,gr,y, grn
4	Borax	$Na_2O \cdot 2B_2O_3 \cdot 10H_2O$	M	2-2.5	1.7	1.470	W,gr,bl, grn
5	Bornite	Cu_5FeS_4	C	3	4.9-5.4	....	copper R, Br
6	Boulangerite	$5PbS \cdot 2Sb_2S_3$	R	2.5-3	5.8-6.2	....	bl lead Gr
7	Bournonite	$3(Pb,Cu_2)S \cdot Sb_2S_3$	R	2.5-3	5.7-5.9	....	steel Gr, iron Blk
8	Brannerite (Ra)	$(UO,TiO, UO_2)TiO_3$	R	4.5	4.5-5.4	2.3_η	Blk
9	Braunite	$3MnMnO_3 \cdot MnSiO_3$	Tet.	6-6.5	4.7-4.8	$>2.72_{\mathrm{Li}\omega}$	d br Blk, steel Gr
10	Brazilite	var. baddeleyite	.....	....	....	....	....
11	Brewsterite	$(Ba,Sr)O \cdot Al_2O_3 \cdot 6SiO_2 + 5H_2O$	M	5	2.1-2.5	1.512	W,Y,Gr
12	Britholite	Basic phospho-silicate of Ce metals, Fe, Ca, Mg, Na, F	R	5.5	4.4	1.775	Br
13	Brochantite	$CuSO_4 \cdot 3Cu(OH)_2$	R	3.5-4	3.8-3.9	1.778	emerald Grn
14	Bröggerite (Ra)	$(U,Th,Pb_2)O_6 \cdot 2UO_3$	C	5.5	8.7-9.1	....	Blk
15	Bromellite	BeO	H	9	3.017	1.719_ω	W
16	Bromyrite	$AgBr$	C	2-3	5.8-6.47	2.25_η	Y
17	Brookite	TiO_2	R	5.5-6	3.8-4.1	2.586	Br,y,r, iron Blk
18	Brucite	$MgO \cdot H_2O$	H	2.5	2.3-2.4	1.5617_ω	W
19	Buszite	Cb, Pr, Er, Eu silicate	H	5.5	5	1.72_η	yR
20	Buttgenbachite	Hydrous chloro-Cu $(NO_3)_2$	H	....	3.33	1.747_η	azure Bl
21	Calamine	$2ZnO \cdot SiO_2 \cdot H_2O$	R	4.5-5	3.4-3.5	1.617	W
22	Calaverite	$AuTe_2$	M	2.5	9.0	....	steel Gr, y
23	Calcio-samarskite (Ra)	samarskite, Ca rich	.....	6.5	4.48-4.73	....	gr Br, Blk
24	Calcio-thorite (Ra)	var. thorite + Ca $5ThSiO_4 \cdot 2Ca_2SiO_4 \cdot 10H_2O$	Am.	4.5	4.114	....	dR
25	Calcite	$CaCO_3$	H	3	2.6-2.71	1.65849_ω	—, W, R, Bl, V, Grn, Y, Gr
26	Calcium-larsenite	$(Pb,Ca)ZnSiO_4$	R?	3	4.421	1.769	W
27	Caldasite	Mixture of baddeleyite with silicates	......	....	....	....	....
28	Caledonite	$2(Pb,Cu)O \cdot SO_3 \cdot H_2O$	R	2.5-3	6.4	1.866	verdigris Grn blGrn
29	Calomel	$HgCl$	Tet.	1-2	6.5	1.9733_ω	W, yGr, yW, Br
30	Cancrinite	$4Na_2O \cdot CaO \cdot 4Al_2O_3 \cdot 9SiO_2 \cdot 2CO_2 \cdot 3H_2O$	H	5-6	2.4-2.5	1.524_ω	W, Y, Gr, Grn, Bl, r
31	Canfieldite	$Ag_8(Sn,Ge)S_6$	C	2-3	6.276	....	Blk
32	Cappelenite	Boro-silicate of Y and Ba	H	6	4.4	1.76_ω	grn Br
33	Carnallite	$MgCl_2 \cdot KCl \cdot 6H_2O$	R	1	1.6	1.475	W-r
34	Carnotite (Ra)	$K_2O \cdot 2U_2O_3 \cdot V_2O_5 \cdot 2H_2O$	R	4	....	1.895-1.925	Y
35	Caryocerite (Ra)	Near melanocerite + ThO_2	H	5-6	4.29	$1.74 \pm_\eta$	Br

Luster	Fusibility	Solubility	Special Properties	Locality	
.....	....	....	....	V.R. Sierra Chica, Argentina	1
.....	....	....	17 % Yttr.; 18 % Cer.	V.R. Boden, Saxony	2
V, A	2	s. HCl	intumescence, strongly pyroelectric	Unc. Germany	3
V-E	1-1.5	s. H_2O	decrepitates; diamagnetic	C. Kashmir; Tibet; California; Nevada	4
M	2	s. HNO_3	streak: pale gr-Br	C. Common, widespread, in copper regions	5
M	ef.	s. h. HCl	streak: RBr; decrepitates; photoelectric	Unc. Germany; France; Washington; Nevada	6
M	ef.	dec. HNO_3	decrepitates; photoelectric	Unc. Germany; France; England; Peru; Bolivia; Arizona; Utah; Nevada	7
sM	....	s. a.	streak: d grnBr	V.R. Stanley Basin, Idaho	8
sM	if.	s. HCl	streak: as color	R. Harz Mts.; Sweden; India; Brazil	9
.....	....	....	0.5 % Hf ?	V.R. Brazil	10
V-Pl	3	dec. HCl	B.B. swells; pyroelectric	R. Scotland; Ireland; Germany; France	11
.....	....	....	60.5-60.9 % Cer.	V.R. South Greenland	12
V	3.5	s. HNO_3	....	Unc. Algeria; S. W. Africa; Chile; Arizona; Utah; California	13
sM	if	d. HNO_3	0.4 % Cer.; 1.4-4.3 % Yttr.; 4.7-6.1 % ThO_2	V.R. Annerod, Norway	14
.....	....	....	....	V.R. Vermland, Sweden	15
A-G	1, 422°C	s. NH_4OH	diathermanous	V.R. Mexico; Chile	16
A-sM	if.	i.	....	R. Europe; Massachusetts; New York; Arkansas	17
V,P,W	if.	s.	pyroelectric; (A) photoluminescent	C. Italy; Sweden; New York; Pennsylvania; California; Texas	18
.....	....	....	....	V.R. Kahn, S. W. Africa	19
.....	....	....	....	V. R. Lihasi, Belgian Congo	20
V	6	gel. a.	decrepitates, strongly pyroelectric; triboluminescent	C. Siberia; Germany; England New Jersey; Nevada; Montana; Colorado	21
M	ef.	dec. HNO_3	....	R. Roumania; W. Australia; California; Colorado	22
.....	....	....	....	V.R. Hybla and Parry Sounds, Ontario	23
V	if.	gel. a.	59.3 % ThO_2	V.R. Islands of Läven and Arö, Norway	24
V-E	if.	s.HCl	glows under B. B. some var. fluoresce red, pink; photoluminescent	A. World-wide; Optical, Pedro Mts., N. Mex.	25
G	....	....	photoluminescent; vivid lemon. Diamagnetic	V.R. Franklin, New Jersey	26
.....	....	....	....	V.R. Caldas district, Minas Geraes, Brazil	27
W	1.5	sl.s.HNO_3	....	R. Atacama Desert, Chile; Europe; California; New Mexico; Utah	28
A	vol.	s. aq. reg.	cathode phosphorescent and colored	R. Bavaria; Bohemia; Italy; Texas	29
sV-G	2	s. HCl	intumesces, X-ray shows similarity to sodalite group	Unc. In rocks, i.e., nepheline syenites; Norway; Maine	30
M	ef.	dec. HNO_3	1.82 % Ge	V.R. Bolivia	31
.....	if.	s. HCl	4.2 % Cer.; 52.5 % Yttr.	V.R. Langesundfiord, Norway	32
G	1	s. H_2O	strongly phosphorescent	Unc. Stassfurt; Upper Silesia	33
E	if.	....	....	V.R. Colorado; Utah; Pennsylvania; S. Australia; Belgian Congo	34
V,R	if.	dec. HCl	swells; 41. 8 % Cer.; 2.2 % Yttr.; 13.6 % ThO_2	V.R. Langesundfiord, Norway	35

	Name	Composition	Crystal System	Hard-ness	Specific Gravity	Refractive Index	Color
1	Cassiterite	SnO_2	Tet.	6-7	6.8-7.1	1.9966ω	Br, Blk, R
2	Castelnaudite	var. xenotime with Zr	Tet.	4-5	4.5	....	....
3	Catapleiite	$H_4(Na_2,Ca)ZrSi_3O_{11}$	M	6	2.75	1.592	pY, yBr
4	Celestite	$SrSO_4$	R	3-3.5	3.95	1.624	W, bl, r
5	Cenosite	$2CaO\cdot(Ce,Y)_2O_3\cdot CO_2\cdot 4SiO_2\cdot H_2O$	R	5-6	3.4-3.6	1.689	yBr
6	Cerargyrite	$AgCl$	C	1-1.5	5.552	2.0611	pearl Gr, gr. Grn, W, —
7	Cerite	$H_3(Ca,Fe)Ce_3Si_3O_{13}$	R	5.5	4.8-4.9	1.818	clove Br, cherry R
8	Cerussite	$PbCO_3$	R	3-3.5	6.46-6.574	2.076	W, Gr
9	Ceylonite	$(Mg,Fe)O\cdot(Al,Fe)_2O_3$	C	8	3.5-3.6	....	dGrn, Br, Blk
10	Chabazite	$(Ca,Na_2)Al_2Si_4O_{12}\cdot 6H_2O$	H	4-5	2.1-2.2	1.480ω 1.485β	W, flesh R
11	Chalcanthite	$CuSO_4\cdot 5H_2O$	Tri.	2-2.5	2.2	1.539	Berlin Bl, sky Bl
12	Chalcedony	SiO_2	Crypt.	7	2.6-2.64	1.537η	varied
13	Chalcocite	Cu_2S	R	2.5-3	5.5-5.8	....	blk lead Gr
14	Chalcolamprite	$Na_4(CaF)_2Cb_2SiO_9$?	C	5.5	3.8	1.87η	dGr Br
15	Chalcomenite	$CuSeO_3\cdot 2H_2O$	M	2.5-3	3.76	1.731	Bl
16	Chalcopyrite	$CuFeS_2$	Tet.	3.5-4	4.1-4.3	....	grn brass Y
17	Chillagite	$3PbWO_4\cdot PbMoO_4$	Tet.	3.5	7.5	....	Y, br
18	Chiviatite	$2PbS\cdot 3Bi_2S_6$	.....	....	....	....	lead Gr
19	Chlorite	....	.....	....	....	....	....
20	(a) Clinochlore	$1H_4Mg_3Si_2O_9\cdot 1H_4Mg_2Al_2SiO_9 >$	M	2-2.5	2.65-2.78	1.57-1.59	d grass Grn to y, W, R
21	(b Penninite	$H_4Mg_3Si_2O_9 > H_4Mg_2Al_2SiO_9$	M	2-2.5	2.6-2.85	1.576-1.60	"
22	(c) Prochlorite	$H_4Mg_3Si_2O_9 < H_4Mg_2Al_2SiO_9$	M	1-2	2.78-2.96	1.58-1.67	"
23	Chloritoid	$H_2(Fe,Mg)Al_2SiO_7$	M or T	6.5	3.4-3.6	1.72	dGr, grn Gr, gr Blk, Grn
24	Chlormagnesite	$MgCl_2$	H	soft	2.325	1.675ω	....
25	Chondrodite	$2Mg_2SiO_4\cdot Mg(F,OH)_2$	M	6-6.5	3.1-3.3	1.619-1.656	W, pY, Br, R
26	Chromite	$FeO\cdot Cr_2O_3$	C	5.5	4.3-4.6	2.1η	iron Blk, bl Blk
27	Chrysoberyl	$BeO\cdot Al_2O_3$	R	8.5	3.5-3.8	1.748	various Grns to Y
28	Chrysocolla	$CuSiO_3\cdot 2H_2O$	Crypt.	2.4	2-2.24	1.597	Grn, bl Grn, Bl
29	Chrysolite	$2(Mg,Fe)O\cdot SiO_2$	R	6-7	3.3-3.6	1.65-1.68	olive Grn, Grn, bl, gr Grn
30	Churchite	$(Ce,Ca)PO_4\cdot 2H_2O$	R?	3-3.5	3.14	1.62	pGr
31	Cinnabar	HgS	H	2-2.5	8-8.2	2.913ω	R, brR, lead Gr
32	Clarkeite (Ra)	$(Na_2,Pb)O\cdot 3UO_3\cdot 3H_2O$	.....	4-4.5	6.39	2.098	v. dBr
33	Clausthalite	$PbSe$	C	2.5-3	7.6-8.8	....	lead Gr
34	Cleveite (Ra)	Related to uraninite; rich in rare earths, He	C	5.5	7.49	....	Blk
35	Clinohedrite	$H_2CaZnSiO_5$	M	5.5	3.33	1.67η	—, W

Luster	Fusibility	Solubility	Special Properties	Locality	
A	if.	sl. s.	....	Unc. England; Malay States; Bolivia	1
.....	....	....	....	V.R. Diamantinos, and Bahia, Brazil	2
DV	3	s. HCl	becomes hexagonal at 140°C; 0.3%Hf	V.R. Langesundfiord, Norway; S. Greenland; Arkansas	3
V-Pl	3	i.	frequently decrepitates; Ra luminescent	R. Put-in-Bay, Ohio; Pennsylvania; New York; Colorado; Europe	4
GV	5	s. HCl	little exfoliation	V.R. Norway; Sweden; Ontario	5
R-A	1	i. HNO_3, s. NH_4OH	highly sectile; X-ray: atomic structure similar to halite	R. Harz Mts.; N. S. Wales; Chile; Colorado; Idaho	6
D, A, R	if.	gel. HCl	51-72%Ce	V.R. Sweden	7
A-V	1	s. HNO_3	decrepitates; pyroelectric; (A) photoluminescent	C. Common lead ore; Europe; N.S. Wales; Missouri; Idaho	8
V	2135°C	sl. s. H_2SO_4	....	R. Ceylon; Franklin, New Jersey	9
V	3	dec. HCl	intumesces	C. Common zeolite; Germany; New Jersey; Nova Scotia	10
V	3	s. H_2O	....	Unc. Desert regions; copper mine waters	11
W	if.	i.	thermophosphorescent; (A) photoluminescent	A. Widespread	12
M	1130°C	s. HNO_3	above 91°C changes to isometric	C. Important copper ore, widespread	13
M ?	....	....	3.41%E	V.R. Narsarsuk, S. Greenland	14
V	1.5	s.a.	....	R. Mendoza, LaRioja, Argentina	15
M	2	dec. HNO_3	X-ray: structure similar to sphalerite. Cu, Fe replacing Zn	A. Common copper ore, widespread	16
V	ef.	dec. a.	....	V.R. Chillagoe, N. S. Wales	17
M	....	....	microscopic study shows this to be a mixt. of bismuthinite and Cu minerals	R. Chivaiato, Peru	18
.....	....	....	....	A. Very common and widespread	19
Pl	6	dec. H_2SO_4	....	.. Most common of chlorite minerals; Urals; New York	20
Pl, V	5-6	sl. dec. HCl; dec. H_2SO_4	exfoliates	.. Crystals; Switzerland; Utah	21
sPl	5	dec. h. H_2SO_4	....	.. Crystals: common in Alps; N. Carolina	22
Pl	6	dec. H_2SO_4	....	C. Crystals: Urals; France; Rhode Island; Michigan; common	23
V	1	s. H_2O	deliquescent	V.R. Near volcanoes	24
V-R	if.	gel.	h. H_2SO_4 gives F_2	Unc. Mt. Somma; Sweden; New York	25
sM-M	if.	i.	sometimes feebly magnetic	Unc. S. Rhodesia; New Caledonia; N. Carolina; Pennsylvania; California	26
V	if.	i.	X-ray: atomic structure similar to chrysolite; heating discolors; ultraviolet recolors	Unc. Maine; Connecticut; New York; Brazil; Urals; S. Rhodesia	27
V, E	if.	dec. a.	decrepitates, rather sectile	Unc. Minor copper ore	28
V	if.	s. HCl	pale yellowish green, transparent is gem variety	C. Basic igneous rocks; meteorstones	29
V, P	if.	s.a.	51.87%Ce	V.R. Cornwall, England	30
A	vol.	d. aq. reg.	strong circular polarization about 15 times quartz	Unc. Almaden, Spain; California; Texas; Nevada; Italy	31
W	.....	s. HCl	....	V.R. Spruce Pine, N. Carolina	32
M	vol.	s.a.	decrepitates	R. Harz Mts.; Argentina	33
D	if.	s. H_2SO_4	very rich in He. 2-3%Cer.; 10%Yttr., 4-5%ThO_2	V.R. Arendal, Norway	34
Pl	4	gel. HCl	exfoliates; photoluminescent orange	V.R. Franklin, New Jersey	35

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Cobaltite	$CoS_2 \cdot CoAs_2$	C	5.5	6-6.3	....	silver W + r tint
2	Codazzite	$(Ca,Mg,Fe,Ce)CO_3$	H	4	2.5	....	ashy Br
3	Columbite	$(Fe,Mn)(Cb,Ta)_2O_6$	R	6	5.3-7.3	2.2-2.4	iron Blk, grn, br Bl
3.1	Colemanite	$Ca_2B_6O_{11} \cdot 5H_2O$	M	4.0-4.5	2.43	1.592	YW
4	Cookeite	$(HO)_6LiAl_3Si_2O_6$	M	2.5	2.67	1.579	W, y, Grn, Br, p.Pk
5	Cooperite	PtS	Tet.	4-5.5	9	....	steel Gr
6	Copper	Cu	C	2.5-3	8.8-8.92	0.641_{Na}	copper R
7	Cordierite	$Mg_2Al_4Si_5O_{18}$	R	7-7.5	2.6-2.7	1.534 to 1.599_η	various Bl
8	Cordylite	parisite with Ba (Cer. 49.4%)	H	4.5	4.31	1.760_ω	wax Y
9	Corundum	Al_2O_3	H	9	3.9-4.1	1.7676 to 1.7682_ω	Bl, R, V, Gr, Br, W
10	Covellite	CuS	H	1.5-2	4.6	1.45_{Na} ω; 2.688	indigo Bl
11	Crocidolite	$Na_2O \cdot Fe_2O_3 \cdot 2FeO \cdot 6SiO_2$	M	4	3.2-3.3	1.699	lavender Bl, leek Grn
12	Crocoite	$PbO \cdot CrO_3$	M	2.5-3	5.9-6.1	2.37 to 2.42	hyacinth R
13	Cryolite	$3NaF \cdot AlF_3$	M	2.5	2.9-3.0	1.3389	snow W, r, br, Bl
14	Cryolithionite	$3NaF \cdot 3LiF \cdot 2AlF_3$	C	2.5	2.78	1.339_η	—, W
15	Cuprite	Cu_2O	C	3.5-4	5.8-6.2	2.849_η	Reds
16	Cuprotungstite	$CuWO_4$	Crypt.	4.5	....	2.15_η	Grn
17	Curite (Ra)	$2PbO \cdot 5UO_3 \cdot 4H_2O$	R	4-5	7.192	2.11	rBr, dY
18	Cyrtolite	Related to alvite; pseudomorph after zircon	Tet.	5-6	3.3-4.3	....	br R
19	Danalite	$3(Fe,Zn,Mn)BeSiO_4 \cdot ZnS$	C	5.5	3.4	1.754_η	flesh R, Gr
20	Danburite	$CaO \cdot B_2O_3 \cdot 2SiO_2$	R	7	3	1.633	pY, yW, yBr, —
21	Darapskite	$NaNO_3 \cdot Na_2SO_4 \cdot H_2O$	M	2-3	2.2	1.481	colorl.
22	Datolite	$2CaO \cdot B_2O_3 \cdot 2SiO_2 \cdot H_2O$	M	5-5.5	2.9-3.0	1.654	W, pGrn, Y, R
23	Davidite (Ra)	titanate of Fe, U, V, Cr, rare earths	C	....	4	....	Blk
24	Delorenzite (Ra)	$2FeO, UO_2, 2Y_2O_3 \cdot 24TiO_2$?	R	5-5.5	4.7	$1.70(?)_\eta$	Blk
25	Descloizite	$4(Pb,Zn)O \cdot V_2O_5 \cdot H_2O$	R	3.5	5.9-6.1	2.265	R, Br, Blk
26	Dewindtite (Ra)	$3PbO \cdot 5UO_3 \cdot 2P_2O_5 \cdot 12H_2O$	R	....	4.08	1.763	canary Y
27	Diamond	C	C	10	3.516-3.525	2.4195_η	—, W, y, r, o, grn, bl, Blk
28	Diaspore	$Al_2O_3 \cdot H_2O$	R	6.5-7	3.3-3.5	1.722	w, gr, Y, —, Br
29	Dickinsonite	$(Mn,Fe,Ca,H,Na)_3 \cdot P_2O_8$	M	3.5-4	3.4	1.655 to 1.662	olive Grn to grass Grn
30	Dioptase	$CuO \cdot SiO_2 + H_2O$	H	5	3.2-3.4	1.644 to 1.658_ω	emerald Grn

Luster	Fusibility	Solubility	Special Properties	Locality	
M	f.	s. h. HNO_3	thermoelectric; X-ray: isometric lattice; evidences of tetartohedral symmetry rare in crystals	Unc. Trans-Caucasia; Norway; Sweden; Cobalt, Ontario	1
sV	....	....	Ce due to included parisite	V.R. Colombia emerald mine	2
M-A	if.	sl. dec. h. HCl, H_2SO_4	X-ray: structure closely resembles brookite	R. Ilmen Mts.; Finland; Norway; Madagascar; Greenland; Me.; Colo.; N. Car.; S. D.	3
....	....	....	....	Unc. Death Valley, Calif.	3.1
Pl, V	6	dec. H_2SO_4	exfoliates	R. With tourmaline: Maine; Connecticut	4
....	....	....	....	V.R. Transvaal and Lydenburg, S. Africa	5
M	1087° C	s. HNO_3	....	Unc. Russia; England; N. S. Wales; Bolivia, Michigan	6
V	5-5.5	sl. dec.	Ceylon gives intense blue transparent "saphir d'eau"	Unc. Igneous rocks; Bavaria; Ceylon, Connecticut	7
W	if. decrepitates	s. HCl	X-ray: structure different from parisite	V.R. Narsarsuk, S. Greenland	8
V-A	if.	i.	X-ray: shows complex structure; likened to deformed halite structure	Unc. Urals; N. Carolina; Georgia; gems: India; Siam; Burma	9
sM-R	2.5	s. HNO_3	....	R. Serbia; Saxony; Peru; Chile; Bolivia; Colorado; Montana	10
Sk, D	3(?)	i.	fibrous = "Blue Asbestos"; silicified = "Tiger's eye."	Unc. S. Africa; Austria; France; Massachusetts; Rhode Island	11
A-V	1.5	s. a.	streak: orange-yellow; decrepitates	R. Urals; Tasmania; Brazil; Philippine Islands; Arizona	12
V-G	1	s. H_2SO_4	X-ray: atomic structure similar to garnet. Cubic form at 570°C.; colored by cathode rays	Unc. Ivigtut, Arksukfiord, Greenland; Colorado; Russia	13
V	1.5	s. a.	X-ray: body centered cubic similar to garnet	V.R. With cryolite	14
A-sM	f.	s. conc. HCl	X-ray: structure of normal symmetry; photoelectric	Unc. Perm, Russia; N. S. Wales; Rhone, France; Arizona	15
V	3(?)	dec. HCl	....	V.R. Santiago, Chile; Mexico; Spain; N. S. Wales; Utah	16
......	....	s. a.	strongly radioactive	V.R. Katanga, Belgian Congo	17
sA	....	....	5.5%Hf	V.R. Ytterby, Sweden	18
V-R	3	gel. HCl	....	R. Cape Ann, Massachusetts; New Hampshire; Colorado; Cornwall, England	19
V-G	3.5	sl. dec. HCl	thermophosphorescent	R. Connecticut; New York; Japan; Switzerland; Madagascar	20
V	1(?)	s. H_2O	....	R. Taltal, Chile	21
V	2	gel. HCl	X-ray: shows close relation structurally between datolite and euclase	Unc. New Jersey; Massachusetts; Michigan; Hartz Mts.; Norway	22
Sp	....	....	5-10%E_2O_3	V.R. Olary, S. Australia	23
R	if.	dec. H_2SO_4	14.6% Y	V.R. In pegmatite: Piedmont, Italy	24
G	1.5	s. d. HNO_3	decrepitates	Unc. Austria; Africa; Argentina; New Mexico; Arizona	25
A	.....	s. HNO_3	....	V.R. Katanga, Belgian Congo	26
A-G	if. out of contact with air, changes to graphite at 1900°C.	i.	transparent to X-rays; triboluminescent; phosphoresces; triboelectric and photoluminescent	Unc. S. Africa; Brazil; India; Arkansas; N. Carolina; Wisconsin; Virginia; Colorado; California; Georgia	27
V-P	if.	i.; s. h. NaOH	decrepitates	Unc. Urals; Greece	28
V	2.5-3	s.a.	....	V.R. Connecticut; Maine	29
V	if.	gel. HCl	decrepitates; paramagnetic; pyroelectric	R. French Congo; Katanga, Belgian Congo; Chile; Arizona	30

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Dolomite	$CaCO_3 \cdot MgCO_3$	H	3.5-4	2.8-2.9	1.68174ω	W,r,Grn, Br,Gr, Blk
2	Dumontite (Ra)	$2PbO \cdot 3UO_3 \cdot P_2O_5 \cdot 5H_2O$	R?	....	....	$1.77\text{-}1.89\eta$	dark Y
3	Dumortierite	$8Al_2O_3 \cdot B_2O_3 \cdot 6SiO_2 \cdot H_2O$?	R	7	3.3-3.4	1.686	smalt Bl, grnBl
4	Dysanalyte	$(Ca, Fe)_7Cb_2Ti_6O_{24}$?	C	5-6	4.13	2.33η	iron Blk
5	Dyscrasite	Ag_3Sb	R	3.5-4	9.4-9.8	....	silver W
6	Edingtonite	$BaO \cdot Al_2O_3 \cdot 3SiO_2 \cdot 3H_2O$	R	4-4.5	2.7-2.8	1.549	W,grnW, Pk
7	Eglestonite	Hg_4Cl_2O	C	2-3	8.3	2.49η	bl Y, Blk
8	Elbrussite	Hydrous silicate Al, Fe''', Fe'', Mg, Ca, K	Uniaxial	2	2.281	1.56	dBr
9	Electrum	Au + 36-18% Ag	C?	2.5-3	15.5-12.5	....	pY, yW
10	Eliasite (Ra)	var. gummite	Am.	3.5-4.5	4.0-5.0	....	hyacinth R, Blk
11	Ellsworthite (Ra)	$CaO \cdot Cb_2O_5 \cdot 2H_2O$ approx. plus U oxides, Ti, etc.	C	4	3.608-3.758	1.89η	amber Y, dBr
12	Elpidite	$H_6Na_2Zr(SiO_3)_6$	R	7	2.54	1.565	W—, brick R
13	Embolite	Ag(Cl, Br)	C	1.5	5.8	2.15η	gr,Grn, yGrn, Y
14	Emmonsite	$FeTeO_3$	M	2	5	2.09	yGrn
15	Enargite	$3Cu_2S \cdot As_2S_5$	R	3	4.3-4.5	....	grBlk, iron Blk
16	Endeiolite	Near chalcolamprite with F replaced by (OH)	C	4	3.44	....	dBr
17	Epididymite	$HNaBeSi_3O_8$	R	5.5	2.55	1.544 Larsen: 1.569β	colorl.
18	Epidote	$4CaO \cdot 3(Al,Fe)_2O_3 \cdot 6SiO_2 \cdot H_2O$	M	6-7	3.2-3.5	1.754	pistachio Grn, y Grn, brGrn, Blk
19	Epistilbite	$CaO \cdot Al_2O_3 \cdot 6SiO_2 \cdot 5H_2O$	M	3.5-4	2.25	1.510	W
20	Epistolite	$H_7Na_6Cb_3TiSi_5O_{26}$?	M	1-1.5	2.9	1.650	W,gr,br
21	Epsomite	$MgSO_4 \cdot 7H_2O$	R	2-2.5	1.75	1.455	W
22	Erdmannite (Ra)	Silicate, Ce, Y, Th, Zr, Be, Ca, Al, Fe, H_2O	Am.	4.5	3.01-3.39	....	Br, leek Grn
23	Erikite (Ra)	Phospho-silicate, Ca, Ce, Al, K, Na, Th, H_2O	R	5.5	3.5	....	pYBr, d grBr
24	Erythrite	$3CoO \cdot As_2O_5 \cdot 8H_2O$	M	1.5-2.5	3.0	1.663	crimson, peach R
25	Eschwegite	Hydrous titanate, columbate, tantalate of Y, Er	.....	5.5	5.87	$2.15\text{-}2.20\eta$	d rGr
26	Eschynite (Ra)	$(Ca,Fe)_2Ce_4Cb_6(Ti,Th)_8O_{39}$?	R	5.5	4.9-5.1	2.205η	BrBlk
27	Eucairite	$Cu_2Se \cdot Ag_2Se$	C	1	7.50	....	silver W, lead Gr
28	Euclase	$2BeO \cdot Al_2O_3 \cdot 2SiO_2 \cdot H_2O$	M	7.5	3.1	1.655	—, pGrn, Bl
29	Eucolite	Similar to eudialyte	H	5	3.1	1.621ω	—, Br, R
30	Eucrasite (Ra)	Altered thorite with Ce, Y, Th, Zr, Ti, Ca, Mn, Fe, Na	R	4.5-5	4.4	....	brBlk
31	Eucryptite	$LiAlSiO_4$	H	....	2.667	1.545ω	—, W
32	Eudialyte	$(Na,Ca,Fe)_6Zr(OH,Cl)(SiO_3)_6$ with Ce	H	5-6	2.8-3.1	1.606 to 1.610ω	R, Br, Pk
33	Eudidymite	$HNaBeSi_3O_8$	M	6	2.553	1.546	W
34	Eulytite	$Bi_4(SiO_4)_3$	C	4-6	6.1	2.05	Br, gr, —, straw Y

Luster	Fusibility	Solubility	Special Properties	Locality	
V, Pl, D	if.	s. h. HCl	X-ray: lower symmetry than calcite. $\frac{1}{3}$ replacement of Mg by Fe, no change; paramagnetic	A. Saxony; Switzerland; Missouri; Vermont; New Jersey; New York	1
E	....	....	....	V.R. Belgian Congo	2
V	If.	i. HF	exhibits idiophanous figures analogous to andalusite	Unc. Rhone, France; California; New York; Nevada; Ontario	3
A-sM	If.	dec. HCl	0-5% Cer.	V.R. Kaiserstuhl, Baden, Germany; Vesuvius	4
M	1.5	s. HNO_3	X-ray: identical to artificial Ag_3Sb	Unc. Chief ore, Baden; Harz Mts.; N. S. Wales; Chile	5
V	5	gel. a.	....	V.R. Glasgow, Scotland; Sweden	6
A, R	vol.	dec. a.	decrepitates	R. Terlingua, Texas	7
G	3	....	streak: dark lemon yellow; adheres to tongue	R. Karatschaev, N. Caucasus	8
M	ef. at 1100°C	s. aq. reg.	....	R. Verespatak, Hungary; Peru; Colombia; Altai Mts.; Bodie, Calif.; Virginia	9
R	....	....	as gummite	V.R. Bohemia	10
A	....	....	....	V.R. In pegmatite: Hasting County, Haliburton County, Ontario	11
.....	....	....	0.2% Hf	V.R. Narsarsuk, S. Greenland	12
A	ef.	s. NH_4OH	diathermanous	R. Chile; N. S. Wales; Nevada; Colorado; Arizona; New Mexico	13
.....	f.	s. HCl	....	V.R. Tombstone, Arizona	14
M	1	s. aq. reg., s. HNO_3	decrepitates	C. Peru; important ore Butte, Montana	15
.....	....	....	4.43% E_2O_3	V.R. Narsarsuk, Greenland	16
V	3	v. sl. s. a.	....	V.R. Narsarsuk, Greenland; Langesundfiord, Norway	17
V	3-3.5	sl. dec. HCl	intumesces	A. Widespread; France; Italy; Colorado; Alaska	18
V-Pl	3	dec. HCl	intumesces	R. Iceland; Scotland; India	19
.....	....	....	....	V.R. Julianehaab, Greenland; in pegmatite	20
V-E	1	s. H_2O	found in mineral waters; efflorescence on mine walls	Unc. Epsom, England; Italy; Stassfurt; Kentucky; Tennessee; Indiana	21
V	2.5	gel. HCl	18-35% Cer., 1.5-2% Yttr., 0-12% ThO_2+ZrO_2	V.R. Brevig, Norway	22
.....	....	....	40.5% Cer., 3.3% ThO_2	V.R. Julianehaab, Greenland	23
A, V, Pl, D	2	s. HCl	sectile	R. Saxony; Sweden; Ontario; rare in United States	24
.....	....	....	....	V.R. Pebbles at Minas Geraes, Brazil	25
.....	if.	i.	....	R. Ilmen Mts., Siberia; Hitterö, Norway	26
M	ef.	s. h. HNO_3	....	R. Sweden; Chile; Argentina	27
V	5.5	i.	tribo- and pyro-electric	R. Ural Mts.; Salzburg, Bavaria; Brazil	28
.....	2.5	gel. HCl	0.2% Hf	V.R. S. Norway; Madagascar; Magnet Cove, Arkansas	29
W G	4	s. H_2SO_4	streak: brown	V.R. Brevig, Norway	30
.....	ef..	gel. HCl	....	V.R Branchville, Connecticut	31
V	2.5	gel. HCl	0.1, 0.2, 0.17% Hf	V.R. Julianehaab, Greenland; Russia; Russian Lapland	32
V, Pl	3	s. HF	....	V.R. Narsarsuk, Greenland; Langesundfiord, Norway	33
A	2	gel. HCl	....	V.R. Saxony	34

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Euxenite (Ra)	Columbate, titanate of Y, Ce, Er, U, Th, Zr	R	6.5	4.7-5.0	2.06-2.26$_{\eta}$	br Blk
2	Fairfieldite	$Ca_2MnP_2O_8\cdot 2H_2O$	Tri.	3.5	3.1	1.644	W, gr, Y
3	Fayalite	$2FeO\cdot SiO_2$	R	6.5	4.1-4.3	1.877	p, grn Y, Br, Blk
4	Feldspar	. . . .	. . . . .	. . . .	. . . .	. . . .	. . . .
5	(a) Albite	Ab. = $NaAlSi_3O_8$	Tri.	6-6.5	2.60-2.62	1.529	W, grn, blk, r
6	(b) Andesine	$Ab_{70}An_{30}$-$Ab_{50}An_{50}$	Tri.	6	2.676	1.553	W, grn, —
7	(c) Anorthite	An. = $CaAl_2Si_2O_8$	Tri.	6-6.5	2.74-2.76	1.584	W
8	(d) Anorthoclase	$(Na,K)AlSi_3O_8$	Tri.	6	2.57-2.60	1.529	W
9	(e) Bytownite	$Ab_{70}An_{30}$-$Ab_{10}An_{90}$	Tri.	6	2.73	1.572	colorl.
10	(f) Celsian	$BaAl_2Si_2O_8$	M	6-6.5	3.37	1.589	colorl.
11	(g) Hyalophane	$(K_2,Ba)Al_2Si_4O_{12}$	M	6-6.5	2.805	1.545	—, W, Pk, grn
12	(h) Labradorite	$Ab_{50}An_{50}$-$Ab_{30}An_{70}$	Tri.	6	2.68-2.72	1.563	W, Gr, Br, grn, —
13	(i) Microcline	$KAlSi_3O_8$	Tri.	6-6.5	2.54-2.57	1.522	W, R, Grn, pY
14	(j) Oligoclase	$Ab_{90}An_{10}$-$Ab_{70}An_{30}$	Tri.	6	2.62-2.65	1.543	W, Gr, grn, r
15	(k) Orthoclase	$KAlSi_3O_8$	M	6	2.56-2.58	1.524	W, Pk, —
16	Ferberite	$FeWO_4$	M	5-5.5	7.1	2.4$_{Li}$	br R, Blk, Br
17	Ferghanite (Ra)	$U_3(VO_4)_2\cdot 6H_2O$	R	2	3.3	. . . .	sulfur Y
18	Fergusonite (Ra)	$Y(Cb,Ta)O_4$ with Er, Ce, U, Fe, Ca, etc.	Tet. ?	5.5-6	5.8	2.115 2.175$_{\eta}$	br Blk
19	Ferritungstite	$Fe_2O_3\cdot WO_3\cdot 6H_2O$	H	. . . .	. . . .	1.80$_{\omega}$	pY-Br Y
20	Fersmannite	$2Na_2(O,F_2)\cdot 4CaO\cdot 4TiO_2\cdot 3SiO_2$	M	5.5	3.44	1.930	Br
21	Fischerite	$AlPO_4\cdot Al(OH)_3\cdot 2\frac{1}{2}H_2O$	R	5	2.5	1.55$_{\eta}$	Grn
22	Florencite	$3Al_2O_3\cdot Ce_2O_3\cdot 2P_2O_5\cdot 6H_2O$	H	5	3.58	1.680$_{\omega}$	p Y
23	Fluellite	$AlF_3\cdot H_2O$	R	3	2.17	1.490	—, W
24	Fluocerite	$(Ce,La,Di)F_3$	H	4.5-5	5.7-6.13	1.614$_{\eta}$	p wax Y, y, r, Br
25	Fluorite	CaF_2	C	4	3-3.3	1.4339$_{\eta}$	—, all colors
26	Forsterite	$2MgO\cdot SiO_2$	R	6-7	3.2-3.3	1.651	W, grn Y
27	Fourmarierite (Ra)	Hydrous Pb uranate	R	3-4	6.046	1.92	R
28	Fowlerite	$Ca(Mn,Fe,Zn)_5(SiO_3)_6$	M	6	3.67	. . . .	. . . .
29	Franklinite	$(Fe,Mn,Zn)O\cdot Fe_2O_3$	C	5.5-6.5	5-5.2	2.36$_{Li\,\eta}$	iron Blk
30	Freieslebenite	$2Ag_2S\cdot 3PbS\cdot 2Sb_2S_3$	M	2	6.2-6.4	. . . .	steel Gr, silver W
31	Fremontite	$(Na,Li)Al(OH,F)PO_4$	Tri. ?	5.5	3.04	1.603	gr W, W
32	Freyalite	Silicate of Th, rare earths, with Al, Fe, Mn, Na, H_2O	Am.	6	4.06-4.17	. . . .	Br
33	Fuchsite	Muscovite + Cr	M	2-2.25	2.6-2.8	1.594	bright Grn, yGrn
34	Gadolinite	$Be_2Fe(YO)_2(SiO_4)_2$	M	6.5-7	4.0-4.5	1.77-1.82$_{\eta}$	Blk, grn Blk, Br

Luster	Fusibility	Solubility	Special Properties	Locality	
G	if.	i.	2-8 % Cer.; 13-35 % Yttr.	R. Madagascar; Brazil; Norway; Finland; N. Carolina	1
V	4	s.a.	....	R. Branchville, Connecticut; Buckfield, Poland, Maine	2
sM, R	4	gel. HCl	turns to brown or black on exposure	R. Lipari Islands, Fayal, Azores; France; Ireland	3
.....	....	....	....	A. World-wide in igneous, metamorphic rocks	4
V, Pl	4	i.	pyroelectric	A. Switzerland; France; Virginia; Colorado.	5
V	4-4.5	i.	....	.. Small crysts.: Japan	6
V	5	dec. HCl	....	.. Mte. Somma, Vesuvius, Italy; Japan; New Jersey; in meteorites	7
V	if.	i.	....	.. Pantelleria, Italy; S. Norway; New York	8
V	5	gel. h. HCl	....	R. Rarest of feldspars; found in some meteorites	9
V	if.	s. HCl	....	V.R. Sweden	10
V	6	i.	....	R. Switzerland; Sweden; Franklin, N. J.	11
V	1280 to 1500°C	sl. s. h. HCl	play of colors	A. Labrador	12
V	1450°C	i.	green type = "Amazon stone"	A. Ilmen Mts.; Urals; Italy; Virginia; Colorado	13
V	1120 to 1380°C	i.	....	A. Norway; Sweden; New York; Pennsylvania; N. Carolina	14
V	1450°C	i.	pyroelectric	A. Most common silicate; Ceylon; Italy; Colorado; California	15
G, M	2	dec. a.	....	R. Spain; Boulder County, Colorado	16
.....	....	....	....	V.R. Fergahana, Russian Turkestan	17
sM-V	if.	dec. H_2SO_4	X-ray: shows normally no cryst. atomic structure, but at 400°C crystalline tetr. 0.5-14 % Ce.; 28-47 % Y.; 0-7 % $ThO_2 + ZrO_2$	V.R. Greenland; Sweden; Norway; N. Carolina; S. Carolina; Texas	18
E	....	dec. a.	....	V.R. Germania tungsten mine, Washington	19
V	....	....	....	R. Chibines Mts., Russia	20
V	....	s. H_2SO_4	....	V.R. Ural Mts.	21
R	if.	sl. s. HCl	28 % Ce	V.R. Minas Geraes, Brazil	22
V	if.	i.	....	V.R. St. Austell, Cornwall	23
W	if.	s. H_2SO_4	81.4-82.6 % Cer.; 1.1-4.3 % Yttr.; decrepitates	V.R. Sweden; variety tysonite, Colorado	24
V	1:5	s. a.	decrepitates; color changed by heat, pressure; tribo-, thermo-, photoluminescent diathermanous	C. Cumberland, England; Illinois; Kentucky; Pennsylvania; Ontario	25
V	if.	s. ±	....	R. Italy; Norway; Urals	26
A	....	....	....	V.R. Katanga, Belgian Congo	27
V	....	....	....	V.R. Franklin and Sterling Hill, N. J.	28
M	if.	s. HCl	slightly magnetic	Unc. Franklin Furnace, N. J.; Hessen-Nassau	29
M	ef.	sl.s. HCl	....	R. Roumania; Saxony; Spain; Colorado	30
V-G	ef.	sl.s. H_2SO_4	....	R. Fremont County, Colorado	31
R	....	....	31.3 % Cer.; 28.4 % ThO_2	V.R. Brevig, Norway	32
V-R	5	i.	....	R. Georgia; Vermont; Maryland; Zillerthal, Germany; Transvaal, S. Africa	33
V, G	if.	gel.	3.4-51.5 % Cer. (usual 6-20 %); 5-60 % Yttr. (usual 35-48 %); thermoluminescent	R. Sweden; Norway; Texas; Arizona; Colorado	34

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Gahnite	$ZnAl_2O_4$	C	7.5-8	4-4.6	$1.80\pm\eta$	dGrn, Grn,bl Blk,ygr
2	Galena	PbS	C	2.5-2.7	7.4-7.7	3.912	lead Gr
3	Garnet	....	.....	....	....	....	....
4	(a) Almandite	$Fe_3Al_2(SiO_4)_3$	C	6.5-7	4.25	1.801 impure 1.830 pure	dR,brR, Blk
5	(b) Andradite	$Ca_3Fe_2(SiO_4)_3$	C	6.5-7	3.75	1.895	Y,Grn, Br,Blk
6	(c) Grossularite	$Ca_3Al_2(SiO_4)_3$	C	6.5-7	3.53	1.735_η	varies Br
7	(d) Pyrope	$Mg_3Al_2(SiO_4)_3$	C	6.5-7	3.51	1.705_η	R
8	(e) Spessarite	$Mn_3Al_2(SiO_4)_3$	C	6.5-7	4.18	1.800_η	—, r
9	(f) Uvarovite	$Ca_3Cr_2(SiO_4)_3$	C	6.5-7.5	3.41-3.52	1.838_η	emerald Grn
10	Garnierite	$(Mg,Ni)O\cdot SiO_2+xH_2O$	Am.	1-3	2.3-2.9	1.59_η	apple Grn
11	Gay-Lussite	$Na_2CO_3\cdot CaCO_3\cdot 5H_2O$	M	2-3	1.9	1.516	W,yW
12	Gehlenite	$CaO\cdot MgO\cdot Al_2O_3\cdot SiO_2$	Tet.	5.5-6	3.04	$1.666\text{-}1.691_\omega$	grGrn, liver Br
13	Geikielite	$(Mg,Fe)TiO_3$	H	6	4	2.31_ω	Bl-BrBlk
14	Genthite	$Mg_2Ni_2O_3\cdot 3SiO_2\cdot 6H_2O$	Am.	3-4	2.409	$1.59(?)_\eta$	p apple Grn, y
15	Geocronite	$5PbS\cdot Sb_2S_3$	R	2-3	6.3-6.5	....	lead Gr
16	Gerhardite	$Cu(NO_3)_2\cdot 3H_2O$	R	2	3.43	1.713	emerald Grn
17	Gersdoffite	$NiS_2\cdot NiAs_2$	C	5.5	5.6-6.2	....	silver W, steel Gr
18	Gibbsite	$Al_2O_3\cdot 3H_2O$	M	2.5-3.5	2.3-2.4	1.566	W,gr,grn, rW
19	Gismondite	$(Ca,K_2)Al_2Si_2O_8\cdot 4H_2O$	M	4.5	2.265	1.539	—,W,r,gr
20	Glauberite	$CaSO_4\cdot Na_2SO_4$	M	2.5-3	2.7-2.8	1.535	pY,Gr, brick R
21	Glaucodot	$(Fe,Co)S_2\cdot(Fe,Co)As_2$	R	5	5.9-6.0	....	gr tin W
22	Glauconite	Silicate Al, Ca, Fe, K, Mg $+H_2O$	M	2	2.2-2.8	1.628	dull Grn
23	Gmelinite	$(Ca,Na_2)O\cdot Al_2O_3\cdot 3SiO_2\cdot 6H_2O$	H	4.5	2-2.1	1.465 to 1.481_ω	yW,grn,W, rW, R
24	Goethite	$Fe_2O_3\cdot H_2O$	R	5-5.5	4.28	2.39	y,r,blkBr
25	Gold	Au	C	2.5-3	15.6-19.33	$0.366_{Na\eta}$	gold
26	Gorceixite	$2BaO\cdot 3Al_2O_3\cdot 2P_2O_5\cdot 7H_2O$	Micro.	6	3.1	1.6253_ω	[illegible] W
27	Goslarite	$ZnSO_4\cdot 7H_2O$	R	2	1.75-2	1.480	W,r,y
28	Graphite	C	H	1-2	2-2.3	....	iron Blk
29	Greenockite	CdS	H	3-3.5	4.5-5.0	2.506_ω; 2.688	honey to orange Y
30	Guanovulite	$3(SO_4)_2(K,NH_4)_3H\cdot 4H_2O$?	.....	2	2.3-2.6	....	—,W
31	Guarinite	$(Na_2,Ca)(Si,Zr)O_3+F$	Tri.	5.5	3.31	1.716 ± 0.003	Y,Br
32	Guitermannite	$3PbS\cdot As_2S_3$?	.....	3	5.94	....	blGr
33	Gummite (Ra)	Alteration product of uraninite. Composition?	Am.?	2.5	3.9-4.2	1.61_η	rY,oR, rBr
34	Gypsum	$CaSO_4\cdot 2H_2O$	M	1.5-2	2.32	1.523	W,Gr,y,Bl
35	Haidingerite	$HCaAsO_4\cdot H_2O$	R	2-2.5	2.85	1.602	W
36	Hainite	Tantalo-silicate, titanate of Zr, Ca, Na	Tri.	5	3.2	$1.7\pm$	Y, —

Luster	Fusibility	Solubility	Special Properties	Locality	
V-G	if.	i.	may contain Ga	R. Bavaria; Sweden; New Jersey; N. Carolina; Georgia; Maryland; Colorado	1
M	2	dec. HNO_3	may decrepitate; photoelectric	C. Saxony; Harz Mts.; England; Missouri; Colorado; Idaho	2
.....	....	....	....	.. ..	3
V	3	i.	....	A. Most common of garnets	4
V	3.5	i.	....	Unc. Franklin, New Jersey	5
V	3	i.	....	C. Siberia; Urals; Italy; Mexico; Lower California	6
V	3.5	i.	....	Unc. Bohemia	7
V	3	i.	....	Unc. Bavaria; Urals; Italy; Norway; Madagascar	8
V	if.	i.	....	R. Urals: Siberia	9
D-E	if.	dec. HCl	....	Unc. New Caledonia; N. Carolina	10
V	1.5	s.a.	decrepitates	Unc. Venezuela; Utah; Nevada; Wyoming	11
R, V	6(1450°C.)	gel. HCl	....	R. Italy; Roumania; Mexico	12
M-A	if.	s. HCl	....	R. Rakwana, Ceylon	13
R	if.	dec. HCl	....	R. Pennsylvania; Spain; Ontario	14
M	ef.	s. h. HCl	decrepitates	R. Sweden; Spain; Tuscany	15
M	2	s. dil. a.	....	R. Jerome, Arizona; Katanga, Belgian Congo	16
M	f.	dec. h. HNO_3	decrepitates	R. Ontario; Austria; Hessen-Nassau	17
V	if.	s. conc. H_2SO_4	....	Unc. Urals; Norway; Brazil; Arkansas; Massachusetts; Pennsylvania	18
V, Pl	3	gel. HCl	intumesces	R. Italy; Bohemia; Westphalia	19
V	1.5	s. HCl	decrepitates; photoluminescent	Unc. Austria; Saxony; India; Spain; Chile; Arizona; California	20
M	f.	....	thermoelectric	R. Norway; Chile; Ontario; Arizona	21
D	ef.	may dec. HCl	....	Unc. In marine sediments	22
V	2.5-3	dec. HCl	intumesces	Unc. Ireland; Scotland; Nova Scotia; New Jersey	23
sA	if.	s. HCl	streak: yellow	C. Crystals: Cornwall; common iron ore	24
M	1100°C	s.aq.reg	....	Unc. Africa; Australia; S. America; Canada; Alaska; United States	25
.....	....	....	0-3% Cer.	V.R. Brazil	26
V	if.	s. H_2O	dehydrates in air; diamagnetic	R. Schemnitz; Harz Mts.; France; Sweden; Montana; Utah	27
M, D, E	if.	i.	....	C. Siberia; Finland; Ceylon; Mexico; New York	28
A-R	sublimes	s. HCl	....	R. Scotland; New Jersey; Missouri; Arkansas; California	29
Sk	dec.	s. H_2O	....	V.R. Peru	30
A-R	3(?)	gel. HCl	....	V.R. Mte. Somma, Italy	31
M	....	....	....	R. Silverton, Colorado	32
G	if.	s. a.	....	R. Saxony; Katanga, Belgian Congo; N. Carolina	33
Pl, sV, Sn	2.5-3	s. HCl	athermanous; (A) photoluminescent; colored by Ra	A. Switzerland; Mexico; Ohio; Utah; Michigan; California	34
V, Pl	2.5	s. HNO_3	....	V. R. Bohemia; Baden	35
.....	4±	dec. HCl	....	V.R. Found in the rock phonolite	36

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Halite	$NaCl$	C	2.5	2.1-2.6	1.5442_{η}	—, W, pk, y, bl, r
2	Halloysite	$Al_2O_3 \cdot 2SiO_2 \cdot H_2O$	Am.	1-2	2.0-2.20	$1.47\text{-}1.52_{\eta}$	W, gr, grn, y, bl, r
3	Halotrichite	$Al_2O_3 \cdot FeO \cdot 4SO_3 \cdot 24H_2O$	M	2	1.9	1.49	y
4	Hambergite	$Be_2(OH)BO_3$	R	7.5	2.347	1.588	GrW
5	Hanksite	$9Na_2SO_4 \cdot 2Na_2CO_3 \cdot KCl$	H	3-3.5	2.56	1.481_{ω}	W
6	Hannayite	$H_4(NH_4)_2Mg(PO_4)_2 \cdot 8H_2O$	Tri. or M	soft	1.9	1.572	W, y
7	Hardystonite	$Ca_2ZnSi_2O_7$	Tet.	3-4	3.4	1.672_{ω}	W
8	Harmotome	$(K_2, Ba)Al_2Si_5O_{14} \cdot 5H_2O$	M	4.5	2.44-2.50	1.505	W, Gr, Y, R, Br
9	Hatchettolite (Ra)	$U(Cb, Ta)O_3 \cdot H_2O$	C	5	4.8	1.98_{η}	yBr
10	Hauerite	MnS_2	C	4	3.46	$2.69_{\mathrm{Li}\eta}$	BrBlk
11	Hausmannite	Mn_3O_4	Tet.	5-5.5	4.71-4.85	$2.46_{\mathrm{Li}\omega}$	brBlk
12	Haüynite	$3NaAlSiO_4 \cdot CaSO_4$	C	5.5-6	2.4-2.5	1.4961_{η}	Bl, sky Bl, Gr, RY, Br
13	Hedyphane	Ca variety of mimetite (5-15% CaO)	M?	4.5	5.404	1.948_{ω}	YW
14	Hellandite	$Ca(Al, Y, Er, Fe \cdot OH)_3Si_2O_8$	M	5.5	3.7	1.65	Br
15	Helvite	$3(Mn, Fe)BeSiO_4 \cdot MnS$	C	6-6.5	3.1-3.3	1.739_{η}	honey Y, yBr, Grn, rBr
16	Hematite	Fe_2O_3	H	5.5-6.5	4.9-5.3	$3.042_{\mathrm{Li}\omega}$	R, steel Gr, iron Blk
17	Hercynite	$FeO \cdot Al_2O_3$	C	7.5-8	3.95	1.800_{η}	Blk
18	Herderite	$Be(OH, F) \cdot CaPO_4$	M	5	3	1.612	y, grnW
19	Hessite	Ag_2Te	C	2.5-3	8.3-8.5	....	lead or steel Gr
20	Hielmite (Ra)	Stanno-tantalate, (columbate) of Y, U, Fe, Ca, Mn, H	R ?	5	5.82	$2.30_{\mathrm{Li}\omega}$	Blk
21	Heulandite	$(Ca, Na_2)O \cdot Al_2O_3 \cdot 6SiO_2 \cdot 5H_2O$	M	3.5-4	2.1-2.2	1.499	W, R, Gr, Br
22	Högbomite	Chiefly $Al_2O_3 \cdot Fe_2O_3 \cdot MgO$, TiO_2	H	6.5	3.81	1.853_{ω}	Blk
23	Homilite	$(Ca, Fe)_3(BO)_2(SiO_4)_2$	M	5.5	3.38	1.725	Blk, blk Br
24	Hopeite-α -β	$Zn_3P_2O_8 \cdot 4H_2O$	R	3.2	3.03	1.591 1.582	grW ....
25	Hübnerite	$MnWO_4$	M	5-5.5	7-7.5	2.22	brR
26	Huntilite	Ag_2As ?	Am.	2.5-3.5	7.5	....	dGr, Blk
27	Hutchinsonite	$PbS \cdot (Tl, Ag)_2S \cdot 2As_2S_3$	R	1.5-2	4.6	3.176_{Na}	scarlet R
28	Hydromagnesite	$3MgCO_3 \cdot Mg(OH)_2 \cdot 3H_2O$	M	3.5	2.16	1.530	colorless
29	Hydrothorite (Ra)	Hydrous silicate of Th, alteration of mackintoshite	.....	1-2	....	1.638_{η}	p, pk, buff
30	Ianthinite (Ra)	$2UO_2 \cdot 7H_2O$ perhaps	R	....	....	1.90	V, Blk
31	Ice	H_2O	H	1.5	0.918	1.309_{ω}	—, W
32	Ilmenite	$FeO \cdot TiO_2$	H	5-6	4.5-5.1	....	iron Blk
33	Ilvaite	$H_2O \cdot CaO \cdot 4FeO \cdot Fe_2O_3 \cdot 4SiO_2$	R	5.5-6	3.99-4.05	1.91	iron Blk, d.grBlk
34	Iridium	$Ir(Fe, Pt)$	C	6-7	22.6-22.8	....	silver W
35	Iridosmine	IrOs (Pt, Rh, Ru, etc.)	H	6-7	19.3-21.2	....	tin W to steel Gr
36	Iron	Fe	C	4.5	7.3-7.8	....	steel Gr, iron Blk

Luster	Fusibility	Solubility	Special Properties	Locality	
V	ef. (802°C)	s. H_2O	decrepitates; diathermanous; X-ray luminescent	A. World-wide; Stassfurt; crystd.: Sicily	1
Pl, W, D	if.	i.	index varies with H_2O	C. Common in clays	2
Sk	4.5-5	s. H_2O	....	R. Bavaria; Italy; Chile; Mexico	3
V	if.	s. only HF	....	V.R. Langesundfiord, Norway; Madagascar	4
V	1.5	s. H_2O	photo- and cathode-luminescent	R. Borax Lake, Death Valley, Calif.	5
V	f.	sl. s. HCl	....	V.R. Victoria, Australia	6
......	6	gel. HCl	photoluminescent: violet	V.R. Franklin, New Jersey	7
V	3.5	dec. HCl	no intumescence	Unc. Germany; Norway; Scotland; New York	8
W	if.	i.	....	V.R. Mitchell County, N. Carolina; Hasting County, Ontario	9
R	3	s. HCl	X-ray: structure similar to pyrite; paramagnetic	R. Sicily; New Zealand; Czechoslovakia	10
sM	if.	s. HCl	X-ray: closely related to magnetite	R. Harz Mts.; Sweden; Brazil; Arkansas	11
V-G	4.5	s. HCl	....	Unc. Mte. Somma; Germany	12
R	....	....	photoluminescent: bluish gray	V.R. Vermland, Sweden; Franklin, N. J.	13
....	ef.	s. HCl	40% E_2O_3	V.R. Telemark, Norway	14
V, R	3	s. HCl	X-ray: similar to sodalite; pyroelectric; intumesces	R. Ilmen Mts.; Saxony; Norway; Virginia	15
M, D, E	if.	s. HCl	streak: cherry red; cathodeluminescent	R. Urals; Switzerland; Island of Elba; Brazil	16
V, D	if.	i.	....	R. Bohemia; Saxony; New York	17
V	df.	s. a.	thermophosphorescent	V.R. Saxony; Bavaria; Maine	18
M	f.	s. HCl	somewhat sectile	V.R. Altai Mts.; Roumania; Chile; California; Colorado	19
M	if.	i.	decrepitates; 1-6% E_2O_3	V.R. Kopparberg, Sweden	20
V, Pl	2-2.5	dec. HCl	....	Unc. Iceland; Scotland; Switzerland; Harz Mts.; New Jersey	21
.....	if.	i.	....	R. Lapland; Norway; microscopic from Virginia	22
W, V	2	gel. HCl	sometimes contains ceria earths, 0-2.6%	R. Langesundfiord, Norway	23
V	5	s.a.	New Jersey hopeite may contain Ga	R. Belgium; Germany; Rhodesia; Brit. Columbia; Franklin, N. J.	24
sM	4	dec. HCl	decrepitates	Unc. Peru; Missouri; S. Dakota; Colorado	25
M	....	....	....	V.R. Silver Islet, Lake Superior	26
......	....	....	....	R. Binnental, Switzerland	27
V, Sk, sPl, E	if.	s.a.	....	R. San Benito County, California	28
......	....	s. h. a., flakes in H_2O	strongly radioactive	V.R. Wodgina, W. Australia	29
......	....	....	streak: brown-violet	V.R. Kasolo, Belgian Congo	30
V	0°C		diamagnetic	A. Polar regions; glaciers	31
M	if.	s. HCl	X-ray: similar to corundum	C. Norway; Ilmen Mts.; Urals; New York; Massachusetts	32
sM	2.5	gel. HCl	conducts electricity	C. Elba; Japan; Idaho	33
M	2300°C (?)	s.aq.reg.	....	V.R. Urals; Brazil; Burma; northern California	34
M	.....	i.aq.reg.	slightly malleable	V.R. Colombia; Urals; N. S. Wales; California; Oregon	35
M	1530°C	s. HCl	....	V.R. W. Greenland; Germany; Ontario; in meteorites	36

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Ishikawaite (Ra)	Columbate, tantalate, U, Fe'', rare earths	R	5-6	6.2-6.4	....	Blk
2	Jamesonite	$2PbS \cdot Sb_2S_3$	M	2-3	5.5-6	....	steel Gr, d lead Gr
3	Joaquinite	Titano-silicate of Ca, Fe	R	....	....	....	honey Y
4	Johannite (Ra)	$(Cu,Fe,Na_2)O \cdot UO_3 \cdot SO_3 \cdot 4H_2O$	Tri.	2	>3.3	1.59	grn Y, canary Y, Grn
5	Johnstrupite	$Na_2O \cdot 3CaO \cdot Ce(F,OH)_3 \cdot (Ti,Zr)O_2 \cdot 5SiO_2$?	M	4	3.29	1.666	brGrn
6	Julienite	Hydrated cobalt nitrate?	Tet.	....	1.594	1.556ω	Bl
7	Kainite	$KCl \cdot MgSO_4 \cdot 3H_2O$	M	3	2.1	1.505	W, d flesh R
8	Kalinite	$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	M	2-2.5	1.75	1.452	W
9	Kalkowskite	$(Fe,Ce)_2O_3 \cdot 4(Ti,Si)O_2$	.....	3-4	4.01	$>1.77\eta$	Blk, Br
10	Kaolin	Term now restricted to white or china clays	.....	....	....	....	....
11	(a) Anauxite	$Al_2O_3 \cdot 2 \pm SiO_2 \cdot 2H_2O$	M ?	+2.5	2.524	1.565-1.561α	W
12	(b) Dickite	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	M	+2.5	2.62	1.562-1.560α	W
13	(c) Kaolinite	$Al_2O_3 \cdot 2 \pm SiO_2 \cdot 2H_2O$	M ?	+2.5	2.59	1.565-1.561α	W, yW, pale Green
14	(d) Nacrite	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	M	+2.5	2.5	1.562 1.557α	W
15	Kasolite (Ra)	$PbO \cdot UO_3 \cdot SiO_2 \cdot H_2O$	M	4-5	5.96	1.91	Y, Br
16	Kermesite	$2Sb_2S_3 \cdot Sb_2O_3$	R or M	1-1.5	4.5-4.6	2.75η	cherry R
16.1	Kernite	$Na_2B_4O_7 \cdot 4H_2O$	M	2.5	1.91	1.472	W, colorl.
17	Kieserite	$MgSO_4 \cdot H_2O$	M	3.5	2.5-2.6	1.533	W, gr, Y
18	Kischtimite	Fluo-carbonate of Ce metals near parisite	.....	4.5	4.78	....	yBr
19	Knopite	Near perovskite, plus Ce_2O_3, FeO	C	5.5	4.2	2.30η	Blk
20	Kochelite (Ra)	Columbate of Y, Zr, Th, Fe, SiO_2, Ca, H_2O, etc.	Tet.?	3.5	3.74	....	Br, Y
21	Kolbeckite	Be phosphate or silicophosphate	M ?	3.5-4	2.39	....	Bl, BlGr
22	Koppite	$Ca_2Ta_2O_7 + Ce, Na, Fe, F$, etc.	C	5.5	4.5	2.15η	Br
23	Kyanite	$Al_2O_3 \cdot SiO_2$	Tri.	5-7	3.6-3.7	1.722	Bl, W, Gr, Grn, Blk
24	Lanarkite	$Pb_2O \cdot (SO_4)$	M	2-2.5	6.4-6.8	1.99	grnW, pY, Gr
25	Langite	$4CuO \cdot SO_3 \cdot 4H_2O$	R	2.5-3	3.49	1.760	Bl, grnBl
26	Lanthanite	$(La,Di,Ce)_2(CO_3)_3 \cdot 8H_2O$	R	3	2.6-2.7	1.587	grW, Pk, y
27	Larsenite	$PbZnSiO_4$	R	3	5.90	1.95	—, W
28	Laumontite	$(Ca,Na_2)Al_2Si_4O_{12} \cdot 4H_2O$	M	3-4	2.2-2.4	1.524	W, y, grR
29	Lavenite	Complex zirconium silicate with Mn, Ca, etc., F, Ti, Ta, etc.	M	6	3.5-3.6	1.750	Y, Br
30	Lawsonite	$H_4CaAl_2Si_2O_{10}$	R	7-8	3.1	1.674	pBl, grBl
31	Lazulite	$(Fe,Mg)Al_2(OH)_2P_2O_8 \pm Ca$	M	5-6	3.1	1.634	azure Bl, p grnBl
32	Lazurite	$3NaAlSiO_4 \cdot Na_2S$	C	5-5.5	2.4-2.5	1.500η	berlin Bl, azure Bl

Luster	Fusibility	Solubility	Special Properties	Locality	
.....	....	....	....	V.R. Ishikawa, Japan	1
M	ef.	s.h.HCl	decrepitates; photoelectric	Unc. Czechoslovakia; England; Tasmania; Arkansas; S. Dakota	2
.....	....	....	....	R. Associated with benitoite; California	3
V	if.	s. a., s. H_2O	....	V.R. Bohemia; Gilpin County, Colorado	4
V, R, G	3	s.HCl	13.5%Cer.;1.1%Yttr.; 3.6%ThO_2+ZrO_2; no Cl or NO_3 as first reported	V.R. Langesundfiord, Norway	5
.....	....	....	....	V.R. Katanga, Belgian Congo	6
V	1.5-2	s. H_2O	....	R. Galicia; Stassfurt; northern Germany	7
V	1	s. H_2O	....	Unc. Lipari Island; Vesuvius; Germany; S. America; Nevada; Maryland	8
sM	....	....	streak: red-brown; may be identical with arizonite or pseudobrookite	V.R. Minas Geraes, Brazil	9
.....	....	....	....	....	10
.....	if.	sl. dec. HCl	X-ray: pattern as kaolinite	A. In kaolins: New York; New Jersey; Bilin, Bohemia; France	11
.....	if.	....	intumesces; X-ray: distinct pattern	R. Anglesey, England;Chihuahua Mexico; Peru; Arkansas; Oklahoma; Iowa	12
Pl, E, A	if.	sl. dec. HCl	does not intumesce; X-ray: distinct pattern	C. In kaolins: Cornwal:, England, N. Carolina; S. Carolina; Arizona	13
Pl	if.	....	X-ray: distinct pattern; exfoliates	R. Brand, Saxony; Colorado	14
R, G	ef.	gel. s. a.	....	V.R. Kasalo, Katanga, Belgian Congo	15
A	l; vol.517°C	...	....	R. Canada, France, Saxony	16
V, Sn•	3	s. h. H_2O	intumesces	V.R. Kern Co., Calif.	16.1
V	2-3	s. H_2O	decrepitates	A. Germany; Poland; Austria; India	17
G, V	....	....	74.2%Ce	V.R. Kyshtymsk, Urals	18
M	if.	s. HF	4-7%Ce	V.R. Alnö, Sweden; Brit. Columbia ?	19
dG	6	....	17.22%Y.; 1.33%ThO_2	V.R. Kochelweise, Silesia	20
V, Pl	....	sl. s. a.	....	V.R. Niederpöbel, Saxony	21
sA-V	if.	dec. H_2SO_4	4-10%Ce	V.R. Schelingen, Baden	22
V, Pl	if.	i.	above 1200°C changes to a mixture of mullite and silica	C. Urals; France; Massachusetts; Connecticut; N. Carolina	23
Pl, G	2 977°C	sl. s. dil. a.	photoluminescent	V.R. Lanark, Scotland; Harz Mts.; Austria; France	24
V	3.5	s. HCl	....	V.R. Cornwall; Slovakia	25
D, Pl	if.	s. a.	54.9%Cer.	V.R. Sweden; New York; Pennsylvannia	26
A	....	s. HNO	photoluminescent; pale violet	V.R. Franklin Furnace, N. J.	27
V, Pl	2.5-3	gel. HCl	swells up	Unc. Italy; Scotland; India; New Jersey; Michigan; Nova Scotia	28
V	f.	sl. s. HCl	....	V.R. Läven, Norway; Brazil; French Guinea; Azores	29
V-G	4	i.	....	R. California; Italy; France	30
V	if.	i.	....	R. Austria; Madagascar; N. Carolina; Georgia	31
V	3	s. HCl	intumesces; Chile var. thermophosphorescent beetle-green	Unc. Ovalle, Chile; Persia; Turkestan; Kokcha	32

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Lead	Pb	C	1.5	11.4	2.01_{Na}	lead Gr
2	Leadhillite	$Pb(OH)_2 \cdot PbSO_4 \cdot 2PbCO_3$	M	2.5	6.2-6.4	2.00	W, Y, Grn, Gr
3	Lecontite	$(Na, NH_4, K)_2SO_4 \cdot 2H_2O$	R	2-2.5	1.63	1.452	colorless
4	Lessingite	Silicate Ca, rare earths	.....	4.5	4.7	1.785_{γ}	Grn-RY
5	Leucite	$KAl(SiO_3)_2$	C at 600°C	5.5-6	2.45-2.50	1.508	W, Gr
6	Leucophanite	$(Ca, Na)_2BeSi_2(O,OH,F)_7$	R	3-4	2.96	1.595	grn Y
7	Leucosphenite	$Na_4Ba(TiO)_2(Si_2O_5)_5$	M	6.5	3.0	1.661	W
8	Levynite	$CaO \cdot Al_2O_3 \cdot 3SiO_2 \cdot 5H_2O$	H	4-4.5	2.1-2.2	1.496_{ω}	W, gr, r, y
9	Lewisite	$5CaO \cdot 2TiO_2 \cdot 3Sb_2O_5$	C	5.5	4.9	$2.2 \pm 0.01_{m}$	Y, Br
10	Libethenite	$4CuO \cdot P_2O_5 \cdot H_2O$	R	4	3.6-3.8	1.745	olive Grn
11	Limonite	Mixture of goethite and hematite, ± jarosite	.....	5-5.5	3.6-4.0	....	....
12	Linarite	$2CuO \cdot 5PbO \cdot 3SO_3 \cdot CO_2 \cdot 3H_2O$	M	2.5	5.3-5.5	1.838	dBl
13	Linnaeite	$CoS \cdot Co_2S_3$	C	5.5	4.8-5.0	....	p steel Gr, copper R
14	Lithomarge	Compact kaolin	.....	....	....	....	....
15	Lithiophilite	$LiMnPO_4$	R	4.5-5	3.42-3.56	1.679	pPk, liver Br
16	Löllingite	$FeAs_2$	R	5-5.5	6.8-7.4	....	silver W, steel Gr
17	Loparite	$(Na, Ce, Ca)_2(Ti, Cb)_2O_6$?	C ?	5.5	2.77	....	Blk
18	Lorandite	$Tl_2S \cdot As_2S_3$	M	2-2.5	5.53	$>2.72_{Li}$	cochineal R
19	Loranskite	Tantalate of Y, Ce, Zr, Fe, etc.	R	6	3.8-4.8	....	Blk, Br, Y
20	Lorenzenite	$Na_2(TiO)_2Si_2O_7$ plus considerable ZrO_2	R	6	3.4	1.76-2.01	....
21	Löweite	$2MgSO_4 \cdot 2Na_2SO_4 \cdot 5H_2O$	Tet.	3.5	2.4	1.490_{ω}	pY
22	Ludwigite	$3MgO \cdot B_2O_3 \cdot FeO \cdot Fe_2O_3$	R	5	4.1	1.85	blkGr, Blk
23	Mackintoshite (Ra)	$3ThO_2 \cdot 3SiO_2 \cdot UO_2 \cdot 3H_2O$?	Tet.	5.5	5.4	1.77_{η}	Blk
24	Magnesite	$MgCO_3$	H	3.5-4.5	3-3.1	1.717_{ω}	W, y, Br, grW
25	Magnetite	$FeO \cdot Fe_2O_3$	C	5.5-6.5	5.16-5.18	$2.42_{Na\eta}$	iron Blk
26	Maitlandite (Ra)	Related to mackintoshite plus Pb, Ca	Am.	....	....	....	Blk
27	Malachite	$CuCO_3 \cdot Cu(OH)_2$	M	3.5-4	3.9-4.03	1.875	bright Grn
28	Malacon	Altered zircon with rare earths, Ca, Fe, H_2O	Tet.	6	3.9-4.1	1.826_{η}	—, br
29	Manandonite	$H_{24}Li_4Al_{14}B_4Si_6O_{53}$	R ?	....	2.89	1.6 ±	W, —
30	Manganite	$Mn_2O_3 \cdot H_2O$	R	4	4.2-4.4	2.24_{Li}	steel Gr, iron Blk
31	Manganosite	MnO	C	5-6	5.18	2.16_{η}	emerald Grn
32	Manganotantalite	$MnO \cdot Ta_2O_5$	R	6-6.5	7.3	2.29	Blk
33	Marcasite	FeS_2	R	6-6.5	4.85-4.9	....	pale bronze Y
34	Margarite	$H_2CaAl_4Si_2O_{12}$	M	3.5-4.5	2.99-3.08	1.643	Grn, Pk, Y
35	Martite	Fe_2O_3	C	6-7	4.8-5.3	....	iron Blk

Luster	Fusibility	Solubility	Special Properties	Locality	
M	1	sl. s. HNO_3	malleable	V.R. Sweden; Urals; Mexico; New Jersey; Idaho	1
G, A	1.5	s. HNO_3	rather sectile; photo-, cathode- and (R)-luminescent	R. Scotland; England; Missouri; Arizona; Utah	2
V	1	s. H_2O	....	V.R. From bat guano, Las Piedras, Honduras	3
V	....	....	22.48 % Ce_2O_3; 36.65 % $(Di, La)_2O_3$	V.R. Stream pebbles, near Kychtym, Urals	4
V	if.	dec. HCl	....	Unc. Vesuvius; Mte. Somma; Wyoming; Hawaii	5
V-G	6	s. HF	intumesces; thermoluminescent	V.R. Langesundfiord, Norway	6
.....	6.5	dec. HF	....	V.R. Narsarsuk, Greenland	7
V	2-2.5	gel. a.	intumesces	R. Ireland; Greenland; Colorado	8
.....	ef.	i.	....	V.R. Mines Geraes, Brazil	9
G-R	2-2.5	s. HNO_3	....	R. Urals; Slovakia; Cornwall; Chile; Arizona	10
.....	if.	s. HCl	....	A. World-wide	11
V, A	1.5	sl. s. HNO_3	photoluminescent	R. Urals; Siberia; Spain; Scotland; Chile; Utah; California	12
M	f.	s. HNO_3	X-ray: structure practically identical in linnaeite, polydymite, sychnodymite	R. Westphalia; Katanga; Sweden; Maryland; Missouri	13
.....	....	....	....	....	14
V, R	1.5	s. HCl	sometimes decrepitates	R. Branchville, Connecticut; Maine; California	15
M	if.	s. HNO_3	....	R. Lölling, Austria; Harz. Mts.; Maine; New York; Colorado	16
.....	....	....	streak: red-brown	V.R. Kola, Russia	17
sM-A	1	s. HNO_3	....	V.R. Macedonia; Rambler Mine, Wyoming	18
M	....	....	10 % Yttr.; 3 % Cer.	V.R. Impilaks, Finland	19
.....	ef.	i. HCl	....	V.R. Narsarsuk, Greenland	20
V	1	s. H_2O	....	R. Salzburg, Austria	21
V, Sk	4	s. HCl	....	R. Roumania; Montana; Utah	22
.....	if.	v. sl. s. a.	45.3 % ThO_2; 1.9 % E_2O_3	V.R. Llano, Texas	23
V, Sk, D	if.	s. h. HCl	photoluminescent	Unc. Greece; Austria; Norway; California; Nevada	24
M, sM	6	s. HCl	magnetic; sometimes polar, e. g., lodestone	A. Widespread; Sweden; Norway; New York; Pennsylvania; Arkansas	25
.....	....	....	....	V.R. Wodgina, W. Australia	26
A, V, Sk	2	s. a.	streak: green	C. Urals; Katanga; Bisbee, Arizona	27
V, sV	....	....	2.6-3.4 % Hf	V.R. Hitterö, Norway; Haute Loire, France; United States	28
Pl	ef.	dec. H_2SO_4	....	V.R. Madagascar	29
sM	if.	s. HCl	....	Unc. Harz Mts.; Cornwall; Michigan; Sweden	30
V	if.	s. a.	becomes black on exposure; photoluminescent, pale violet	V.R. Sweden; Franklin, N. J.	31
sM	if.	i.	....	R. Western Australia	32
M	2.5-3	i. HCl s. conc. HNO_3	dec. in air (?); diamagnetic	C. Bohemia; Saxony; France; Missouri; Illinois; Iowa; Mexico	33
Pl, V	6	sl. dec. HCl	....	Unc. Ural Mts.; Greece; Massachusetts; Pennsylvania; N. Carolina	34
sM	....	....	Not or feebly magnetic	R. Saxony; France; Mexico; Brazil; New York; Michigan; Utah	35

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Mascagnite	$(NH_4)_2SO_4$	R	2	1.76	1.523	—, y, grn
2	Matlockite	$PbFCl$	Tet.	2-3	7.21	2.15ω	y, grn
3	Mauzeliite	Titano-antimonate Pb, Ca	C	6-6.5	5-11	....	dBr
4	Medjidite (Ra)	$CaSO_4\cdot(UO_2)SO_4\cdot 15H_2O$?	.....	2.5	....	....	d amber
5	Melanocerite	Complex silicate Ca, Ce, La, Di, Y, Ta, B, etc.	H	5-6	4.13	1.73ω	Br, Blk
6	Melanterite	$FeSO_4\cdot 7H_2O$	M	2	1.89-1.9	1.478	Grn, W, y
7	Meliphanite	$NaF\cdot 2CaO\cdot 2BeO\cdot 3SiO_2$	Tet.	5-5.5	3.0	1.612ω	Y
8	Melonite	$NiTe_2$	H	1-1.5	7.3	....	rW
9	Mendelyeevite (Ra)	Ca urano-titano-columbate	C	....	....	....	Blk
10	Mendipite	$2PbO\cdot PbCl_2$	R	2.5-3	7-7.2	2.27	W
11	Mercury	Hg	H, -40° C.	....	13.55	....	Tin W
12	Mesolite	$Na_2O\cdot Al_2O_3\cdot 3SiO_2\cdot 2H_2O$	M	5	2.29	1.505	W, —
13	Metatorbernite (Ra)	$Cu(UO_2)_2P_2O_8\cdot 8H_2O$	Tet. ?	2.5	3.67	1.619-1.650ω	emerald or grass Grn
14	Metazeunerite (Ra)	$Cu(UO_2)_2As_2O_8\cdot 8(?)H_2O$	Tet. ?	2-2.5	3.28	1.585ω	Grn
15	Miargyrite	$Ag_2S\cdot Sb_2S_3$	M	2-2.5	5.1-5.3	$>2.72_{Li}$	iron Blk, steel Gr
16	Mica	....	.....	....	....	....	....
17	(a) Biotite	$H_2K(Mg,Fe)_3(Al,Fe)(SiO_4)_3$	M	2.5-3	2.7-3.1	1.574	Grn to Blk
18	(b) Lepidolite	$(HO,F)_2KLiAl_2Si_3O_{10}$	M	2.5-4	2.8-3.3	1.598	rose, V, Gr, lilac, y Grn, W
19	(c) Lepidomelane	Near biotite plus large amount of ferric iron	M	3	3.1	1.638	Blk, Br
20	(d) Muscovite	$H_2KAl_3(SiO_4)_3$	M	2-2.25	2.76-3	1.590	—, Gr, Br, pGrn, Y, V
21	(e) Paragonite	$H_2NaAl_3(SiO_4)_3$	M	3	2.78-2.9	1.60	y, grn, gr
22	(f) Phlogopite	$H_2KMg_3Al(SiO_4)_3$	M	2.5-3	2.78-2.85	1.606	yBr, brR, Grn, W
23	(g) Zinnwaldite	Lithium-iron mica	M	3	3 ±	1.60	Grn, V
24	Microlite (Ra?)	$Ca_2Ta_2O_7$ with Cb, F	C	5.5	5.5	1.93	pY, Br
25	Milarite	$K_2O\cdot 4CaO\cdot 4BeO\cdot Al_2O_3\cdot 24SiO_2\cdot H_2O$	H	5.5-6	2.55-2.59	1.529-1.532	—, pGrn
26	Millerite	NiS	H	3-3.5	5.3-5.6	....	brass Y
27	Mimetite	$3Pb_3As_2O_8\cdot PbCl_2$	H	3.5	7-7.25	2.135ω	pY, Br, O, W, —
28	Minium	Pb_3O_4	Crypt.	2-3	4.6	2.4_η	vivid R with Y
29	Mirabilite	$Na_2SO_4\cdot 10H_2O$	M	1.5-2	1.481	1.396 pure	W
30	Moissanite	SiC	H	9.5	3.2	$2.654_{Na\omega}$	—, Grn, Bl, R, Blk
31	Molengraafite	Titano-silicate Ca, Na, Al	M	....	....	1.74	yBr
32	Molybdenite	MoS_2	H	1-1.5	4.7-4.8	4.7_{Na}	lead Gr
33	Monazite	Essentially $(Ce,La,Di)PO_4$	M	5-5.5	4.9-5.3	1.788	hyacinth R, Br
34	Monticellite	$MgCaSiO_4$	R	5-5.5	3.1-3.3	1.66	—, Gr
35	Montmorillonite	$(Mg,Ca)O\cdot Al_2O_3\cdot 5SiO_2\cdot nH_2O$ $n=5\text{-}7$	.....	soft	2 ±	1.560 ± 0.01	W, Pk, Gr, bl, Grn

Luster	Fusibility	Solubility	Special Properties	Locality	
V	1	s. H_2O	.....	V.R. Near volcanoes: Etna, Vesuvius, islands off Peru	1
A, Pl	1	s. h. HNO_3	decrepitates	V.R. Matlock, England; Greece; Chile	2
V-G	f.	i.	.....	V.R. Jacobsberg, Sweden	3
.....	....	s.a.	.....	V.R. Turkey	4
G, V	if.	dec. HCl	48% Cer.; 9.2% Yttr.; 2.0% ThO_2+ZrO_2	V.R. Kjeö Islands, Norway	5
V, D	1	s. H_2O	from dec. of pyrite, marcasite in air	C. Harz Mts.; Sweden; California	6
V	f.	i.	intumesces	V.R. Langesundfiord, Norway	7
M	f.	s. HNO_3	.....	V.R. Magnolia, Colo.; N. S. Wales; Melones Mine, California	8
.....	....	.....	.....	V.R. Sludianka, Transbaikalia	9
Pl-A	1	s. HNO_3	decrepitates	V.R. Mendip Hills, England; Brilon, Westphalia	10
M	vol.	s. HNO_3	crysts. at −40°C.; X-ray: shows rhombohedral structure	R. Idria, Italy; Mexico; with cinnabar	11
V	ef.	gel. HCl	X-ray: shows it to be intermediate, natrolite—scolecite	Unc. Scotland; Ireland; Pennsylvania; Colorado; Nova Scotia	12
.....	2.5	s. HNO_3	easily formed by dehydrn. of torbenite at 60°-65° C.	R. Cornwall; Spain	13
.....	....	.....	.....	R. Schneeberg, Saxony; Cornwall	14
A, M	1	dec. HNO_3	streak: cherry-red; photoelectric	R. Freiberg; Roumania; Idaho; Chile; Bolivia; Mexico; California	15
.....	....	.....	.....	.. ..	16
V, Pl, Sp	6	dec. H_2SO_4	.....	A. Vesuvius; Norway; New York; N. Carolina; Colorado	17
Pl	2.5	v. sl. s. HCl	intumesces	Unc. Urals; Saxony; Maine; Madagascar; California; Nevada	18
V, Pl	4.5-5	gel.	.....	C. Sweden; Norway; Ireland; Maryland; Maine; Connecticut	19
V, Pl	5.7	i.	.....	A. Most common mica; Switzerland; Pennsylvania; Virginia	20
Pl	6	i. HCl	.....	Unc. Switzerland; Saxony; Italy	21
Pl, sM	5	dec. H_2SO_4	.....	C. Ceylon; Italy; New York; Ontario	22
Pl	1.5-2	sl. s. HCl	.....	R. Saxony; Cornwall; Alaska; Greenland	23
V, G	if.	dec. H_2SO_4	8% E_2O_3	V.R. Sweden; Greenland; Maine; Virginia; Massachusetts	24
V	3	i.	.....	V.R. Switzerland	25
M	f.	s. HNO_3	capillary crysts. elastic	R. Bohemia; Westphalia; Wales; Iowa; Missouri; Ontario	26
R	1	s. HNO_3	.....	R. France; Saxony; Mexico; W. So. Africa; Pennsylvania; Utah	27
D, sG	1.5	.....	.....	Unc Altai Mts.; Germany; N. S. Wales; Idaho; Colorado	28
V	1.5	s. H_2O	effloresces rapidly	Unc. Austria; Bohemia; Utah	29
.....	if.	i. even in HF	dissociates at about 3400° C.	V.R. Found in the Canon Diablo meteorite	30
.....	....	.....	.....	V.R. Transvaal, S. Africa	31
M	if.	dec. HNO_3	photoelectric	Unc. Norway; Australia; Maine; Pennsylvania; Ontario	32
R, A	if.	sl. s. HCl	49-74% Cer.; 1-4% Yttr.; 1-20% ThO_2	R Ilmen Mts.; France; Norway; Virginia; N. Carolina; Quebec	33
V	6	gel. HCl	.....	R. Italy; Arkansas; California	34
.....	if.	.....	.....	C. In bentonites; Maine; California; France; Ireland	35

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Mosandrite	Similar to johnstrupite	M	4	2.9-3.0	1.649	rBr
2	Mossite	$(Fe,Mn)[(Cb,Ta)O_3]_2$	Tet.	....	6.45	....	Blk
3	Muromontite	var. allanite, rich in yttria earths, Be	M	7	4.263	....	Blk,grn Blk
4	Nadorite	$PbSb_2O_4\cdot PbCl_2$	R	3.5-4	7	2.35	br Y
5	Naëgite (Ra)	Zircon with Y, Cb, Ta, U, Th oxides	Tet.	7.5	4.1	1.818_η	Grn,Gr, Br
6	Nagatelite	Silicate, phosphate, Al, Ca, Fe, rare earths	M	5.5	3.91	1.760	Blk
7	Nagyagite	$10PbS\cdot Sb_2S_3\cdot 2AuTe_3$ or $2AuS$	R	1-1.5	6.8-7.2	....	blk lead Gr
8	Narsarsukite	$Na_6FeFTi_2Si_{12}O_{32}$?	Tet.	7	2.7	1.609_ω	honey Y
9	Natrolite	$Na_2O\cdot Al_2O_3\cdot 3SiO_2\cdot 2H_2O$	R	5-5.5	2.2-2.35	1.482	—,W,gr, yr,R
10	Natron	$Na_2CO_3\cdot 10H_2O$	M	1-1.15	1.4	1.425	W
11	Naumannite	$(Ag_2Pb)Se$	C	2.5	6.5-7	....	iron Blk
12	Neotantalite	$H_2O\cdot FeO, MnO, (Ta,Cb)_2O_5$ etc.	C	5-6	5.19	1.96_η	clear Y
13	Nepheline	$(Na,K)AlSiO_4$	H	5.5-6	2.5-2.6	1.536-1.549_ω	—,W,yd Grn, br, R,Blk
14	Neptunite	$(Na,K)_2(Fe,Mn)(Si,Ti)_5O_{12}$	M	5-6	3.23	1.70	Blk
15	Niccolite	$NiAs$	H	5-5.5	7.3-7.7	....	p copper R
16	Nicolayite (Ra)	Related to mackintoshite plus Pb, Ca	Tet. ?	....	4.13	1.617_η	Y
17	Niter	KNO_3	R	2	2.1	1.504	colorl.
18	Nitrobarite	$Ba(NO_3)_2$	C	1.5-2.5	3.244	1.5717	colorl.
19	Nitrocalcite	$Ca(NO_3)_2\cdot nH_2O$	M	soft	1.90	1.498	W, Gr
20	Nitroglauberite	$6NaNO_3\cdot 2Na_2SO_4\cdot 3H_2O$	R	....	....	1.500	....
21	Nitromagnesite	$Mg(NO_3)_2\cdot nH_2O$	M ?	....	....	1.506	—, W
22	Nivenite (Ra)	Related to uraninite, higher UO_3	C	5.5	8.01	....	velvet Blk
23	Nocerite	$Ca_3Mg_3O_2F_8$	H	....	2.96	1.509_ω	W,—,br
24	Nohlite (Ra)	var. samarskite $+H_2O$	.....	4.5-5.5	5.04	....	brBlk
25	Nontronite	$H_4Fe_2Si_2O_9$	M ?	soft	2.5	1.58-1.65	pale straw Y, Y,grn
26	Noselite	$3Na_2Al_2Si_2O_8\cdot Na_2SO_4$	C	5.5	2.25-2.4	1.48-1.495_η	grn,bl,br
27	Octahedrite	TiO_2	Tet.	5.5-6	3.82-3.95	2.534-2.564_ω	Br, Blk, indigo Bl
28	Oerstedite	Altered zircon	Tet.	5.5	3.629	....	rBr
29	Oliveiraite	$3ZrO\cdot{}_22TiO_2\cdot 2H_2O$	Am.	....	....	....	yGrn
30	Olivenite	$4CuO\cdot As_2O_5\cdot H_2O$	R	3	4.1-4.4	1.785-1.795	various Grn, Br, grW
31	Olivine	See chrysolite	.....	....	....	....	....
32	Opal	$SiO_2\cdot nH_2O$	Am.	5.5-6.5	1.9-2.3	1.406 ±	various
33	Orangite (Ra)	var. thorite	Tet.	4.5-5	5.19-5.40	....	OY
34	Orpiment	As_2S_3	M	1.5-2	3.4-3.5	$>2.72_{Li}$	lemon Y
35	Orthite	See allanite	.....	....	....	....	....
36	Orvillite	Altered zircon	.....	....	....	....	....
37	Pachnolite	$NaF\cdot CaF_2\cdot AlF_3\cdot H_2O$	M	3	2.98	1.413	colorl.
38	Palladium	$Pd(Pt,Ir)$	C	4.5-5	11.3-11.8	....	w steel Gr

Luster	Fusibility	Solubility	Special Properties	Locality	
V, G	3	s. HCl	....	V.R. Langesundfiord region, S. Norway	1
M	....	....	....	V.R. Norway; Black Hills, N. Dakota	2
V, G	....	....	9.1 %Ce; 37.1 %Y	V.R. Mauersberg, Erzgebirge, Saxony	3
A, G	1.5	s. HCl	....	V.R. Constantine, Algeria	4
.....	....	....	9.12 %Yttr.; 5 %ThO_2; 3.5 %Hf	V.R. Mino, Japan	5
R	.....	s. HCl	7.84 %La; 4.51 %Yttr.; 14.58 %Ce_2O_3; 0.88 %ThO_2	V.R. Nagatejima, Japan	6
M, Sp	vol.	dec. HNO_3	streak: as color	R. Transylvania; Roumania; Colorado; New Zealand	7
.....	ef.	s. only HF	....	A. Narsarsuk, Greenland	8
V, Pl	2	gel. a.	X-ray: confirms orthorhombic symmetry; pyroelectric	Unc. Bohemia; Italy; France; New Jersey; Arkansas; Nova Scotia; British Columbia	9
V, E	in nature, occurs only in solution		....	Unc. Soda lakes of Egypt; Nevada; California	10
M	1	sl. s. HNO_3	very sectile; malleable	R. Harz Mts.; Idaho	11
.....	....	....	....	V.R. With kaolin: Allier, France	12
G, V	3.5	gel. a.	....	Unc. Ilmen Mts.; Norway; Greenland; Maine; Ontario	13
V, M, G	2.5	i. HF	streak: cinnamon brown	R. Greenland; California	14
M	2	s. aq. reg.	X-ray: niccolite, breithauptite, hexagonal, closely related	R. Saxony; Hessen-Nassau; Ontario; Colorado; New Jersey	15
.....	....	....	....	V.R. Wodgina, W. Australia	16
V	1	s. H_2O	deflagrates violently	R. Chile; India; in caves, Kentucky; Tennessee; Missouri	17
V	ef.	s. H_2O	decrepitates; pyroelectric	V.R. Chile	18
Sk	ef.	s. H_2O	....	V.R. Kentucky limestone caves; Norway	19
.....	....		*	V.R. Taltal, Chile	20
V	ef.	s. H_2O	....	R. Efflorescences in limestone caves	21
sM	if.	s. dil. a.	....	V.R. Llano, Texas	22
Sk	....	....	....	V.R. Nocera, Italy	23
V	6	dec. H_2SO_4	decrepitates	V.R. Nohl, Sweden	24
W, E	if.	gel. HCl	....	R. Nontron, France; Germany; Pennsylvania; Nevada	25
V	5	gel. HCl	....	Unc. Germany; Italy; Canary and Cape Verde Islands	26
A, sA	if.	i.	....	R. Switzerland; France; England; Brazil; Arkansas; Colorado; Massachusetts	27
A, Sp	....	....	....	R. Norway	28
.....	....	....	....	V.R. Minas Geraes, Brazil	29
A, V	2-2.5	s. HNO_3	deflagrates; decrepitates	Unc. Cornwall; S. W. Africa; Utah	30
.....	....	....	....	... .	31
V	if.	s. HF	decrepitates; photoluminescent	C. N. S. Wales; Queensland; Mexico; Nevada	32
G	....	....	....	V.R. Sweden; Madagascar	33
Pl, R, D	1 (320°C)	s. H_2SO_4	Wholly volatile	Unc. Japan; Utah; Nevada	34
.....	....	....	....	....	35
.....	....	....	0.5-0.7 %Hf	V.R. Minas Geraes, Brazil	36
V	1.5	s. H_2SO_4	....	R. Greenland; Colorado; Ural Mts.	37
M	Pd:1550°C	s. aq. reg.	....	R. Brazil; Ural Mts.; N. Carolina	38

* Synthetic studies show this not possible; in nature: probably a mixture of darapskite and soda niter

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Parisite	$[(Ce,La,Di)F]_2Ca(CO_3)_3$	H	4-5	4.358	1.676ω	br Y
2	Parsonsite (Ra)	$2PbO \cdot UO_3 \cdot P_2O_5 \cdot H_2O$	M or Tri.	....	6.23	1.85α	p Br
3	Patronite	Complex, perhaps VS_4	Am.	....	....	....	Blk
4	Pectolite	$4CaO \cdot Na_2O \cdot 6SiO_2 \cdot H_2O$	M	5	2.74-2.88	1.606	w,gr
5	Periclase	MgO	C	5.5-6	3.64-3.9	1.736η	colorl.
6	Perovskite	$CaTiO_3$	C or R	5.5	4	2.38	p Y, O Y, r Br, gr Blk
7	Petalite	$Al_2O_3 \cdot Li_2O \cdot 8SiO_2$	M	6-6.5	2.39-2.46	1.510	—, W, Gr, r W, grn W
8	Petzite	$(Ag,Au)_2Te$ [Ag:Au = 3:1]	C	2.5-3	8.7-9.0	....	steel Gr, iron Blk
9	Pharmacolite	$HCaAsO_4 \cdot 2H_2O$	M	2-2.5	2.6-2.73	1.589	W,gr,r
10	Pharmacosiderite	$6FeAsO_4 \cdot 2Fe(OH)_3 \cdot 12H_2O$	M ?	2.5	2.9-3.0	1.676η 1.693β	Grn, y Br
11	Phenakite	$2BeO \cdot SiO_2$	H	7.5-8	2.97-3.0	1.6540ω	—, p Y, Br, p. rose
12	Phillipsite	$(K_2,Ca)Al_2Si_4O_{12} \cdot 4\frac{1}{2}H_2O$	M	4-4.5	2.2-2.4	1.500	W,r
13	Phoenicochroite	$3PbO \cdot 2CrO_3$	R	3-3.5	5.78	2.38	cochineal R
14	Phosphuranylite (Ra)	$(UO_2)_3P_2O_8 \cdot 5H_2O$	M ?	....	3.0	1.720	d lemon Y
15	Pickeringite	$MgSO_4 \cdot Al_2(SO_4)_3 \cdot 22H_2O$	M	1	1.85	1.480	—, Y, R
16	Picotite	$MgO \cdot Al_2O_3 + Fe$, 7% CrO_3	C	8	4.1 ±	$2.05 \pm \eta$	d y Br, grn Br
17	Picromerite	$K_2O \cdot MgO \cdot 2SO_3 \cdot 6H_2O$	M	2-2.5	2.15	1.462	colorl.
18	Pilbarite (Ra)	$ThO_2 \cdot UO_2 \cdot 2SiO_2 \cdot PbO \cdot 4H_2O$	Am.	3	4.6	$1.74 \pm \eta$	canary Y
19	Pisekite (Ra)	Columbate, titanate of U and rare earths	Am.	5.5-6	4.032	....	y, Blk
20	Pitchblende (Ra)	Massive, amorphous or cryptocrystalline uraninite	.....	3-4	5-6.5	....	Blk
21	Plagionite	$5PbS \cdot 4Sb_2S_3$	M	2-3	5.5	....	blk lead Gr
22	Platinum	Pt(Ir,Pd,Rh,Os,Cu)	C	4-4.5	14-19	....	w steel Gr
23	Plumbogummite	$PbAl_3(OH)_7P_2O_7$	H	4-5	4-5	$1.65\text{-}1.67\eta$	y,br
24	Plumboniobite (Ra)	Columbate of Y, U, Pb, Fe, etc.	Am.	5-5.5	4.81	....	d Br, Blk
25	Pollucite	$2Al_2O_3 \cdot 2Cs_2O \cdot 9SiO_2 \cdot H_2O$	C	6.5	2.87-2.99	1.525η	colorl., W
26	Polybasite	$9Ag_2S \cdot Sb_2S_3$	M	2-3	6-6.2	>2.72	iron Blk
27	Polycrase (Ra)	Columbate, titanate, Y, Er, Ce, U	R	5-6	4.97-5.04	1.70η	Blk
28	Polydymite	Ni_3S_4	C	4.5	4.5-4.8	....	Gr
29	Polyhalite	$2CaSO_4 \cdot MgSO_4 \cdot K_2SO_4 \cdot 2H_2O$	Tri.	2.5-3	2.78	1.562	flesh R, brick R
30	Polymignite	$4(Ca,Ce,Fe)O \cdot (Ti,Zr)O_2 \cdot CaO \cdot Cb_2O_5$	R ?	6.5	4.8	2.215η	Blk
31	Porpezite	Au + 7-11 % Pd	C	....	11-15	....	....
32	Potash alum	$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	C	2	1.76	1.456η	colorl.
33	Powelute	$Ca(Mo,W)O_4$	Tet.	3.5	4.349	1.974ω	Y
34	Prehnite	$2CaO \cdot Al_2O_3 \cdot 3SiO_2 \cdot H_2O$	R	6-6.5	2.8-2.95	1.626	Grn, p Grn, W, Gr
35	Priceite	$5CaO \cdot 6B_2O_3 \cdot 9H_2O$	Tri.	3-3.5	2.43	1.591	snow W
36	Priorite (Ra)	Columbate, titanate, Y, Er, Ce, U [$Cb_2O_5 : TiO_2$ = 1:2]	R	5.5	4.8-4.9	....	br Blk

Luster	Fusibility	Solubility	Special Properties	Locality	
S, Pl	if.	s. HCl	50.8-64.4 % Cer.; 0-2.5 % Yttr.; thermoluminescent	R. Colombia; S. Greenland; Italy; Massachusetts; Montana	1
E	f.	s. a.	....	V.R. Kasolo, Katanga, Belgian Congo	2
.....	....	....	....	V.R. Cerro de Pasco, Peru	3
sV, Sk	2	gel. HCl	triboluminescent; photoluminescent, yellow	Unc. Italy; Scotland; New Jersey; Michigan; Arkansas	4
V	if. (2800°C)	s.a.	....	R. Mte. Somma; Vesuvius; Sweden; California	5
A, M	if.	dec. h. H_2SO_4	....	R. Ural Mts.; Baden; Switzerland; Italy	6
V, Pl	5	s. HF	thermophosphorescent, blue	R. Sweden; Massachusetts; Maine	7
M	f.	sl.s. HCl	slightly sectile	R. Roumania; W. Australia; Colorado; California	8
V	2.5	s. a.	intumesces	R. Germany; France	9
A, G	1.5-2	s. HCl	pseudo isometric; pyroelectric	Unc. Czechoslovakia; France; Cornwall; Utah	10
V	if.	i.	....	R. Ural Mts ; Brazil; Maine; New Hampshire; Colorado	11
V	3	gel. HCl	....	R. Germany; Italy; Ireland; ocean sediments	12
R, A	ef.	s. HCl	....	V.R. Beresovsk, Ural Mts.	13
Pl	3(?)	s. HCl	....	V.R. Mitchell County, N. Carolina	14
Sk	1	s. H_2O	....	R. Chile; New Mexico; Nova Scotia	15
A	if. (2135°C)	v. sl. s. H_2SO_4	....	V.R. Rocklin, California	16
V	2	s. H_2O	....	R. Italy; Saxony; Poland	17
R	.....	s. a.	31.3 % ThO_2	V.R. Pilbara, W. Australia	18
.....	....	....	....	V.R. Pisek, Czechoslovakia	19
R	....	....	contains no thoria or E_2O_3	R. Germany; Bohemia; Colorado, Canada	20
M		as zinkenite	....	R. Wolfsberg, Harz Mts.; Bavaria; France	21
M	if.	s. h. aq. reg.	sometimes magnetic, and may show polarity	R. Colombia; Ural Mts.; S. Africa; California	22
R	2(?)	s. HNO_3	....	V.R. Cumberland, England; Georgia	23
Pitchy	....	....	14.3 % Y	V.R. Tanganyika, E. Africa	24
V	6	dec. a.	....	R. Island of Elba; Hebron, Maine	25
M	1	dec. HNO_3	photoelectric	R. Czechoslovakia; Harz Mts.; Chile; Mexico; Nevada; Idaho	26
V.R.	if.	dec. H_2SO_4	19-33 % Y; trace of Ce, ThO_2	R. Norway; Sweden; N. Carolina; S. Carolina;	27
M	f.	i. HCl, s. HNO_3	decrepitates	V.R. Germany; Ontario ?	28
G	1.5	sl. s. H_2O	....	Unc. Austria; Germany	29
sM, Sp	if.	dec. a.	2.2-21.5 % Y; 3.9 % ThO_2; 0.6 % Hf; 0-11 % Ce	V.R. Norway; Siberia	30
M	....	....	....	V.R. Porpez, Brazil	31
V	1	s. H_2O	see also Kalinite	R. Esmeralda County, Nev.; Imperial Valley, Calif.	32
R	4	dec. a.	....	V.R. Siberia; Michigan; Idaho; Texas; Utah	33
V	2	dec. HCl	intumesces; pyroelectric	Unc. Italy; Harz Mts.; Scotland; Massachusetts: New Jersey Michigan	34
.....	f.	s. HCl	....	V.R. Oregon; California; Turkey	35
.....	....	....	....	V.R. Swaziland, S. Africa; Madagascar	36

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Pseudobrookite	Fe_2TiO_5	R	6	4.4-4.98	2.39_{Li}	dBr, Blk
2	Psilomelane	Colloidal MnO_2 adsorbing $(Ba, K_2, Na_2)O, H_2O$	Am.	5-7	3.3-4.7	....	iron Blk
3	Pucherite	$Bi_2O_3 \cdot V_2O_5$	R	4	6.25	2.50	rBr
4	Pyrargyrite	$3AgS \cdot Sb_2S_3$	H	2.5	5.77-5.86	3.084_{ω}	Blk, gr Blk
5	Pyrite	FeS_2	C	6-6.5	4.95-5.10	....	p brass Y
6	Pyrobelonite	$4(Mn,Pb)O \cdot V_2O_5 \cdot H_2O$	R	3.5	5.377	2.36	fire R
7	Pyrochlore	$(Na,Ca)_2(Cb,Ti)_2(OF)_7$, (suggested by X-ray studies)	C	5-5.5	4.2-4.36	$1.96\text{-}2.02_{\eta}$	Br, dr, blkBr
8	Pyrolusite	$MnO_2 + 2\% H_2O$	R	2-2.5	4.73-4.86	....	iron Blk
9	Pyromorphite (Ra?)	$3Pb_3P_2O_8 \cdot PbCl_2$	H	3.5-4	6.5-7.1	2.050_{ω}	Grn, Y, Br
10	Pyrophanite	$MnTiO_3$	H	5	4.537	2.481_{ω}	d blood R
11	Pyrophyllite	$Al_2O_3 \cdot 4SiO_2 \cdot H_2O$	R	1-2	2.8-2.9	1.588	W, Grn, gr Y, brGrn
12	Pyroxene	....	......	....	....	....	....
13	(a) Acmite	$NaFe'''(SiO_3)_2$	M	6-6.5	3.50-3.55	1.803 ± 0.003	br, rBr, Grn
14	(b) Augite	$CaMg(SiO_3)_2$ with $(Mg, Fe)(Al, Fe)_2SiO_6$	M	5-6	3.2-3.6	1.704	Blk, Br, Grn
15	(c) Babingtonite	$(Ca,Fe,Mn)SiO_3 \cdot Fe_2(SiO_3)_3$	Tri.	5.5-6	3.35-3.37	1.726	grnBlk, br Blk
16	(d) Bronzite	$(Mg,Fe)SiO_3$	R	5.5	3.3-3.5	1.685	olive Grn, Br
17	(e) Clinoenstatite	$MgSiO_3$	M	6	3.19	1.654	—, Y
18	(f) Diopside	$CaMg(SiO_3)_2$	M	5-6	3.2-3.38	1.680	—, Grn
19	(g) Enstatite	$MgSiO_3$	R	5.5	3.1-3.3	1.669	Grn, y Grn
20	(h) Hedenbergite	$CaFe(SiO_3)_2$	M	5-6	3.5-3.58	1.745	Blk
21	(i) Hypersthene	$(Fe,Mg)SiO_3$	R	5-6	3.40-3.5	1.702	d brGrn, grnBlk Br
22	(j) Jadeite	$NaAl(SiO_3)_2$	M	6.5-7	3.3-3.5	1.659	Greens
23	(k) Rhodonite	$MnSiO_3$	Tri.	5.5-6.5	3.4-3.68	1.730-1.740	flesh R, rose, grn, y
24	(l) Spodumene	$LiAl(SiO_3)_2$	M	6.5-7	3.13-3.20	1.666	grnW, grW, y Grn, Y, Pr
25	Pyrrhotite	$Fe_5S_6\text{-}Fe_{16}S_{17}$	H	3.5-4.5	4.58-4.64	....	bronze Y
26	Quartz	SiO_2	H	7	2.653	1.54418_{ω}	varied; W to Blk
27	(a) Cristobalite	SiO_2	Tet.?	6-7	2.27	1.486 1.487_{ω}	W
28	(b) Tridymite	SiO_2	H?	7	2.28-2.33	1.47	—, W
29	Ralstonite	$3Al(OH,F)_3 \cdot (Na_2,Mg)F_2 \cdot 2H_2O$	C	4.5	2.6	1.43_{η}	—, W
30	Rammelsbergite	$NiAs_2$	R	5.5-6	6.9-7.2	....	tin W

Luster	Fusibility	Solubility	Special Properties	Locality	
V	if.	dec. H_2SO_4	streak: ocher yellow	R. Norway; Roumania; Italy; France; Spain	1
D,sM	d. f.	s. HCl	X-ray: shows that material included under this name may be one of several substances	Unc. Saxony; Brazil; India	2
V,A	2	s. HCl	decrepitates	V.R. Saxony; Brazil; California	3
M,A	1	dec. HNO_3	photoelectric	Unc. Harz Mts.; Chile; Nevada; Idaho; Cobalt, Ontario	4
M	2.5-3	i. HNO_3. powd. s. HNO_3	X-ray: structure similar to fluorite, but of lower symmetry class; thermoelectric	A. Widespread	5
E, sM, A	....	s.HNO_3	....	R. Vermland, Sweden	6
V-R	if.	dec. H_2SO_4	B. B. becomes yellowish-green, hence its name; 18%E_2O_3; trace Hf	V.R. Norway; Ilmen Mts.; Tasmania; Urals	7
M	if.	s. HCl	X-ray: same structure as polianite, which is apparently only cryst. form of MnO_2	C. Widespread; Germany; India; Brazil; United States	8
R	1.5	s. HNO_3	photo-, cathode- and (R) luminescent; thermoelectric	R. Urals; Czechoslovakia; France; N. S. Wales; Pennsylvania; Idaho; S. Africa	9
V,sM	if.	s. HCl	streak: ocher yellow	V.R. Sweden; Brazil	10
Pl, G	6	sl. dec. H_2SO_4	B. B. fuses after much change in volume	C. Urals; Sweden; Switzerland; N. Carolina; Georgia; S. Carolina; California	11
......	....	....	....	....	12
V, sR	2	v. sl. s. a.	....	R. Norway; Magnet Cove, Arkansas	13
V	3	i.	....	A. Bohemia; Italy; Finland; Utah; Hawaiian Islands	14
V	3	i.	....	V.R. Mt. Tom, Massachusetts; New Jersey; Norway; Italy	15
A, P, sM	6	i. HCl	....	Unc. Austria; Bavaria	16
V	if.	i.	....	R. Rare in igneous rocks and meteorites	17
V	if.	i.	paramagnetic	Unc. Italy; Austria; Sweden; Connecticut; Massachusetts	18
P,V, sM	6	i. HCl	....	Unc.	19
V	3.5–4	i.HCl	....	R. Sweden	20
Pl,sM	5	i.a.	....	Unc. Bavaria; Norway; Canada	21
sV,Pl	2.5	i.	....	V.R. Burma; Tibet; New Zealand; Mexico	22
V, Pl	2.5	sl. s. HCl	(A) photoluminescent	V.R. Urals; Italy; Sweden; N.S. Wales; Massachusetts; New Jersey	23
V, Pl	3.5	i.	....	R. Sweden; Madagascar; Brazil; Maine; N. Carolina; California	24
M	1170°C.	dec. HCl	....	C. Austria; Germany; France; Ontario; Norway; Brazil; Tenn.	25
V	if.	s. only HF	See Note.	A World-wide	26
D	if.	i.	....	Unc. Mexico; California; on lavas and meteorites	27
V, Pl	if.	s. h. Na_2CO_3	....	Unc. Mexico; Germany; France; Japan; Wyoming; Washington	28
V	if.	dec. H_2SO_4	....	V.R. Ivigtut, Greenland; Colorado; Japan	29
M	2	s. aq. reg.	....	Unc. Austria; Saxony; Franklin, N. J.; Cobalt, Ontario	30

NOTE: circular polarization; X-ray: complicated structure; pyro- and piezo-electric.

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Randite (Ra)	$Ca_5U_2C_6O_{20}\cdot 3H_2O$	.....	2-3	....	....	canary Y
2	Raspite	$PbWO_4$	M	2.5	8.46	2.27	br Y
3	Rauvite (Ra)	$CaO\cdot 2UO_3\cdot 6V_2O_5\cdot 20H_2O$	.....	....	....	1.88η	p Blk,
4	Realgar	AsS	M	1.5-2	3.4-3.6	2.68	aurora R, OY
5	Renardite (Ra)	$PbO\cdot 4UO_3\cdot P_2O_5\cdot 9H_2O$	R	....	4.0	1.736	Y
6	Retzian	Basic arsenate Y, Ce, Mn, Ca, H	R	4	4.15	1.788	Br
7	Rhabdophanite	$(La, Di, Y, Er)PO_4\cdot H_2O$	Tet. or H	3.5	4	1.654ω	Br, pk, yW
8	Rhodium gold	30—45% Rh + Au	C	....	15.5-16.8	....	....
9	Rhodizite	$(K, Na, Li)_8Be_7Al_6B_{14}O_{39}$?	C	8	3-3.4	1.69η	W
10	Rhodochrosite	$MnCO_3$	H	3.5-4.5	3.4-3.6	1.820ω	rose R, Pk, Br, dR
11	Rinkite	$3NaF\cdot 4CaO\cdot 6(Si, Ti)O_2\cdot Ce_2O_3$	M	5	3.46	1.688	Y, Br
12	Rinkolite	Titano-silicate of Ce, Ca, Sr, Na	M	5	3.4	1.645-1.667	Br, Grn, Y
13	Risörite (Ra)	$Y(Ta, Cb)O_4 \pm Ce, Ca, Er$, etc. + Ti	Tet.	5.5	4.18	$2.05\pm\eta$	YBl
14	Roeblingite	$2PbSO_4\cdot H_{10}Ca_7(SiO_4)_6$	R	3	3.433	1.64	W
15	Rogersite (Lausenite)	$Fe_2O_3\cdot 3SO_3\cdot 6H_2O$?	M	3.5	3.313	1.628	W, colorl.
16	Rogersite	Hydrated yttria columbate	Am.	3.5	3.313	....	W
17	Roscoelite	Muscovite with part of Al replaced by V	M	2.5	2.97	1.685	clove Br, grn Br
18	Roselite	$3(Ca, Co, Mg)_3As_2O_8\cdot 2H_2O$	Tri.	3.5	3.5-3.6	1.725	p rose R to d rose R
19	Rosenbuschite	$Na_2Ca_3(Si, Ti, Zr)_4O_{12}$	M	5-6	3.3	1.687	O, Gr
20	Rossite	$CaO\cdot V_2O_5\cdot 4H_2O$	Tri.	2-3	2.45	1.770	Y
21	Rowlandite	$Fe(Y, Ce, La)_2(YF)_2Si_4O_{14}$	C	6-7	4.5	1.725η	drab Gr
22	Rutherfordite (Ra)	UO_2CO_3	R ?	soft	4.8	$1.72\text{-}1.80\eta$	ocher Y
23	Rutile	TiO_2	Tet.	6-6.5	4.18-4.25	2.6158ω	r Br, Blk, R, bl V
24	Safflorite	$CoAs_2$ + Fe, Ni	R	4.5-5	6.9-7.3	....	tin W
25	Sal ammoniac	NH_4Cl	C	1.5-2	1.528	1.639η	W
26	Samarskite (Ra)	$R_3''R_2'''(Cb, Ta)_6O_{21}$ $R'' = Fe, Ca, UO_2$ $R''' = Ce, Y$, etc.	R	5-6	5.6-5.8	2.21η	velvet Blk
27	Samiresite (Ra)	Columbate, titanate U, Pb, etc.	C	....	5.24	$1.92\text{-}1.96\eta$	gold Y
28	Sanidine	Glassy orthoclase	M	6	2.57-2.58	....	....
29	Sapphirine	$5MgO\cdot 6Al_2O_3\cdot 2SiO_2$	M	7.5	3.42-3.48	1.709	p Bl, Grn
30	Sassolite	$B_2O_3\cdot 3H_2O$	Tri.	1	1.44-1.48	1.456	W
31	Scheelite	$CaWO_4$	Tet.	4.5-5	5.9-6.1	1.918ω	W, yW, br, pY, grn, r
32	Schorlomite	$3CaO\cdot (Fe, Ti)_2O_3\cdot 3(Si, Ti)O_2$	C	7-7.5	3.8	$1.9\text{-}2.0\eta$	Blk
33	Schroeckeringite (Ra)	Hydrous U carbonate	M	soft	....	1.685	grn, Y
34	Scolecite	$CaO\cdot Al_2O_3\cdot 3SiO_2\cdot 3H_2O$	M	5-5.5	2.16-2.4	1.519	—, W, Y

Luster	Fusibility	Solubility	Special Properties	Locality	
V	if.	s. HCl	.....	V.R. Frankford, Penn.	1
A	2.5-3	dec. HCl	.....	V.R. Broken Hills, N. S. Wales; Minas Geraes, Brazil	2
E	....	.....	apparently metacolloidal	R. Temple Mt., San Rafael Swell, Utah	3
R	1	s. caustic alkalies	burns: blue flame; disintegrates on exposure to light to mixt. of $As_2S_3 + As_2O_3$	Unc. Roumania; Switzerland; Japan; Wyoming; Utah; Nevada	4
.....	....	.....	.....	V.R. Kasolo, Katanga, Belgian Congo	5
.....	if.	s. a.	8-11 %Cer. + Yttr.	V.R. Vermland, Sweden	6
G	if.	s.a.	resembles brown sphalerite; 53-57 %Cer.; 2-10 % Yttr.	V.R. Cornwall, England; Scoville, Connecticut	7
M	....	.....	.....	V.R. Colombia; Mexico (?)	8
V	if.	i.	heat does not make crysts. isotropic	V.R. Urals; Madagascar	9
V, Pl	if.	s. h. HCl	decrepitates strongly; photoluminescent	Unc. Roumania; Germany; Cornwall; New Jersey; Colorado; Nevada	10
V	if.	dec. H_2SO_4	.....	V.R. Greenland in the Julianehaab district	11
.....	....	.....	21 %Cer.; 0.4-1.4 % Yttr.	V.R. Kola, Russia	12
V	if.	s. H_2SO_4	X-ray: tetragonal structure 2.9-40 %Cer.; 37 % Yttr.	V.R. Risör, Norway	13
.....	3	gel. a.	photoluminescent: pale pink	V.R. Franklin, N. J.	14
Sk	....	.....	.....	V.R. Formed under fumarolic conditions during fire; United Verde mine, Arizona	15
.....	....	.....	60.12 % Y.	V.R. Mitchell County, N. Carolina	16
Pl	3 (?)	i.a.	.....	R. California; Colorado; W. Australia	17
V	3	s. a.	.....	V.R. Schneeberg, Saxony	18
V	ef.	s. HCl	0.3-2.4 % Cer.; 0.3 % Hf	V.R. Langesundfiord, Norway; Red Hill, N. H.	19
Pl, V	....	.....	.....	V.R. Bull Penn Canyon, Colorado	20
V	if.	gel. HCl	14.5 %Cer.; 47.7 % Yttr.; 0.6 % ThO_2	V.R. Llano County, Texas	21
V, R	....	s. a.	.....	R. Uluguru Mts., East Africa	22
sM, A	if.	i.	.....	C. Germany; Switzerland; Brazil; Virginia; N. Carolina; Georgia; Pennsylvania	23
M	like smaltite		.....	R. Germany; Sweden; Quebec	24
V	1.5-2	s. H_2O	reversible inversion at 156° C., with volume increase, but no change in symmetry	Unc. About volcanic fumaroles: Etna, Vesuvius, etc.	25
sM, R, V	6	v. sl. s. a.	decrepitates; 7 % $ThO_2 + ZrO_2$; 1.2-6.4 %Cer.; 4-21 % Yttr.	R. Ilmen Mts.; Madagascar; N. Carolina; Ontario	26
.....	....	.....	.....	V.R. Samiresy, Madagascar	27
V	....	.....	.....	R. Siebengebirge, Germany	28
V	if.	i.	.....	R. S. Greenland; Madagascar; Quebec	29
Pl	0.5	s. H_2O	.....	V.R. Sasso, Tuscany; Lipari Islands	30
A, V	5	dec. HCl	photoluminescent: fluoresces bright blue	R. Bohemia; Saxony; Italy; Cornwall; S. Dakota; California; Colorado	31
V	4	gel. HCl	.....	R. Magnet Cove, Ark.; Brit. Columbia	32
Pl	....	.....	.....	V.R. Joachimsthal, Bohemia	33
V, Sk	2-2.2	gel. a.	B.B. curls up like worm, hence name; X-ray: confirms monoclinic symmetry; pyroelectric	R. Iceland; Greenland; India; Colorado; New Jersey; Rhode Island; Nova Scotia	34

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Sellaite	MgF_2	Tet.	5-6	2.97-3.17	1.378ω	colorl.
2	Senaite	$(Fe,Mn,Pb)O\cdot TiO_2$	H	6	5.3	$2.50_{Li}\omega$	Blk
3	Sepiolite	$2H_2O\cdot 2MgO\cdot 3SiO_2$	R ?	2-2.5	2	....	grnW, W, y,bl,r
4	α-sepiolite	$2H_2O\cdot 2MgO\cdot 3SiO_2$	R ?	2-2.5	2	1.506	....
5	β-sepiolite	$2H_2O\cdot 2MgO\cdot 3SiO_2$	Am.	2-2.5	2	1.52-1.53η	....
6	Serpentine	$3MgO\cdot 2SiO_2\cdot 2H_2O$	M	2.5-4.5	2.5-2.65	1.490 1.571	Greens, br R
7	Seybertite	$10(Mg,Ca)O\cdot 5Al_2O_3\cdot 4SiO_2\cdot 3H_2O$	M	4-5	3-3.1	1.657	rBr,y, copper R
8	Sicklerite	$Fe_2O_3\cdot 6MnO\cdot 4P_2O_5\cdot 3(Li,H)_2O$	R ?	4	3.45	1.735	dBr
9	Siderite	$FeCO_3$	H	3.5-4	3.83-3.88	1.873ω	Gr,grnGr, Br,brR, W
10	Sillimanite	Al_2SiO_5	R	6-7	3.23-3.24	1.660 red	yGr, gr Grn
11	Silver	Ag	C	2.5-3	10.1-11.1	$0.181_{Na}\eta$	silver W
12	Sincosite	$CaO\cdot V_2O_4\cdot P_2O_5\cdot 5H_2O$	Tet.	low	2.84	1.680ω	leek Grn
13	Sipylite	Identical with fergusonite; no erbium	Tet.	5.5-6	4.9	2.06±η	O; Blk
14	Sklodowskite (Ra)	$MgO\cdot 2UO_3\cdot 2SiO_2\cdot 7H_2O$	R	....	3.54	1.635	p lemon Y
15	Smaltite	Essentially cobalt diarsenide	C	5.5-6	5.7-6.8	....	r silver W
16	Smectite	Hydrous silicate Al, Mg, Ca, Fe	.....	soft	1.9-2.1	1.490α	grn
17	Smithsonite	$ZnCO_3$	H	5.5	4.3-4.5	1.849ω	W, gr, grn, brW
18	Soda niter	$NaNO_3$	H	1.5-2	2.24-2.29	1.5874ω	W, Br, Gr, lemon Y
19	Sodalite	$3Na_2O\cdot 3Al_2O_3\cdot 6SiO_2\cdot 2NaCl$	C	5.5-6	2.1-2.4	1.4827η	Gr,grn,y, W, Bl, R
20	Soddyite (Ra)	$5UO_3\cdot 2SiO_2\cdot 6H_2O$?	R	3-4	4.627	1.68	Y
21	Sperrylite	$PtAs_2$	C	6-7	10.6	....	tin W
22	Sphalerite	ZnS	C	3.5-4	3.9-4.1	2.370-2.428η	Y, Br, Blk, R, Grn, W,—
23	Spinel	$MgO\cdot Al_2O_3$	C	8	3.5-4.1	1.7155-2.00 η	various W-Blk
24	Stannite	$FeS\cdot Cu_2S\cdot SnS_2$	C	3.5	4.3-4.52	....	steel Gr, iron Blk
25	Staurolite	$2FeO\cdot 5Al_2O_3\cdot 4SiO_2\cdot H_2O$	R	7-7.5	3.65-3.77	1.741	dBr, brBlk, yBr
26	Steenstrupine (Ra)	Silicate, rare earths, Zr, Fe, Na, Th, Mn, Al, Ti, H_2O	H	4	3.4	....	dBr, Blk
27	Stephanite	$5Ag_2S\cdot Sb_2S_3$	R	2-2.5	6.2-6.3	....	iron Blk
28	Stercorite	$HNa(NH_4)PO_4$	M	2	1.615	1.442	W, yBr
29	Sternbergite	$Ag_2S\cdot Fe_4S_5$	R	1-1.5	4.21	....	pinchbeck Br
30	Stibotantalite	$(SbO)_2(Ta,Cb)_2O_6$	R	5.5	6.0-7.4	2.419	Br, Y, rY
31	Stibnite	Sb_2S_3	R	2	4.52-4.62	4.046	lead Gr, steel Gr
32	Stichtite	$MgCO_3\cdot 5Mg(OH)_2\cdot 2Cr(OH)_3\cdot 4H_2O$	H	1.7	2.16	1.542ω	lilac

Luster	Fusibility	Solubility	Special Properties	Locality		
V	4(1221°C)	s. H_2SO_4	intumesces; thermoluminescent	V.R.	With fluorite	1
sM	if.	s. h. H_2SO_4	streak: brownish black	V.R.	Minas Geraes, Brazil	2
D, E	6-7	dec. HCl	dry masses float on water	R.	Asia Minor; Greece; Spain; Morocco; Pennsylvania; New Mexico	3
.....	6-7	gel. a.	....	....	....	4
.....	6-7	dec. HCl	....	....	....	5
R, G	6	dec. a.	....	A.	Saxony; Cornwall; Massachusetts; Rhode Island; New York; Pennsylvania; Canada; Maryland	6
Pl, sM	if.	dec. a.	....	R.	Warwick, N. Y.; Ural Mts.; Italy	7
.....	ef.	s. a.	....	R.	Tintic, Utah; Pala, California	8
V, Pl	4.5-5	s. h. HCl	decrepitates; photoluminescent	C.	Widespread; France; England; Greenland	9
A-V	if.	i.	....	C.	Germany; Austria; France; Mass.; N. Y.; Penn.; N. Car.	10
M	1050°C	s. HNO_3	ductile, malleable	R.	Norway; Germany; Chile; N.S. Wales; Michigan; Colorado; Ontario	11
M	.....	s. a.	decrepitates	V.R.	Sincos, Peru	12
M, R	if. (6)	i.	decrepitates; glows brilliantly	V.R.	Amherst County, Virginia	13
.....	....	gel. HCl	....	V.R.	Katanga, Belgian Congo	14
M	f.	s. h. HNO_3	streak: grayish black; thermoelectric	R.	Sweden; Norway; Ontario	15
.....	....	....	X-ray: same powder pattern as montmorillonite	C.	Conde, France; Cilly, Styria; Woburn, England	16
V, Pl	if.	s. HCl	photoluminescent	Unc.	Siberia; Greece; England; N. S. Wales; Missouri; Arkansas; Utah	17
V	1	s. H_2O	deflagrates; diamagnetic	R.	Northern Chile; Nevada; California	18
V, G	3.5-4	s. HCl	X-ray: normal symmetry, unlike etch figures; lattice: simple cubic but near that of body-centered cubic type.	Unc.	Ilmen Mts.; Italy; Norway; Maine; Canada	19
.....	if.	gel. HCl	....	V.R.	Kasolo, Belgian Congo	20
M	if.	sl. s. HCl	decrepitates; streak: black; X-ray: structure like pyrite	R.	Sudbury, Ontario; Pennsylvania; Wyoming; Transvaal; Siberia	21
R, A	5	s. HCl	some varieties ,triboluminescent; may contain Ga; pyroelectric and diathermanous	C.	Bohemia; Harz Mts.; Japan; Mexico; Missouri; Illinois; Wisconsin	22
V	if.	sl. s. H_2SO_4	....	Unc.	Ceylon; Burma; Italy; Madagascar; New York; New Jersey	23
M	f.	dec. HNO_3	decrepitates	R.	Bohemia; Cornwall; Tasmania; Bolivia; S. Dakota	24
sV, R	if.	sl. dec. H_2SO_4	X-ray: arrangement partly identical with kyanite	R.	Switzerland; New England; Virginia; N. Carolina; Georgia	25
D	ef.	dec. a.	14-32.5% Cer.; 0-16% Yttr.; 2-7% ThO_2	V.R.	Kangerdluarsuk, Greenland	26
M	f.	s. h. HNO_3	streak: iron black; decrepitates; photoelectric	R.	Czechoslovakia; Germany; Chile; Mexico; Nevada	27
V	f.	s. H_2O	non-efflorescent	V.R.	In guano: Ichaboe, Africa; Guanope, Peru	28
M	f.	s. aq. reg.	streak: black; thin laminae, flexible like tin foil	V.R.	Bohemia; Saxony	29
A, R	4	s. only HF	pyroelectric	V.R.	Nelson, W. Australia; Mesa Grande, California	30
M, Sp	1	s. HCl	photoelectric	Unc.	Japan; Harz Mts.; China; California: Nevada	31
G	if.	s. a.	....	R.	Tasmania; Quebec; Transvaal, S. Africa	32

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Stilbite	$(Na_2,Ca)O \cdot Al_2O_3 \cdot 6SiO_2 \cdot 6H_2O$	M	3.5-4	2.0-2.2	1.498	W, Y, Br, R
2	Stolzite (Ra?)	$PbWO_4$	Tet.	3	7.07-8.23	2.27_ω	Grn, Gr, Br
3	Strengite	$FePO_4 \cdot 2H_2O$	R	3-4	2.8-2.9	$1.70\text{-}1.76_\eta$	pR
4	Stromeyerite	$Ag_2S \cdot Cu_2S$	R	2.5-3	6.1-6.3	....	steel Gr
5	Strontianite	$SrCO_3$	R	3.5-4	3.6-3.71	1.664	W, Gr, Y, Greens
6	Strüverite	$Fe(Ta,Cb)_2Ti_6O_{18}$	Tet.	6	5.56	$2.50_{Li\omega}$	iron Blk
7	Struvite	$NH_4MgPO_4 \cdot 6H_2O$	R	2	1.7-1.8	1.496	W, y
8	Sulfur	S	R	1.5-2.5	2.05-2.09	2.038	Y
9	Sussexite	$HRBO_3$ [R = Mn, Zn, Mg]	R ?	3	3.12	1.709	W, pk, y
10	Sylvite	KCl	C	2	1.97-1.99	1.490_η	W, bl, y
11	Sylvanite	$(Au,Ag)Te_2$	M	1.5-2	7.9-8.3	....	steel Gr, silver W
12	Tachhydrite	$CaCl_2 \cdot 2MgCl_2 \cdot 12H_2O$	H	2	1.66-1.67	1.520_ω	wax Y, honey Y
13	Tachyaphaltite	Altered zircon	Tet.	5.5	3.6	....	dBr
14	Talc	$3MgO \cdot 4SiO_2 \cdot H_2O$	R or M	1-1.5	2.6-2.8	1.589	W, Grn, Gr
15	Tamarugite	$NaAl(SO_4)_2 \cdot 6H_2O$	M ?	1	2.3	1.487	colorl.
16	Tantalite	$(Fe,Mn)(Ta,Cb)_2O_6$	R	6	5.3-7.8	2.25	iron Blk, grbr Blk
17	Tantalum	Ta	C	6-6.5	16.6	....	gr Y
18	Tapiolite	$(Fe,Mn)(Cb,Ta)_2O_6$	Tet.	6	7.3-7.8	2.27_ω	Blk
19	Tellurium	Te	H	2-2.5	6.1-6.3	....	tin W
20	Tengerite	A supposed yttrium carbonate	.....	....	....	1.57	W
21	Tennantite	$5Cu_2S \cdot 2ZnS \cdot 2As_2S_3$	C	3-4	4.37-4.49	$>2.72_{Li}$	blk, lead Gr, iron Blk
22	Tenorite	CuO	Tri.	3-4	6.45	2.63_{red}	Blk
23	Teschermacherite	HNH_4CO_3	R	1.5	1.45	1.536	W to y
24	Tetradymite	$Bi_2(S,Te)_3$	H	1.5-2	7.2-7.6	....	p steel Gr
25	Tetrahedrite	$3Cu_2S \cdot Sb_2S_3 \pm Fe,Zn$	C	3-4	4.4-5.1	$>2.72_{Li\eta}$	flint Gr, iron Blk
26	Thalenite	$2Y_2O_3 \cdot 4SiO_2 \cdot H_2O$	M	6.5	4.1-4.45	1.738	flesh R
27	Thenardite	Na_2SO_4	R	2.5	2.68-2.69	1.477	W, br
28	Thermonatrite	$Na_2CO_3 \cdot H_2O$	R	1.5-2	1.6	1.506	W
29	Thomsonite	$2(Ca,Na_2)O \cdot 2Al_2O_3 \cdot 4SiO_2 \cdot 5H_2O$	R	5-5.5	2.3-2.4	1.503	W, rGrn
30	Thorianite (Ra)	$(Th,U)O_2$	C	6.5	8.0-9.7	2.2_η	Blk
31	Thorite (Ra)	$ThSiO_4$	Tet.	4.5-5	4.5-5	$1.68\text{-}1.72_\eta$	Blk
32	Thorogummite (Ra)	$UO_3 \cdot 3ThO_2 \cdot 3SiO_2 \cdot 6H_2O$? altered mackintoshite	Tet.?	4-4.5	4.5	....	dYBr
33	Thorotungstite (Ra)	Essentially tungstic and thorium oxides, rare earths	R ?	....	5.55	$>1.74_\eta$	honey Y

Luster	Fusibility	Solubility	Special Properties	Locality	
V, Pl	2-2.5	dec. HCl	exfoliates	Unc. India; Mexico; New Jersey; Nova Scotia	1
R	2	dec. HNO_3	....	R. Bohemia; N. S. Wales; Minas Geraes, Brazil	2
V, Pl	2.5-3	s. HCl, i. H_2SO_4	....	R. Germany; France; Sweden; Virginia; California	3
M	f.	s. HNO_3	....	R. Altai, Siberia; Silesia; Chile; Arizona; Montana; Colorado; Ontario	4
V, r	1497°C	s. HCl	B.B. swells; thermoelectric	C. Austria; Germany; New York	5
.....	if.	....	....	V.R. Italy; Madagascar; South Dakota	6
V, R	3	s. a.	pyroelectric	R. Guano beds	7
R	108°C	s. CS_2	X-ray: shows normal symmetry	A. Sicily; Italy; Louisiana; Texas; Nevada	8
Pl, Sk	2	s. HCl	....	V.R. Franklin Furnace; New Jersey	9
V	1.5	s. H_2O	X-ray: normal symmetry; diathermanous; cathodeluminescent	C. Vesuvius; Stassfurt; Galicia; Poland	10
M	f.	sl. s. HNO_3	....	V.R. Roumania; Australia; Colorado; California	11
V	1	s. H_2O	decrepitates	R. Stassfurt, Germany	12
.....	....	....	....	V.R. Hiterö and Kragerö, Norway	13
Pl, G	if.	undec. a.	exfoliates	A. Switzerland; India; China; Vermont; New York; N. Carolina; Canada	14
V	if.	i.	....	V.R. Chile	15
sM-G	if.	v. sl. s. a.	....	R. Finland; Norway; Massachusetts; Connecticut; Alabama; S. Dakota	16
M	2900°C	s. HF	....	V.R. Ural and Altai Mts.	17
M	if.	sl. s. a.	X-ray: shows close relationship to rutile group	V.R. Sukula, Finland; Topsham, Maine	18
M	vol.	s. h. H_2SO_4	....	V.R. Roumania; W. Australia; Colorado; New Mexico	19
D	....	s.a.	....	V.R. Ytterby, Sweden; Llano County, Texas	20
M	1.5	dec. HNO_3	....	R. Binnental. Switzerland; Sweden; England; Peru; Chile; Colorado; Montana	21
M	3	s. HCl	....	Unc. Vesuvius; Etna; Europe; Tennessee; Michigan; Arizona	22
V	vol.	s. H_2O	....	V.R. Guano deposits: Africa; Patagonia	23
M,Sp	f. vol.	s. HCl	thermoelectric	V.R. Czechoslovakia; Norway; Sweden; England; Virginia; Montana; Colorado	24
M	1.5	dec. HNO_3	X-ray: closely similar to sphalerite in structure; fundamental formula $3Cu_2S \cdot Sb_2S_3$	V.R. Bohemia; Germany; Cornwall; Utah; Colorado; Arizona; Nevada	25
G	....	....	59-64% Yttr.	V.R. Østerby, Askagen, Sweden; Hundholmen, Norway	26
V	1.5	s. H_2O	changes at 235°C ± to negative uniaxial form called metathenardite	R. Siberia; Spain; Chile; Arizona; California; Nevada	27
V	1.5	s. H_2O	....	V.R. Vesuvius	28
V, Pl	2	gel. HCl	pyroelectric; intumesces	Unc. Italy; Ireland; Scotland; India; New Jersey; Arkansas; Michigan; Nova Scotia	29
.....	if.	s. HNO_3	72-79% ThO_2; 1-8% Cer.	V.R. Balangoda, Ceylon; Betroka, Madagascar	30
V	if.	gel. a.	does not gel. after calcination; 41-58% ThO_2; 0-6% E_2O_3	R. Norway; Sweden	31
.....	....	v. s. HNO_3	41.4% ThO_2; 6.7% E_2O_3	V.R. Llano County, Texas	32
.....	....	dec. a., sl. s. NaOH	16% ThO_2	V.R. Pulai, Malay States	33

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Thortveitite	$(Sc,Y)_2Si_2O_7$	M	6-7	3.57	1.793	grGrn, Blk
2	Thucholite (Ra)	Hydrocarbon, Th, Ce, La, Di, Y, Er, H_2, N	.....	3.5-4	1.78-1.57	....	jet Blk
3	Tiemannite	HgSe	C	2-3	8.19	....	steel Gr, blk lead Gr
4	Tin	Sn	Tet.	2	7.17	....	tin W
5	Titanite	$CaO \cdot TiO_2 \cdot SiO_2$	M	5-5.5	3.4-3.6	1.907	Br, Gr, Y, Grn, R, Blk
6	Titano-elpidite	Elpidite with high Ti	.....	6.5	2.55	1.686	Br
7	Topaz	$[Al(F,\pm OH)]_2SiO_4$	R	8	3.4-3.6	1.6308_D	Y, W, gr, grn, bl, r
8	Torbernite (Ra)	$Cu(UO_2)_2P_2O_8 \cdot 12H_2O$	R	2-2.5	3.2	1.592_ω	Grns
9	Törnebohmite	$(Ce,La,Al)_3(F,OH)(SiO_4)_2$	M ?	4.5	4.9	1.85	Grn to olive
10	Tourmaline	Complex Al boro-silicate ± Li, Fe, Na, Mg	H	7-7.5	2.9-3.2	$1.6366_{\omega\gamma}$	various, W to Blk
11	Trimerite	$(Mn,Ca)_2SiO_4 \cdot Be_2SiO_4$	M	6-7	3.474	1.720	salmonPk, colorl.
12	Triphylite	$Li(Fe,Mn)PO_4$	R	4.5-5	3.42-3.56	1.702	blGrn, grnGr
13	Triplite	$(Mn,Fe)_2FPO_4$	M	4-5.5	3.5-3.8	1.660-1.673	Br, blkBr
14	Tritomite	Complex fluo-silicate of Ce, La, Y, Di, Ca, Ba, etc.	H	5.5-6.0	4.2	1.75_η	dBr
15	Trögerite (Ra)	$(UO_2)_3As_2O_8 \cdot 12H_2O$	M ?	soft	3.3	$1.58\text{-}1.63_\eta$	lemon Y
16	Trona	$Na_2CO_3 \cdot NaHCO_3 \cdot 2H_2O$	M	2.5-3	2.11-2.14	1.492	Gr, yW
17	Tscheffkinite	$(Ca,Fe)(Ce,Y,Di)_2(Si,Ti)_3O_{10}$	R? or M?	5-5.5	4.5	1.63-1.97-	velvet Blk
18	Tschermigite	$(NH_4)Al(SO_4)_2 \cdot 12H_2O$	C	2	1.64	1.459_η	W,—
19	Tungstenite	WS_2 ?	.....	2.5	7.4	....	d lead Gr
20	Tungstite	WO_3 (H_2O ?)	R ?	2.5	5.5?	2.24	Y, yGrn
21	Turquois	$3Al_2O_3 \cdot CuO \cdot 2P_2O_5 \cdot 9H_2O$	Tri.	5-6	2.6-2.83	1.62	sky Bl, bl Grn, apple Grn
22	Tyuyamunite (Ra)	$CaO \cdot UO_3 \cdot V_2O_5 \cdot nH_2O$	R	soft	3.7-4.3	1.870±	Y
23	Uhligite	$Ca(Zr,Ti)_2O_5 + Al_2TiO_5$	C	5-6	....	....	Blk, Br
24	Ulexite	$NaCaB_5O_9 \cdot 8H_2O$	M	1	1.65	1.508	W
25	Ullmannite	NiSbS	C	5-5.5	6.2-6.7	....	steel Gr, silver W
26	Uraconite (Ra)	Hydrous U sulfate ?	R	soft	3.7-3.9	1.79	YO
27	Uraninite (Ra)	Complex, variable uranate with Th, Zr, La, Y, Pb, He, A, N	C	5.5	9.0-9.7	....	gr, grn, br, velvet Blk
28	Uranochalcite (Ra)	$UO_3 \cdot SO_3 \cdot CaO \cdot CuO \cdot H_2O$?	.....	2-2.5	....	1.655	grass Grn, apple Grn
29	Uranocircite (Ra)	$Ba(UO_2)_2 \cdot P_2O_8 \cdot 8H_2O$	R	2	3.5	1.623	yGr
30	Uranoniobite (Ra)	Crystallized uraninite	C	....	9.0-9.7	....	....
31	Uranophane (Ra)	$CaO \cdot 2UO_3 \cdot 2SiO_2 \cdot 7H_2O$	R	2-3	3.81-3.90	1.666	Y
32	Uranopilite (Ra)	$CaO \cdot 8UO_3 \cdot 2SO_3 \cdot 25H_2O$?	Tri.?	....	3.9	1.623	Y

Luster	Fusibility	Solubility	Special Properties	Locality	
A, R	ef.	i. HCl	51-55% Yttr. of which $Sc_2O_3 = 37.6$-42%; 0.5% Hf	V.R. Sätersdalen, Norway; Madagascar	1
D, E brilliant	.....	sl.s.HCl	decrepitates	V.R. Conger, Ellsworth, Ontario; Quebec	2
M	vol.	s. aq. reg.	streak: black; decrepitates	R. Harz Mts.; Marysvale, Utah	3
M	223°C	s. HCl	....	V.R. Russia; N. S. Wales; Bolivia; Mexico; Pennsylvania	4
A, R	3	s. H_2SO_4	pyroelectric	Unc. Austria; Switzerland; Madagascar; New York; Rhode Island; Arkansas	5
.....	....	....	....	R. Mt. Chilbina, Russian Lapland	6
V	if.	sl.dec.H_2SO_4	pyroelectric	R. Ural Mts.; Japan; Mexico; Brazil; Maine; New Hampshire; Colorado; Utah	7
Pl, sA	2.5	s. HNO_3	fluorescent; in air below 100° dehydration forms metatorbenite I, with $8H_2O$; at 130°, metatorbenite II	V R Bohemia; Saxony; Cornwall; S. Australia	8
.....	...	s.h. conc. a.	....	V.R. Vastmanland, Sweden	9
V, R	4-5.5	undec. a.	electric by friction; pyroelectric; piezoelectric	C. Madagascar; Ceylon; Brazil; Maine; California	10
V, brilliant	6	s. HCl	....	V.R. Vermland, Sweden	11
V, R	1.5	s. a.	sometimes decrepitates	V.R. Bavaria; Finland; Maine; New Hampshire; Massachusetts	12
R, A	2.5	s. a.	streak: yellowish gray	V.R. Bohemia; France; Maine; Nevada	13
R	(?)	gel. HCl	44-59% Cer.; 0.4-4.6% Yttr; 0-10.6% $ThO_2 + ZrO_2$; decrepitates (?)	V.R. Langesundfiord, Norway	14
P	2.5	s. a.	....	V.R. Neustädtel, Saxony	15
V	1	s. H_2O	photoluminescent	C. Northern Africa; Egypt; Venezuela; Nevada; California	16
V	4	gel. HCl	23-47% Cer.; 0-34% Yttr.; 0-20% $ThO_2 + ZrO_2$	R. Ilmen Mts.; India; Madagascar; Virginia	17
V	1	s. H_2O	....	R. Bohemia; Italy; Wyoming; New Mexico	18
......	....	....	streak: as color	V.R. Emma Mine, Utah	19
E	if.	i. a., s. KOH	Material from Salmo, B.C. proved $WO_3 \cdot H_2O$	R. Cornwall; Cumberland; Monroe; Connecticut	20
W	if.	s. HCl	decrepitates; often artificially treated to give desirable color	R. Persia; Siberia; Virginia; New Mexico; Nevada	21
E, A, Pl	1	......	....	V.R. Alai Mts.; Colorado; Utah	22
.....	....	....	near zirkelite	V.R. Lake Magad, E. Africa	23
S	1	sl. s. h. H_2O	intumesces	C. Chile; Nevada; California; Nova Scotia	24
M	f.	dec. HNO_3	....	R. Austria; Germany; Sardinia; England; France	25
E	.....	s. a.	similar to zippeite	V.R. Joachimstal, Bohemia	26
sM, G, D	if.	s. HNO_3, s. H_2SO_4	0-3% Cer.; 0-10.2% Yttr.; 1.6-11% ThO_2	R. Roumania; Bohemia; Saxony; E. Africa; Connecticut; Colorado; Canada	27
Sk	......	s. a.	streak: as color	V.R. Joachimsthal, Bohemia	28
Pl	3	s. HCl	fluorescent; photoluminescent	V.R. Falkenstein; Saxony; Madagascar	29
.....	....	....	....	V.R. Norway	30
V, Pl	if.	gel. HCl	....	R. Silesia; Bavaria; Saxony; S. Australia; Pennsylvania; N. Carolina	31
.....	......	s.a.	....	V.R. Saxony; Bohemia; Colorado	32

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Uranospathite (Ra)	Hydrated uranyl phosphate	R	....	2.5	1.510	Y,pGrn
2	Uranosphaerite (Ra)	$Bi_2O_3 \cdot 2UO_3 \cdot 3H_2O$	R ?	2-3	6.36	1.985	O Y, brick R
3	Uranospinite (Ra)	$Ca(UO_2)_2 \cdot As_2O_8 \cdot 8H_2O$?	R	2-3	3.45	1.586ω 1.582β	siskin Grn
4	Uranothallite (Ra)	$2CaCO_3 \cdot U(CO_3)_2 \cdot 10H_2O$	R	2.5-3	2.14-2.15	1.503	siskin Grn
5	Uvanite (Ra)	$2UO_3 \cdot 3V_2O_5 \cdot 15H_2O$	R	....	....	1.879	br Y
6	Valentinite	Sb_2O_3	R	2.5-3	5.76	2.35	W
7	Vanadinite	$3Pb_3V_2O_8 \cdot PbCl_2$	H	2.5-3	6.6-7.1	2.354ω	d ruby R, br Y, Y, r Br
8	Variscite	$AlPO_4 \cdot 2H_2O$	R	4	2.5	1.558	variscite Grn
9	Vesuvianite	$Ca_6[Al(OH,F)]Al_2(SiO_4)_5$?	Tet.	6.5	3.35-3.45	1.708 to 1.720	Br, Grn, Y, pBl
10	Vietinghofite	Hydrated Fe samarskite	Am.	5.5-6	5.53	....	Blk
11	Vivianite	$3FeO \cdot P_2O_5 \cdot 8H_2O$	M	1.5-2	2.58-2.68	1.598	—, Bl, Grn
12	Voglite (Ra)	Hydrous carbonate of U, Ca, Cu	Tri.?	soft	3.35	1.547	emerald Grn
13	Volborthite	$6(Cu,Ca,Ba)O \cdot V_2O_5 \cdot 15H_2O$	M ?	3	3.5	2.02=	olive Grn, citron Y
14	Vrbaite	$Tl_2S \cdot 3(As,Sb)_2S_3$	R	3.5	5.3	extreme	gr Blk
15	Wagnerite	$3MgO \cdot P_2O_5 \cdot MgF_2$	M	5-5.5	3.07-3.14	1.570	Y, gr, grn R
16	Walpurgite (Ra)	$3UO_2 \cdot 5Bi_2O_3 \cdot 2As_2O_5 \cdot 12H_2O$?	Tri.	3.5	5.8	1.87-2.05-	Y
17	Warwickite	$(Mg,Fe)_3TiB_2O_8$	R	3-4	3.36	1.809	d Br, Blk
18	Wavellite	$4AlPO_4 \cdot 2Al(OH)_3 \cdot 9H_2O$	R	3.5-4	2.31-2.34	1.534	W, Y, Grn, Gr, Br, Blk
19	Weibyeite	Related to ancylite, hydrous carbonate rare earths, Ca, Sr, F	R	....	3.19		y, r, Br
20	Weinschenkite	$(Y,Er)PO_4 \cdot 2H_2O$	M	....	....	1.6 ± =	W
21	Wernerite	$Me_{80}Ma_{20}$ - $Me_{40}Ma_{60}$ [$Me = CaCO_3 \cdot 3CaAl_2Si_2O_8$; $Ma = NaCl \cdot 3NaAlSi_3O_8$]	Tet.	5-6	2.66-2.73	1.567ω	W, Gr, bl, grn, r
22	Wiikite	Columbate, titanate, silicate Fe, rare earths; mixture	R ?	6	3.8-4.8	2.0 ± =	Blk
23	Willemite	$2ZnO \cdot SiO_2$	H	5-5.5	3.89-4.18	1.691ω	W, grn Y, Grn, R, gr W, y Br
24	Witherite	$BaCO_3$	R	3-3.75	4.27-4.35	1.676	W, y, gr
25	Wöhlerite	Zr silicate and columbate of Ca, Na, etc.	M	5.5-6	3.42	1.716	Y, Br
26	Wolframite	$(Fe,Mn)WO_4$	M	5-5.5	7.0-7.5	2.32	d gr Blk, br Blk
27	Wollastonite	$CaO \cdot SiO_2$	M	4.5-5	2.8-2.9	1.629	W, Gr, Y, R, Br
28	Wulfenite	$PbMoO_4$	Tet.	2.75-3	6.7-7.0	2.402ω	O Y, Gr, Grn, Br, R
29	Wurtzite	ZnS	H	3.5-4	3.98	2.33ω	br Blk
30	Xenotime	$Y_2O_3 \cdot P_2O_5 \pm Ce, Th, Si$	Tet.	4-5	4.5-4.6	1.72ω	y Br, r Br, R, W, Y

Luster	Fusibility	Solubility	Special Properties	Locality	
.....	....	....	on losing H_2O becomes uniaxial	V.R. Redruth, Cornwall	1
D	....	....	decrepitates	V.R. Neustádtel, Saxony	2
V, Pl	f.	s. a.	fluorescent	V.R. Neustádtel, Saxony	3
V,Pl	if.	s.a.	fluorescent	R. Bohemia; Saxony; Greece	4
.....	....	s.$(NH_4)_2CO_3$	....	V.R. Emery County, Utah; Colorado	5
A, Pl	1.5	s.HCl	....	V.R. Czechoslovakia; Saxony; Algeria; South Ham, Quebec	6
G	990°C	v. s. HCl	decrepitates	Unc. Urals; Austria; Spain; Scotland; Mexico; Arizona; New Mexico	7
V, brilliant	if.	s. HCl after ign.	....	R. Messbach, Saxon Vogtland; Arkansas; Utah	8
V, R	3	sl. dec. HCl	intumesces; pyroelectric	C. Vesuvius; Norway; Japan; Maine; New York; Arkansas; New Jersey; California	9
D	....	....	$8.2\% E_2O_3$	V.R. Lake Baikal, Siberia	10
Pl, V	1.5	s. HCl	exfoliates; color changes on exposure to light, Fe'' to Fe'''	Unc. France; Cornwall; New Jersey; Delaware; Colorado	11
Pl	if.	s. a.	....	R. Joachimstal, Bohemia; Russia	12
Pl, V	1.5(?)	i.	....	V.R. Russia; Thuringia; Utah; Asia; Colorado; Africa	13
.....	ef.	s. HCl	streak: light red	V.R. Allchar, Macedonia	14
V	4	s.HCl,HNO_3	thermophcsphorescent	V.R. Salzburg, Austria; Norway	15
A, G	1.5	....	resembles gypsum	V.R. Neustädtel, Saxony; Joachimstal, Bohemia	16
sM, Pl sV	5.5	dec. H_2SO_4	....	R. Warwick, New York	17
V,Pl, R	if.	s. HCl	swells; (A) photoluminescent	Unc. Bohemia; Germany; England; Pennsylvania; Arkansas	18
V	......	s. HCl	66.96% Ce	V.R. Langesundfiord, Norway	19
.....	if.	s. dec. a.	....	V.R. Amberg-Auerbach mines, Bavaria	20
V, Pl, R	3	sl.dec.HCl	intumesces	Unc. Siberia; Finland; Sweden; Madagascar; Massachusetts; New York; New Jersey	21
.....	if.	....	2.5% Cer.; 7.6% Yttr.; $1.2\% Sc_2O_3$; $5.5\% ThO_2$	V.R. In pegmatite: Finland	22
V, R	3.5–4	gel. HCl	photoluminescent: green, yellow	Unc. Belgium; Germany; Africa; New Jersey; Colorado; New Mexico	23
V, R	2.5–3	s. dec. HCl	pyroelectric	C. Cumberland, England; Japan; Kentucky; Ontario	24
V, R	3–3.5	s. HCl	0.5% Hf; trace Ce	V.R. Brevik, Norway; Fr. Guinea; Red Hill, New Hampshire	25
M, D	2–4	dec. a.	decrepitates	Unc. Transbaikalia; Saxony; Cornwall; N. S. Wales; Bolivia	26
V, Pl	4(1540°C)	dec.HCl	often thermophosphorescent; fuses after inversion at 1200°C; photoluminescent	C. Roumania; Italy; Finland; New York; California; Michigan; Canada	27
R, A	2	dec. HCl	decrepitates; diamagnetic; ultra-violet color change	R. N. S. Wales; Mexico; Austria; Bohemia; Pennsylvania; New Mexico; Arizona	28
R	6	s. HCl	sublimes in nitrogen at 1185°C; reforms on cooling; photoluminescent	R. Bohemia; Bolivia; Peru; Butte, Montana; Missouri; Utah	29
R, V	if.	i.	0–11 $\%$ Cer.; 54–64.7 $\%$ Yttr.; $1.5\% ThO_2$	R. Norway; Sweden; Brazil; Switzerland; N. Carolina; Colorado	30

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Yttrialite (Ra)	Silicate Th and Y metals	Am.	5-7	4.575	1.758η	olive Grn, OY
2	Yttrocalcite	$Ca_5Y_2F_{16}$	H	4-6	3.19	$1.45(?)\eta$	W, grn
3	Yttrocerite	CaF_2 with varying amounts $(Y,Ce)F_3$	C	4-5	3.3-3.4	1.434η	VBl, Gr, rBr
4	Yttrocrasite (Ra)	$(Ca,Pb)O\cdot(Th,U)O_2\cdot 16TiO_2\cdot 3(Y,Ce,Th)_2O_3\cdot 6H_2O$?	R	5.5-6	4.8	2.1η	Blk
5	Yttrofluorite	CaF_2 with varying amounts of YF_3	C	4.5	3.55	1.46η	Y, Br, Grn
6	Yttrogummite (Ra)	Decomposition product of cleveite	Tet.	4-4.5	4.43-4.54	....	yBr, Blk
7	Yttrotantalite	$Y_4(Ta_2O_7)_3$? Cb, Ca, Fe, H	R	5-5.5	5.5-5.9	2.15η	Blk, Br, br Y, Y
8	Yttrotitanite	Titanite with ±12% $(Y,Ce)_2O_3$ ±5% $Fe_2O_3\cdot Al_2O_3$	M	6-7	3.5-3.7	1.935	Br Blk
9	Zaratite	$NiCO_3\cdot 2Ni(OH)_2\cdot 4H_2O$?	Am.	3-3.5	2.5-2.7	$1.56\text{-}1.61\eta$	emerald Grn
10	Zeunerite (Ra) (Ra)	$Cu(UO_3)_2As_2O_8\cdot 8H_2O$	R	2-2.5	3.2	1.643ω	apple Grn, emerald Grn
11	Zinc	Zn	H	2	6.9-7.2	....	W to blGr
12	Zincite	ZnO	H	4-4.5	5.4-5.7	2.013ω	dR, OY
13	Zinkenite	$PbS\cdot Sb_2S_3$	R	3-3.5	5.12-5.35	....	steel Gr
14	Zippeite (Ra)	$2UO_3\cdot SO_3\cdot H_2O$	M ?	3	1.689-1.710	1.615	Y
15	Zircon	$ZrO_2\cdot SiO_2$	Tet.	7.5	4.68-4.7	1.923 1.960ω	—, y, gr, br Y, r Br
16	Zirkelite (Ra)	$(Ca,Fe)(Zr,Ti,Th)_2O$	C	5.5	4.7	2.19η	Blk
17	Zirkite	Mixture silicate and oxide of Zr	.....	....	....	....	....
18	Zoisite	$4CaO\cdot 3Al_2O_3\cdot 6SiO_2\cdot H_2O$	R	6-6.5	3.25-3.37	1.703	grW, Gr, yBr, grn
19	Zunyite	$[Al(OH,F,Cl)_2]_6Al_2Si_3O_{12}$	C	7	2.875	1.589η	colorl., W

TABLE B—SALTS

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Humboldtine	$FeC_2O_4\cdot 2H_2O$	R	2	2.28	1.561	Y
2	Mellite	$Al_2C_{12}O_{12}\cdot 18H_2O$	Tet.	2-2.5	1.55-1.65	1.539ω	honey Y
3	Oxammite	$(NH_4)_2C_2O_4\cdot 2H_2O$	R	soft	1.48	1.547	W
4	Whewellite	$CaC_2O_4\cdot H_2O$	M	2.5	2.23	1.555	colorl.

MINERALS

Luster	Fusibility	Solubility	Special Properties	Locality	
V, G	if.	s. HCl	6-8.2 % Ce; 43-47 % Y; 10.8-12.8 % ThO_2	V.R. Llano County, Texas	1
V	if.	s. a.	. . . .	V.R. Norway	2
V, Pl	if.	s. HCl	proven experimently that CaF_2 can take up 55 % CeF_3; 9-18 % Cer.; 8-29 % Yttr.; decrepitates	V.R. Falun, Sweden; Sussex County, New Jersey; New York	3
R	if.	s. H_2SO_4	3 % Cer.; 25.7 % Yttr.; 8.7 % ThO_2	R. Llano County, Texas	4
V	f.	s. a.	proven experimentally that CaF_2 can take up 50 % YF_3; atomic structure similar to fluorite	V.R. Hundholmen, Norway	5
brilliant	. . . .	. . . .	20-25 % Yttr.; 1-2 % Cer.; 41.4 % ThO_2; 6.7 % E_2O_3	V.R. Norway	6
sM, V, G	if.	i.	17-38 % Yttr.; 0-2.4 % Cer.	V.R. Ytterby, Finbo and Broddbo, Sweden	7
V	f.	dec. HCl	. . . .	V.R. Arendal and other places in Norway	8
V	if.	s. HCl	. . . .	R. Spain; Tasmania; N. S. Wales; Greenland; Pennsylvania	9
Pl	3	s. HNO_3	. . . .	R. Bohemia; Utah; Schneeberg, Saxony	10
M	420°C.	s. a.	. . . .	V.R. Australia; N. S. Wales; New Zealand; Alabama; California	11
sA	if.	s. a.	streak: orange yellow; X-ray: atomic structure closely related to greenockite and wurtzite	R. Franklin Furnace, New Jersey; Poland; Spain; Tasmania	12
M	1	s. h. HCl	decrepitates; streak: as color	R. Harz Mts.; France; Tasmania; Arkansas; Colorado; Nevada	13
Sk	. . . . . .	s. a.	. . . .	V.R. Joachimstal, Bohemia; Fruita, Utah	14
A	if.	almost i.	0.98 % Hf average six analyses; diamagnetic	Unc. Ilmen Mts.; Urals; Norway; Sweden; Ceylon; Madagascar; Maine; New York; N. Carolina; Colorado; Texas	15
R	if.	i.	0-7.3 % ThO_2; 0-3 % E_2O_3; 1.0 % Hf	V.R. Brazil; Ceylon	16
. . . . .	. . . .	. . . .	. . . .	. . . . Caldas, Brazil	17
V, Pl	3-3.5	i.	B. B. swells	Unc. Austria; Italy; Switzerland; Mexico; Massachusetts; Pennsylvania; Tennessee	18
V	if.	i.	. . . .	V.R. Postmasburg, S. Africa; Zuni mine, Colorado; Guatemala	19

OF ORGANIC ACIDS

Luster	Fusibility	Solubility	Special Properties	Locality	
. . . . . .	. . . .	s.a.	. . . .	R. Bilin, Bohemia; Germany; Elba; Lambton County, Ontario	1
. . . . .	. . . .	dec. h. H_2O; s. HNO_3	. . . .	Unc. Bilin, Bohemia; Saxony; Russia; Siberia; Montana	2
. . . . .	ef.	s. H_2O	. . . .	R. From the guanao of the Guanape Islands, Peru	3
V	7	s.a.	. . . .	R. Saxony; Bohemia; Alsace	4

TABLE C—HYDRO-

	Name	Composition	Crystal System	Hardness	Specific Gravity	Refractive Index	Color
1	Albertite	86.04 % C; 8.96 % H; 2.93 % N; 1.97 % O	Am.	1-2	1.097	....	jet Blk
2	Amber	C:H:O = 40:64:4	Am.	2-2.5	1.096	$1.54 \pm \eta$	Y,r,br,W
3	Asphaltum	83.68 % C; 10.84 % H; 0.45 % N; 5.10 % S	Am.	1-2	1-1.8	....	br Blk, Blk
4	Coal	See also special table of coals	.....	.....	......	....	....
5	(a) Anthracite	93.5 % C; 2.81 % H; 0.97 % N; 2.72 % O; fixed C, 74.32 %	Am.	2-2.5	1.32-1.7	....	Blk
6	(b) Bituminous	84.2 % C; 5.6 % H; 1.5 % N; 8.7 % O; fixed C, 68 %	Am.	....	1.14-1.40	....	Blk,br
7	(c) Cannel	Differs from Bituminous in low fixed C (40 %) and high volatile	Am.	1.5-2	1.14-1.51	....	Blk,gr Blk, Br
8	(d) Lignite	73.0 % C; 5.2 % H; 1.3 % N; 20.5 % O; fixed C, 39.5 %	Am.	....	1.15-1.3	....	Br, Blk
9	Curtisite	$C_{24}H_{18}$?	R ?	<2	1.236	1.734	grn Y
10	Dopplerite	C:H:O = 10:12:5	.....	....	....	....	br Blk
11	Dysodile	Oxygenated hydrocarbon with 2.3 % S, 1.7 % N	.....	....	....	....	Y,grn Gr
12	Elaterite	80.0 % C; 12.23 % H; 1.78 % N; 5.83 % S	Am.	soft	.....	....	d Br
13	Fichtelite	C_5H_8 ?	M	1	....	1.578	W
14	Flagstaffite	$C_{10}H_{22}O_3$	R	1	1.092	1.51η	colorl.
15	Gilsonite	89.28 % C; 8.66 % H; 0.79 % N; 1.79 % S	Am.	2-2.5	1.065-1.070	....	Blk
16	Grahamite	59.2 % C; 5.77 % H; 1.01 % N; 14.68 % O; 19.34 % ash	Am.	2	1.145	....	Blk
17	Hartite	$C_{18}H_{30}$	Tri.	....	1.04	....	....
18	Hatchettite	C:H = nearly 1:1; also given $C_{38}H_{78}$	R	1	0.96	1.523	y
19	Hoelite	$C_{14}H_8O_2$	R	....	1.43	1.75	colorl.
20	Napalite	C_3H_4	.....	soft	....	....	Y
21	Ozocerite	85.25 % C; 15.09 % H	R ?	soft	0.9	$1.51\text{-}1.54 \eta$	W, leek Grn, y, br, Br
22	Paraffin	C_nH_{2n+2} n = 16 or more	uniaxial	soft	0.9	$1.49\text{-}1.52 \eta$	—,W
23	Petroleum	Complex hydrocarbon mostly C_nH_{2n+2}	liquid	....	0.6-0.9	....	—, dY, Br, Blk
24	Scharizarite	Nitrogenous carbon compound	.....	....	....	....	....
25	Scheererite	Perhaps a homolog of marsh gas (CH_4)	M	....	....	....	W
26	Simonellite	$C_{15}H_{28}$?	R	....	....	....	W
27	Tasmanite	Oxygenated hydrocarbon	.....	...	....	....	r Br
28	Thucholite	See Table A	.....	...	....	....	....

CARBON DERIVATIVES

Luster	Fusibility	Solubility	Special Properties	Locality	
brilliant pitch-like	fuses imperfectly;	sl. s. turpentine	differs from asphaltum in fusion and solubility	R. Nova Scotia	1
R	softens 150°C, melts 250-300° C.		electric by friction; may fluoresce	Unc. Coast of the Baltic; Prussia; Denmark; Russia	2
pitch-like	melts 90-100°C;	sol. turp., ether, alc.	bituminous odor	Unc. Trinidad; Region of the Dead Sea; California	3
.....	....	....	....	....	4
bright, sM	if., burns	i.	....	C. Pennsylvania; France; Saxony; Russia; South Wales	5
bright pitchy, G	sl. f.	....	....	A. United States; Gt. Britain: Europe; Alaska; China	6
D	....	....	burns readily	Unc. Texas; Kentucky; England	7
D	....	....	....	A. Gulf Coast States; Rocky Mt. States; Europe; Asia	8
V, A	350°C.	s. h. benzene	photoluminescent	V.R. Sonoma County, California	9
.....	....	....	....	V.R. Styria; Bavaria	10
.....	....	....	....	V.R. Melili, Sicily	11
D	....	....	elastic	R. England	12
Pl	46°C.	s. ether	....	R. Bavaria; Bohemia	13
.....	116°C.	s. h. alc.	....	R. Flagstaff, Arizona	14
brilliant	ef.	sl. s. eth., alc.; s. h. turp., $CHCl_3$	very brittle	Unc. Ft. Duchesne, Utah	15
pitchy	f.	s. turp.; sl. s. eth., i. alc.	melts imperfectly with decompn. at surface	Unc. West Virginia	16
.....	74°C.	s. alc.	....	V.R. Found on lignite	17
W	burns, f. 80°C.	s. oils, i. a.	....	R. England; Galicia	18
.....	....	....	....	V.R. Spitzbergen	19
W	....	....	....	V.R. Napa County, California	20
W	½ ef.	i. a., s. turp., CS_2	....	R. Southern Utah; Roumania; Carpathians	21
W	44°C.	s. ether, i. a.	related to liquid crystals	V.R. Paterno, Sicily	22
.....	....	....	....	C. World-wide	23
.....	....	....	....	V.R. Styria, Austria	24
.....	....	....	....	V.R. Uznach, Switzerland	25
.....	....	....	....	V.R. Fognano, Tuscany	26
.....	....	i ether, alc., benzene, CS_2	remarkable as yielding 5.3%S; shale containing it is inflammable	R. Tasmania	27
.....	....	....	....	....	28

SYNONYMS OF MINERAL NAMES

The following list contains the synonym names of minerals listed in the preceding tables of minerals and also some minerals not listed in those tables; some of the names given below are the names of varieties and these are indicated by the abbreviation: *var.*

Acmite, cf. pyroxene
Actinolite, cf. amphibole
Adamine, cf. adamite
Adularia, var. orthoclase
Agalmatolite, cf. pyrophyllite
Agaric mineral, cf. calcite
Agate, cf. chalcedony and quartz
Alabandin, cf. alabandite
Alalite, cf. diopside
Alamandine, cf. alamandite
Alamandine ruby, cf. spinel
Albite, var. feldspar
Allanite cf., bagrationite
Almandite, cf. garnet
Alstonite, var. bromlite
Alum, cf. kalinite
Alum stone, cf. alumite
Aluminum phosphate, cf. wavellite
Aluminum sulfate, cf. aluminite; alunogene
Alunogenite, cf. alunogene
Amazonstone, cf. microcline
Amblystegite, cf. enstatite
Amianthus—silky asbestos
Ammonium alum, cf. tschermigite
Ammonium chloride, cf. sal ammoniac
Ammonium phosphate, cf. struvite
Ammonium sulfate, cf. mascagnite
Amphigene, cf. leucite
Analcime, cf. analcite
Anatase, cf. octahedrite
Anauxite, cf. kaolin
Andesine, var. feldspar (between labradorite and oligoclase)
Andradite, var. garnet (iron-lime)
Anomite, var. biotite + (Li)
Anorthite, cf. feldspar
Anorthoclase, cf. feldspar
Anthraquinone = hoelite
Antimonial nickel sulfide, cf. ullmanite
Anthophyllite, cf. amphibole
Antimonial silver, cf. dyscrasite
Anthracite, cf. coal
Antimonius nickel, cf. breithauptite
Antimony blende, cf. stibnite
Antimony sulfide, cf. stibnite
Aphanesite, cf. clinoclasite
Aquamarine—color phase of beryl
Arfvedsonite, var. amphibole with soda
Argentiferous tetrahedrite, cf. freibergite
Argentine, cf. calcite
Arkansite, var. brookite
Arsenic sulfide, cf. realgar; orpiment
Arsenic white, cf. arsenolite
Arsenical cobalt, cf. smaltite
Arsenical iron, cf. arsenoferrite
Arsenical iron ore, cf. freislebenite
Arsenical nickel, cf. niccolite
Arsenical pyrites, cf. arsenopyrite
Asbolane, cf. asbolite
Asparagus stone, cf. apatite
Astrakanite, var. blodite
Augite, cf. pyroxene
Auriferous pyrites—iron pyrite + Au
Automolite, cf. gahnite; + Zn = zinc spinel
Aventurine feldspar, var. feldspar
Azorite—$ZrSiO_4$
Babingtonite, cf. pyroxene
Baikalite, cf. diopside
Balas ruby—color phase of spinel
Barium carbonate, cf. witherite
Barium sulfate, cf. barite
Barytes, cf. barite
Barytocalcite, cf. alstonite
Bell-metal ore, cf. stannite
Biotite, cf. mica
Bismuth, cf. bismuth ochre
Bismuth carbonate, cf. bismutite
Bismuth glance, cf. bismuthinite
Bismuth sulfide, cf. bismuthinite
Bismuthine cf. bismuthinite
Bitter spar, cf. dolomite
Bitumen, cf. asphaltum
Bituminous coal, cf. coal
Black cobalt, cf. earthy cobalt
Black jack, cf. sphalerite
Black lead, cf. graphite
Black silver, cf. stephanite
Blende, cf. sphalerite
Bloodstone—impure SiO_2; jasper
Blue asbestos, cf. crocidolite
Blue iron ore, cf. vivianite
Blue John, cf. fluorite
Blue vitriol, cf. chalcanthite
Bodenite, var. allanite
Bog iron ore, cf. limonite
Boghead coal—cannel coal (high ash)
Bone turquois—fossil teeth or bone colored with $Fe_3(PO_4)_2$
Boracic acid, cf. sassoline
Borate of calcium-sodium, cf. ulexite
Boronatrocalcite, cf. ulexite
Bort, var. of diamond
Botryolite, var. datolite
Bowenite, var. serpentine
Bragite, cf. fergusonite
Brandisite, cf. seybertite
Bravaisite—near glauconite
Brazilian emerald—color phase of tourmaline
Brazilian saphire—color phase of tourmaline
Brazilite, var. baddeleyite
Brittle silver ore, cf. stephanite
Bromargyrite, cf. bromyrite
Bronzite, cf. pyroxene
Brown coal—lignite
Brown hematite, cf. limonite
Brown ochre, cf. limonite
Brown spar—dolomite + (Mn_2O_3 and Fe_2O_3)
Bucholzite, var. sillimanite
Bunsenine—NiO
Bytownite, cf. feldspar
Cadmium sulfide, cf. greenockite
Calcium nitrate, cf. nitrocalcite
Calcium phosphate, cf. apatite
Calcium sulfate, cf. anhydrite; gypsum
Cannel coal, cf. coal
Capillary pyrites, cf. millerite
Caporcianite, cf. laumonite
Carbonado—diamond for cutting purposes
Castelnaudite, var. xenotime + Zr
Cat's eye—fine fibrous structure SiO_2
Celestine, cf. celestite
Celsian, cf. feldspar
Cerium phosphate, cf. monazite
Cervantite—stibnite decomposed to $Sb_2O_3 \cdot Sb_2O_5$
Chalcolite, cf. torbernite
Chalcotrichite—capillary cuprite
Chalybite, cf. siderite
Chessylite, cf. azurite
Chiastolite, var. andalusite with black crosses on end sections
China clay, cf. kaolin

SYNONYMS OF MINERAL NAMES

Chlorite—group term
Chrome yellow, cf. crocoite
Chromic iron, cf. chromite
Chrysotile, cf. serpentine (fibrous)
Cinnabarite, cf. cinnabar
Cinnamon stone, cf. garnet (lime-alumina)
Citrine, cf. quartz (yellow)
Claudetite—As_2O_3
Clay ironstone, cf. limonite
Cleavelandite—lamellar albite
Clinochlor, var. chlorite; cf. chlorite
Clinoclase, cf. clinoclasite
Clinoenstatite, cf. pyroxene
Clintonite, cf. seyberite
Cobalt arsenate, cf. erythrite
Cobalt glance, cf. smaltite
Cobalt pyrites, cf. smaltite
Cobalt sulfate, cf. bieberite
Cobalt sulfide, cf. linnaeite
Cobalt vitriol, cf. bieberite
Cobaltine, cf. cobaltite
Coccolite, var. hedenbergite; cf. pyroxene
Colophonite, var. andradite garnet (iron-lime); also var. vesuvianite
Copaline—a bitumen
Copper arsenate (44% CuO), cf. tyrolite
Copper black, cf. melaconite
Copper blue, cf. covellite
Copper carbonate, cf. malachite; azurite
Copper chloride, cf. atacamite
Copper emerald, cf. dioptase
Copper froth—copper arsenate (44%CuO)
Copper glance, cf. chalcocite
Copper gray, cf. tetrahedrite
Copper lead selenide, cf. zorgite
Copper mica, cf. chalcophyllite
Copper nickel, cf. kupfernickel
Copper phosphate, cf. pseudomalachite and libethenite
Copper pyrites, cf. chalcopyrite
Copper red, cf. cuprite
Copper selenide, cf. berzelianite
Copper silicate, cf. dioptase; chrysocolla
Copper sulfate, cf. chalcanthite
Copper sulfide, cf. bornite; chalcopyrite
Copper uranite, cf. torbernite
Copper vitriol, cf. chalcanthite
Copperas, cf. melanterite
Cotunnite—$PbCl_2$ (74.5%Pb)
Coxcomb pyrites, cf. marcasite
Cristobalite, cf. quartz
Crocoisite, cf. crocoite
Cromfordite, var. phosgenite
Cyanite, cf. kyanite
Cyanosite, cf. chalcanthite
Cymophane, cf. chrysoberyl
Danaite—mispickel with 6.5% Co
Dawsonite—$Al_2(CO_3)_3 \cdot Na_2CO_3 \cdot xH_2O$
Decloizite, cf. descloizite
Derbyshire spar, cf. fluorite
Desmine, cf. stilbite
Dialogite, cf. rhodochrosite
Dichroite, cf. cordierite
Dickite, cf. kaolin
Diopside, cf. pyroxene
Diphanite, var. margarite
Disthene, cf. kyanite
Dog-tooth spar, cf. calcite
Dry bone earth, cf. smithsonite
Earthy cobalt, cf. asbolite
Ehlite, var. pseudomalachite
Elaeolite, cf. nephelite
Elaterite—elastic bitumen
Electric calamine, cf. calamine
Eleonorite, var. beraunite
Eliasite, var. gummite
Elpasolite—cryolite with K replacing Na
Emerald—color phase of beryl; contains Cr
Emerald nickel, cf. zaratite
Emery—corundum $+Fe_2O_3$, Fe_3O_4
Emeryllite, cf. margarite
Endellionite, var. bournonite
Epsom salt, cf. epsomite
Enstatite, cf. pyroxene
Erubescite, cf. bornite
Erythrine, cf. erythrite
Essonite, var. grossularite, garnet (lime-alumina)
Eulytine, cf. eulytite
Eusynchite—$(Pb, Cu)O \cdot V_2O_5$
Fahlerz, cf. tetrahedrite
False topaz, cf. quartz, SiO_2
Feather ore, cf. jamesonite
Ferrotellurite—$FeTeO_4$
Fibrolite, cf. sillimanite
Fiorite, var. opal, SiO_2
Float stone—porous opal
Flos ferri, cf. aragonite
Fluor spar, cf. fluorite
Folliated tellurium, cf. nagyagite
Freyalite, cf. thorite
Galmei, cf. calamine
Geokronite, cf. geocronite
Gismondine, cf. gismondite
Glassy feldspar, cf. sanidine
Glauber salt, cf. mirabilite
Glaucophane, cf. amphibole group
Gold telluride—$AuTe_2$
Gothite, cf. goethite
Grammatite, var. tremolite
Graphic tellurium, cf. sylvanite
Gray copper, cf. tetrahedrite
Green vitriol, cf. melanterite
Greenovite, var. titanite $+$Mn
Greenstone, cf. hornblende and oligoclase
Grossularite, var. garnet (lime-alumina)
Guanajuatite—Bi_2Se_3
Guano—mostly $Ca_3(PO_4)_2$ of organic origin
Guayacanite, cf. enargite
Gymnite, nickel, cf. genthite
Hair salt, cf. epsomite
Hamartite, cf. basnasite
Hauyine, cf. hauynite
Heavy spar, cf. barite
Hedenbergite, cf. pyroxene
Heliotrope, var. jasper, same as bloodstone
Hematite, brown, cf. limonite
Hemimorphite, cf. calamine
Hiddenite, var. spodumene with emerald-green color
Highgate resin—a bitumen
Hopeite—$Zn_3(PO_4)_2 \cdot xH_2O$
Horn lead, cf. cromfordite
Horn silver, cf. cerargyrite
Horn stone, cf. flint; cryptocrystalline var. quartz
Hornblend, cf. amphibole group
Horse flesh ore, cf. bornite
Huantajayite—$(Na, Ag)Cl$
Humboldtilite, var. melilite
Humite—member of group of same name
Hyacinth—color phase of zircon
Hyalite, var. opal
Hyalophane, cf. feldspar
Hydrogillite, cf. gibbsite
Hydronepheline, cf. hydronephelite
Hydrophane, var. opal
Hydrous silica, cf. opal
Hypersthene, cf. pyroxene
Ice stone, cf. cryolite
Iceland spar, cf. calcite
Idocrase, cf. vesuvianite
Indicolite, var. tourmaline with blue color
Iolite, cf. cordierite
Iron carbonate, cf. siderite
Iron phosphate, cf. vivianite

SYNONYMS OF MINERAL NAMES

Iron pyrites, cf. pyrite
Iron sinter, cf. scorodite
Iron stone, clay, cf. limonite
Iron sulfate, cf. melanterite
Iron sulfide, cf. pyrite
Iron titanic, cf. ilmenite
Iron tungstate, cf. wolframite
Iserine, cf. ilmenite
Jade, cf. tremolite or actinolite; or jadeite
Jadeite, var. pyroxene
Jasper, impure SiO_2
Jet—cannel coal
Kalaite, cf. turquois (+Cu, Fe)
Kalinite, cf. alum
Kampylite, cf. mimetite
Kaolinite, cf. kaolin
Kidney ore, cf. red hematite
Kupfernickel, cf. niccolite
Labradorite, cf. feldspar
Lapis lazuli, cf. lazurite
Lausenite, cf. rogersite
Lead arsenate, cf. mimetite
Lead carbonate, cf. cerussite
Lead chloride, cf. phosgenite
Lead chromate, cf. crocoite
Lead molybdate, cf. wulfenite
Lead phosphate, cf. pyromorphite
Lead selenide, cf. clausthalite
Lead sulfate, cf. anglesite
Lead sulfide, cf. galena
Lead telluride, cf. nagyagite
Lead tungstate, cf. stolzite
Leonhardite, cf. laumonite
Lieverite, cf. ilvaite
Lepidolite, cf. mica
Lepidomelane, cf. mica
Lignite, cf. coal
Lime tungstate, cf. scheelite
Lime uranite, cf. autunite
Lithia mica, cf. lepidolite
Liver ore, cf. cinnabar
Livingstonite, cf. antimonite (+14%Hg)
Lodestone, cf. magnetite
Lollingite, cf. arsenical iron
Loranskite—euxenite-like mineral
Lovenite—$(Ca, Na_2, Zr)O \cdot SiO_2$
Ludlamite—$Fe_3(PO_4)_2 + H_2O$
Lydian stone—black variety of jasper
Magnesia alum, cf. pickeringite
Magnesium borate, cf. boracite
Magnesium carbonate, cf. magnesite
Magnesium chloride, cf. carnallite
Magnesium sulfate, cf. epsomite
Magnetic iron ore, cf. magnetite
Magnetic pyrites, cf. pyrrhotite
Malachite, blue, cf. azurite
Malacolite, cf. diopside
Manganblende, cf. alabandite
Manganese carbonate, cf. rhodochrosite
Manganese phosphate, cf. triphylite
Manganese silicate, cf. rhodonite
Manganese spar, cf. rhodonite
Manganese sulfide, cf. alabandite
Manganostilbite—$MnS(+As_2S_3$ and $Sb_2S_3)$
Martite—isometric Fe_2O_3
Masonite, var. chloritoid
Maxite, var. leadhillite
Meerschaum, cf. sepiolite
Melanite, var. andradite; garnet (iron-lime)
Melanosiderite—$Fe_2O_3 \cdot xH_2O$ (+7.4%SiO_2)
Meliphanite, cf. melinophane
Menaccanite, cf. ilmenite
Menilite—reniform opal
Mercuriferous tetrahedrite—schwatzite
Mercury chloride, cf. calomel
Mercury selenide, cf. tiemannite
Mercury sulfide, cf. cinnabar
Mesotype, cf. natrolite
Mica, cf. biotite, lepidolite, muscovite and phlogopite
Microcline, cf. feldspar
Mimetisite, cf. mimetite
Mineral pitch, cf. asphaltum
Mispickel, cf. arsenopyrite
Mixite—$Cu_2O \cdot As_2O_5 \cdot xH_2O + 13\% Bi_2O_3$
Mocha stone—chalcedony $+Fe_2O_3$ dendrites
Molybdenum sulfide, cf. molybdenite
Molybdic ochre, cf. ferri molybdite
Moonstone—opalescent adularia
Moss agate—chalcedony $+Fe_2O_3$ dendrites
Mountain cork, cf. asbestos
Mountain leather, cf. asbestos
Mountain tallow, cf. hatchettite
Muller's glass, cf. opal, hyalite
Mundic, cf. iron pyrite
Muriacite, cf. anhydrite
Muscovite, cf. mica
Muscovy glass, cf. muscovite
Nacrite, cf. kaolin
Natrocalcite, cf. gaylussite
Needle ore, cf. aikenite
Nemalite, var. brucite (fibrous +Fe)
Neocianite—$CuO \cdot SiO_2$
Neotype, cf. bromlite
Nepheline, cf. nephelite
Nephrite, cf. jade of amphibole group
Nickel gymnite, cf. genthite
Nickel pyrites, cf. millerite
Nickel silicate, cf. garnierite; genthite
Nickel stibnine, cf. ullmannite
Nickel sulfate, cf. morenosite
Nickel sulfide, cf. millerite
Nickel vitriol, cf. morenosite
Nitratine, cf. soda niter
Noumeite, cf. garnierite
Oerstedite—altered zircon ($+TiO_2$)
Oligoclase, cf. feldspar
Olivine, cf. chrysolite
Onyx, cf. chalcedony
Opal jasper, cf. jasp-opal
Ophiolite = serpentine + calcite
Oriental emerald, cf. corundum
Oriental topaz, cf. corundum
Orthite, cf. allanite
Orthoclase, cf. feldspar
Osteolite—altered apatite
Ostranite, cf. zircon
Ottrelite, cf. chloritoid
Ouvarovite, var. garnet (lime-chrome)
Oxalite, cf. humboldtine
Pagodite, cf. pinite
Pandermite, cf. priceite
Paragonite, cf. mica
Parathine, cf. scapolite
Pattersonite, cf. thuringite
Peacock ore, cf. bornite
Pearl sinter—SiO_2
Pearl spar, cf. dolomite
Pelagite—$xFe_2O_3 \cdot yMnO_2 \cdot nH_2O$
Pencil stone, cf. pyrophyllite
Pennine, cf. penninite
Penninite, cf. chlorite
Pericline, var. albite
Peridot, cf. chrysolite
Phacolite, cf. chabazite (colorless)
Philippite—$CuSO_4 \cdot FeSO_4 \cdot xH_2O$
Phlogopite, cf. mica
Phosphorite, var. apatite
Phosphuranylite—$(U, Pb)O \cdot P_2O_5 + H_2O$
Phyllite, var. chloritoid
Physalite, cf. opaque var. topaz
Pisolite—pea sized concretions
Pistacite, cf. epidote
Pitchblende, cf. uraninite
Pitticite—established specie
Plagioclase—general name for basic feldspars

SYNONYMS OF MINERAL NAMES

Plessite—meteoric nickel iron
Plumbago, cf. graphite
Polianite—MnO_2
Pollux, cf. pollucite
Porcelain jasper—a black clay
Potash mica, cf. muscovite
Potassium chloride, cf. sylvite
Potassium nitrate, cf. niter
Potstone—ordinary soapstone; cf. steatite
Praseolite—decomposed cordierite (iolite)
Prochlorite, var. chlorite
Proidonite—SiF_4
Purple copper ore, cf. bornite
Pyreneite, var. melanite; cf. andradite
Pyrochroite—$Mn(OH)_2$
Pyrope, var. garnet (magnesia—alumina)
Pyrostibite, cf. kermesite
Pyroxene—a group term
Pyrrhosiderite, cf. goethite
Quicksilver, cf. mercury
Rabdophane, cf. rabdophanite
Radiated pyrites, cf. marcasite
Rasorite, cf. kernite
Ratholite, cf. pectolite
Red antimony, cf. kermesite
Red chalk, cf. red hematite
Red copper ore, cf. cuprite
Red ochre, cf. red hematite
Red silver ore, cf. pyrargyrite
Red zinc ore, cf. zincite
Reddingite—$3(Mn, Fe)O \cdot P_2O_5 + H_2O$
Reddle, cf. red ochre; cf. hematite
Redruthite, cf. chalcocite
Remolinite, cf. atacamite
Rennselaerite, var. talc
Retinite, var. amber
Retzbanyite—$Cu_2S \cdot 3PbS \cdot 5Bi_2S_3$
Rhodonite, cf. pyroxene
Rhoetizite, cf. kyanite
Rhomb spar—dolomite in rhombs
Richellite—$(Ca, Fe)_3 [F_6, (PO_4)_2]$
Riebeckite, cf. amphibole group
Rivotite—$Cu(CO_3, Sb_2O_4)$
Rock crystal, cf. quartz
Rock salt, cf. halite
Rock tallow, cf. hatchettite
Rogersite ($Fe_2O_3 \cdot 3SO_2 \cdot 6H_2O$), cf. lausenite
Romeite—$CaO \cdot Sb_2O_5$
Roscoelite—vanadium mica
Rosellane—decomposed anorthite
Rosite—decomposed anorthite
Rubellite, var. tourmaline, pink
Rubicelle, cf. ruby spinel
Ruby silver ore, cf. pyrargyrite
Ruby spinel, cf. magnesium spinel
Sagenite—SiO_2 + rutile crystals
Sahlite—cf. salite; cf. hedenbergite
Salite, cf. hedenbergite
Salmiak, cf. sal ammoniac
Salt, cf. halite
Saltpeter, cf. soda niter
Sardonyx—banded chalcedony
Sassoline, cf. sassolite
Satin spar—fibrous calcite or fibrous gypsum
Saussurite—basic feldspar alteration to near zoisite
Scapolite, cf. wernerite
Schiller spar—altered bronzite or enstatite; cf. bastite
Schorl, cf. tourmaline
Selenite, cf. gypsum
Selwynite, cf. limonite
Sericite—muscovite, fine scaly and silky
Siderazote—Fe_5N_2
Silica, cf. quartz
Siliceous sinter—SiO_2, cf. fiorite
Silver chloride, cf. cerargyrite
Silver glance, cf. argentite
Silver iodide, cf. iodyrite
Silver lead ore—argentiferous PbS
Silver ruby, cf. pyrargyrite
Silver selenide, cf. naumannite
Silver sulfide, cf. argentite
Sipylite, cf. fergusonite
Smaltine, cf. smaltite
Soap stone, cf. talc
Soda alum, cf. mendozite
Soda feldspar, cf. plagioclase feldspar
Sodium carbonate, cf. natron
Sodium chloride, cf. halite
Sodium sulfate, anhydrous, cf. thenardite
Sodium sulfate, hydrous, cf. mirabilite
Spathic iron ore, cf. siderite
Spear pyrites, cf. marcasite
Specular iron, cf. black micaceous hematite
Spessarite, cf. garnet (manganese—alumina)
Spinel ruby, cf. spinel
Spodumene, cf. pyroxene
Stannine, cf. stannite
Staurotide, cf. staurolite
Steatite, var. talc (massive, rock form)
Stinkstone, cf. enthraconite
Strontium carbonate, cf. strontianite
Strontium sulfate, cf. celestite
Succinite, var. grossularite; garnet (lime-alumina); cf. amber
Sunstone, var. orthoclase
Tabular spar, cf. wollastonite
Tarapacaite—K_2CrO_4
Telluric bismuth, cf. tetradymite
Telluric ochre—TeO_2, cf. tellurite
Terpin hydrate = flagstaffite
Thomsenolite—$NaF \cdot CaF_2 \cdot AlF_3 \cdot H_2O$
Thorogummite, cf. nicolayite
Tile ore, cf. cuprite (earthy variety)
Tin pyrites, cf. stannite
Tin stone, cf. cassiterite
Tin sulfide, cf. stannite
Tincal = crude borax
Titanic iron, cf. ilmenite
Topazolite, var. andradite garnet (iron-lime)
Torbanite, var. cannel coal
Touchstone—jasper; lydian stone; SiO_2
Traversellite, var. diopside
Tremolite, cf. amphibole group
Tridymite, var. quartz formed above 800°C
Tripestone—concretionary anhydrite
Tripolite—remains of diatoms; SiO_2
Trippkeite—($nCuO \cdot As_2O_3$)
Troostite, cf. willemite, crystallized, red color
Tyrite, cf. fergusonite
Tysonite, cf. fluocerite
Uintaite, cf. gilsonite
Ultramarine, cf. lazurite
Uraconite—U_2O_3 + (Ra)
Uralite—pyroxene altered to amphibole
Uranic ochre—U_2O_3 + (Ra)
Uranium phosphate, cf. torbernite
Uranium sulfate, cf. johannite
Uranvitrol, cf. johannite
Urarovite, cf. garnet
Vermiculites—group term
Vermilion, cf. cinnabar
Vitreous copper ore, cf. chalcocite
Vitreous silver ore, cf. argentite
Voltzite—$4ZnS + ZnO$
Vulpinite, var. anhydrite (scaly)
Warringtonite, var. brochantite
Websterite, cf. aluminite
White iron pyrites, cf. marcasite
White lead ore, cf. cerussite
White nickel, cf. smaltite
White vitriol, cf. goslarite
Woodwardite—$CuSO_4 \cdot Al_2(SO_4)_3 + H_2O$
Wurtzilite, cf. elaterite
Yellow ochre, cf. limonite
Yenite, cf. ilvaite
Yttrium carbonate, cf. parisite

Yttrium phosphate, cf. monazite
Zinc arsenate, cf. adamite
Zinc carbonate, cf. smithsonite
Zinc silicate, cf. willemite; calamine
Zinc sulfate, cf. goslarite
Zinc sulfide, cf. sphalerite
Zinnwaldite, cf. mica
Zippeite—$U_2(SO_4)_3+CuO$
Zirkite, trade name for zirconia ore; impure baddeleyite

TABLE OF RADIO DETECTOR MINERALS

E. T. Wherry, *Amer. Mineralogist, 10, part 2, page 28 (1925).*

GOOD DETECTORS:

Pyrite, impure.
Tennantite
Enargite
Galena, impure.

FAIR DETECTORS:

Graphite
Octahedrite
Brookite
Molybdenite
Pyrolusite
Loilingite
Hematite
Taenite
Chalcopyrite
Tetrahedrite
Linneite
Glaucodite
Rammelsbergite
Chalcocite
Beegerite
Berzelianite
Famatinite
Stromeyerite
Aguilarite
Naumannite
Hessite
Sylvanite
Calaverite
Zincite
Tiemannite
Coloradorite
Clausthalite
Chiviatite
Guitermanite

HEAVY LIQUIDS FOR MINERALOGICAL ANALYSES

Recommended by Messmore, and Sullivan (*Bu. of Mines*, *Techn. Paper*, No. 381).

For the laboratory study of ores, only two heavy liquids are usually necessary. Acetylene tetrabromide is recommended for all low gravity work. Many ores contain quartz or calcite as gangue, and acetylene tetrabromide has enough gravity to float free a gangue composed of either of these minerals. As many ores contain more gangue than valuable minerals, the use of acetylene tetrabromide is recommended because it will remove the larger part of the sample; the smaller remaining part may then be treated with a more expensive, heavier liquid.

The most suitable liquid for sink-and-float work on minerals of high specific gravity is a water solution of the double thallous formate-malonate. This double salt, with a specific gravity of 4.9, melts at 60°C. and is miscible in all proportions with water. At room temperatures the salt is sufficiently soluble to give a solution with a specific gravity of nearly 4.3. As a liquid of intermediate gravity, an aqueous solution of thallous formate is recommended. It is less expensive than the formate-malonate. A maximum specific gravity of about 3.5 is reached at room temperatures, and gravities up to 4.95, the gravity of the molten salt, may be obtained.

Because of the cheapness and desirable properties acetylene tetrabromide diluted with carbon tetrachloride is recommended for gravities of 2.95 and below; because of its cheapness compared with the malonate-formate, thallous formate solution is recommended for gravities from 2.95 to 3.5; and the malonate-formate solution is recommended for gravities above 3.5.

Sp. Gr. Range	Heavy Liquid	Diluting and Washing Reagent	Recovery, etc.
Messmore:—			
1.6 to 2.95	acetylene tetrabromide	chloroform or benzene	evapn. or fractional distn.
2.95 to 3.5	thallous formate	water	evapn. on the steam bath
3.5 to 4.9	thallous formate-malonate	water	evapn. on the steam bath
Sullivan:—			
1.58 to 2.6	bromoform	carbon tetrachloride	fractional distn.; liquid at room temp.
2.6 to 2.9	acetylene tetrabromide	carbon tetrachloride or benzene	fractional distn.; liquid at room temp.
2.9 to 3.3	stannic bromide ($SnBr_4$)*	carbon tetrachloride	distn.; $SnBr_4$ melts at 31°C. but addition of CCl_4 lowers m.p. to room temp.
3.3 to 3.65	antimony tribromide stannic bromide*	carbon disulfide, abs. alcohol, bromoform or dry acetone	fractional distn.; melts on the steam bath
3.65 to 4.95	thallous formate	water	evapn. on steam bath; melts on the steam bath
4.95 to 5.2	eutectic of mercuric chloride and mercuric iodide + antimony trichloride	aniline, followed by alcohol or ether	melts on oil bath; cannot be used when sulfides are present

* Decomposed by water; mineral particles must be dry.

PHYSICAL CONSTANTS OF

Formula Weights are based upon the International Atomic Weights of 1941 and are computed to the nearest hundredth.

Refractive Index, where given for a uniaxial crystal, is for the ordinary (ω) ray; where given for a biaxial crystal, the index given is for the median (β) value. The other indices may be found by referring to the table *Index of Refraction.* Unless otherwise specified, the index is given for the sodium D-line ($\lambda = 589.3 m\mu$).

Specific Gravity values are given at room temperatures (15° to 20°C) unless otherwise indicated by the small figures which follow the value; thus, "$5.6_{4}^{18^\circ}$" indicates a specific gravity of 5.6 for the substance at 18°C referred to water at 4°C. In this table the values for the specific gravity of gases are given with reference to air (A) = 1, or hydrogen (D) = 1.

Melting Point is recorded in a certain case as "82 d." and in some other case as "d. 82", the distinction being made in this manner to indicate that the former is a melting point with decomposition at 82°C, while in the latter decomposition only occurs at 82°C. Where a value such as "$-2H_2O$, 82" is given it indicates loss of two moles of water per formula weight of the compound at a temperature of 82°C.

Boiling Point is given at atmospheric pressure (760 mm of mercury) unless otherwise indicated; thus, "82^{15mm}" indicates the boiling point is 82°C when the pressure is 15 mm.

Solubility is given in parts by weight (of the formula shown at the extreme left) per 100 parts by weight of the solvent; the small superscript indicates the temperature. In the case of gases the solubility is often expressed in some manner as "5^{10° cc" which indicates that at 10°C, 5 cc of the gas are soluble in 100 grams of the solvent. The symbols of the common mineral acids: H_2SO_4, HNO_3, HCl, etc., represent dilute aqueous solutions of these acids. See also special tables on *Solubility.*

Synonyms listed at the bottom of each page include common or trade names as well as alternate chemical names for compounds to be found in the main body of the table but under a different name. The number following the name refers to the

---

Abbreviations used in the table

a., acid
A., specific gravity with reference to air = 1
abs., absolute
ac., acetic acid
act., acetone
al., 95% ethyl alcohol
alk., alkali (i. e. aq. NaOH or KOH)
am., amyl (C_5H_{11})
amor., amorphous
anh., anhydrous
aq., aqueous or water
aq. reg., aqua regia
atm., atmosphere or 760 mm of mercury pressure
bk., black
brn., brown
bz., benzene
c., cold
cb., cubic
cc, cubic centimeter
chl., chloroform
col., colorless or white
conc., concentrated
cr., crystals or crystalline
d., decomposes
D., specific gravity with reference to hydrogen = 1
d. 50, decomposes at 50°C; 50d., melts at 50°C with decomposition
delq., deliquescent
dil., dilute
dk., dark
eff., effloresces or efflorescent
et., ethyl ether
expl., explodes
gel., gelatinous
gly., glycerol, (glycerine)
gn., green
h., hot

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
1	**Aluminum**	Al	26.97	silv., cb.
2	acetate, normal	$Al(C_2H_3O_2)_3$	204.10	wh. pd.
3	acetate, basic	$Al(OH)(C_2H_3O_2)_2$	162.07	wh., amor.
4	arsenate	$AlAsO_4$	165.88	wh., trig., 1.596
5	bromate	$Al(BrO_3)_3 \cdot 9H_2O$	572.86	hyg. cr.
6	bromide	$AlBr_3$	266.72	trig.
7	bromide	$AlBr_3 \cdot 6H_2O$	374.82	col., delq. cr.
8	carbide	Al_4C_3	143.91	yel., hex., 2.70

Acanthite 1997
Acerdol 461
Acetic acid, cf. organic table
Acetylenogen 426
Acetylith 426
Acid sodium phosphate 2119
Agaric mineral 428
Agate 1947
Alabandite 1297
Alalite 452
Albite 35
Altaite 1105

INORGANIC COMPOUNDS

numerical place in the table for the same substance; thus *Albite 35* indicates that this compound is the 35th compound in the table where it will be found listed under the name *Aluminum sodium silicate.*

References. The information given in this table has been collected mainly from the following sources:

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hex., hexagonal
hyg., hygroscopic
i., insoluble
ign., ignites
lq., liquid
lt., light
m. al., methyl alcohol
mn., monoclinic
nd., needles
NH_3, liquid ammonia
NH_4OH, ammonium hydroxide solution
oct., octahedral
or., orange
pd., powder
pl., plates
pr., prisms or prismatic
pyr., pyridine
rhb., rhombic (orthorhombic)
s., soluble
satd., saturated
sl., slightly
soln., solution
subl., sublimes
sulf., sulfides
tart. a., tartaric acid
tet., tetragonal
tr., transition
tri., triclinic
trig., trigonal
v., very
vac., in vacuo
vl., violet
volt., volatile or volatilizes
wh., white
yel., yellow
∞, soluble in all proportions
<, less than
>, greater than
42 ±, about or near 42
$-3H_2O$,100, loses 3 moles of water per formula weight at 100°C.

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1	$2.70^{20°}$	660	2057	i.	i.	s. HCl, H_2SO_4, alk.
2	....	d.200	....	s.	d.	....
3	....	d.	....	i.	....	s.a.; i. NH_4 salts
4	3.25	....	....	i.	i.	sl. s. a.
5	....	62.3	d.100	s.	s.	....
6	$3.01^{25°}_{4}$	97.5	268	s.	....	s.al., act., CS_2
7	....	d.100	....	s.	s.	s.al., CS_2
8	2.95	d. >2200	....	d. to CH_4	....	s. a.; i. act.

Alum 44, 37
Alum, burnt 43
Alum, filter 37
Alum, paper-makers' 37
Alum, pickle 36
Alum flour 44
Alum meal 44
Alumina 21
Aluminum ammonium sulfate 39
Aluminum beryllium silicate 296
Aluminum calcium oxide 414
Aluminum calcium silicate 415

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Aluminum			
9	chlorate	$Al(ClO_3)_3 \cdot 6H_2O$	385.44	rhombohedral
10	chloride	$AlCl_3$	133.34	wh., delq., hex.
11	chloride	$AlCl_3 \cdot 6H_2O$	241.44	col., delq., trig., 1.560
12	citrate	$AlC_6H_5O_7$	216.07	wh.
13	fluoride	AlF_3	83.97	tri.
14	fluoride (fluellite)	$AlF_3 \cdot H_2O$	101.99	col., rhb., 1.490
15	fluoride	$Al_2F_6 \cdot 7H_2O$	294.05	wh., cr. pd.
16	hydroxide	$Al(OH)_3$	77.99	wh., mn.
17	iodide	AlI_3	407.73	brn. cr.†
18	iodide	$AlI_3 \cdot 6H_2O$	515.83	wh.
19	nitrate	$Al(NO_3)_3 \cdot 9H_2O$	375.14	rhb., delq.
20	nitride	Al_2N_2	81.96	yel., hex.
21	oxide	Al_2O_3	101.94	col., hex., 1.67-8
22	oxide (corundum)	Al_2O_3	101.94	wh., trig., 1.768
23	oxide (diaspore)	$Al_2O_3 \cdot H_2O$	119.96	rhb., 1.722
23.1	oxide (bauxite)	$Al_2O_3 \cdot 2H_2O$*	137.97	wh., amor.
24	oxide (gibbsite)	$Al_2O_3 \cdot 3H_2O$	155.99	wh., mn., 1.566
25	phosphate	$AlPO_4$	121.95	col., hex.
26	phosphate (metavariscite)	$AlPO_4 \cdot 2H_2O$	157.98	rhb., 1.558
27	phosphate (variscite)	$AlPO_4 \cdot 2H_2O$	157.98	rhb., 1.571
28	potassium silicate (muscovite)	$3Al_2O_3 \cdot K_2O \cdot 6SiO_2 \cdot 2H_2O$	796.40	mn., 1.590
29	potassium silicate (orthoclase)	$Al_2O_3 \cdot K_2O \cdot 6SiO_2$	556.49	col., mn., 1.524
29.1	potassium silicate (microcline)	$Al_2O_3 \cdot K_2O \cdot 6SiO_2$	556.49	col., tri., 1.526
30	potassium tartrate	$AlK(C_4H_4O_6)_2$	362.21	col.
31	silicate (sillimanite)	Al_2SiO_5	162.00	wh., rhb., 1.66
32	silicofluoride	$Al_2(SiF_6)_3$	480.12	wh. pd.
33	sodium chloride	$AlCl_3 \cdot NaCl$	191.80	wh. pd.
34	sodium fluoride (cryolite)	$AlF_3 \cdot 3NaF$	209.96	wh., mn., 1.3389
35	sodium silicate	$Al_2O_3 \cdot Na_2O \cdot 6SiO_2$	524.29	col., tri., 1.529
36	sulfate	$Al_2(SO_4)_3$	342.12	wh. cr.
37	sulfate (alunogenite)	$Al_2(SO_4)_3 \cdot 18H_2O$	666.41	col., mn.
38	sulfide	Al_2S_3	150.12	yel., hex.
39	**Alum**, ammonium (tschermigite)	$Al_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$	906.64	col., oct., 1.4594
40	ammonium chrome	$Cr_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$	956.72	gn. or vl., oct., 1.4842
41	ammonium iron	$Fe_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$	964.40	vl., oct., 1.485
42	cesium	$Al_2(SO_4)_3 \cdot Cs_2SO_4 \cdot 24H_2O$	1136.38	col., oct.
43	potassium, exsiccated	$AlK(SO_4)_2$*	258.19	wh., delq. pd.
44	potassium (kalinite)	$Al_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$	948.76	col., mn., 1.4564

† Color caused by free iodine.
* Usual commercial form.

Aluminum fluosilicate 32
Aluminum potassium sulfate 44

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
9	....	d.	....	v.s.	v.s.	....
10	$2.44_{4}^{25^\circ}$	$194^{5.2 atm.}$	182.7^{752mm}; subl. 178	69.87^{15°	s. d.	s.et., chl., CCl_4;i.bz.
11	....	....	....	400	v. s.	50 al.; s. et.
12	....	....	....	sl. s.	s.	s. NH_4OH
13	2.88^{25°	1040	....	0.56^{25°	s.	i. act.
14	2.17	d.	....	sl. s.	....	....
15	....	$-4H_2O$, 120	$-6H_2O$, 250	i.	sl. s.	....
16	2.42	$-2H_2O$, 300	....	0.000104^{18°	i.	s. a., alk.; i. al.
17	3.98	191	382	s.	d.	s. al., et., CS_2
18	....	....	....	v. s.	v. s.	s. al., CS_2
19	....	73	d.134	v. s.	v. s. d.	s. al., CS_2
20	$3.05_{4}^{25^\circ}$	$2150^{4 atm.}$	d. >1400	d. slowly	....	s. alk. d.
21	3.99	1999 to 2032	....	i.	i.	v. sl. s. a., alk.
22	4.00	1999 to 2032	2210	i.	i.	v. sl. s. a., alk.
23	3.41	d.360	....	i.	i.	v. sl. s. a., alk.
23.1	2.55	d.360	....	i.	i.	v. sl. s. a., alk.
24	2.423	d.200	....	i.	i.	v. sl. s. a., alk.
25	2.59	....	....	i.	i.	s. a., alk.; i. ac.
26	2.54	>1500	....	....	....	....
27	2.52	....	....	....	....	....
28	2.9	d.	....	i.	....	....
29	2.56	1450 (1150)	....	i.	....	....
29.1	2.55	1150	....	i.	....	....
30	....	....	....	s.	s.	....
31	3.23	1860	....	i.	i.	i. a.
32	....	....	....	sl. s.	s.	....
33	....	185	....	s.	s.	....
34	2.90	1000	....	sl. s.	....	i. HCl
35	2.61	1100	....	i.	i.	d. a.
36	2.71	d.770	....	31.3^{0°	89^{100°	....
37	1.69^{17°	d.86.5	....	86.9^{0°	1104^{100°	i. al.
38	$2.02_{4}^{13^\circ}$	1118	subl. 1550 in N_2	d.	....	s. a.; i. act.
39	$1.64_{4}^{20^\circ}$	93.5	$-20H_2O$, 120; $-24H_2O$, 200	3.9^{0°	$\infty 100^\circ$	i. al.
40	1.72	100d.	....	21.2^{25°	....	s. al.
41	1.71	40	....	124^{25°	....	i. al.
42	1.87^{0°	117	....	0.34^{0°	42.54^{100°	....
43	2.75^{20°	....	....	3.0^{0°	109^{90°	i. al.
44	$1.76_{4}^{26^\circ}$	92	$-18H_2O$, 64.5	5.7^{0°	∞^{93°	....

Aluminum sodium sulfate 49
Aluminum trioxide 21
Alum meal 44

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Alum			
45	potassium chrome	$Cr_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$	998.84	red or gn., cb., 1.4814
46	potassium iron	$Fe_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$	1006.52	col. or vl., oct., 1.4817
47	potassium manganese	$Mn_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$	1004.68	vl., cb.
48	rubidium	$Al_2(SO_4)_3 \cdot Rb_2SO_4 \cdot 24H_2O$	1041.53	col., oct., 1.4566
49	sodium	$Al_2(SO_4)_3 \cdot Na_2SO_4 \cdot 24H_2O$	916.56	col., oct., 1.4388
50	thallium	$Al_2(SO_4)_3 \cdot Tl_2SO_4 \cdot 24H_2O$	1279.34	col., oct.
51	**Ammonia**†	NH_3	17.03	col. gas, 1.325 (lq.)
52	**Ammonium** acetate	$NH_4C_2H_3O_2$	77.08	wh., hyg. cr.
53	antimonate, meta-	$NH_4SbO_3 \cdot 2H_2O$	223.83	cr.
54	arsenate	$(NH_4)_3AsO_4 \cdot 3H_2O$	247.08	rhb.
55	arsenate, acid	$(NH_4)_2HAsO_4$	176.00	mn.
56	arsenate, acid	$NH_4H_2AsO_4$	158.97	tet., 1.5766
57	arsenite, meta-	NH_4AsO_2	124.95	pr.
58	auricyanide	$NH_4CN \cdot Au(CN)_3 \cdot H_2O$	337.33	pl.
59	aurocyanide	$NH_4CN \cdot AuCN$	267.28	....
60	benzoate	$NH_4C_7H_5O_2$	139.15	col., rhb.
61	bicarbonate	NH_4HCO_3	79.06	mn. or rhb., 1.5358
62	borate	$NH_4HB_4O_7 \cdot 3H_2O$	228.37	col. cr.
63	bromide	NH_4Br	97.96	col., cb., 1.7108
64	bromoplatinate	$(NH_4)_2PtBr_6$	710.81	red., cb.
65	bromoselenate	$(NH_4)_2SeBr_6$	594.54	cb.
66	carbonate	$(NH_4)_2CO_3 \cdot H_2O$	114.11	col. pl.
67	carbonate, carbamate	$NH_4HCO_3 \cdot NH_2CO_2NH_4$*	157.11	wh. cr.
68	carbonate, sesqui-	$(NH_4)_2CO_3 \cdot 2NH_4HCO_3 \cdot H_2O$	272.22	wh.
69	chlorate	NH_4ClO_3	101.50	wh., mn.
70	chloraurate	$(NH_4AuCl_4)_4 \cdot 5H_2O$	1518.35	yel., mn.
71	chloride (salammoniac)	NH_4Cl	53.50	wh., cb., 1.639, 1.6426
72	chloroiridate	$(NH_4)_2IrCl_6$	441.92	red-brn., cb.
73	chloropalladate	$(NH_4)_2PdCl_6$	355.52	red-brn., cb.
74	chloropalladite	$(NH_4)_2PdCl_4$	284.61	olive gn., tet.
75	chloroplatinate	$(NH_4)_2PtCl_6$	444.05	yel., cb.
76	chloroplatinite	$(NH_4)_2PtCl_4$	373.14	tet.
77	chloroplumbate	$(NH_4)_2PbCl_6$	456.03	lemon yel., cb.
78	chlorostannate	$(NH_4)_2SnCl_6$	367.52	pink., cb.
79	chromate	$(NH_4)_2CrO_4$	152.09	yel., mn.
80	citrate	$(NH_4)_3C_6H_5O_7$	243.22	wh., delq. pd.
81	cyanate	NH_4CNO	60.06	nd.
82	cyanide	NH_4CN	44.06	col., cb.

† See special tables.
* Usual commercial form.

Alundum 21
Alunogene 37
Alunogenite 37
Amazonstone 29.1
American ashes 1659
Amidosulfonic acid 2258
Ammonia alum 39
Ammoniac 71
Ammonio-cupric sulfate 720
Ammonio-nickelous bromide 1415
Ammonio-nickelous chloride 1423
Ammonio-nickelous iodide 1439
Ammonio-nickelous nitrate 1441
Ammonio-palladous chloride 1528
Ammonio-palladous hydroxide 1529
Ammonium acid carbonate 61
Ammonium acid fluoride 88
Ammonium acid oxalate 105
Ammonium acid sulfate 122

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
45	1.83	89	....	20	50	i. al.
46	1.83	33	....	$20^{12.5°}$	v. s.	i. al.
47	....	....	....	d.	....	....
48	1.89	99	....	$1.3^{0°}$	$43.25^{80°}$	....
49	$1.675_{4}^{20°}$	61	....	$106.4^{0°}$	$121.7^{45°}$	i. al.
50	2.32	91	....	$4.84^{0°}$	$65.19^{50°}$	....
51	$0.817^{-79°}$ 0.5971 (A)	−77.7	−33.4	$89.9^{0°}$	$7.4^{96°}$	$14.8^{20°}$ al.; s. et.
52	1.073	114	d.	$148^{4°}$	....	s. al.; sl. s. act.
53	....	d.	....	i.	....	....
54	....	....	....	s.	d.	....
55	$1.989_{4}^{20°}$	d.	....	$33.7^{40°}$	$122.4^{90°}$	....
56	$2.311_{4}^{21°}$	d.	....	sl. s.	....	....
57	....	....	....	v. s.	....	s. alk.; i. act.
58	....	d.200	....	s.	v. s.	i. al.
59	....	d.150-200	....	s.	....	s. alk.
60	$1.262^{4°}$	198	....	$19.6^{14.5°}$	$83.3^{100°}$	$3.57^{25°}$, $13.2^{78°}$ al.
61	1.573	d.35-60	....	$11.9^{0°}$	$27^{30°}$	i. al.
62	2.6	d.	....	10	s.	i. al.
63	$2.327_{4}^{15°}$	subl. 542	....	$68^{10°}$	$145.6^{100°}$	s. al., et., act.
64	$4.265_{4}^{24°}$	d.	....	$0.59^{20°}$	....	....
65	3.326	....	....	....	....	....
66	....	d.58	....	$100^{15°}$	....	i. al., CS_2, NH_3
67	....	subl.	....	$25^{15°}$	$67^{65°}$	....
68	....	d.	....	$20^{15°}$	$50^{49°}$	....
69	....	expl. 100	....	v. s.	....	i. al.
70	....	$-5H_2O$, 100	....	s.	....	s. al.
71	$1.53^{17°}$	d.350	subl. 520	$29.4^{0°}$	$77.3^{100°}$	s. NH_3; sl. s. al., m. al.
72	2.856	....	....	$0.7^{14.4°}$	$2.8^{69°}$	i. al.
73	2.418	d.	....	s.	....	....
74	2.17	d.	....	v. s.	....	i. al.
75	3.065	d.	....	$0.7^{15°}$	$1.25^{100°}$	0.005 al.
76	....	d.	....	s.	v. s.	....
77	2.925	d.120	....	s.	....	....
78	2.4	....	....	$33.3^{15°}$	....	....
79	$1.917^{12°}$	d.180	....	$40.5^{30°}$	d.	sl. s. act., NH_3; i. al.
80	....	d.	....	s.	....	....
81	....	d.	....	v. s.	d.	sl. s. al.
82	$0.79^{100°}$(A)	36	....	s.	v. s.	s. al.

Ammonium acid sulfite 126
Ammonium acid tartrate 128
Ammonium aluminum sulfate 39
Ammonium bichromate 83
Ammonium bifluoride 88
Ammonium binoxalate 105
Ammonium biphosphate 111
Ammonium bisulfate 122
Ammonium bisulfite 126
Ammonium bitartrate 128
Ammonium borofluoride 86
Ammonium cadmium chloride 367
Ammonium calcium arsenate 416
Ammonium calcium phosphate 417
Ammonium carbonate, acid 61
Ammonium chloro-osmate 103
Ammonium cobaltous chloride 652
Ammonium cobaltous sulfate 653
Ammonium cupric chloride 719
Ammonium cuprous iodide 763

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Ammonium			
83	dichromate	$(NH_4)_2Cr_2O_7$	252.10	or., mn.
84	dithionate	$(NH_4)_2S_2O_6\cdot\frac{1}{2}H_2O$	205.21	col., mn.
85	ferrocyanide	$(NH_4)_4Fe(CN)_6\cdot 6H_2O$	392.21	mn.
86	fluoborate	NH_4BF_4	104.86	wh., rhb.
87	fluoride	NH_4F	37.04	wh., hex.
88	fluoride, acid	$NH_4F\cdot HF$	57.05	wh., rhb., 1.390
89	fluosulfonate	NH_4SO_3F	117.10	wh.
90	formate	HCO_2NH_4	63.06	col., mn., delq.
91	gallate	$NH_4C_7H_5O_5\cdot H_2O$	205.17	....
92	hydrosulfide	NH_4HS	51.11	col., rhb.
93	hydroxide	NH_4OH	35.05	in soln. only
94	hypophosphite	$NH_4H_2PO_2$	83.04	col., rhb.
95	iodate	NH_4IO_3	192.96	rhb.
96	iodide	NH_4I	144.96	col., cb., 1.7031
97	iodoplatinate	$(NH_4)_2PtI_6$	992.83	cb.
98	molybdate	$(NH_4)_2MoO_4$	196.03	mn.
99	molybdate, hepta-	$(NH_4)_6Mo_7O_{24}\cdot 4H_2O$*	1235.95	col., mn.
100	nitrate (α), stable −16° to 32°	NH_4NO_3	80.05	col., tet., 1.611
101	nitrate (β), stable 32° to 84°	NH_4NO_3	80.05	col., rhb. or mn.
102	nitrite	NH_4NO_2	64.05	wh. nd.
103	osmochloride	$(NH_4)_2OsCl_6$	439.02	cb.
104	oxalate	$(NH_4)_2C_2O_4\cdot H_2O$	142.12	col., rhb.
105	oxalate, acid	$NH_4HC_2O_4\cdot H_2O$	125.08	col., trimetric
106	perchlorate	NH_4ClO_4	117.50	col., rhb., 1.4833
107	perchromate	$(NH_4)_3CrO_8$	234.13	red, oct.
108	periodate	NH_4IO_4	208.96	tet.
109	permanganate	NH_4MnO_4	136.97	rhb.
110	persulfate	$(NH_4)_2S_2O_8$	228.20	wh., mn., 1.5016
111	phosphate, monobasic	$NH_4H_2PO_4$	115.04	col., tet., 1.5246
112	phosphate, dibasic	$(NH_4)_2HPO_4$	132.07	col., mn., 1.53
113	phosphate, meta-	NH_4PO_3	97.02	col., mn.
114	phosphite, acid	$NH_4H_2PO_3$	99.04	col., delq.
115	phosphomolybdate	$(NH_4)_3PO_4\cdot 12MoO_3\cdot 3H_2O$ (?)	1930.55	yel.
116	salicylate	$NH_4C_7H_5O_3$	155.15	col., mn.
117	selenate	$(NH_4)_2SeO_4$	179.04	wh., mn., 1.5630
118	selenate, acid	NH_4HSeO_4	162.01	rhb.
119	silicofluoride	$(NH_4)_2SiF_6$	178.14	cb., 1.3696
120	sulfamate	$NH_4\cdot SO_3NH_2$	114.12	col. pl.
121	sulfate (mascagnite)	$(NH_4)_2SO_4$	132.14	col., rhb., 1.5230
122	sulfate, acid	NH_4HSO_4	115.11	col., rhb., 1.480
123	sulfide	$(NH_4)_2S$	68.14	yel.-wh.
124	sulfide, penta-	$(NH_4)_2S_5$	196.38	or.-red pr.
125	sulfite	$(NH_4)_2SO_3\cdot H_2O$	134.16	col., mn.
126	sulfite, acid	NH_4HSO_3	99.11	rhb.
127	tartrate	$(NH_4)_2C_4H_4O_6$	184.15	col., mn.

* Usual commercial form.

Ammonium ferric oxalate 808
Ammonium ferric sulfate 41
Ammonium ferrous sulfate 839
Ammonium fluosilicate 119
Ammonium gold chloride 70
Ammonium gold cyanide 58, 59
Ammonium hyposulfite 132
Ammonium iodide, tri- 133
Ammonium magnesium arsenate 1171
Ammonium magnesium chloride 1172
Ammonium magnesium chromate 1173
Ammonium magnesium phosphate 1174
Ammonium magnesium sulfate 1175
Ammonium manganese arsenate 1236

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
83	2.15	d.185	....	$47.2^{30\circ}$	v. s.	s. al.; i. act.
84	1.704	d.130	....	$178.5^{19\circ}$	....	i. al.
85	....	d.	....	s.	....	i. al.
86	$1.851^{17\circ}$	230	subl.	$25^{16\circ}$	$97^{100\circ}$	s. NH_4OH; d. conc. H_2SO_4
87	....	....	....	v. s.	d.	s. al.; i. NH_3
88	$1.21^{12\circ}_{12}$	....	....	v. s.	....	....
89	....	244.7	....	s.	s.	s. m. al.; d. excess NH_4OH
90	1.266	114-116	d.180; subl. in vac.	$102^{0\circ}$	$531^{80\circ}$	s. al.
91	....	....	....	s.	....	....
92	....	d.	subl. 120	v. s.	....	s. al.
93	....	....	....	s.	....	....
94	....	200	d.240	s.	v. s.	v. s. al.
95	$3.309^{21\circ}_{4}$	d.150	....	$2.6^{15\circ}$	$14.5^{100\circ}$	....
96	2.511	subl. 551	235 vac.	154.2^{0}	$250.3^{100\circ}$	v. s. al., act.; v. sl. s. et.
97	$4.61^{20\circ}_{4}$	....	....	....	....	....
98	2.27	d.	....	d.	d.	i. al., NH_3
99	....	....	....	$44^{25\circ}$	....	i. al.
100	$1.66^{25\circ}_{4}$	169.6	d.210	$118.3^{0\circ}$	$241.8^{30\circ}$	....
101	$1.725^{25\circ}_{4}$	....	d.210	$365.8^{35\circ}$	$580^{80\circ}$	$3.8^{20\circ}$ al., 17 $1^{20\circ}$ m. al.; v. s. NH_3
102	1.69	expl.	....	s.	d.	s. al.
103	$2.93^{20\circ}_{4}$	....	....	....	....	....
104	1.501	....	....	$2.5^{0\circ}$	$11.8^{50\circ}$	sl. s. al.; i. NH_3
105	1.556	d.	....	s.	....	....
106	1.95	d.	....	$10.9^{0\circ}$	$46.9^{100\circ}$	$2^{25\circ}$ al.; s. act.; i et.
107	....	d.40	....	sl. s.	....	sl. s. NH_3; i. al., et.
108	$3.056^{18\circ}_{4}$	expl.	....	$2.7^{16\circ}$	....	....
109	2.208	expl. 60	....	$8^{15\circ}$	d.	....
110	1.98	d.120	....	$58.2^{0\circ}$	d.	....
111	$1.803^{19\circ}_{4}$	....	....	$22.7^{0\circ}$	$173.2^{100\circ}$	i. ac.
112	1.619	....	....	$131^{15\circ}$	....	i. act.
113	2.21	....	....	s.	....	....
114	....	123	d.150	$171^{0\circ}$	$260^{31\circ}$	i. al.
115	....	d.	....	$0.03^{15\circ}$	i.	s. alk.; i. al., HNO_3
116	....	....	....	$103^{25\circ}$	s.	$43.5^{25\circ}$, $100^{79\circ}$ al.
117	$2.194^{20\circ}_{4}$	d.	....	$117^{7\circ}$	$197^{100\circ}$	i. al., act., NH_3
118	$2.162^{20\circ}_{4}$	d.	....	....	....	....
119	2.01	....	subl.	$18.5^{17.5\circ}$	55.5	s. al.; i. act.
120	....	132	d.160	$134^{0\circ}$	$357^{50\circ}$	....
121	$1.769^{20\circ}_{4}$	513d.	....	$70.6^{0\circ}$	$103.3^{100\circ}$	i. al., act., CS_2
122	1.78	146.9	490	100	....	v. sl. s. al.; i. act.
123	....	d.	....	v. s.	....	$120^{25\circ}$ NH_3
124	....	....	....	s.	....	....
125	1.41	d.	....	$100^{12\circ}$	....	i. al., act.
126	$2.03^{12\circ}_{4}$	d.	....	s.	....	....
127	1.60	d.	....	$45^{0\circ}$	$87^{60\circ}$	sl. s. al.

Ammonium manganese phosphate 1237
Ammonium manganese sulfate 1238
Ammonium metaphosphate 113
Ammonium metatungstate 134
Ammonium muriate 71
Ammonium nickel chloride 1405
Ammonium nickel sulfate 1406
Ammonium osmium chloride 1492
Ammonium paratungstate 135
Ammonium phosphite, hypo- 94
Ammonium praseodymium sulfate 1793
Ammonium sodium phosphate 2011
Ammonium stannic chloride 2170
Ammonium sulfhydrate 92
Ammonium sulfocyanate 131

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Ammonium			
128	tartrate, acid	$NH_4HC_4H_4O_6$	167.12	col., rhb.
129	tellurate	$(NH_4)_2TeO_4$	227.69	wh. pd.
130	thiocarbonate	$(NH_4)_2CS_3$	144.27	yel.
131	thiocyanate	NH_4CNS	76.12	col., mn., 1.685 ±
132	thiosulfate	$(NH_4)_2S_2O_3$	148.20	col., mn.
133	triiodide	NH_4I_3	398.80	brn., rhb.
134	tungstate, meta-	$(NH_4)_2W_4O_{13}\cdot 8H_2O$	1123.89	col., oct.
135	tungstate, para-	$(NH_4)_6W_7O_{24}\cdot 6H_2O$	1887.78	rhb.
136	vanadate, meta-	NH_4VO_3	116.99	col. cr.
137	**Antimonic** acid, meta-	$HSbO_3$	170.77	wh. pd.
138	acid, ortho-	H_3SbO_4	188.78	wh. pd.
139	acid, pyro-	$H_4Sb_2O_7$	359.55	wh., amor.
140	**Antimonous** acid, ortho-	H_3SbO_3	172.78	wh., amor.
141	**Antimony**	Sb	121.76	tin wh., trig.
142	bromide, tri-	$SbBr_3$	361.51	col., rhb., 1.74+
143	chloride, tri- (butter of antimony)†	$SbCl_3$	228.13	col., rhb., delq.
144	chloride, penta-	$SbCl_5$	299.05	pa. yel. lq.
145	fluoride, tri-	SbF_3	178.76	col., rhb.
146	fluoride, penta-	SbF_5	216.76	oily lq.
147	hydride (stibine)	SbH_3	124.78	col. gas
148	iodide, tri-	SbI_3	502.52	red-yel., rhb. or mn.
149	iodide, penta-	SbI_5	756.36	dark brn.
150	oxide, tri- (valentinite)	Sb_2O_3	291.52	rhb., 2.35
151	oxide, tri- (senarmontite)	Sb_2O_3	291.52	cb., 2.087
152	oxide, tetra-	Sb_2O_4	307.52	wh. pd.
153	oxide, penta-	Sb_2O_5	323.52	yel. pd.
154	oxychloride (ous)	$SbOCl$	173.22	wh., mn.
155	oxychloride (ic)	$SbOCl_3$	244.13	yel.
156	selenide, tri-	Sb_2Se_3	480.40	gray pd.
157	sulfate, tri-	$Sb_2(SO_4)_3$	531.70	wh. pd.
158	sulfide, tri- (stibnite)	Sb_2S_3	339.70	bk., rhb., 4.046
159	sulfide, penta-	Sb_2S_5	403.82	golden
160	telluride, tri-	Sb_2Te_3	626.35	gray
161	**Antimonyl** potassium tartrate (tartar emetic)	$(SbO)KC_4H_4O_6\cdot \frac{1}{2}H_2O$	333.94	wh., rhb.
162	sulfate, normal	$(SbO)_2SO_4$	371.58	wh. pd.
163	sulfate, basic	$(SbO)_2SO_4\cdot Sb_2(OH)_4$	683.13	wh. pd.
164	**Argon**	A	39.94	col. gas
165	**Arsenic** (crystalline)(α)	As_4	299.64	met., hex.
166	**Arsenic** (black)(β)	As_4	299.64	bk., amor.
167	**Arsenic** (yellow)(γ)	As_4	299.64	yel., cb.

† Usually the solution.

Ammonium uranyl carbonate 2453
Ammonium uranyl fluoride 2454
Ammonium zinc sulfate 2534
Anatase 2399
Anglesite 1099
Anhydrite 481
Anhydrone 1208
Anorthite 415
Anthion 1732
Antichlor 2166
Antimony, crude 158
Antimony black 158
Antimony blende 158
Antimony bloom 150
Antimony glance 158
Antimony gray 158
Antimonyl chloride 154

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
128	1.68	d.	....	$2.35^{15°}$	$3.24^{25°}$	s. a., alk.; i. al.
129	$3.01\frac{25°}{4}$	....	....	sl. s.	s.	s. a.
130	....	subl.	....	v. s.	....	i. al., et.
131	1.305	149.6	d.170	$120^{0°}$	$170^{20°}$	s. al., act., NH_3, SO_2
132	....	d.150	....	s.	....	s. act.,; i. al., et.
133	3.749	....	....	s. d.	d.	....
134	....	$-7H_2O$, 100	....	$120^{15°}$	v. s.	i. al., et.
135	....	$-4H_2O$, 100	....	$2.8^{15°}$	$4.5^{22°}$	i. al.
136	2.326	d.	....	$0.44^{18°}$	$3.05^{70°}$	i. al., NH_4Cl
137	6.6	d.	....	sl. s.	sl. s.	s. a., alk.; i. act.
138	6.6	d.	....	sl. s.	sl. s.	s. alk.
139	....	$-H_2O$, 200	....	sl. s.	sl. s.	s. alk.
140	....	d.	....	i.	i.	i. al.
141	$6.684^{25°}$	630.5	1380	i.	i.	s. aq. reg., h. conc. H_2SO_4
142	$4.148^{23°}$	96.6	280	d.	d.	s. CS_2, HCl, HBr, NH_3, act.
143	$3.14\frac{20°}{4}$	73.4	220.2	$601.6^{0°}$	$\infty^{72°}$	s. al., HCl, HBr, $H_2C_4H_4O_6$
144	2.346	2.8	92^{30mm}	d.	d.	s. HCl, chl.
145	$4.379^{20.9°}$	292	subl.	$384.7^{0°}$	$563.6^{30°}$	i. NH_3
146	$2.99^{23°}$	7	149.5	s.	....	s. KF
147	$2.26^{-25°}$; $4.344^{15°}$(A)	−88	−17; d.150	$0.41^{10°}$	4cc.	1500cc. al.; 2500cc.CS_2
148	$4.768^{22°}$ (mn.)	167	401	d.	d.	s. al., act., CS_2, HCl, HI, KI
149	....	79	400.6	d.	d.	....
150	5.67	656	1570	v. sl. s.	sl. s.	s. HCl, KOH, $H_2C_4H_4O_6$
151	5.2	652	....	....	....	....
152	6.2	−O, 1060	....	i.	i.	s. HCl, HI, KOH
153	3.78	−O, 450	−2O, 1060	0.3	....	s. HCl, HI, KOH
154	....	170d.	....	i.	d.	s. HCl, CS_2; i. NH_3, chl.
155	....	d.	....	i.	d.	s. al.
156	....	611	....	v. sl. s.	....	....
157	$3.62\frac{4°}{4}$	d.	....	d.	d.	s. H_2SO_4
158	4.64	550	....	$0.00017^{18°}$	d.	s. HCl; alk., NH_4HS, K_2S; i. ac.
159	$4.12^{20°}$	−2S, 135	....	i.	i.	s. HCl, alk., NH_4HS
160	....	629	....	....	....	....
161	2.60	$-\frac{1}{2}H_2O$, 100	....	$5.26^{8.7°}$	$35.7^{100°}$	s. gly.; i. al.
162	4.89	....	....	d.	d.	....
163	....	....	....	i.	d.	$5.15^{15°}$ gly.
164	$1.65^{-233°}$; $1.402^{-185.7°}$ 1.38(A)	−189.2	−185.7	$5.6^{0°}$ cc	$2.23^{50°}$ cc	$24^{25°}$ cc al.
165	$5.727^{14°}$	$814^{36 atm.}$	subl. 615	i.	i.	s. HNO_3
166	$4.7^{20°}$	....	....	i.	i.	s. HNO_3, aq. reg., aq. Cl_2, h. alk.
167	$2.0^{20°}$	d.358	....	....	....	....

Antimony needle 158
Antimony oxysulfate 162
Antimony pentachloride 144
Antimony pentoxide 153
Antimony potassium tartrate 161
Antimony sulfuret 159
Antimony trichloride 143
Antimony trifluoride 145
Antimony trioxide 150
Antimony trisulfide 158
Antimony white 150
Aqua fortis 1469
Aragonite 427
Arcanite 1760
Argentine 428
Argentite 1998
Argol 1771
Arkansite 2400

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
168	**Arsenic** acid, ortho-	$H_3AsO_4\cdot\frac{1}{2}H_2O$	150.94	col., hyg.
169	acid, meta-	$HAsO_3$	123.92	wh., hyg.
170	acid, pyro-	$H_4As_2O_7$	265.85	col.
171	fluoride	AsF_5	169.91	col. gas
172	iodide, di-	AsI_2	328.75	red cr.
173	iodide, penta-	AsI_5	709.51	brn., mn.
174	pentoxide	As_2O_5	229.82	wh., amor.
175	sulfide, di- (realgar)	As_2S_2	213.94	red, mn., 2.68
176	sulfide, penta-	As_2S_5	310.12	yel.
177	**Arsenous** bromide	$AsBr_3$	314.66	col. pr.
178	chloride (butter of arsenic)	$AsCl_3$	181.28	oily lq.
179	fluoride	AsF_3	131.91	oily lq.
180	hydride (arsine)	AsH_3	77.93	col. gas
181	iodide	AsI_3	455.67	red, hex.
182	oxide (arsenolite)	As_2O_3	197.82	col., cb., fibrous, 1.755
183	oxide (claudetite)	As_2O_3	197.82	col., mn., 1.92
184	oxide	As_2O_3	197.82	amor. or vitreous
185	oxychloride	$AsOCl$	126.39	....
186	phosphide	AsP	105.89	red pd.
187	selenide	As_2Se_3	386.70	dark brn.
188	sulfide (orpiment)	As_2S_3	246.00	red or yel., mn., >2.72
189	**Auribromic acid**	$HAuBr_4\cdot5H_2O$	607.95	brn. cr.
190	**Auric** bromide	$AuBr_3$	436.95	dark brn.
191	chloride	$AuCl_3$	303.57	red. delq.
192	chloride	$AuCl_3\cdot2H_2O$	339.60	or. cr.
193	cyanide	$Au(CN)_3\cdot6H_2O$	383.35	....
194	hydrogen nitrate	$Au(NO_3)_3\cdot HNO_3\cdot 3H_2O$	500.29	yel., tri. or oct.
195	hydroxide	$Au(OH)_3$	248.22	brn.-bk. pd.
196	iodide	AuI_3	577.96	dark gn., rhb.
197	oxide	Au_2O_3	442.40	brn.-bk.
198	phosphide	Au_2P_3	487.46	gray
199	sulfate	$Au_2(SO_4)_3\cdot H_2O$	700.60	purple-red, delq.
200	sulfide	Au_2S_3	490.58	brn.-bk.
201	**Aurous** bromide	$AuBr$	277.12	yel.-gray
202	chloride	$AuCl$	232.66	yel. cr.
203	cyanide	$AuCN$	223.22	yel. cr.
204	hydroxide	$AuOH$	214.21	vl.
205	iodide	AuI	324.12	yel. or wh.
206	oxide	Au_2O	410.40	gray-vl.
207	sulfide	Au_2S	426.46	bk.-brn.
208	Cf. also under gold	....	......	....

Arsenic anhydride 174
Arsenic chloride, tri- 178
Arsenic glass 184
Arsenic orange 175
Arsenic phosphide 1558
Arsenic red 175
Arsenic sodium sulfide 2160
Arsenic trioxide 182
Arsenoferrite 1012
Arsenolite 182
Arsenous acid 182
Arsenous anhydride 182
Arsine 180
Auric ammonium chloride 70

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
168	2.0-2.5	35.5	$-H_2O$, 160	16.7	50	s. alk.
169	....	d.	....	d. to form	H_3AsO_4	....
170	....	d.206	....	d. to form	H_3AsO_4	....
171	5.964(A)	−80	−53	s.	....	s. alk., al., et.
172	....	130	380	d.	....	s. al., et., chl., CS_2
173	$3.93^{20^\circ}_{4}$	70	....	s.	....	s. al., et.
174	4.086	....	d.	59.5^{0°	76.7^{100°	s. alk., al.
175	(α)3.506^{19°; (β)3.254^{19°	(α)tr. 267; (β)307	565	i.	d.	s. K_2S, $NaHCO_3$
176	....	....	d. 500	0.00013^{60°	i.	s. HNO_3, alk.
177	$3.54^{25^\circ}_{4}$	31	221	d.	d.	s. HCl, HBr, CS_2
178	lq. 2.163	−18	130	d.	d.	s. HCl, HBr, PCl_3
179	lq. $2.666^{0^\circ}_{4}$	−8.5	63^{752mm}	d.	d.	s. al., et., bz.
180	2.695(A)	−113.5	−55; d. 230	20 cc	sl. s.	sl. s. alk.
181	$4.39^{15^\circ}_{4}$	146	403	6^{25°	30^{100°	s. al., et., bz., chl., CS_2
182	$3.865^{25^\circ}_{4}$	subl.	....	sl. s.	sl. s.	i. al., et.
183	3.85	subl.	....	sl. s.	sl. s.	i. al., et.
184	3.738	315	....	1.2^{10°	2.93^{40°	s. HCl, alk., Na_2CO_3; i. al., et.
185	....	....	....	d.	d.	....
186	....	subl. d.	....	d.	d.	sl. s. CS_2; i. al., et., chl.; d. HNO_3
187	4.75	360	....	i.	d.	s. alk.
188	3.43	300	707	0.00005^{18°	sl. s.	s. alk., Na_2CO_3
189	....	27	....	s.	....	....
190	....	160 d.	....	s.	....	s. et.
191	3.9	254 d.	subl. 265	68	v. s.	s. al., et.; sl. s. NH_3; i. CS_2
192	....	d.	....	v. s.	v. s.	s. HCl, al., et.; sl. s. NH_3
193	....	d. 50	....	v. s.	v. s.	s. al.
194	2.84	72 d.	....	d.	....	s. HNO_3
195	....	$-1\frac{1}{2}H_2O$, 250	....	i.	i.	s. HNO_3
196	....	....	....	i.	d.	s. iodides; d. alk.
197	....	−O, 160	−3O, 250	i.	i.	s. HCl
198	6.67	d.	....	....	....	i. HCl
199	....	....	....	s.	d.	s. HCl, H_2SO_4
200	8.754	d. 197	....	i.	....	s. Na_2S; i. a., et.; d. conc. HNO_3
201	....	d. 115	....	i.	i.	s. NH_4OH; d. a.
202	7.4	$AuCl_3$, 170	d. 290	d.	d.	s. HCl, HBr; d. al.
203	....	d.	....	i.	i.	s. KCN; i. al., et.
204	....	$-H_2O$, 200	....	s.	....	....
205	....	d. 120	....	i.	sl. s. d.	s. warm dil. a., excess KI
206	....	−O, 205	....	i.	i.	s. HCl; sl. s. alk.; i. H_2SO_4, HNO_3, al.
207	....	....	....	i.	....	s. KCN, K_2S_x; i. a.
208	....	....	....	....	....	....

Auric ammonium cyanide 58
Auric nitrate, acid 194
Auricome 953
Auric potassium bromide 1655
Auric potassium chloride 1664
Auric potassium cyanide 1643
Auric potassium oxide 1642
Auric sodium chloride 2048
Auripigment 188
Aurora orange 408
Aurora yellow 408
Aurous ammonium cyanide 59
Aurous potassium cyanide 1644
Azoimide 933
Azurite 727

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
209	**Barium**	Ba	137.36	silv. met.
210	acetate	$Ba(C_2H_3O_2)_2$	255.45	col.
211	acetate	$Ba(C_2H_3O_2)_2 \cdot H_2O$	273.46	wh., tri. pr., 1.517
212	amide	$Ba(NH_2)_2$	169.41	gray-wh.
213	arsenate	$Ba_3(AsO_4)_2$	689.90	wh. pd.
214	arsenate, acid	$BaHAsO_4 \cdot H_2O$	295.29	rhb. or mn.
215	arsenide	Ba_3As_2	561.90	brn.
216	boride	BaB_6	202.28	bk., cb.
217	bromate	$Ba(BrO_3)_2 \cdot H_2O$	411.21	col., mn.
218	bromide	$BaBr_2$	297.19	col.
219	bromide	$BaBr_2 \cdot 2H_2O$	333.22	col., mn., 1.7266
220	bromoplatinate	$BaPtBr_6 \cdot 10H_2O$	992.25	mn.
221	butyrate	$Ba(C_4H_7O_2)_2 \cdot 2H_2O$	347.59	col.
222	carbide	BaC_2	161.38	gray cr.
223	carbonate (witherite)	$BaCO_3$	197.37	wh., rhb., 1.676
224	carbonate (α)	$BaCO_3$	197.37	wh., hex.
225	carbonate (β)	$BaCO_3$	197.37	wh.
226	chlorate	$Ba(ClO_3)_2$	304.27	col.
227	chlorate	$Ba(ClO_3)_2 \cdot H_2O$*	322.29	col., mn., 1.577
228	chloride	$BaCl_2$	208.27	col., mn., 1.7361
229	chloride	$BaCl_2$	208.27	col., cb.
230	chloride	$BaCl_2 \cdot 2H_2O$*	244.31	col., mn., 1.646
231	chloroplatinate	$BaPtCl_6 \cdot 6H_2O$	653.43	red, mn.
232	chloroplatinite	$BaPtCl_4 \cdot 3H_2O$	528.47	....
233	chromate	$BaCrO_4$	253.37	yel., rhb.
234	citrate	$Ba_3(C_6H_5O_7)_2 \cdot 7H_2O$	916.39	wh. pd.
235	cyanide	$Ba(CN)_2$	189.40	wh. pd.
236	dichromate	$BaCr_2O_7$	353.38	red, mn.
237	dichromate	$BaCr_2O_7 \cdot 2H_2O$	389.41	yel. nd.
238	dithionate	$BaS_2O_6 \cdot 2H_2O$	333.51	col., rhb. or mn., 1.5951
239	ferrocyanide	$Ba_2Fe(CN)_6 \cdot 6H_2O$	594.77	yel., mn.
240	fluobromide	$BaF_2 \cdot BaBr_2$	472.55	col. pl.
241	fluochloride	$BaF_2 \cdot BaCl_2$	383.63	col., tet.
242	fluoiodide	$BaF_2 \cdot BaI_2$	566.56	pl.
243	fluoride	BaF_2	175.36	col., cb., 1.475
244	formate	$Ba(HCO_2)_2$	227.40	col., rhb.
245	hydride	BaH_2	139.38	cr.
246	hydrosulfide	$Ba(SH)_2 \cdot 4H_2O$	275.65	wh., rhb.
247	hydroxide	$Ba(OH)_2$	171.38	col., mn.
248	hydroxide	$Ba(OH)_2 \cdot 8H_2O$	315.50	col., mn., 1.5017
249	hypochlorite	$Ba(ClO)_2$	240.27	col.
250	hypophosphate	$BaPO_3$	216.34	nd.
251	hypophosphite	$Ba(H_2PO_2)_2 \cdot H_2O$	285.37	col., mn.
252	iodate	$Ba(IO_3)_2$	487.20	mn.
253	iodate	$Ba(IO_3)_2 \cdot H_2O$	505.22	mn.
254	iodide	$BaI_2 \cdot 2H_2O$	427.23	mn.
255	iodide	$BaI_2 \cdot 6H_2O$	499.30	hex.
256	malate	$BaC_4H_4O_5$	269.43	col.
257	malonate	$BaC_3H_2O_4 \cdot H_2O$	257.42	col.
258	manganate	$BaMnO_4$	256.29	gn., hex.
259	molybdate	$BaMoO_4$	297.31	wh. pd.

* Usual commercial form.

Baddeleyite 2597
Baking soda 2025
Baldwin's phosphorus 454
Barite 284
Barium bichromate 236
Barium bromofluoride 240
Barium chlorofluoride 241
Barium cyanoplatinate 277

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
209	3.5	850	1140	d.	d.	s. a.; d. al.
210	2.468	....	....	58.8^{0°	75.0^{100°	....
211	2.19	$-H_2O$, 41	....	75^{30°(anh.)	79^{40° (anh.)	i. al.
212	....	280	....	d.	d.	....
213	....	....	....	0.055	....	s. a., NH_4Cl
214	3.93^{15°	$-H_2O$, 150	$-1\frac{1}{2}H_2O$, 225	d .to $Ba_3(AsO_4)_2$ and d to $BaH_4(AsO_4)_2$		....
215	4.1^{15°	....	....	....	....	d. by Cl_2, F_2 or Br_2
216	4.36^{15°	....	....	i.	i.	s. HNO_3
217	3.99^{18°	$-H_2O$, 170	d. 260	0.3^{0°	5.97^{100°	i. act., al.
218	$4.781^{\frac{24^\circ}{4}}$	847	d.	98^{0°	149^{100°	v. s. m. al.; v. sl. s. act.
219	3.69	$-2H_2O$, 100	d.	v. s.	v. s.	s. al.
220	3.713	....	....	....	....	....
221	....	....	....	37.42^{0°	42.12^{80°	....
222	3.75	....	....	d. to form C_2H_2		d. a.
223	4.29	tr. 811 to α	d. 1450	0.0022^{18°	0.0065^{100°	s. a.; i. al.
224	....	tr. 982 to β	....	....	....	....
225	....	$1740^{90\text{ atm.}}$	....	0.0022^{18°	0.0065^{100°	s. a.; i. al.
226	....	414	....	20.35^{0°	84.8^{80°	....
227	3.179	d. 120	....	s.	s.	sl. s. al., act.
228	$3.856^{\frac{24^\circ}{4}}$	tr. 925	1560	31^{0°	59^{100°	sl. s. HCl, HNO_3; i. al.
229	....	962	1560	....	....	....
230	$3.097^{\frac{24^\circ}{4}}$	$-2H_2O$, 100	....	39.3^{0°	76.8^{100°	sl. s. HCl, HNO_3; i. al.
231	2.86	....	....	s.	....	d. a.
232	2.868	....	....	s.	....	v. s. 93% al.
233	4.498^{15°	....	....	0.00037^{20°	0.00046^{30°	s. HCl, HNO_3
234	....	$-7H_2O$, 150	....	0.0406^{18°	0.0572^{25°	s. HCl; sl. s. al.
235	....	....	....	80^{14°	....	18^{14° 70% al.
236	....	....	....	d.	....	s. h. conc. H_2SO_4
237	....	$-2H_2O$, 120	....	d.	....	....
238	$4.536^{13.5^\circ}$	....	....	24.75^{18°	90.9^{100°	i. al.
239	....	....	....	0.1^{15°	1^{75°	i. al.
240	4.96^{18°	....	....	d.	d.	s. conc. HCl, HNO_3; i.al.
241	4.51^{18°	1008	....	d.	d.	s. conc. HCl, HNO_3; i. al.
242	5.21^{18°	....	....	d.	d.	s. conc. HCl, HNO_3; i. al.
243	4.828	1280	1400	0.159^{0°	0.162^{30°	s. a., NH_4Cl
244	3.21	....	....	26.2^{0°	51.3^{100°	i. al., et.
245	4.21^{0°	d. 675	volt. 1200	d.	d.	d. a.
246	....	d.	....	s.	s.	i. al.
247	4.495	....	....	1.67^{0°	101.4^{80°	....
248	2.188^{16°	77.9	$-8H_2O$, 550	5.6^{15°	....	v. sl. s. al.; i. et.
249	....	d. 235	....	....	....	....
250	....	....	....	sl. s.	....	s. al.; v. sl. s. ac.
251	2.90^{17°	....	....	29	33.3^{100°	i. al.
252	5.0^{15°	....	....	0.008^{0°	0.197^{100°	sl. s. warm HNO_3; i. al.
253	5.5^{15°	$-H_2O$, 130	....	0.008^{0°	0.21^{100°	s. HCl, HNO_3; i. H_2SO_4, al., act.
254	5.15	740 d.	$-2H_2O$, 539	322^{40°	396^{100°	v. s. al.
255	....	25.7	....	410^{0°	v. s.	v. s. al.
256	....	....	....	0.883^{20°	1.044^{80°	....
257	....	....	....	0.143	0.326^{80°	....
258	4.85	....	....	i.	....	d. a.
259	4.65	....	....	0.0058^{23°	....	s. a.

Barium dioxide 270
Barium fluosilicate 282
Barium hyposulfite 291
Barium iodofluoride 242

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Barium			
260	nitrate (nitrobarite)	$Ba(NO_3)_2$	261.38	col., cb., 1.572
261	nitride, hexa-	BaN_6	221.41	rhb.
262	nitride, hexa-	$BaN_6 \cdot H_2O$	239.42	cr.
263	nitrite	$Ba(NO_2)_2$	229.38	col.
264	nitrite	$Ba(NO_2)_2 \cdot H_2O$	247.39	hex. nd.
265	oxalate	BaC_2O_4	225.38	wh. cr.
266	oxide	BaO	153.36	col., cb., 1.98
267	perchlorate	$Ba(ClO_4)_2$*	336.27	hex.
268	perchlorate	$Ba(ClO_4)_2 \cdot 3H_2O$	390.32	hex., 1.5330
269	permanganate	$Ba(MnO_4)_2$	375.22	bk., rhb.
270	peroxide	BaO_2*	169.36	gray or wh. pd.
271	peroxide	$BaO_2 \cdot 8H_2O$	313.49	pearly sc.
272	persulfate	$BaS_2O_8 \cdot 4H_2O$	401.54	pr.
273	phosphate, monobasic	$BaH_4(PO_4)_2$	331.35	tri.
274	phosphate, dibasic	$BaHPO_4$	233.35	wh., rhb. nd., 1.635
275	phosphate, tribasic	$Ba_3(PO_4)_2$	602.04	wh., cb.
276	phosphate, pyro-	$Ba_2P_2O_7$	448.68	wh., rhb.
277	platinocyanide	$BaPt(CN)_4 \cdot 4H_2O$	508.73	yel., mn.
278	propionate	$Ba(C_3H_5O_2)_2 \cdot H_2O$	301.52	wh., rhb.
279	selenate	$BaSeO_4$	280.32	wh., rhb.
280	silicate	$BaSiO_3$	213.42	col., mn.
281	silicate	$BaSiO_3 \cdot 6H_2O$	321.52	rhb., 1.547
282	silicofluoride	$BaSiF_6$	279.42	pr.
283	succinate	$BaC_4H_4O_4$	253.43	wh. pd.
284	sulfate (barite, barytes)	$BaSO_4$	233.42	col., rhb., 1.636
285	sulfide, mono-	BaS	169.42	col., cb., 2.155
286	sulfide, tri-	BaS_3	233.54	yel.-gn.
287	sulfide, tetra-	$BaS_4 \cdot 2H_2O$	301.63	red, rhb.
288	sulfite	$BaSO_3$	217.42	wh., tet.
289	tellurate	$BaTeO_4$	328.97	wh.
290	thiocyanate	$Ba(CNS)_2 \cdot 2H_2O$	289.55	col. nd.
291	thiosulfate	$BaS_2O_3 \cdot H_2O$	267.50	wh., rhb.
292	tungstate	$BaWO_4$	385.28	wh., tet.
293	tungstate, meta-	$BaW_4O_{13} \cdot 9H_2O$	1243.18	rhb.
294	vanadate, pyro-	$Ba_2V_2O_7$	488.62	wh.
295	**Beryllium (glucinum)**	Be (Gl)	9.02	gray, met., hex.
296	aluminum silicate (beryl)	$3BeO \cdot Al_2O_3 \cdot 6SiO_2$	537.36	usually gr.; hex., 1.580
297	bromide	$BeBr_2$	168.85	col. nd., delq.
298	carbide	Be_2C	30.05	yel., hex.
299	carbonate	$BeCO_3 \cdot 4H_2O$	141.09	wh.
300	carbonate, basic	$(BeO)_5 \cdot CO_2 \cdot 5H_2O$	259.19	wh. pd.
301	chloride	$BeCl_2$	79.93	wh., delq. nd.
302	chloride	$BeCl_2 \cdot 4H_2O$	152.00	cr.
303	fluoride	BeF_2	47.02	transparent glass
304	hydroxide	$Be(OH)_2$	43.04	wh., amor.
305	iodide	BeI_2	262.86	col. nd.

* Usual commercial form.

Barium oxide, hydrated 247
Barium phosphate, hypo- 250
Barium phosphite, hypo- 251
Barium sulfhydrate 246
Barium sulfocyanate 290
Barium sulfocyanide 290
Barium white 284
Barium yellow 233
Baryta yellow 233
Barytes 284
Battery acid 2277

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
260	$3.244^{23\circ}$	592	d.	$5.0^{0\circ}$	$34.2^{100\circ}$	sl. s. a.; i. al.
261	....	d. 219	expl.	....	....	....
262	....	expl.	....	v. s.	v. s.	sl. s. abs. al.; i. et.
263	$3.23^{23\circ}$	217	....	$67.5^{20\circ}$	$300^{100\circ}$	sl. s. al.
264	$3.173^{29\circ}$	d. 115	....	s.	v. s.	1.6, 94% al.; i. act.
265	2.658	....	....	$0.0016^{8\circ}$	$0.0024^{24\circ}$	s. a., NH_4Cl; i. al.
266	5.72	1923	2000 ±	$1.5^{0\circ}$	$90.8^{80\circ}$	s. HCl, HNO_3, abs. al.; i. NH_3, act.
267	....	505	....	$205.8^{0\circ}$	$562.3^{100\circ}$	v. s. al., act.; i. et.
268	2.74	d. 400	....	s.	s.	v. s. al.
269	3.77	d. 220	....	$62.5^{11\circ}$	$72.4^{25\circ}$	d. al.
270	4.958	−O, 800	....	v. sl. s.	d.	s. dil. a.; i. act.
271	....	$-8H_2O$, 100	....	0.168	d.	s. dil. a.; i. al., et., act.
272	....	....	....	$52.2^{0\circ}$	....	i. al.
273	$2.9^{4\circ}$	....	....	d.	d.	s. a.
274	$4.165^{15\circ}$	....	....	0.015	....	s. a., NH_4 salts
275	$4.1^{16\circ}$	....	....	i.	....	s. a.
276	$3.9^{20\circ}$	....	....	0.01	....	s. a., NH_4 salts
277	3.05	$-2H_2O$, 100	$-4H_2O$, 150	$3^{16\circ}$	....	s. al.
278	....	....	....	$36.5^{0\circ}$ (anh.)	$44.7^{100\circ}$ (anh.)	sl. s. al.
279	4.75	d.	....	0.0118	$0.0138^{100\circ}$	s. HCl; i. HNO_3
280	$4.399^{4\circ}$	1604	....	s.	d.	s. HCl
281	2.59	....	....	0.17 d.	d.	....
282	$4.279^{15\circ}$	....	....	$0.026^{17\circ}$	$0.09^{100\circ}$	sl. s. HCl, NH_4Cl; i. al.
283	....	....	....	$0.421^{0\circ}$	$0.237^{80\circ}$	sl. s. al.
284	$4.499^{15\circ}$	1580 d.	tr. to mn. 1149	$0.000115^{0\circ}$	$0.000285^{30\circ}$	s. conc. H_2SO_4; 0.006, 3% HCl
285	$4.25^{15\circ}$	....	....	d.	d.	d. HCl; i. al.
286	....	d. 400	....	s.	s.	....
287	$2.988^{20\circ}$	d. 200	....	$41^{15\circ}$	v. s.	i. al., CS_2
288	....	....	....	$0.0197^{0\circ}$	$0.00177^{80\circ}$	s. HCl, al.
289	$4.48^{16\circ}$	....	....	v. sl. s.	sl. s.	....
290	....	....	....	$43^{20\circ}$	s.	s. al.
291	$3.45^{18\circ}$	d. 100	....	$0.208^{20\circ}$	....	i. al.
292	6.35	d.	....	v. sl. s.	....	....
293	4.298	....	....	d.	....	....
294	....	863 ±	....	....	....	....
295	1.816	1284	2767	i.	sl. s. d.	s. dil. a., alk.
296	2.66	1410	....	i.	i.	....
297	....	490	subl. 450	v. s.	v. s.	s. abs. al., pyridine
298	$1.9^{15\circ}$	d. >2100	....	d.	d.	s. a.
299	....	d. 100	....	$0.36^{0\circ}$	....	i. NH_3
300	....	....	....	i.	d.	s. a.; alk.
301	$1.899^{25\circ}_{4}$	440	520	v. s.	v. s.	v. s. al., et.; sl. s. chl., CS_2; i. NH_3, or act.
302	....	....	....	delq.	v. s.	s. al.
303	$2.01^{15\circ}$	800	subl.	v. s.	v. s.	s. H_2SO_4, al.
304	....	d. 138	....	0.0002	i.	s. a., alk., $(NH_4)_2CO_3$
305	$4.2^{15\circ}$	510	590	d.	d.	s. al., et.

Battery manganese 1269
Bauxite 23.1
Beryl 296
Berzelianite 777
Beyrichite 1463
Bicarbonate of soda 2025
Bichloride of mercury 1308
Biebeorite 692
Bischofite 1191

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Beryllium (**glucinum**)			
306	nitrate	$Be(NO_3)_2 \cdot 4H_2O$	205.10	delq. cr.
307	oxide (bromellite)	BeO	25.02	wh., hex., 1.719
308	potassium fluoride	$BeF_2 \cdot 2KF$	163.21	wh., rhb.
309	selenate	$BeSeO_4 \cdot 4H_2O$	224.04	rhb., 1.5007
310	sodium fluoride	$BeF_2 \cdot 2NaF$	131.01	wh., rhb. or mn.
311	stearate	$Be(C_{18}H_{35}O_2)_2$	575.94	wh., waxy
312	stearate, basic	$Be(OH)C_{18}H_{35}O_2$	310.50	wh. pd.
313	sulfate	$BeSO_4$	105.08	col.
314	sulfate	$BeSO_4 \cdot 4H_2O$	177.14	col., tet., 1.4720
315	**Bismuth**	Bi	209.00	silv. wh. or reddish, hex.
316	arsenate	$BiAsO_4$	347.91	mn.
317	bromide	$BiBr_3$	448.75	yel.
318	carbonate, sub-	$Bi_2O_3 \cdot CO_2 \cdot H_2O$	528.03	wh. pd.
319	chloride, di-	$BiCl_2$(?)	279.91	bk. nd.
320	chloride, tri-	$BiCl_3$*	315.37	wh. cr.
321	citrate	$BiC_6H_5O_7$	398.10	col. cr.
322	dichromate, basic	$(BiO)_2Cr_2O_7$	666.02	or.-red.
323	fluoride	BiF_3	266.00	gray pd.
324	hydroxide	$Bi(OH)_3$	260.02	wh., amor.
325	iodate	$Bi(IO_3)_3$	733.76	wh.
326	iodide	BiI_3	589.76	dark, hex.
327	nitrate	$Bi(NO_3)_3 \cdot 5H_2O$	485.10	col., tri.
328	nitrate, sub-	$BiONO_3 \cdot H_2O$	305.02	hex. pl.
329	oxalate	$Bi_2(C_2O_4)_3$	682.06	wh. pd.
330	oxide, tri-	Bi_2O_3	466.00	yel., rhb.
331	oxide, tri-	Bi_2O_3	466.00	yel., tet.
332	oxide, tri-	Bi_2O_3	466.00	yel., cb.
333	oxide, tetra-	$Bi_2O_4 \cdot 2H_2O$	518.03	brn.-yel.
334	oxide, penta-	Bi_2O_5	498.00	brn.
335	oxide, penta-	$Bi_2O_5 \cdot H_2O$	516.02	red
336	oxybromide	$BiOBr$	304.92	col. cr.
337	oxychloride	$BiOCl$	260.46	wh., amor.
338	oxyfluoride	$BiOF$	244.00	wh. cr.
339	oxyiodide	$BiOI$	351.92	red, rhb.
340	phosphate, ortho-	$BiPO_4$	303.98	wh., mn.
341	selenide (guanajuatite)	Bi_2Se_3	654.88	bk., rhb.
342	sulfate	$Bi_2(SO_4)_3$	706.18	wh. nd.
343	sulfide (bismuthinite)	Bi_2S_3	514.18	brn., rhb.
344	telluride	Bi_2Te_3	800.83	....
345	**Boric acid**	H_3BO_3	61.84	wh., tri.
346	**Boron**	B	10.82	gray or bk., amor. or mn.
347	bromide	BBr_3	250.57	col. lq.

* Usual commercial form.

Bismuth bichromate, basic 322
Bismuth bromide, basic 336
Bismuth chloride, basic 337
Bismuth peroxide 333
Bismuth sodium thioglycollate 2027
Bismuth sub-bromide 336
Bismuth sub-carbonate 318
Bismuth subchloride 337
Bismuth subiodide 339
Bismuth subnitrate 328
Bismuth tetroxide 333
Bismuth trichloride 320
Bismuth trioxide 330
Bismuthinite 343
Bitter salt 1228
Black antimony 158
Black copper oxide 748
Black iron oxide 835
Black jack 2583
Black lead 495
Black precipitate 1344
Black tin oxide 2198
Blanc de perle 337

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
306	....	60	d. 100	v. s.	v. s.	s. al.; i. act.
307	$3.02^{0^{\circ}}$	2585	3900	i.	....	s. conc. H_2SO_4; sl. s. dil. a.; i. alk.
308	....	....	....	$2^{20^{\circ}}$	$5.26^{100^{\circ}}$	i. al.
309	2.03	d. 110	....	s.	....	....
310	....	d.	....	$1.47^{18^{\circ}}$	$2.94^{100^{\circ}}$	....
311	....	45-46	....	i.	i.	s. et., CCl_4, xylene; i. al.
312	....	174	....	i.	i.	sl. s. CCl_4; i. al., et.
313	2.443	....	....	$27^{0^{\circ}}$	$45^{100^{\circ}}$	....
314	$1.713^{10.5^{\circ}}$	$-4H_2O$, 190	d. 550	$105.5^{30^{\circ}}$	$\infty^{100^{\circ}}$	i. al., act.
315	$9.80^{20^{\circ}}$	271	1450	i.	i.	s. aq. reg., conc. H_2SO_4, HNO_3
316	$7.142^{15^{\circ}}_{4}$	....	....	sl. s.	....	v. sl. s. a.
317	5.604	218	453	d.	d.	s. HBr, et.
318	6.86	d.	....	i.	i.	s. a.
319	4.86	163	d. 300	d.	....	....
320	4.75	230	447	d.	....	s. al.
321	....	d.	....	$0.01^{25^{\circ}}$	....	s. NH_4OH; i. al.
322	....	....	....	i.	i.	s. a.; i. alk.
323	$5.32^{20^{\circ}}_{4}$	....	....	i.	....	d. a.
324	4.36	$-H_2O$, 100	$-1\frac{1}{2}H_2O$, 150	0.00014	....	s. a.; i. alk.
325	....	....	....	i.	....	sl. s. HNO_3
326	5.64	439	500 d.	i.	d.	$3.5^{20^{\circ}}$ abs. al.; s. HI, KI
327	2.82	d. 30	$-5H_2O$, 80	d.	....	$42^{19^{\circ}}$ act.; s. a.; i. al.
328	$4.928^{15^{\circ}}$	d. 260	....	i.	i.	s. a.
329	....	....	....	i.	i.	s. a.
330	8.9	820	1900 ±	i.	i.	s. a.
331	8.55	860	....	i.	i.	s. a.
332	8.20	tr. 704	....	i.	i.	s. a.
333	5.6	d. 100	−O, 305	i.	....	s. a.
334	5.10	−O, 150	−2O, 357	i.	i.	s. a., KOH
335	5.75	$-H_2O$, 120	−2O, 357	i.	....	s. a., KOH
336	8.08	d.	....	i.	....	s. a.; i. al.
337	$7.72^{15^{\circ}}$	....	....	sl. s.	sl. s.	s. a.; i. act., NH_3, $H_2C_4H_4O_6$
338	7.5	d.	....	i.	....	s. a.
339	7.92	d.	....	i.	....	s. a.; i. KI, al.
340	6.323	d.	....	v. sl. s.	sl. s.	s. HCl; i. dil. HNO_3
341	6.82	710	d.	i.	....	i. alk.
342	5.08	d. 418	....	d.	....	s. a.
343	7.00	685 d.	....	$0.000018^{18^{\circ}}$	....	s. HNO_3
344	$7.7^{20^{\circ}}_{4}$	573	....	....	....	d. HNO_3; i. c. HCl or H_2SO_4
345	$1.435^{15^{\circ}}$	185 d.	....	$2.66^{0^{\circ}}$	$40.2^{100^{\circ}}$	$22.2^{20^{\circ}}$ gly., $0.24^{25^{\circ}}$ et.; s. al.
346	2.32	2300	2550	i.	i.	s. HNO_3; i. al.
347	lq. 2.69	−45	90.6	d.	....	d. al.

Blanc d'Espagne 337
Blanc fixe 284
Bleaching powder 444
Bleaching solution 2077
Blende 2584
Blue copperas 760
Blue iron ore 861
Blue John 440
Blue salts 1461
Blue stone 760
Blue verdigris 717
Blue verditer 727
Blue vitrol 760
Bobierite 1214
Boracic acid 345
Borax 2036
Boric (acid) anhydride 353
Boroethane 351
Borofluoric acid 872

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Boron			
348	carbide	B_4C	55.29	bk. cr.
349	chloride	BCl_3	117.19	col. lq.
350	fluoride	BF_3	67.82	col. gas
351	hydride (boroethane)	B_2H_6	27.69	col. gas
352	iodide	BI_3	391.58	col. pl.
353	oxide	B_2O_3	69.64	col. glass, 1.459
354	oxide (sassolite)	$B_2O_3 \cdot 3H_2O$	123.69	tri., 1.456
355	phosphide	BP	41.80	maroon pd.
356	sulfide, tri-	B_2S_3	117.82	wh. cr.
357	sulfide, penta-(?)	B_2S_5	181.94	wh. cr.
358	**Bromic acid**	$HBrO_3$	128.92	col.; in soln. only
359	**Bromine**	Br_2	159.83	rhb., or red lq.
360	fluoride	BrF_3	136.92	col. lq.
361	hydrate	$Br_2 \cdot 10H_2O$	339.99	red, oct.
362	iodide	BrI	206.84	dark gray cr.
363	**Bromoplatinic acid**	$H_2PtBr_6 \cdot 9H_2O$	838.89	red, delq., mn.
364	**Cadmium**	Cd	112.41	silv. met., hex.
365	acetate	$Cd(C_2H_3O_2)_2$	230.50	col.
366	acetate	$Cd(C_2H_3O_2)_2 \cdot 2H_2O$*	266.53	col., mn.
367	ammonium chloride	$CdCl_2 \cdot 4NH_4Cl$	397.31	rhb., 1.6038
368	arsenate, acid	$CdHAsO_4 \cdot H_2O$	270.34	....
369	arsenide	Cd_3As_2	487.05	dark gray, cb.
370	borotungstate	$Cd_2B_2W_9O_{32} \cdot 18H_2O$	2738.03	yel. cr.
371	bromate	$Cd(BrO_3)_2 \cdot H_2O$	386.26	mn.
372	bromide	$CdBr_2$	272.24	wh. pl.
372.1	bromide	$CdBr_2 \cdot 4H_2O$	344.30	wh., eff. nd.
373	carbonate	$CdCO_3$	172.42	wh., trig.
374	chlorate	$Cd(ClO_3)_2 \cdot 2H_2O$	315.36	col. delq.
375	chloride	$CdCl_2$	183.32	wh., cb.
376	chloride	$CdCl_2 \cdot 2\frac{1}{2}H_2O$	228.36	col., mn., 1.6513
377	cyanide	$Cd(CN)_2$	164.45	....
378	dithionate	$CdS_2O_6 \cdot 6H_2O$	380.63	tri.
379	ferrocyanide	$Cd_2Fe(CN)_6$	436.78	....
380	fluoride	CdF_2	150.41	cb., 1.56
381	formate	$Cd(HCO_2)_2 \cdot 2H_2O$	238.48	mn.
382	hydroxide	$Cd(OH)_2$	146.43	wh., trig.
383	iodate	$Cd(IO_3)_2$	462.25	pa. brn. cr.
384	iodate	$Cd(IO_3)_2 \cdot H_2O$	480.27	....
385	iodide (α)	CdI_2	366.25	brn., hex.
386	iodide (β)	CdI_2	366.25	....
387	lactate	$Cd(C_3H_5O_3)_2$	290.55	nd.
388	nitrate	$Cd(NO_3)_2$	236.43	col.
389	nitrate	$Cd(NO_3)_2 \cdot 4H_2O$*	308.49	col. nd.
390	oxalate	CdC_2O_4	200.43	col.
391	oxalate	$CdC_2O_4 \cdot 3H_2O$	254.48	col. cr.
392	oxide	CdO	128.41	brn., cb.

* Usual commercial form.

Bort 494
Boussingaultite 1175
Bremen green 728
Brimstone 2259
Bromauric acid 189
Bromellite 307
Bromine iodide 983
Bromous acid, hypo- 962
Bromyrite 1965
Brookite 2400
Brucite 1200

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
348	2.54	2450	>3500	i.	i.	i. a.
349	lq. $1.434_{4}^{0^\circ}$	−107	$13^{764\text{mm}}$	d.	d.	d. al.
350	2.3(A)	−126.8	−101	105.7^{0° cc	....	d. al.
351	....	−169	−87.5	sl. s.	d.	s. NH_4OH
352	lq. 3.3^{50°	43	210	d.	....	v. s. CS_2, CCl_4
353	1.85	577	>1500	1.1^{0°	15.7^{100°	s. a., al., gly.
354	1.49	d.	....	sl. s.	s.	....
355	....	ign. 200	....	i.	i.	i. in most solvents
356	1.55	310	....	d.	....	sl. s. PCl_3, SCl_2
357	1.85	390	....	d.	....	d. al.
358	....	d. 100	....	v. s.	d.	....
359	3.119^{20°; 5.87(A)	−7.2	58.78	4.22^{0°	3.13^{30°	s. al., et., alk., CS_2
360	....	5	135	forms O_2, HOBr, $HBrO_3$ and HF		d. alk.
361	....	d. 6.8	....	s.	....	....
362	4.414^{10°	42±	116±	d.	....	s. schl., CS_2
363	....	<100d.	....	v. s.	v. s.	v. s. al., et., chl.
364	8.65^{20°	320.9	767	i.	i.	s. a., NH_4NO_3
365	2.341	256	d.	v. s.	....	s. m. al.
366	2.01	$-H_2O$, 130	....	v. s.	....	s. al.
367	$2.01_{4}^{20^\circ}$	tr. −20	....	s.	....	....
368	$4.164_{4}^{15^\circ}$	>120	....	....	....	....
369	$6.211_{4}^{15^\circ}$	721	....	....	....	d. a.
370	....	....	....	1250^{17°	....	....
371	3.8	d.	....	125^{17°	....	....
372	$5.192_{4}^{25^\circ}$	580	963	61.08^{0°	165^{80°	26.6^{15° al., 0.4^{15° et., 1.6^{18° act.
372.1	....	....	....	s.	v. s.	s. al., sl. s. act., et.
373	4.258^{4°	d. <500	....	i.	i.	s. a., KCN, NH_4 salts; i. NH_3
374	2.3	80	....	298^{0°	487^{65°	s. a., act., al.
375	$4.047_{4}^{25^\circ}$	568	960	90^{0°	147^{100°	1.52^{15° al.; i. et., act.
376	3.327	tr. 34	....	168^{20°	180^{100°	2.05^{15° m. al.
377	....	d. >200	....	0.0247^{18°	....	s. a.; NH_4OH, KCN
378	$2.272_{4}^{20^\circ}$	d.	....	....	....	....
379	....	....	....	i.	....	s. HCl
380	6.64	520	>1200	4.35^{25°	....	s. a., i. al., NH_3
381	2.44	d.	....	8.4^{0° (anh.)	94.6^{100° (anh.)	....
382	$4.79_{4}^{15^\circ}$	d. 300	....	0.00026^{25°	....	s. a., NH_4 salts; i. alk.
383	6.43	d.	....	sl. s.	sl. s.	s. HNO_3, NH_4OH
384	$6.43_{4}^{20^\circ}$	tr. 160	....	s.	....	s. HNO_3
385	$5.670_{4}^{30^\circ}$	385	713	79.8^{0°	127.6^{100°	s. a., al., et., NH_4OH; sl. s. NH_3
386	$5.305_{4}^{30^\circ}$	....	....	....	....	....
387	....	....	....	10	12.5	i. al.
388	....	350	....	109.7^{0°	$326^{59.5^\circ}$	v. s. a.
389	$2.455_{4}^{17^\circ}$	59.4	132	215^{0°	....	s. al., NH_3; i. HNO_3
390	$3.32_{4}^{18^\circ}$	d. 340	....	0.00337^{18°	0.009	s. a.; i. al.
391	....	d.	....	....	....	s. a., NH_4OH
392	8.15	....	....	i.	i.	s. a., NH_4 salts; i. alk.

Brunswick green 727
Brushite 467
Bunsenite 1443
Burnt alum 43
Burnt lime 459
Burnt ochre 824
Burnt ore 824
Butter of antimony 143
Butter of arsenic 178
Buttercup yellow 2542
Cadmium dihydrogen phosphate 396

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Cadmium			
393	oxide	CdO	128.41	brn., amor., 2.49
394	oxide, sub-	Cd_2O	240.82	gn., amor.
395	permanganate	$Cd(MnO_4)_2 \cdot 6H_2O$	458.37	....
396	phosphate, monobasic	$Cd(H_2PO_4)_2 \cdot 2H_2O$	342.43	tri.
397	phosphate, tribasic	$Cd_3(PO_4)_2$	527.19	amor.
398	phosphate, pyro-	$Cd_2P_2O_7 \cdot 2H_2O$	434.81	....
399	potassium iodide	$CdI_2 \cdot 2KI \cdot 2H_2O$	734.31	wh., delq.
400	selenate	$CdSeO_4 \cdot 2H_2O$	291.40	rhb.
401	selenide	$CdSe$	191.37	gray-brn., hex.
402	silicate	$CdSiO_3$	188.47	rhb.
403	sulfate	$CdSO_4$	208.47	rhb.
404	sulfate	$CdSO_4 \cdot H_2O$	226.49	mn.
405	sulfate	$3CdSO_4 \cdot 8H_2O$*	769.54	col., mn., 1.565
406	sulfate	$CdSO_4 \cdot 4H_2O$	280.53	col.
407	sulfate	$CdSO_4 \cdot 7H_2O$	334.58	mn.
408	sulfide (greenockite)	CdS	144.47	yel.-or., hex., 2.506
409	sulfite	$CdSO_3$	192.47	cr.
410	telluride	$CdTe$	240.02	bk., cb.
411	tungstate	$CdWO_4$	360.33	yel., rhb.
412	**Calcium**	Ca	40.08	silv. met., cb.
413	acetate	$Ca(C_2H_3O_2)_2 \cdot H_2O$	176.18	wh. nd.
414	aluminate	$Ca(AlO_2)_2$	158.02	col., rhb. or mn.
415	aluminum silicate (anorthite)	$CaO \cdot Al_2O_3 \cdot 2SiO_2$	278.14	tri., 1.5832
416	ammonium arsenate	$CaNH_4AsO_4 \cdot 6H_2O$	305.13	mn. pl.
417	ammonium phosphate	$CaNH_4PO_4 \cdot 7H_2O$	279.24	mn.
418	arsenate	$Ca_3(AsO_4)_2$	398.06	wh. pd.
419	arsenide	Ca_3As_2	270.06	red cr.
420	benzoate	$Ca(C_6H_5CO_2)_2 \cdot 3H_2O$	336.35	wh. pd.
421	borate, meta-	$Ca(BO_2)_2 \cdot 2H_2O$	161.75	col., cb.
422	boride	CaB_6	105.00	bk., cb.
423	bromate	$Ca(BrO_3)_2 \cdot H_2O$	313.93	mn.
424	bromide	$CaBr_2$	199.91	delq. nd.
425	bromide	$CaBr_2 \cdot 6H_2O$	308.01	hex.
426	carbide	CaC_2	64.10	gray., rhb., 1.75
427	carbonate (aragonite)	$CaCO_3$	100.09	col., rhb., 1.6809
428	carbonate (calcite)	$CaCO_3$	100.09	col., hex., 1.6585
429	chlorate	$Ca(ClO_3)_2 \cdot 2H_2O$	243.03	wh., delq., mn.
430	chloride (hydrophilite)	$CaCl_2$*	110.99	wh., delq., cb., 1.52
431	chloride	$CaCl_2 \cdot H_2O$	129.01	col., delq.
431.1	chloride	$CaCl_2 \cdot 2H_2O$	147.03	col., delq.
432	chloride	$CaCl_2 \cdot 6H_2O$	219.09	col., trig., 1.417
433	chromate	$CaCrO_4 \cdot 2H_2O$	192.12	yel., mn.
434	citrate	$Ca_3(C_6H_5O_7)_2 \cdot 4H_2O$	570.50	col. nd.
435	cyanamide	$CaCN_2$	80.11	col., rhombohedral
436	cyanide	$Ca(CN)_2$	92.12	wh., cb.
437	dithionate	$CaS_2O_6 \cdot 4H_2O$	272.26	trig., 1.5516
438	ferricyanide	$Ca_3[Fe(CN)_6]_2 \cdot 12H_2O$	760.35	red, delq. nd.
439	ferrocyanide	$Ca_2Fe(CN)_6 \cdot 12H_2O$	508.31	yel., tri., 1.5818
440	fluoride (fluorite)	CaF_2	78.08	wh., cb., 1.4339

* Usual commercial form.
Cadmium suboxide 394
Cadmium yellow 408
Caesium 540
Caesium salts 541 to 578
Calamine 2539; cf. also table of minerals.
Calcic liver of sulfur 485

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
393	6.95	d. 900-1000	....	i.	i.	s. a., NH_4 salts; i. alk.
394	$8.192^{18°}_{4}$	d.	....	....	....	d. a., alk.
395	2.81	d. 95	....	v. s.	....	....
396	$2.742^{15°}_{4}$	d. 100	....	....	....	s. HCl; i. al., et.
397	....	1500	....	i.	....	s. .a, NH_4 salts
398	$4.965^{15°}_{4}$	900 (anh.)	....	....	....	....
399	3.359	....	....	$137^{15°}$	....	71 al.
400	3.632	d. 100	....	v. s.	....	....
401	$5.81^{15°}_{4}$	>1350	....	....	....	d. a.
402	$4.93^{25°}_{4}$	1242	....	....	....	....
403	$4.691^{24°}_{4}$	1000	....	$76.5^{0°}$	$60.8^{100°}$	i. act., NH_3
404	$3.786^{20°}$	tr. 108	....	s.	s.	....
405	3.09	tr. 41.5	....	$114.2^{0°}$	$127.6^{60°}$	i. al.
406	3.05	....	....	s.	s.	i. al.
407	$2.48^{20°}_{4}$	tr. 4	....	$350^{-5°}$	....	i. al.
408	4.58	$1750^{100\,atm}$	subl. in N_2, 980	0.000001	colloidal	s. a.; v. s. NH_4OH
409	....	d.	....	sl. s.	....	s. a., NH_4OH; i. al.
410	$6.20^{15°}_{4}$	1041	....	i.	....	d. HNO_3; i. a.
411	....	....	....	0.05	....	s. NH_4OH
412	$1.55^{20°}$	810	1200 ± 30	d.	d.	s. a.; sl. s. al.
413	....	d.	....	$52^{0°}$	$45.5^{80°}$	sl. s. al.
414	$3.67^{20°}$	1600	....	d.	....	s. HCl
415	2.765	1551	....	....	....	....
416	$1.905^{15°}$	d.	....	0.02	s.	s. NH_4Cl; i. NH_4OH
417	$1.561^{15°}$	d.	....	i.	d.	s. a.
418	....	....	....	$0.013^{25°}$	i.	s. dil. a.
419	$2.5^{15°}$	d.	....	d.	d.	s. a.
420	1.44	....	....	4	v. s.	....
421	....	$-2H_2O$, 200-300	....	$0.40^{30°}$	$0.40^{90°}$	s. a., NH_4 salts
422	$2.33^{15°}$	....	....	i.	i.	s. HNO_3
423	3.329	d.	....	v. s.	....	....
424	$3.353^{25°}_{4}$	760	810	$125^{0°}$	$312^{105°}$	s. al., act.; sl. s. NH_3
425	....	38.2	149-150	$594^{0°}$	v. s.	....
426	$2.22^{18°}$	2300	....	forms C_2H_2	....	....
427	2.93	d. 825	....	†$0.0012^{20°}$	$0.002^{100°}$	s. a., NH_4Cl
428	$2.711^{25°}_{4}$	$1339^{103\,atm.}$	....	$0.0014^{25°}$	$0.002^{100°}$	s. a., NH_4Cl
429	....	$-H_2O > 100$	....	$177.7^{8°}$	....	s. al., act.
430	$2.152^{15°}_{4}$	772	>1600	$59.5^{0°}$	$347^{260°}$	s. al.
431	....	....	....	s.	s.	s. al.
431.1	....	....	....	$130^{20°}$	v. s.	$10^{15°}$, $50^{80°}$ al.
432	$1.68^{17°}$	29.92	$-6H_2O$, 200	v. s.	v. s.	s. al.
433	....	$-2H_2O$, 200	....	$22.2^{0°}$	$18.2^{45°}$	s. a.
434	....	$-2H_2O$, 130	$-4H_2O$, 185	$0.085^{18°}$	$0.096^{25°}$	$0.0065^{18°}$ al.
435	....	....	....	s. d.	d.	....
436	....	....	....	s.	d.	....
437	2.18	d. 110	$-4H_2O$, 78	$40.65^{19°}$	$125^{100°}$	i. al., act.
438	....	....	....	v. s.	v. s. d.	....
439	1.7	....	....	s.	$150^{90°}$	i. al.
440	$3.180^{20°}$	1330	....	$0.0016^{18°}$	$0.0017^{26°}$	sl. s. a.

† The solubility of $CaCO_3$ in H_2O is greatly increased by increasing the amount of CO_2 in the H_2O.

Calcite 428
Calcium acid phosphate 463
Calcium azide 456
Calcium biphosphate 462
Calcium dioxide 460
Calcium fluosilicate 478

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Calcium			
441	formate	$Ca(HCO_2)_2$	130.12	col., rhb.
442	hydride	CaH_2	42.10	wh. cr. or pd.
443	hydroxide	$Ca(OH)_2$	74.10	col., hex., 1.574
444	hypochlorite	$Ca(ClO)_2 \cdot 4H_2O$	215.06	wh., feathery cr.
445	hypophosphate	$Ca_2P_2O_6 \cdot 2H_2O$	274.15	granular
446	hypophosphite	$Ca(H_2PO_2)_2$	170.07	col., mn.
447	iodate (lautarite)	$Ca(IO_3)_2$	389.92	tri.
448	iodide	CaI_2	293.92	wh., delq. pl.
449	iodide	$CaI_2 \cdot 6H_2O$	402.02	wh., delq.
450	lactate	$Ca(C_3H_5O_3)_2 \cdot 5H_2O$	308.30	col., eff.
451	magnesium carbonate (dolomite)	$CaO \cdot MgO \cdot 2CO_2$	184.42	trig., 1.68174
452	magnesium silicate (diopside)	$CaO \cdot MgO \cdot 2SiO_2$	216.52	wh., mn.
453	molybdate	$CaMoO_4$	200.03	wh., tet., 1.974
454	nitrate (nitrocalcite)	$Ca(NO_3)_2$	164.10	col., cb.
455	nitrate	$Ca(NO_3)_2 \cdot 4H_2O$*	236.16	col., mn., 1.498
456	nitride	Ca_3N_2	148.26	brn. cr.
457	nitrite	$Ca(NO_2)_2 \cdot H_2O$	150.11	delq., hex.
458	oxalate	CaC_2O_4	128.10	col., cb.
458.1	oxalate	$CaC_2O_4 \cdot H_2O$	146.12	col.
459	oxide	CaO	56.08	col., cb., 1.837
459.1	perchlorate	$Ca(ClO_4)_2$	238.99	col.
460	peroxide	$CaO_2 \cdot 8H_2O$	216.21	pearly, tet.
461	permanganate	$Ca(MnO_4)_2 \cdot 4H_2O$	350.00	purple pr.
462	phosphate, monobasic	$CaH_4(PO_4)_2 \cdot H_2O$	252.09	wh., tri.
463	phosphate, dibasic	$CaHPO_4 \cdot 2H_2O$	172.10	wh., mn. pl.
464	phosphate, tribasic	$Ca_3(PO_4)_2$	310.20	wh., amor.
465	phosphate, meta-	$Ca(PO_3)_2$	198.04	wh., tet., 1.588
466	phosphate, pyro-	$Ca_2P_2O_7$	254.12	col., biaxial, 1.60
467	phosphate, pyro- (brushite)	$Ca_2P_2O_7 \cdot 5H_2O$	344.20	wh., mn.
468	phosphide	Ca_3P_2	182.20	red cr.
469	phosphite, ortho-	$2CaHPO_3 \cdot 3H_2O$	294.19	....
470	plumbate	Ca_2PbO_4	351.38	yel. pd.
471	plumbite	$CaPbO_2$	279.30	cr.
472	potassium sulfate (syngenite)	$CaK_2(SO_4)_2 \cdot H_2O$	328.41	mn.
473	salicylate	$Ca(C_7H_5O_3)_2 \cdot 2H_2O$	350.33	wh., oct.
474	selenate	$CaSeO_4 \cdot 2H_2O$	219.07	mn.
475	silicate (α) (pseudowollastonite)	$CaSiO_3$	116.14	col., pseudo hex., 1.6150 or mn.(?)
476	silicate (β) (wollastonite)	$CaSiO_3$	116.14	col., mn., 1.610
477	silicide	$CaSi_2$	96.20	....
478	silicofluoride	$CaSiF_6$	182.14	col.
479	silicofluoride	$CaSiF_6 \cdot 2H_2O$	218.17	wh., tet.
480	sodium sulfate	$CaSO_4 \cdot 2Na_2SO_4 \cdot 2H_2O$	456.28	col.
481	sulfate (anhydrite)	$CaSO_4$	136.14	col., rhb., 1.576, or mn, 1.50

*Usual commercial form

Calcium hydrosulfide 484
Calcium lead oxide 470
Calcium metaborate 421
Calcium oxide hydrated 443
Calcium phosphate, hypo- 445
Calcium phosphate,primary 462
Calcium phosphate, secondary 463

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Cold Water	Hot Water	Other Reagents
441	2.015	d.	....	$16.1^{0°}$	$18.4^{100°}$	i. al., et.
442	1.7	d. 675	....	d.	....	d. a.; i. bz.
443	2.2	$-H_2O$, 580	....	$0.185^{0°}$	$0.077^{100°}$	s. NH_4Cl
444	....	d.	....	delq.; d.	d.	d. a.
445	....	$-2H_2O$, 200	....	i.	....	s. HCl, $H_4P_2O_6$
446	....	d.	....	17	s.	i. al.
447	$4.591^{15°}$	d.	....	$0.12^{5°}$	$0.67^{90°}$	s. HNO_3
448	$3.956\frac{25°}{4}$	575	718	$182^{0°}$	$426^{100°}$	s. a., abs. al., act.
449	....	42	160	$754^{0°}$	v. s.	v. s. al.
450	....	$-3H_2O$, 100	....	10.5	∞	∞ h. al.; i. et.
451	2.872	d. 730-760	....	$0.032^{18°}$	....	....
452	3.3	1391	....	i.	i.	....
453	4.35	....	....	i.	....	s. a.; i. al.
454	2.36	561	....	$102^{0°}$	$376^{151°}$	$14^{15°}$ al.; s. amyl al., NH_3
455	1.82	42.7	....	$266^{0°}$	v. s.	....
456	$2.63^{17°}$	900	....	d.	d.	s. dil. a.; i. abs. al.
457	$2.23^{34°}$	....	....	$77^{0°}$	$417^{90°}$	s. 90% al.
458	$2.2^{4°}$	d.	....	$0.00067^{13°}$	$0.0014^{95°}$	s. a.; i. ac.
458.1	2.2	$-H_2O$, 200	....	i.	i.	s. a.; i. ac.
459	3.32	2570	2850	forms $Ca(OH)_2$	....	s. a.; i. al.
459.1	....	....	....	$188.6^{25°}$	v. s.	$166.2^{25°}$ al.; $237.4^{25°}$ m. al.; v. sl. s. et.
460	....	$-8H_2O$, 100	expl. 275	sl. s.	d.	s. a. d.; i. al., et.
461	2.4	d.	....	$331^{14°}$	$388^{25°}$	d. al.
462	$2.220\frac{16°}{4}$	$-H_2O$, 100	d. 200	....	d.	....
463	$2.306\frac{16°}{4}$	d.	....	$0.02^{24.5°}$	$0.075^{100°}$	....
464	3.14	1670	....	0.0025	d.	s. a.; i. al., ac.
465	2.82	975	....	i.	i.	i. a.
466	3.09	1230	....	i.	....	s. a.
467	2.25	....	....	sl. s.	....	s. a.; i. NH_4Cl
468	$2.51^{15°}$	>1600	....	d.	....	s. dil. a.; i. al., et.
469	....	$-3H_2O$, 200-300	....	sl. s.	d.	s. NH_4Cl
470	5.71(97%)	d.	....	i.	....	s. a.
471	....	....	....	sl. s.	....	....
472	2.60	....	....	0.25	d.	s. a.
473	....	$-H_2O$, 120	....	s.	....	i. al.
474	2.676	....	....	$9.4^{0°}$	$6.1^{70°}$	....
475	2.905	1540	....	$0.0095^{17°}$	....	s. HCl
476	2.915	tr. 1190 to α	....	....	....	....
477	2.5	....	....	i.	d.	....
478	$2.662^{17.5°}$	....	....	sl. s. d.	....	s. HCl, HF, al.
479	2.25	....	....	d.	....	s. H_2SiF_6
480	....	$-2H_2O$, 80	....	....	d.	....
481	2.96	1450(mn.)	tr. 1193 to rhb.	$0.298^{20°}$	$0.1619^{100°}$	s. a., $Na_2S_2O_3$, NH_4 salts

Calcium phosphate, tertiary 464
Calcium phosphite, hypo- 446
Calcium sulfocyanate 489
Calcium sulfocyanide 489
Calomel 1344
Calx 459
Canton's phosphorus 485
Caput mortum 824

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Calcium			
482	sulfate (plaster of Paris)	$CaSO_4 \cdot \frac{1}{2}H_2O$	145.15	wh. pd.
483	sulfate (gypsum)	$CaSO_4 \cdot 2H_2O$	172.17	col., mn., 1.5226
484	sulfhydrate	$Ca(SH)_2 \cdot 6H_2O$	214.31	col. pr.
485	sulfide (oldhamite)	CaS	72.14	col., cb.
486	sulfite	$CaSO_3 \cdot 2H_2O$	156.17	wh., cr., 1.595
487	tartrate	$CaC_4H_4O_6 \cdot 4H_2O$	260.22	col., rhb.
488	thiocarbonate	$CaCS_3$	148.27	yel.
489	thiocyanate	$Ca(CNS)_2 \cdot 3H_2O$	210.28	wh., delq. cr.
490	thiosulfate	$CaS_2O_3 \cdot 6H_2O$	260.30	col., tri., 1.56
491	tungstate (scheelite)	$CaWO_4$	288.00	wh., tet., 1.9200
492	**Carbon,** cf. table of organic compounds	....	.....	....
493	**Carbon,** amorphous	C	12.01	bk., amor.
494	**Carbon,** diamond	C	12.01	col., cb., 2.4195
495	**Carbon,** graphite	C	12.01	bk., hex.
496	dioxide†	CO_2	44.01	col. gas
497	disulfide	CS_2	76.13	col. lq.
498	monoxide	CO	28.01	col., poisonous, odorless gas
499	monosulfide	CS	44.07	red pd.
500	oxybromide	$COBr_2$	187.84	lq.
501	oxychloride (phosgene)	$COCl_2$	98.92	poisonous gas
502	oxysulfide	COS	60.07	gas
503	selenosulfide	$CSSe$	123.03	yel. lq.
504	silicide	CSi_2	68.13	gray cr.
505	suboxide	C_3O_2	68.03	gas
506	tellurosulfide	$CSTe$	171.68	yel.-red lq.
507	thionyl chloride	$CSCl_2$	114.98	yel.-red lq.
508	thionyl perchloride	$CSCl_4$	185.90	golden yel. lq.
509	**Ceric** carbide	CeC_2	164.15	red, hex.
510	fluoride (fluocerite)	$CeF_4 \cdot H_2O$	234.15	brn., amor. or hex. 1.614
511	hydroxide	$2CeO_2 \cdot 3H_2O$	398.31	yel., gelatinous
512	hydroxynitrate	$Ce(OH)(NO_3)_3 \cdot 3H_2O$	397.21	red, mn.
513	oxide	CeO_2	172.13	wh. or pa. yel., cb.
514	peroxide	CeO_3	188.13	red
515	silicide	$CeSi_2$	196.25	....
516	sulfate	$Ce(SO_4)_2 \cdot 4H_2O$	404.31	yel., rhb.
517	**Cerium**	Ce	140.13	steel gray, cb. or hex.
518	**Cerous** acetate	$Ce(C_2H_3O_2)_3$	317.26	col.
519	acetate	$Ce_2(C_2H_3O_2)_6 \cdot 3H_2O$	688.57	col. nd.

† Cf. special table.

Carbon bisulfide 497
Carbon sulfoselenide 503
Carbon sulfotelluride 506
Carbon tetrachloride, cf. organic table
Carbonado 494
Carbonic acid 496 (aq. soln.)
Carbonic anhydride 496
Carbonyl bromide 500
Carbonyl chloride 501
Carbonyl sulfide 502
Carnallite 1218
Cassel's green 258

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Cold Water	Hot Water	Other Reagents
482	....	$-\frac{1}{2}H_2O$, 163	....	$0.3^{20°}$	sl. s.	s. a., $Na_2S_2O_3$, NH_4 salts
483	2.32	$-1\frac{1}{2}H_2O$, 128	$-2H_2O$, 163	$0.223^{0°}$	$0.257^{50°}$	s. a., gly., $Na_2S_2O_3$, NH_4 salts
484	....	d. 15	....	v. s.	v. s.	s. al.
485	$2.8^{15°}$	....	....	d.	d.	s. a.
486	....	$-2H_2O$, 100	d. 650	$0.0043^{18°}$	$0.0027^{90°}$	s. H_2SO_3
487	....	d.	....	$0.037^{0°}$	$0.22^{85°}$	sl. s. al.
488	....	....	....	s.	....	s. al.
489	....	....	....	s.	v. s.	v. s. al.
490	$1.873^{16°}$	d.	....	$71.2^{9°}$	d.	i. al.
491	6.06	....	....	0.2	....	s. NH_4Cl; i. a.
492	....	....	....	....	....	....
493	1.8-2.1	>3500	4200	i.	i.	i. a., alk.
494	$3.51^{20°}$	>3500	4200	i.	i.	i. a., alk.
495	$2.26^{20°}$	>3500	4200	i.	i.	i. a., alk.
496	lq.$1.101^{-37°}$; 1.53(A); solid $1.56^{-79°}$	$-56.6^{5.2 atm.}$	subl. −78.5	$179.7^{0°}$cc	$90.1^{20°}$cc	s. a., alk.
497	lq.$1.261^{\frac{22}{20}°}$; 2.63(A)	−108.6	46.3	$0.2^{0°}$	$0.014^{50°}$	s. al., et.
498	lq. $0.814^{\frac{-195°}{4}}$; 0.968(A)	−207	−192	$0.0044^{0°}$; $3.5^{0°}$ cc	$0.0018^{50°}$ $2.32^{20°}$cc	s. al., Cu_2Cl_2
499	1.66	d.	....	i.	....	s. et., CS_2; i. al.
500	2.44	−80	64-5	v. s. d.	d.	....
501	$1.392^{19°}_{4}$	−104	8.2^{756mm}	v. s. sl. d.	d.	s. ac., CCl_4, bz.; d. a.
502	lq.$1.24^{87°}$; 2.10 (A)	−138.2	-50.2^{760mm}	$133^{0°}$cc	$40.3^{30°}$cc	v. s. alk., al.
503	1.98	−85	84.5	i.	i.	s. CS_2; sl. s. al.
504	2.5	....	....	d.	....	s. HNO_3, H_2SO_4; i. al., et.
505	lq. $1.114^{0°}$	−107	7^{761mm}	d.	....	s. et.
506	$2.9^{-50°}$	−54	d.	....	....	s. CS_2, bz.
507	$1.509^{15°}$	....	73.5	....	....	....
508	$1.712^{13°}$	....	146	....	d.	....
509	5.23	....	....	d.	....	s. a.
510	4.5-5.0	d.	....	i.	....	....
511	....	....	....	....	....	s. a.; sl. s. alk. carb.; i. alk.
512	....	....	....	d.	....	....
513	7.3	1950	....	i.	i.	s. H_2SO_4, HCl
514	....	....	....	....	....	....
515	$5.67^{17°}$	....	....	i.	....	....
516	3.91	....	....	s. d.	....	s. dil. H_2SO_4
517	$6.9^{20°}$ cb.; 6.7 hex.	645	1400	i.	slowly oxidized	s. dil. a.; i. al.
518	....	308 d.	....	$20^{15°}$	$12^{75°}$	....
519	....	$-3H_2O$, 115	d.	$26.45^{15°}$	$16.2^{76°}$	....

Cassiopeium 1164
Cassiterite 2182
Cat's eye 1947
Caustic alcohol 2061
Caustic antimony 143
Caustic potash 1697
Caustic soda 2075
Celestite 2249
Cementite 1014
Cerargyrite 1968
Ceric nitrate, basic 512
Ceric oxide, hydrated 511
Cerium dioxide 513
Cerium sesquioxide 531
Cerium trioxide 514

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Cerous			
520	bromate	$Ce(BrO_3)_3 \cdot 9H_2O$	686.02	col., hex.
521	bromide	$CeBr_3 \cdot H_2O$	397.89	col., delq. nd.
522	carbonate	$Ce_2(CO_3)_3 \cdot 5H_2O$	550.37	wh. pd.
523	chloride	$CeCl_3$	246.50	wh., delq.
524	dithionate	$Ce_2(S_2O_6)_3 \cdot 15H_2O$	1030.86	tri., 1.507
525	fluoride	CeF_3	197.13	....
526	hydroxide	$2Ce(OH)_3 \cdot 3H_2O$	436.36	....
527	iodide	$CeI_3 \cdot 9H_2O$	683.03	col. cr.
528	molybdate	$Ce_2(MoO_4)_3$	760.11	yel., tet., 2.04
529	nitrate	$Ce(NO_3)_3 \cdot 6H_2O$	434.25	col., delq.
530	oxalate	$Ce_2(C_2O_4)_3 \cdot 9H_2O$	706.46	wh. pd.
531	oxide	Ce_2O_3	328.26	wh. pd.
532	oxychloride	$Ce_2O_3 \cdot 2CeCl_3$	821.26	purple
533	phosphate (monazite)	$CePO_4$	235.11	rhb. or mn., 1.788
534	phosphate, meta-	$Ce(PO_3)_3$	377.07	....
535	selenate	$Ce_2(SeO_4)_3$	709.14	rhb.
536	sulfate	$Ce_2(SO_4)_3$	568.44	wh., mn. or rhb.
537	sulfate	$Ce_2(SO_4)_3 \cdot 8H_2O$	712.57	tri.
538	sulfide	Ce_2S_3	376.44	yel. cr.
539	tungstate	$Ce_2(WO_4)_3$	1024.02	yel., tet.
540	**Cesium**	Cs	132.91	silv. met., hex.
541	bicarbonate	$CsHCO_3$	193.92	rhb.
542	bromate	$CsBrO_3$	260.83	....
543	bromide	$CsBr$	212.83	cb., 1.582, 1.6984
544	bromide, tri-	$CsBr_3$	372.66	rhb.
545	bromoiodide	$CsBrI_2$	466.67	....
546	carbonate	Cs_2CO_3	325.82	wh., delq.
547	chloraurate	$CsAuCl_4$	471.94	yel., mn.
548	chloride	$CsCl$	168.37	col., delq., cb., 1.534, 1.6418
549	chloroplatinate	Cs_2PtCl_6	673.79	yel., cb.
550	chromate	Cs_2CrO_4	381.83	yel., mn.
551	cyanide	$CsCN$	158.92	col.
552	fluoride	CsF	151.91	col., cb., 1.48, 1.578
553	hydride	CsH	133.92	cr.
554	hydroxide	$CsOH$	149.92	gray, delq.
555	iodate	$CsIO_3$	307.83	mn.
556	iodide	CsI	259.83	cb., 1.661, 1.7876
557	iodide, tri-	CsI_3	513.67	rhb.
558	mercuric bromide	$CsBr \cdot 2HgBr_2$	933.71	....
559	mercuric chloride	$CsCl \cdot HgCl_2$	439.89	cb. or rhb.
560	nitrate	$CsNO_3$	194.92	wh., hex., 1.55
561	nitrite	$CsNO_2$	178.92	yel. cr.
562	oxide, mono-	Cs_2O	281.72	or.-red.
563	oxide, di-	Cs_2O_2	297.72	pa. yel. nd.
564	oxide, tri-	Cs_2O_3	313.72	chocolate brn.
565	oxide, tetra-	Cs_2O_4	329.82	yel. cr.
566	perchlorate	$CsClO_4$	232.37	col., rhb., 1.4788
567	periodate	$CsIO_4$	323.83	rhb. pl.
568	permanganate	$CsMnO_4$	251.84	vl., rhb.

Cerous chloride, basic 532
Ceruse 1055
Cerussite 1054
Cesium alum 42
Cesium aurichloride 547
Cesium bisulfate 572
Cesium bitartrate 578
Cesium carbonate, acid 541
Cesium fluosilicate 569
Cesium iodobromide 545
Chalcanthite 760

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
520	....	49	d.	s.	s.	....
521	....	d.	....	v. s.	v. s.	v. s. al.
522	....	....	....	i.	....	s. $(NH_4)_2CO_3$
523	$3.92_{4}^{0^{\circ}}$	822	....	100	d.	30, al.; s. act.
524	2.288	....	....	....	....	....
525	5.8	1324	....	i.	....	....
526	....	....	....	....	....	s. a., $(NH_4)_2CO_3$; i. alk.
527	....	....	d.	s. d.	....	s. al.
528	$5.03_{18}^{18^{\circ}}$	973	....	....	....	....
529	....	$-3H_2O$, 100	d. 200	s.	v. s.	50, al.; s. act.
530	....	$-8H_2O$, 110	....	$0.000041^{25^{\circ}}$	....	s. dil. h. HCl; i. $H_2C_2O_4$
531	6.9 to 7.0	....	....	i.	....	s. H_2SO_4
532	....	....	....	i.	....	s. dil. a.
533	5.22	....	....	i.	i.	s. a.
534	3.27	....	....	....	....	....
535	4.456	....	....	$39.55^{0^{\circ}}$	$2.513^{100^{\circ}}$	....
536	3.91	....	....	$18.98^{0^{\circ}}$	$0.4^{100^{\circ}}$	....
537	$2.886^{17^{\circ}}$	$-8H_2O$, 630	....	$25^{0^{\circ}}$	$7.6^{40^{\circ}}$	....
538	$5.020^{11^{\circ}}$	d.	....	i.	d.	s. dil. a.
539	$6.77^{16.5^{\circ}}$	1089	....	....	....	....
540	$1.90^{20^{\circ}}$	28.5	670	d.	....	s. a., al., NH_3
541	....	$-\frac{1}{2}CO_2$,175	....	$210^{15^{\circ}}$	v. s.	s. al.
542	$4.10^{19.5^{\circ}}$	420	....	$3.66^{25^{\circ}}$	$5.32^{35^{\circ}}$	....
543	4.433	636	1300	$123^{25^{\circ}}$	....	d. al.
544	....	180	....	....	s.	....
545	....	195.5	....	d.	....	s. al.
546	....	d. 610	....	$260.7^{20^{\circ}}$	v. s.	$11.1^{19^{\circ}}$, $20.1^{79^{\circ}}$ al.
547	....	....	....	$0.5^{10^{\circ}}$	$27.5^{100^{\circ}}$	s. al.
548	$3.97^{20^{\circ}}$	646	1290	$161.4^{0^{\circ}}$	$270.5^{100^{\circ}}$	s. al.
549	....	....	....	$0.024^{0^{\circ}}$	$0.377^{100^{\circ}}$	....
550	4.237	....	....	$71.35^{13^{\circ}}$	$88.66^{30^{\circ}}$	....
551	....	....	....	s.	....	i. al.
552	$3.586_{4}^{75^{\circ}}$	683	1250	$366.5^{18^{\circ}}$	....	i. al.
553	2.7	d.	....	d.	....	d. a.
554	$3.675^{11^{\circ}}$	272	....	$385^{15^{\circ}}$	$305.3^{30^{\circ}}$	s. al.
555	4.85	....	....	$2.6^{24^{\circ}}$	....	....
556	$4.51_{4}^{25^{\circ}}$	621	1280	$44^{0^{\circ}}$	$160^{61^{\circ}}$	s. al.
557	....	207.5	....	v. sl. s.	....	....
558	....	....	....	$0.807^{16^{\circ}}$	....	sl. s. al.
559	....	....	....	$1.44^{17^{\circ}}$	....	i. abs. al.
560	$3.687_{4}^{28^{\circ}}$	414	d.	$9.3^{30^{\circ}}$	$197^{100^{\circ}}$	s. act.; sl. s. abs. al.
561	....	....	....	v. s.	v. s.	....
562	4.36	360 to 400 d.	....	v. s.	d.	reduced by H_2
563	$4.47^{15^{\circ}}$	400 to 500	$-O$, 650	s.	d.	....
564	$4.25^{0^{\circ}}$	400	....	d.	....	....
565	$3.77^{19^{\circ}}$	600	d.	d.	....	....
566	3.327	d.	....	$0.8^{0^{\circ}}$	$30^{100^{\circ}}$	$0.011^{25^{\circ}}$, al.; $0.15^{25^{\circ}}$, act.; i. et.
567	$4.259_{4}^{15^{\circ}}$	....	....	$2.15^{15^{\circ}}$	>2.15	....
568	$3.597^{10.3^{\circ}}$	d. 320	....	$0.093^{0^{\circ}}$	$1.31^{60^{\circ}}$	....

Chalcedony 1947
Chalcocite 779
Chalk 427
Chamber crystals 1471
Chile niter 2097
Chile saltpeter 2097
Chinese blue 815
Chinese oxide 2560
Chinese red 1061
Chinese vermilion 1334
Chinese white 2560
Chloralum 11

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Cesium			
569	silicofluoride	Cs_2SiF_6	407.88	cb.
570	silicotungstate	$Cs_8SiW_{12}O_{42}$	3970.38	wh. cr.
571	sulfate	Cs_2SO_4	361.88	wh., rhb. nd., 1.5644
572	sulfate, acid	$CsHSO_4$	229.98	rhb.
573	sulfide	$Cs_2S \cdot 4H_2O$	369.94	wh., delq.
574	sulfide di-	Cs_2S_2	329.94	dark red, amor., hyg.
575	sulfide, di-	$Cs_2S_2 \cdot H_2O$	347.96	cr.
576	sulfide, tri-	Cs_2S_3	362.00	or.
577	sulfide, penta-	Cs_2S_5	426.12	....
578	tartrate, acid	$CsHC_4H_4O_6$	281.99	rhb.
579	**Chloric acid**	$HClO_3 \cdot 7H_2O$	210.58	lq.
580	**Chlorine**	Cl_2	70.91	rhb., or gn.-yel. gas
581	hydrate	$Cl_2 \cdot 8H_2O$	215.04	rhb.
582	oxide, mono-	Cl_2O	86.91	yel.-red gas or red-brn. lq.
583	oxide, di- or per-	ClO_2	67.46	red-yel. gas
584	oxide, hepta-	Cl_2O_7	182.91	col. lq.
585	oxide, tetra-	ClO_4(?)	99.46	....
586	**Chloroplatinic acid**	$H_2PtCl_6 \cdot 6H_2O$	518.08	red-brn., delq.
587	**Chlorostannic acid**	$H_2SnCl_6 \cdot 6H_2O$	441.55	delq.
588	**Chlorosulfonic acid**	$HO \cdot SO_2 \cdot Cl$	116.52	col. lq.
589	**Chromic** acetate	$Cr_2(C_2H_3O_2)_6 \cdot 2H_2O$	494.32	gn.
590	arsenide	$CrAs$	126.92	gray, hex.
591	boride	CrB	62.83	silv. cr.
592	bromide	$CrBr_3$	291.76	olive gn., hex.
593	bromide	$CrBr_3 \cdot 6H_2O$	399.85	gn., hex. pl.
594	carbide	Cr_3C_2	180.05	gray cr.
595	chloride	$CrCl_3$	158.38	pink, trig.
596	chloride	$CrCl_3 \cdot 6H_2O$*	266.48	vl. or gn., hex. pl.
597	fluoride	CrF_3	109.01	gn., rhb.
598	hydroxide	$Cr(OH)_3$	103.03	gn. or blue, gelatinous
599	hydroxide	$Cr(OH)_3 \cdot 2H_2O$	139.07	gn.
600	nitrate	$Cr(NO_3)_3 \cdot 9H_2O$*	400.18	purple pr.
601	nitrate	$Cr(NO_3)_3 \cdot 7\frac{1}{2}H_2O$	373.15	purple, mn.
602	nitride	CrN	66.02	amor.
603	oxide	Cr_2O_3	152.02	dark gn., hex.
604	phosphate	$CrPO_4 \cdot 3H_2O$	201.04	blue-gn.
605	phosphate	$CrPO_4 \cdot 6H_2O$	255.09	vl., tri.
606	phosphide	CrP	82.99	gray-bk.
607	silicide	Cr_3Si_2	212.15	gray, tet.
608	sulfate	$Cr_2(SO_4)_3$	392.20	rose pd.
609	sulfate	$Cr_2(SO_4)_3 \cdot 5H_2O$	482.28	gn.
610	sulfate	$Cr_2(SO_4)_3 \cdot 15H_2O$	662.44	vl.
611	sulfate	$Cr_2(SO_4)_3 \cdot 18H_2O$	716.49	vl., cb., 1.564

* Usual commercial form.

Chloride of lime 444

Chlorinated lime 444

Chlorine iodide 984

Chloromagnesite 1190

Chrome alum 45

Chrome green 603

Chrome red 1061

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
569	$3.3756^{18°}$	....	....	$60^{17°}$	<60	i. al.
570	....	....	....	$0.005^{20°}$	$0.52^{100°}$	sl. s. NH_4OH; i. HCl, al.
571	$4.243^{20°}_{4}$	1010	tr. to hex. 660	$167^{0°}$	$220^{100°}$	i. al., act.
572	$3.352^{16°}$	d.	....	s.	....	....
573	....	....	....	v. s.	v. s.	....
574	....	460	>800	s.	s.	....
575	....	....	....	s.	s.	....
576	....	217	>800	s.	....	....
577	$2.806^{16°}$	210	....	....	....	s. al.
578	....	....	....	$9.7^{25°}$	$98^{100°}$	....
579	$1.282^{14.2°}$	<−20	d. 40	v. s.	....	....
580	lq. $1.56^{-33.6°}$; $2.49^{0°}$(A)	−101.6	−34.6	$1.46^{0°}$; $310^{10°}$cc	$0.57^{30°}$; $177^{30°}$cc	s. alk.
581	1.23	d. 9.6	....	s.	....	s. alk.
582	2.9(A)	−20	3.8^{766mm} expl.	$20000^{0°}$ cc	forms HOCl	s. alk., H_2SO_4; expl. with C compds.; d. HCl
583	$2.4^{11°}$(A)	−76	9.9^{730mm}; expl. 100	$2000^{4°}$	forms Cl_2, O_2, $HClO_3$	s. alk., H_2SO_4; expl. with C compds.
584	....	....	82; expl.	s. d.	....	s. bz.
585	....	....	d.	....	....	formed from $AgClO_4 + I_2$
586	2.431	60	....	v. s.	v. s.	s. al., et.
587	$1.971^{28°}$	19.2	....	s.	....	....
588	$1.787^{25°}$	−80	151.5^{765mm}	d.	....	d. al.; i. CS_2
589	....	....	....	s.	....	$4.76^{15°}$ m. al.
590	$6.35^{16°}_{4}$	....	....	i.	i.	i. a.
591	$5.4^{17°}$	....	....	i.	....	i. dil. a.; d. by F_2
592	$4.25^{25°}_{4}$	....	....	i.†	sl. s.	v. s. al.
593	$5.4^{17°}$	....	....	200	....	v. s. al., fused Na_2O_2; i. et.
594	6.68	1890	3800	i.	i.	s. dil. HCl
595	$2.757^{15°}$	....	1200-1500 d.	i.†	sl. s.	i. a., act., CS_2
596	$1.835^{25°}_{4}$	subl. 83	....	v. s. d.	....	s. al.; i. et.
597	3.8	>1000	d.	i.	....	sl. s. a.; i. al., NH_3
598	....	....	....	i.	....	s. a., alk.; sl. s. NH_3
599	....	$-2H_2O$, 100	....	i.	i.	s. a., alk.
600	....	36.5	d. 100	s.	s.	s. a., alk., al., act.
601	....	100	d.	s.	s.	....
602	$5.8^{25°}_{4}$	d. 1500	....	i.	i.	i. a., alk.
603	5.21	1900	....	i.	i.	sl. s. a.
604	....	....	....	sl. s.	....	s. a., alk.; i. ac.
605	2.121	$-3\frac{1}{2}H_2O$, 100	....	sl. s.	....	s. a., alk.; i. ac.
606	$5.7^{15°}$	....	....	i.	....	s. $HNO_3 + HF$; i. a.
607	$5.6^{0°}$	....	....	i.	i.	s. HCl, HF; i. H_2SO_4, HNO_3
608	3.012	....	....	i.†	....	i. a.
609	....	....	....	s.	....	s. al., H_2SO_4
610	$1.867^{17°}$	100	$-10H_2O$, 100	s.	d. 67°	sl. s. al.
511	$1.7^{22°}$	....	$-12H_2O$, 100	$120^{20°}$	d.	s. al.

† Also a soluble modification.

Chrome yellow 1060
Chromic acid 617

Chromic ammonium sulfate 40
Chromic (acid) anhydride 617

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Chromic			
612	sulfide	Cr_2S_3	200.02	brn.-bk. pd.
613	sulfite	$Cr_2(SO_3)_3$	344.20	greenish-wh.
614	**Chromium**	Cr	52.01	gray, met., cb.
615	dioxide	CrO_2	84.01	brn. or bk. pd.
616	tetrasulfide	Cr_3S_4	284.27	gray-bk. pd.
617	trioxide (chromic acid)	CrO_3	100.01	red, rhb.
618	**Chromous** carbonate	$CrCO_3$	112.02	blue-gn., amor.
619	chloride	$CrCl_2$	122.92	wh., delq.
620	fluoride	CrF_2	90.01	gray, mn.
621	hydroxide	$Cr(OH)_2$	86.03	yel.-brn.
622	iodide	CrI_2	305.85	gray-wh.
623	oxalate	$CrC_2O_4 \cdot H_2O$	158.05	yel.-wh. pd.
624	oxide	CrO	68.01	bk. pd.
625	sulfate	$CrSO_4 \cdot 7H_2O$	274.18	blue
626	sulfide (daubrelite)	CrS	84.07	bk. pd.
627	**Chromyl chloride**	CrO_2Cl_2	154.92	dark red lq.
628	**Cobalt**	Co	58.94	silv. met., cb.
629	arsenosulfide (cobaltite)	CoAsS	165.91	cb.
630	boride	CoB	69.76	pr.
631	bromoplatinate	$CoPtBr_6 \cdot 12H_2O$	949.86	trig.
632	carbonyl	$Co(CO)_4$	170.98	or. cr.
633	chloroplatinate	$CoPtCl_6 \cdot 6H_2O$	575.01	trig.
634	chlorostannate	$CoSnCl_6 \cdot 6H_2O$	498.48	rhb. or trig.
635	iodoplatinate	$CoPtI_6 \cdot 9H_2O$	1177.83	trig.
636	phosphide	Co_2P	148.86	nd.
637	silicide	CoSi	87.00	nd.
638	sulfide, di-	CoS_2	123.06	bk., cb.
639	**Cobaltic** chloride	$CoCl_3$	165.31	red cr.
640	chloride, dichro	$Co(NH_3)_3Cl_3 \cdot H_2O$	234.42	....
641	chloride, luteo	$Co(NH_3)_6Cl_3$	267.50	or., mn.
642	chloride, praseo	$Co(NH_3)_4Cl_3 \cdot H_2O$	251.46	gn., rhb.
643	chloride, purpureo	$Co(NH_3)_5Cl_3$	250.47	rhb.
644	chloride, roseo	$Co(NH_3)_5Cl_3 \cdot H_2O$	268.49	brick red
645	hydroxide	$Co(OH)_3$	109.96	bk.
646	oxide	Co_2O_3	165.88	bk.
647	sulfate	$Co_2(SO_4)_3$	406.06	blue cr.
648	sulfate	$Co_2(SO_4)_3 \cdot 18H_2O$	730.35	blue-gn.
649	sulfide	Co_2S_3	214.06	bk. cr.
650	**Cobalto-cobaltic oxide**	Co_3O_4	240.82	bk., cb.
651	**Cobaltous** acetate	$Co(C_2H_3O_2)_2 \cdot 4H_2O$	249.09	red-vl., mn., 1.542
652	ammonium chloride	$CoCl_2 \cdot NH_4Cl \cdot 6H_2O$	291.45	red, delq.
653	ammonium sulfate	$CoSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	395.24	red, mn., 1.4953
654	arsenate (erythrite)	$Co_3(AsO_4)_2 \cdot 8H_2O$	598.77	red, mn., 1.661
655	arsenite, acid	$Co_3H_6(AsO_3)_4 \cdot H_2O$	692.52	rose red
656	bromate	$Co(BrO_3)_2 \cdot 6H_2O$	422.87	red, oct.
657	bromide	$CoBr_2$	218.77	gn., delq.
658	bromide	$CoBr_2 \cdot 6H_2O$	326.87	red, delq.

*Usual commercial form
Chromium potassium sulfate 45
Chromium sesquioxide 603
Chromous oxychloride 627
Cinnabar 1334
Cinnabar, Austrian 1061
Citric acid, cf. organic table
Citron yellow 2542
Claudetite 183
Clausthalite 1097
Cobalt black 646
Cobaltic boride 630

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
612	$3.77^{19°}$	−S, 1350	....	i.	d.	s. h. HNO_3
613	2.2	d.	....	....	....	....
614	7.1	1615	2200	i.	i.	s. HCl, dil. H_2SO_4; i. HNO_3
615	....	−O, 300	....	i.	....	s. HNO_3
616	....	....	....	i.	....	s. HNO_3; i. HCl, dil. H_2SO_4
617	2.70	197 d.	....	$164.9^{0°}$	$206.7^{100°}$	s. H_2SO_4, al. et.
618	....	....	....	v. sl. s.	....	i. et.
619	2.75	....	....	v. s.	v. s.	sl. s. al.; i. et.
620	4.11	1100	>1300	sl. s.	....	s. h. HCl; i. abs. al.
621	....	d.	....	d.	....	s. conc. a.
622	5.2	....	....	v. s.	....	....
623	2.46	....	....	....	s.	s. dil. a.
624	....	....	....	i.	i.	i. dil. HNO_3
625	....	....	....	$12.35^{0°}$	....	sl. s. al.
626	3.97	1550	....	i.	....	v. s. a.
627	1.92	−96.5	117.6	d.	....	s. et.
628	$8.9^{20°}$	1480	2900	i.	i.	s. a.
629	6.2	d.	....	....	....	....
630	$7.25^{18°}$	....	....	d.	....	s. HNO_3
631	2.762	....	....	....	....	....
632	$1.73^{18°}$	51	d. 52	i.	d.	s. al., et., CS_2
633	2.699	d.	....	....	....	....
634	2.699	d. 100	....	....	....	....
635	3.618	....	....	....	....	....
636	$6.4^{15°}$	....	....	i.	i.	s. HNO_3
637	$6.30^{\frac{20}{4}°}$	....	....	....	....	s. HCl; i. HNO_3, H_2SO_4
638	4.269	....	....	i.	....	s. HNO_3, aq. reg.
639	2.94	subl.	....	s.	s.	....
640	....	....	....	s.	....	s. a., al.
641	$1.7016^{20°}$	....	....	$4.26^{0°}$	$12.74^{46.5°}$	i. al., NH_4OH
642	1.847	....	....	v. s.	....	s. a.; i. al.
643	$1.819^{\frac{25}{25}°}$	....	....	$0.232^{0°}$	$1.031^{46.5°}$	i. al.
644	....	d. 100	....	$16.12^{0°}$	$24.87^{16°}$	sl. s. HCl
645	....	$-1\frac{1}{2}H_2O$, 100	....	i.	i.	s. a.; i. al.
646	5.18	d. 900	....	i.	i.	s. a.
647	....	....	....	d.	....	s. H_2SO_4
648	....	....	....	s. d.	....	s. H_2SO_4
649	4.8	....	....	i.	....	d. a.
650	6.07	....	....	i.	i.	s. H_2SO_4; i. HCl, HNO_3
651	$1.7053^{18.7°}$	$-4H_2O$, 140	....	s.	s.	s. a., al.
652	....	....	....	s.	v. s.	....
653	1.901	....	....	$20.5^{20°}$	$45.4^{80°}$	i. al.
654	2.912	....	....	i.	i.	s. a., NH_4OH
655	....	$-H_2O$, 100	....	i.	....	s. a.
656	....	....	....	$45.5^{17°}$	....	s. NH_4OH
657	$4.909^{\frac{25}{4}°}$	d.	....	$91.9^{0°}$	$257^{100°}$	s. a., et., al.
658	....	$-4H_2O$, 100	$-6H_2O$, 130	s.	v. s.	s. a., et., al.

Cobaltic potassium cyanide 1675
Cobaltic potassium nitrite 1676
Cobaltic sodium nitrite 2057
Cobaltite 629
Cobaltous bifluoride 670
Cobaltous bromoplatinate 631

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Cobaltous			
659	carbonate (spherocobaltite)	$CoCO_3$	118.95	red, trig.
660	carbonate, basic	$2CoCO_3\cdot 3Co(OH)_2$	516.77	red
661	chlorate	$Co(ClO_3)_2\cdot 6H_2O$	333.95	red, cb., 1.55
662	chloride	$CoCl_2$	129.85	blue cr.
663	chloride	$CoCl_2\cdot 6H_2O$*	237.95	red, mn.
664	chromate	$CoCrO_4$	174.95	yel.-brn.
665	chromate	$2CoO\cdot CrO_3\cdot 2H_2O$	285.92	....
666	cyanide	$Co(CN)_2\cdot 2H_2O$	147.01	buff
667	ferricyanide	$Co_3[Fe(CN)_6]_2$	600.74	red
668	ferrocyanide	$Co_2Fe(CN)_6\cdot 7H_2O$	455.95	gray-gn.
669	fluoride	$CoF_2\cdot 2H_2O$	132.97	rose red, mn.
670	fluoride, acid	$CoF_2\cdot 5HF\cdot 6H_2O$	305.08	or.-red, trig.
671	hydroxide	$Co(OH)_2$	92.96	rose red, rhb.
672	iodate	$Co(IO_3)_2$	408.78	vl. nd.
673	iodate	$Co(IO_3)_2\cdot 6H_2O$	516.88	red, oct.
674	iodide	CoI_2	312.78	delq.
675	iodide	$CoI_2\cdot 2H_2O$	348.81	gn., delq.
676	iodide	$CoI_2\cdot 6H_2O$	420.88	red, hex.
677	nitrate	$Co(NO_3)_2\cdot 6H_2O$	291.05	red, mn., 1.4
678	oxalate	CoC_2O_4	146.96	red-wh.
679	oxide	CoO	74.94	brn., cb.
680	perchlorate	$Co(ClO_4)_2$	257.85	red nd.
681	perchlorate	$Co(ClO_4)_2\cdot 6H_2O$	365.95	red, hex., 1.55±
682	phosphate	$Co_3(PO_4)_2$	366.78	reddish
683	phosphate	$Co_3(PO_4)_2\cdot 8H_2O$	510.91	red pd.
684	phosphite, ortho-	$CoHPO_3\cdot 2H_2O$	174.96	red-wh.
685	potassium bicarbonate	$CoCO_3\cdot KHCO_3\cdot 4H_2O$	291.13	rose cr.
686	selenide	$CoSe$	137.90	yel. cr.
687	silicate, ortho-	Co_2SiO_4	209.94	ruby red
688	silicide	Co_2Si	145.94	....
689	silicofluoride	$CoSiF_6\cdot 6H_2O$	309.10	pa. red, trig.
690	sulfate	$CoSO_4$	155.00	red pd.
691	sulfate	$CoSO_4\cdot H_2O$	173.02	red pd., mn.(?), 1.639
692	sulfate (biebeorite)	$CoSO_4\cdot 7H_2O$*	281.11	red, mn., 1.483
693	sulfide (syeporite)	CoS	91.00	brn. nd.
694	sulfite	$CoSO_3\cdot 5H_2O$	229.08	red
695	**Columbic acid**	$3Cb_2O_5\cdot 7H_2O$	923.57	wh., amor.
696	**Columbium (Niobium)**	$Cb(Nb)$	92.91	steel gray
697	bromide	$CbBr_5$	492.49	purple-red
698	chloride	$CbCl_5$	270.20	yel., delq. nd.
699	fluoride	CbF_5	187.91	col., mn.
700	hydride	CbH	93.92	gray pd.
701	nitride	CbN	106.92	bk.
702	oxalate, acid	$Cb(HC_2O_4)_5$	538.05	mn.
703	oxide, mono-	CbO	108.91	bk., cb.
704	oxide, di-	CbO_2	124.91	bk.
705	oxide, penta-	Cb_2O_5	265.82	wh. cr.
706	oxybromide	$CbOBr_3$	348.66	yel. cr.

*Usual commercial form.
Cobaltous chloroplatinate 633
Cobaltous chlorostannate 634
Cobaltous fluosilicate 689
Cobaltous iodoplatinate 635
Cobaltous potassium cyanide 1677
Cobaltous potassium sulfate 1678
Cobalt sulfoarsenide 629

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
659	4.13	d.	....	i.	i.	s. a.; i. NH_3
660	....	....	....	i.	d.	s. $(NH_4)_2CO_3$
661	1.92	61	d. 100	$185^{0°}$	v. s.	s. al.
662	3.356	subl.	1049	$45^{7°}$	$105^{96°}$	31 al.; 8.6 act.
663	$1.924^{25°}_{25}$	86	$-6H_2O$, 110	$116.5^{0°}$	$177^{30°}$	v. s. et., act.
664	....	d.	....	i.	....	s. a., NH_4OH
665	....	....	....	d.	....	....
666	....	$-2H_2O$, 280	d. 300	i.	....	s. HCl, NH_4OH, KCN
667	....	....	....	i.	....	s. NH_4OH; i. HCl
668	....	....	....	i.	....	s. KCN; i. HCl
669	4.43(anh.)	....	....	s.	d.	s. HF
670	2.045	....	....	s.	....	....
671	$3.597^{15°}$	d.	....	i.	i.	s. NH_4 salts; i. alk.
672	$5.008^{18°}$	....	....	$1.2^{20°}$	$0.91^{100°}$	....
673	$3.689^{21°}$	61 d.	....	s.	....	....
674	5.68	....	....	$159^{9°}$	$420^{100°}$	v. sl. s. al., act.
675	....	....	....	s.	s.	....
676	2.9	$-6H_2O$, 135	....	s.	s.	....
677	$1.883^{25°}_{25}$	<100	d.	$84.03^{0°}$ (anh.)	$334.9^{90°}$ (anh.)	$100^{12.5°}$ al.; s. act.; sl. s. NH_3
678	$2.325^{19°}_{4}$	d.	....	$0.00346^{25°}$	....	s. a., NH_4OH
679	5.68	d. 1800	....	i.	i.	s. a., NH_4OH; i. al.
680	3.327	....	....	$100^{0°}$	$115^{45°}$	s. al., act.
681	....	143	....	v. s.	....	v. s. al.
682	....	....	....	i.	i.	s. NH_4OH, H_3PO_4
683	....	$-8H_2O$, 250	....	i.	i.	s. H_3PO_4
684	....	....	....	sl. s.	....	....
685	....	....	....	d.	....	....
686	7.65	....	....	....	....	....
687	4.63	....	....	i.	....	s. dil. HCl
688	$7.1^{17°}$	1327	....	....	....	d. a.
689	2.087	....	....	s.	....	....
690	$3.710^{25°}$	d. 880	....	$25.6^{0°}$	$83^{100°}$	$1.04^{18°}$ m. al.; i. NH_3
691	3.13	d.	....	s.	s.	....
692	$1.948^{25°}_{25}$	96.8	$-7H_2O$, 420	$33^{20°}$	s.	$2.5^{3°}$ al.
693	$5.45^{18°}$	>1100	....	$0.00038^{18°}$	....	s. a., aq. reg.
694	....	....	....	i.	....	s. H_2SO_3
695	4.3	d.	....	i.	....	s. H_2SO_4, HF, alk.; i. NH_3
696	$8.4^{20°}$	ign. 1950	>3300	i.	i.	s. h. H_2SO_4; sl. s. HCl, HNO_3
697	....	150	270	d.	....	d. al.
698	2.75	194	240.5	d.	....	s. HCl, CCl_4; d. al.
699	3.29	75.5	229	d.	....	s. HNO_3
700	6.0 to 6.6	d.	....	....	....	s. HF; i. a.
701	....	....	....	....	....	s. HF + HNO_3; i. HNO_3
702	....	....	....	d.	....	s. $H_2C_2O_4$; d. al.
703	6.3 to 6.7	....	....	i.	....	s. H_2SO_4, HCl; i. HNO_3, alk.
704	....	....	....	i.	i.	s. H_2SO_4; i. HNO_3
705	$4.6^{61.2°}_{4}$	1520	....	i.	....	s. H_2SO_4, HF
706	....	subl.	....	d.	....	s. a.

Colcothar 824
Cologne yellow 1060
Columbium binoxalate 702
Columbium pentoxide 705
Columbium pentoxide, hydrated 695
Cooperite 1625

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Columbium (**Niobium**)			
707	oxychloride	$CbOCl_3$	215.28	wh. nd.
708	oxysulfide	Cb_2OS_3	298.00	bk.
709	**Copper**	Cu	63.57	yel.-red met., cb.
710	boride	Cu_3B_2	212.35	yel.
711	hydride	Cu_2H_2	129.16	red-brn.
712	nitride	Cu_3N	204.72	....
713	peroxide	$CuO_2 \cdot H_2O$	113.59	olive gn.
714	suboxide	Cu_4O	270.28	olive gn.
715	**Cupric** acetate	$Cu(C_2H_3O_2)_2$	181.66	....
716	acetate	$Cu(C_2H_3O_2)_2 \cdot H_2O$	199.67	dark gn., mn.
717	acetate, basic (verdigris)	$Cu(C_2H_3O_2)_2 \cdot CuO \cdot 6H_2O$	369.32	blue-gn.
718	aceto-arsenite (Paris green)	$(CuOAs_2O_3)_3 \cdot Cu(C_2H_3O_2)_2$*	1013.83	gn.
719	ammonium chloride	$CuCl_2 \cdot 2NH_4Cl \cdot 2H_2O$	277.51	blue, tet., 1.670, 1.744
720	ammonium sulfate	$CuSO_4 \cdot 4NH_3 \cdot H_2O$	245.77	blue, rhb.
721	arsenate	$Cu_3(AsO_4)_2 \cdot 4H_2O$	540.59	blue-gn.
722	arsenate, acid	$Cu_5H_2(AsO_4)_4 \cdot 2H_2O$	911.54	blue
723	arsenide	Cu_5As_2	467.67	blue, oct.
724	arsenite (Scheele's green)	$CuHAsO_3$	187.49	gn.
725	bromate	$Cu(BrO_3)_2 \cdot 6H_2O$	427.50	blue-gn., cb.
726	bromide	$CuBr_2$	223.40	bk., delq., mn.
727	carbonate, basic (azurite)	$2CuCO_3 \cdot Cu(OH)_2$	344.75	blue, mn., 1.758
728	carbonate, basic (malachite)	$CuCO_3 \cdot Cu(OH)_2$	221.17	dark gn., mn., 1.875
729	chlorate	$Cu(ClO_3)_2 \cdot 6H_2O$	338.58	gn., delq., cb.
730	chloride (eriochalcite)	$CuCl_2$	134.48	brn.-yel. pd.
731	chloride	$CuCl_2 \cdot 2H_2O$	170.52	gn., rhb., 1.684
732	chromate, basic	$CuCrO_4 \cdot 2CuO \cdot 2H_2O$	374.75	yel.-brn.
733	cyanide	$Cu(CN)_2$	115.61	yel.-gn.
734	dichromate	$CuCr_2O_7 \cdot 2H_2O$	315.62	bk., tri.
735	ferricyanide	$Cu_3[Fe(CN)_6]_2$	614.63	yel.-gn.
736	ferrocyanide	$Cu_2Fe(CN)_6 \cdot 7H_2O$	465.21	red-brn.
737	fluoride	$CuF_2 \cdot 2H_2O$	137.60	blue, mn.
738	formate	$Cu(HCO_2)_2$	153.61	blue, mn.
739	hydroxide	$Cu(OH)_2$	97.59	blue, gelatinous
740	iodate	$Cu(IO_3)_2$	413.41	gn., mn.
741	iodate	$Cu(IO_3)_2 \cdot H_2O$	431.43	blue, tri.
742	iodate, basic	$Cu(OH)IO_3$	255.50	gn., rhb.
743	lactate	$Cu(C_3H_5O_3)_2 \cdot 2H_2O$	277.74	dark blue, mn.
744	nitrate	$Cu(NO_3)_2 \cdot 3H_2O$*	241.63	blue, delq.
745	nitrate	$Cu(NO_3)_2 \cdot 6H_2O$	295.68	blue, rhb.
746	nitroprusside	$CuFe(CN)_5NO \cdot 2H_2O$	315.55	gn.-wh.
747	oxalate	$CuC_2O_4 \cdot \frac{1}{2}H_2O$	160.60	blue-wh.
748	oxide (paramelaconite)	CuO	79.57	bk., cb.
749	oxide (tenorite)	CuO	79.57	bk., tri., 2.63

* Usual commercial form.

Copper dioxide 713
Copper lasur 727
Copper monochloride 768
Copper oxide, black 748
Copper oxide, red 757
Copperas 865
Coquimbite 830
Corrosive sublimate 1308
Corundum 22
Cosmetic bismuth 337
Cossel yellow 1087
Cotunnite 1057
Covellite 761
Cream of tartar 1771

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
707	....	subl. 400	....	d.	....	s. H_2SO_4, al.; i. HCl
708	....	d.	....	i.	i.	s. H_2SO_4; sl. s. HF; i. HCl
709	8.92^{20°	1083	2300	i.	i.	s. HNO_3, h. H_2SO_4
710	8.116	....	....	....	....	....
711	....	d. 60	....	....	....	d. HCl
712	....	d. 300	....	d.	....	d. a.
713	....	....	....	i.	....	d. a.
714	....	....	....	i.	....	d. a.
715	$1.930^{20^\circ}_{4}$	....	....	s.	....	....
716	1.882	115	240 d.	7.2	20	7 al.; s. et., gly.
717	....	....	....	sl. s.	....	s. dil. a., NH_4OH; sl. s. al
718	....	....	....	i.	....	s. a., NH_4OH
719	1.98	d. 110	....	33.8^{0°	99.3^{80°	s. a.
720	1.81	d. 150	....	$18.05^{21.5^\circ}$	d.	i. al.
721	....	....	....	i.	i.	s. a., NH_4OH
722	....	....	....	i.	....	s. a., NH_4OH
723	7.56	forms Cu_3As	....	i.	i.	s. a., NH_4OH
724	....	d.	....	i.	i.	s. a., NH_4OH
725	2.583	d. 180	$-6H_2O$, 200	v. s.	....	s. NH_4OH
726	....	498	....	v. s.	....	s. NH_3, al., act.; i. bz.
727	3.88	d. 220	....	i.	d.	s. NH_4OH, h. aq. $NaHCO_3$
728	3.9	d.	....	i.	d.	s. KCN; 0.03 aq. CO_2
729	....	65	d. 100	207^{0°	v. s.	s. al., act.
730	3.054	498	forms Cu_2Cl_2 993	70.7^{0°	107.9^{100°	53^{15° al.; 68^{15° m. al.
731	$2.39^{22.4^\circ}$	$-2H_2O$, 110	d.	110.4^{0°	192.4^{100°	s. al., et., NH_4Cl
732	....	$-2H_2O$, 260	....	i.	....	s. HNO_3, NH_4OH
733	....	d.	....	i.	....	s. KCN, C_5H_5N
734	2.286^{18°	$-2H_2O$, 100	....	sl. s.	d.	s. a., NH_4OH
735	....	....	....	i.	....	s. NH_4OH; i. HCl
736	....	....	....	i.	i.	s. NH_4OH; i. a., NH_3
737	2.9	....	....	sl. s.	d.	s. HNO_3, HCl, HF, al.; i. NH_3
738	1.831	....	....	12.5	d.	0.25 al.
739	3.368	$-H_2O$	....	i.	d.	s. a., NH_4OH, KCN, al.
740	5.241^{15°	d.	....	0.1365^{25°	i.	s. dil. H_2SO_4; i. dil. HNO_3
741	4.876^{15°	$-H_2O$, 240	d. 290	0.33^{15°	0.65^{100°	s. NH_4OH, dil. H_2SO_4; i. al., dil. HNO_3
742	4.878^{15°	d. 290	....	i.	i.	s. dil. H_2SO_4
743	....	....	....	16.7	45^{100°	sl. s. al.
744	$2.047^{3.9^\circ}$	114.5	$-HNO_3$,170	381^{40°	666^{80°	$100^{12.5^\circ}$ al.
745	2.074	$-3H_2O$, 26.4	....	243.7^{0°	∞	s. al.
746	....	....	....	i.	....	d. alk.; i. al.
747	....	....	....	i.	....	i. ac.
748	6.40	d. 1026	....	i.	i.	s. a., KCN, NH_4Cl
749	6.45	d. 1026	....	i.	i.	s. a., KCN, NH_4Cl

Cristobalite 1948
Crocoite 1060
Cryolite 34
Cryptohalite 119
Crystal carbonate 2043
Cubic niter 2097
Cuprammonium sulfate 720
Cupric fluosilicate 758
Cupric nitroferrocyanide 746
Cupric oxychromate 732

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Cupric			
750	oxychloride	$CuCl_2 \cdot 2CuO \cdot 4H_2O$	365.69	blue-gn.
751	periodate	Cu_2HIO_6	351.07	gn. pd.
752	phosphate	$Cu_3(PO_4)_2 \cdot 3H_2O$	434.72	blue-gn., rhb.
753	phosphide	Cu_3P_2	252.67	bk.
754	phosphite, ortho-	$CuHPO_3 \cdot 2H_2O$	179.59	....
755	potassium chloride	$CuCl_2 \cdot 2KCl \cdot 2H_2O$	319.62	blue-gn. cr.
756	salicylate	$Cu(C_7H_5O_3)_2 \cdot 4H_2O$	409.86	blue-gn. nd.
757	selenate	$CuSeO_4 \cdot 5H_2O$	296.61	lt. blue cr., 1.56
758	silicofluoride	$CuSiF_6 \cdot 6H_2O$	313.73	blue, delq., rhb.
759	sulfate (hydrocyanite)	$CuSO_4$	159.63	gn.-wh., rhb., 1.733
760	sulfate (blue vitriol or chalcanthite)	$CuSO_4 \cdot 5H_2O$*	249.71	blue, tri., 1.5368
761	sulfide (covellite)	CuS	95.63	blue, hex. or mn., 1.45
762	tartate	$CuC_4H_4O_6 \cdot 3H_2O$	265.69	lt. gn. pd.
763	**Cuprous** ammonium iodide	$CuI \cdot NH_4I \cdot H_2O$	353.47	rhb. pl.
764	antimonide	Cu_3Sb	312.47	lt. gray
765	arsenide	Cu_3As	265.62	hex.
766	bromide	Cu_2Br_2	286.97	wh., tetrahedral, 2.116
767	carbonate	Cu_2CO_3	187.15	yel.
768	chloride (nantokite)	Cu_2Cl_2	198.05	wh., cb., 1.973
769	cyanide	$Cu_2(CN)_2$	179.16	wh., mn.
770	ferricyanide	$Cu_3Fe(CN)_6$	402.67	brn.-red
771	ferrocyanide	$Cu_4Fe(CN)_6$	466.24	brn.-red
772	fluoride	Cu_2F_2	165.14	red cr.
773	hydroxide	$CuOH$	80.58	yel.
774	iodide (marshite)	Cu_2I_2	380.98	red-brn., cb., 2.345
775	oxide (cuprite)	Cu_2O	143.14	red, cb., 2.705
776	phosphide	Cu_6P_2	443.38	gray-bk.
777	selenide (berzelianite)	Cu_2Se	206.10	bk., cb.
778	silicide	Cu_4Si	282.34	wh., met.
779	sulfide (chalcocite)	Cu_2S	159.20	bk., rhb.
780	sulfide	Cu_2S	159.20	bk., cb.
781	sulfite	$Cu_2SO_3 \cdot H_2O$	225.22	red or wh., hex.
782	thiocyanate	$CuCNS$	121.65	wh. pd.
783	**Cyanogen**	C_2N_2	52.02	poisonous gas
784	**Cyanogen compounds,** cf. table of organic compounds	....	......	....
785	**Deuterium** (heavy hydrogen)	D_2	4.028	col. gas
786	**Dysprosium**	Dy	162.46	....
787	acetate	$Dy(C_2H_3O_2)_3 \cdot 4H_2O$	411.66	yel. nd.
788	bromate	$Dy(BrO_3)_3 \cdot 9H_2O$	708.35	yel., hex.
789	carbonate	$Dy_2(CO_3)_3 \cdot 4H_2O$	577.01	....

* Usual commercial form.

Cupric subcarbonate 727
Cupricin 769
Cuprite 775
Cuprous sulfocyanate 782
Cuprous sulfocyanide 782

Dakin's solution 2077
Daubrelite 626
Dehydrite 1208
Dental gas 1478
Derby red 1061
Derbyshire spar 440

Deuterium oxide 2499
Dialozite 1246
Diammine 923
Diammine hydrate 926
Diammonium phosphate 112
Diamond 494

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
750	....	$-3H_2O$, 140	....	i.	....	s. a.
751	....	d. 110	....	i.	i.	s. dil. HNO_3
752	....	d.	....	i.	sl. s.	s. a., NH_4OH; i. NH_3
753	6.35	d.	....	i.	....	s. HNO_3; i. HCl
754	....	d.	....	i.	i.	....
755	....	....	....	s.	s.	....
756	....	....	....	v. s.	d. 100°	v. s. al.
757	2.56	....	....	s.	s.	i. al.
758	$2.158^{19°}$	....	....	$233.6^{17°}$	....	$0.16^{20°}$, 92% al.
759	$3.606^{15°}$	d. >600	forms CuO, 650	$14.3^{0°}$	$75.4^{100°}$	i. al.
760	$2.286^{\frac{15.6°}{4}}$	$-4H_2O$, 110	$-5H_2O$, 250	$24.3^{0°}$	$205^{100°}$	l. $1^{3°}$ al.
761	4.6	tr. 103	d. 220	$0.000033^{18°}$	....	s. HNO_3, KCN
762	....	d.	....	$0.02^{15°}$	$0.14^{85°}$	s. a., KOH
763	....	....	....	d.	....	s. NH_4I
764	$8.51^{\frac{20°}{4}}$	687	....	....	....	....
765	$8.0^{\frac{20°}{4}}$	830	....	....	....	....
766	$4.72^{12°}$	504	1345	v. sl. s.	d.	s. HBr, HCl, NH_4OH; i. act.
767	4.4	d.	....	i.	i.	s. a., NH_4OH
768	3.53	422	1366	$1.52^{25°}$	....	s. HCl, NH_4OH, al.
769	2.9	474.5	d.	i.	i.	s. KCN, HCl, NH_4OH; sl. s. NH_3
770	....	....	....	i.	....	s. NH_4OH; i. HCl
771	....	....	....	i.	....	s. NH_4OH; i. NH_4Cl
772	....	908	subl. 1100	i.	....	s. HF, HCl, HNO_3; i. al.
773	3.4	$-\frac{1}{2}H_2O$, 360	....	i.	i.	s. a., NH_4OH
774	$5.63^{15.5°}$	605	1290	$0.0008^{18°}$	....	s. KI; i. a., al.
775	6.0	1235	−O, 1800	i.	i.	s. HCl, NH_4Cl, NH_4OH
776	6.4 to 6.8	....	....	i.	....	s. HNO_3; i. HCl
777	$6.749^{\frac{20°}{4}}$	1113	....	....	....	d. HCl
778	$7.53^{\frac{20°}{4}}$	850	....	....	....	d. HNO_3; i. HCl
779	5.6	1100	....	$0.0005^{18°}$	....	s. HNO_3, NH_4OH; i. act.
780	5.80	1130	....	$0.0005^{18°}$	....	s. HNO_3, NH_4OH; i. act.
781	$3.83^{15°}$	....	....	sl. s.	....	s. HCl, NH_4OH; i. al., et.
782	2.846	1084 d.	....	$0.0005^{18°}$	....	s. NH_4OH, et.; i. dil. a.
783	lq. $0.866^{-17.2°}$; 1.806(A)	−34.4	−20.5	$450^{20°}$cc	....	$2300^{20°}$ cc al.; $500^{18°}$ cc et.
784	....	....	....	....	....	....
785	2.0(D)	-254.6^{121mm}	−249.7	sl. s.	....	....
786	....	....	....	....	....	....
787	....	d. 120	....	s.	....	v. sl. s. al.
788	....	78	$-6H_2O$, 110	v. s.	....	sl. s. al.
789	....	$-3H_2O$, 150	....	i.	....	....

Diaspore 23
Diazotizing salts 2099
Dibasic ammonium phosphate 112
Dibasic calcium phosphate 463
Dicalcium phosphate 463
Diopside 452
Dipotassium phosphate 1735
Dipping acid 2277
Disodium phosphate 2121
Disodium pyrophosphate 2128
Diuretic salt 1630
Dolomite 451
Dolomol 1226
Double nickel salt 1406
Dry ice 496
Dung salt 2018
Dunging salt 2141
Dysprosia 793

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Dysprosium			
790	chloride	$DyCl_3$	268.83	yel. pl.
791	chromate	$Dy_2(CrO_4)_3·10H_2O$	853.11	yel. cr.
792	oxalate	$Dy_2(C_2O_4)_3·10H_2O$	769.08	pr.
793	oxide	Dy_2O_3	372.92	wh.
794	phosphate	$DyPO_4·5H_2O$	347.52	yel.
795	selenate	$Dy_2(SeO_4)_3·8H_2O$	897.93	yel. nd.
796	sulfate	$Dy_2(SO_4)_3·8H_2O$	757.23	yel. cr.
797	**Erbium**	Er	167.2	dark gray
798	acetate	$Er(C_2H_3O_2)_3·4H_2O$	416.40	tri.
799	chloride	$ErCl_3·6H_2O$	381.67	delq.
800	nitrate	$Er(NO_3)_3·6H_2O$	461.32	red cr.
801	oxide	Er_2O_3	382.40	red-yel.
802	sulfate	$Er_2(SO_4)_3$	622.58	....
803	sulfate	$Er_2(SO_4)_3·8H_2O$	766.71	red, mn.
804	**Europium**	Eu	152.0	....
805	oxide	Eu_2O_3	352.00	pa. pink pd.
806	sulfate	$Eu_2(SO_4)_3·8H_2O$	736.31	pa. red
807	**Ferric** acetate, basic	$Fe(OH)(C_2H_3O_2)_2$	190.95	brn., amor.
808	ammonium oxalate	$Fe(NH_4)_3(C_2O_4)_3·4H_2O$	446.05	lt. gn. cr.
809	arsenate (scorodite)	$FeAsO_4·4H_2O$	266.82	wh., rhb.
810	arsenite, basic	$2FeAsO_3·Fe_2O_3·5H_2O$	607.30	brn.-yel.
811	bromide	$FeBr_3$	295.60	dark red, delq.
812	bromide	$FeBr_3·6H_2O$	403.69	red
813	chloride (molysite)	$FeCl_3$	162.22	bk.-brn., hex. delq.
814	chloride	$FeCl_3·6H_2O$*	270.32	red-yel., delq.
815	ferrocyanide (Prussian blue)	$Fe_4[Fe(CN)_6]_3$	859.27	dark blue
816	fluoride	FeF_3	112.85	gn., rhb.
817	fluoride	$FeF_3·4\frac{1}{2}H_2O$	193.92	yel. cr.
818	formate	$Fe(HCO_2)_3·H_2O$	208.92	yel. cr.
819	hydroxide	$Fe(OH)_3$	106.87	red-brn.
820	hypophosphite	$Fe(H_2PO_2)_3$	250.84	gray pd.
821	lactate	$Fe(C_3H_5O_3)_3$	323.06	brn., amor., delq.
822	nitrate	$Fe(NO_3)_3·6H_2O$	349.97	rhb., delq.
822.1	nitrate	$Fe(NO_3)_3·9H_2O$	404.02	pa. vi., mn., delq.
823	oxalate	$Fe_2(C_2O_4)_3$	375.76	amor.
824	oxide (hematite)	Fe_2O_3	159.70	red or bk., trig., 3.042
825	phoshate (strengite)	$FePO_4·2H_2O$	186.86	yel., mn. or rhb., 1.70-1.76
825.1	phosphate	$FePO_4·4H_2O$	222.89	yel.-wh.
826	potassium oxalate	$FeK(C_2O_4)_2·2\frac{1}{2}H_2O$	316.03	olive brn.
827	potassium oxalate	$FeK_3(C_2O_4)_3·3H_2O$	491.25	mn.
828	pyrophosphate	$Fe_4(P_2O_7)_3·9H_2O$	907.42	yel. pd.
829	sulfate	$Fe_2(SO_4)_3$	399.88	rhb., 1.814
830	sulfate (coquimbite)	$Fe_2(SO_4)_3·9H_2O$	562.02	yel., trig.
831	sulfide	Fe_2S_3	207.88	yel.-gn.
832	thiocyanate	$Fe(CNS)_3·3H_2O$	284.13	red. delq., cb.

* Usual commercial form.

Electrolon 1933
Emerald green 718
English salt 66
English white 427
Epsomite 1228
Epsom salt 1228
Erbia 801
Eriochalcite 730
Erythrine 654
Erythrite 654; cf. also Erythritol in organic table.
Essential salt of lemon 1721
Eunatrol 2101
Europia 805

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Cold Water	 Hot Water	 Other Reagents
790	$3.67^{0^\circ}_{4}$	655	....	s.	....	....
791	....	$-3\frac{1}{2}H_2O$, 150	d.	1.002^{25°	....	....
792	....	....	....	i.	....	s. dil. a.
793	7.81	....	....	....	....	s. a.
794	....	$-5H_2O$, 200	....	i.	....	s. dil. a., ac.
795	....	$-8H_2O$, 200	....	v. s.	....	i. al.
796	....	$-8H_2O$, 360	....	5.072^{20°	3.34^{40°	....
797	4.77	1250(?)	....	....	....	....
798	2.114	....	....	....	....	....
799	....	....	....	s.	s.	s. al.
800	....	....	....	s.	....	s. al., act., et.
801	8.640	....	3000	i.	....	s. h. a.
802	3.678	d. 950	....	12^{20°	4^{40°	....
803	3.18	....	....	30^{20°	100^{100°	....
804	....	1150 ± 50	....	....	....	....
805	7.42	....	....	....	....	....
806	....	$-8H_2O$, 375	....	2.563^{20°	2.19^{40°	....
807	....	....	....	i.	....	s. a., al.
808	1.779^{17°	$-3H_2O$, 100	d. 165	42.8^{0°	345^{100°	....
809	3.18	d.	....	i.	i.	s. HCl; i. HNO_3
810	....	d.	....	sl. s.	....	s. a., alk.
811	....	subl. d.	....	s.	s.	s. al., et.; sl. s. NH_3
812	....	27	....	s.	s.	....
813	2.804^{11°	282	315	74.4^{0°	535.8^{100°	v. s. al., et. +HCl
814	....	37	280	246^{0°	∞	s. al., act., gly.
815	....	d.	....	i.	d.	s. HCl, conc. H_2SO_4; i. al., et.
816	3.18	....	....	0.091^{25°	sl. s.	s. a.; i. al., et.
817	3.18	$-3H_2O$, 100	....	sl. s.	s.	i. al.
818	....	....	....	s.	d.	sl. s. al.
819	3.4 to 3.9	$-1\frac{1}{2}H_2O$, 500	....	i.	i.	s. a.; i. al., et.
820	....	d.	....	0.043^{25°	0.083^{100°	s. alk. citrates
821	....	....	....	v. s.	v. s.	i. et.
822	1.684^{20°	35	d.	150^{0°	∞	s. al., act.
822.1	....	47	d. 100	v. s.	∞	v. s. al.; s. act.; sl. s. conc. HNO_3
823	....	....	....	v. s.	d. 100°	s. a.; i. al.
824	5.12	1560 d.	....	i.	....	s. HCl
825	2.87	....	....	i.	0.67^{100°	s. a.; i. ac.
825.1	....	....	....	i.	sl. s.	s. a.; i. ac.
826	....	d.	....	92^{21°	d.	....
827	....	$-3H_2O$, 100	d. 230	4.7^{0°	117.7^{100°	i. al.
828	....	....	....	i.	....	s. a.
829	3.097^{18°	d. 480	....	sl. s.	d.	i. H_2SO_4, NH_3
830	2.1	....	....	440	d.	s. abs. al.
831	4.3	d.	....	d.	....	d. a.
832	....	d.	....	v. s.	v. s.	v. s. al., et.

Exsiccated alum 43
Feldspar cf. mineral table.
Ferric alum 46
Ferric ammonium sulfate 41
Ferric phosphite, hypo- 820
Ferric potassium sulfate 46
Ferric sodium oxalate 2063
Ferric sodium oxide 2064
Ferric sulfocyanate 832
Ferric sylfocyanide 832
Ferric zinc oxide 2545

No.	Name	Fomula	Formula Weight	Color, Crystalline Form and Refractive Index
833	**Ferroso-ferric** chloride	$FeCl_2 \cdot 2FeCl_3 \cdot 18H_2O$	775.49	yel., delq.
834	ferricyanide (Prussian green)	$Fe'''_4Fe''_3[Fe(CN)_6]_6$	1662.70	gn.
835	oxide (magnetite; magnetic iron oxide)	Fe_3O_4	231.55	bk., cb., 2.42
836	oxide, hydrated	$Fe_3O_4 \cdot 4H_2O$	303.61	bk.
837	sulfide	Fe_3S_4	295.79	hex.
838	**Ferrous** acetate	$Fe(C_2H_3O_2)_2 \cdot 4H_2O$	246.00	mn. nd.
839	ammonium sulfate	$FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	392.15	blue-gn., mn., 1.4915
840	arsenate	$Fe_3(AsO_4)_2 \cdot 6H_2O$	553.47	gn., amor.
841	arsenite, pyro-	$Fe_2As_2O_5$	341.52	gn.-wh.
842	bromide	$FeBr_2$	215.68	gn., hex.
843	bromide	$FeBr_2 \cdot 6H_2O$	323.78	red, rhb.
844	carbonate (siderite)	$FeCO_3$	115.86	gray, trig., 1.875
845	carbonate	$FeCO_3 \cdot H_2O$	133.88	amor.
846	chloride (lawrencite)	$FeCl_2$	126.76	gn.-yel., hex., 1.567
847	chloride	$FeCl_2 \cdot 4H_2O$	198.83	blue-gn., mn.
848	chloroplatinate	$FePtCl_6 \cdot 6H_2O$	571.92	yel., hex.
849	ferricyanide (Turnbull's blue)	$Fe_3[Fe(CN)_6]_2$	591.47	dark blue
850	ferrocyanide	$Fe_2Fe(CN)_6$	323.66	blue-wh., amor.
851	fluoride	$FeF_2 \cdot 8H_2O$	237.98	gn.
852	formate	$Fe(HCO_2)_2 \cdot 2H_2O$	181.92	....
853	hydroxide	$Fe(OH)_2$	89.87	lt. gn.
854	iodide	FeI_2	309.69	gray, hex.
855	iodide	$FeI_2 \cdot 4H_2O$	381.75	gn., delq.
856	lactate	$Fe(C_3H_5O_3)_2 \cdot 3H_2O$	288.04	gn.
857	nitrate	$Fe(NO_3)_2 \cdot 6H_2O$	287.96	cr.
858	oxalate	$FeC_2O_4 \cdot 2H_2O$	179.90	lt. yel., rhb.
859	oxide	FeO	71.85	bk.
860	perchlorate	$Fe(ClO_4)_2 \cdot 6H_2O$	362.86	gn.
861	phosphate (vivianite)	$Fe_3(PO_4)_2 \cdot 8H_2O$	501.64	blue, mn., 1.592, 1.603
862	potassium oxalate	$FeK_2(C_2O_4)_2 \cdot 2H_2O$	346.11	yel. nd.
863	silicate	$FeSiO_3$	131.91	mn.
864	sulfate (siderotilate)	$FeSO_4 \cdot 5H_2O$	241.99	gn., tri., 1.536
865	sulfate (copperas)	$FeSO_4 \cdot 7H_2O$*	278.02	blue-gn., mn.
866	sulfide	FeS	87.91	bk., hex.
867	sulfite	$FeSO_3 \cdot 2\frac{1}{2}H_2O$	180.95	....
868	tartrate	$FeC_4H_4O_6$	203.92	wh. pd.
869	thiocyanate	$Fe(CNS)_2 \cdot 3H_2O$	226.05	gn., rhb. pd.
870	thiosulfate	$FeS_2O_3 \cdot 5H_2O$	258.05	gn., delq.
871	**Cf.** also under iron	....	......	....
872	**Fluoboric acid**	HBF_4	87.83	col. lq.
873	**Fluorine**	F_2	38.00	gn.-yel. gas
874	oxide	F_2O	54.00	col. gas or yel.-brn. lq.
875	**Fluosilicic acid**	H_2SiF_6	144.08	....
876	**Fluosulfonic acid**	HSO_3F	100.07	col. lq.
877	**Gadolinium**	Gd	156.9	....
878	acetate	$Gd(C_2H_3O_2)_3 \cdot 4H_2O$	406.10	tri.
879	bromide	$GdBr_3 \cdot 6H_2O$	504.74	rhb. pl.

* Usual commercial form.

Ferrous ammonium cyanide 85
Ferrous sulfocyanate 869
Ferrous sulfocyanide 869
Filter alum 37
Fiorite 1947
Fisher's salt 1676
Fisher's yellow 1676
Fixed niter 1659
Fixed white 284
Flores martis 814
Flowers of antimony 150
Flowers of bismuth 330
Flowers of sulfur 2260
Flowers of tin 2182

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
833	....	d. 50	....	s.	s.	....
834	....	d. 180	....	i.	....	s. d. h. HCl
835	5.2	1538 d.	....	i.	i.	i. al.
836	....	d.	....	i.	i.	s. a.
837	4.55	....	....	i.	....	s. a.
838	....	d.	....	v. s.	v. s.	....
839	1.864	d.	....	$18^{0°}$	$100^{75°}$	i. al.
840	....	d.	....	i.	i.	s. dil. HCl; sl. s. NH_4OH
841	....	....	....	i.	....	s. NH_4OH
842	$4.636_{4}^{25°}$	d.	....	$109^{10°}$	$170^{95°}$	s. al., $0.49^{25°}$ pyridine
843	....	27	....	$313.2^{0°}$	∞	s. al.
844	3.8	d.	....	$0.0065^{20°}$	i.	s. a., aq. CO_2
845	....	d.	....	sl. s.	....	s. a., aq. CO_2
846	2.7	....	delq.	$64.4^{10°}$	$105.7^{100°}$	100 al.; s. act.; i. et.
847	1.926	....	delq.	$160.1^{10°}$	$415.5^{100°}$	s. al.
848	2.714	....	....	v. s.	v. s.	....
849	....	d.	....	i.	....	i. dil. a., al.
850	....	....	....	i.	....	....
851	4.09 (anh.)	$-8H_2O$, 100	....	sl. s.	....	s. a., HF; i. al., et.
852	....	d.	....	sl. s.	....	....
853	3.4	....	....	0.00067	....	s. a., NH_4Cl
854	....	177	....	s.	....	....
855	2.873	....	....	s.	d.	s. al., et.
856	....	d.	....	$2.1^{10°}$	$8.5^{100°}$	i. al.
857	....	60.5	....	$200^{0°}$	$300^{25°}$	....
858	2.28	d. 160	....	0.022	0.026	s. a.
859	5.7	1420	....	i.	i.	s. a.; i. alk.
860	....	d. >100	....	s.	....	s. al.
861	2.58	....	....	i.	i.	s. a.; i. ac.
862	....	d.	....	s.	s.	....
863	3.5	1550	....	....	....	....
864	2.2	....	$-5H_2O$, 300	s.	s.	i. al.
865	$1.899^{14.8°}$	64	$-7H_2O$, 300	$32.8^{0°}$	$149^{50°}$	i. al.
866	4.84	1193	d.	$0.000616^{18°}$	....	s. a.; i. NH_3
867	....	d. 250	....	v. sl. s.	....	s. aq. SO_2, a.; i. al.
868	....	....	....	$0.877^{16°}$	....	....
869	....	d.	....	v. s.	....	s. al., et., act.
870	....	....	....	v. s.	d.	v. s. al.
871	....	....	....	....	....	....
872	....	....	130 d.	∞	∞	s. al.
873	lq. $1.11^{-187°}$; $1.31^{15°}$(A)	−223	−187	d.	....	....
874	lq. $1.65^{-190°}$	....	−167	v. sl. s.	....	....
875	....	....	....	s.	s.	....
876	$1.743^{15.6°}$	−87.3	165.5	d.	....	....
877	....	....	....	....	....	....
878	1.611	....	....	sl. s.	....	....
879	$2.844^{15°}$	....	....	s.	s.	s. HBr

Flowers of tin stone 2182
Flowers of zinc 2560
Fluellite 14
Fluocerite 510
Fluorine bromide 360
Fluorite 440
Fluorol 2067
Fluorspar 440
Freezing salt 2049
French verdigris 717
Fulminating mercury 1312
Fumarole acid 345
Fusible white precipitate 1363
Gadolinia 884

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Gadolinium			
880	chloride	$GdCl_3$	263.27	wh., mn.
881	chloride	$GdCl_3 \cdot 6H_2O$	371.37	delq.
882	nitrate	$Gd(NO_3)_3 \cdot 6\frac{1}{2}H_2O$	460.03	tri.
883	oxalate	$Gd_2(C_2O_4)_3 \cdot 10H_2O$	758.02	mn.
884	oxide	Gd_2O_3	361.80	wh. pd.
885	potassium sulfate	$Gd_2(SO_4)_3 \cdot K_2SO_4 \cdot 2H_2O$	812.26	cr.
886	selenate	$Gd_2(SeO_4)_3 \cdot 8H_2O$	886.81	pearly, mn.
887	sulfate	$Gd_2(SO_4)_3$	601.98	....
888	sulfate	$Gd_2(SO_4)_3 \cdot 8H_2O$	746.11	mn.
889	**Gallium**	Ga	69.72	gray, tet.
890	bromide	$GaBr_3$	309.47	delq. cr.
891	chloride, di-	$GaCl_2$	140.63	wh. cr., delq.
892	chloride, tri-	$GaCl_3$	176.09	wh., delq. nd.
893	hydroxide	$Ga(OH)_3$	120.74	....
894	iodide	GaI_3	450.48	col. nd., delq.
895	nitrate	$Ga(NO_3)_3$	255.74	delq.
896	oxide, mono-	GaO	85.72	gray
897	oxide, sesqui-	Ga_2O_3	187.44	wh., amor.
898	sulfate	$Ga_2(SO_4)_3$	427.62	wh.
899	sulfide	Ga_2S_3	235.62	wh.
900	**Germanium**	Ge	72.60	gray, cb.
901	bromide	$GeBr_4$	392.26	gray, oct., 1.6269
902	chloride, di-	$GeCl_2$	143.51	wh. pd.
903	chloride, tetra-	$GeCl_4$	214.43	lq.
904	chloroform	$GeHCl_3$	179.98	col. lq.
905	fluoride	$GeF_4 \cdot 3H_2O$	202.65	wh. cr., delq.
906	hydride	GeH_4	76.63	col. gas
907	iodide	GeI_4	580.28	yel.-red, cb., delq.
908	oxide, mono-	GeO	88.60	gray-bk., 1.607
909	oxide, di-	GeO_2	104.60	col., rhb., 1.650
910	oxychloride	$GeOCl_2$	159.51	col. lq.
911	potassium fluoride	GeK_2F_6	264.79	wh. cr.
912	sulfide, mono-	GeS	104.66	rhb. or mn.
913	sulfide, di-	GeS_2	136.72	wh. pd.
914	**Glucinum** cf. beryllium	....	......	....
915	**Gold**	Au	197.20	yel. met., cb.
916	**Gold,** colloidal	Au	197.20	blue to vl.
917	**Gold salts** cf. under auric and aurous	....	......	....
918	**Hafnium**	Hf	178.6	hex.
919	oxide	HfO_2	210.60	....
920	**Helium**	He	4.00	col. gas
921	**Holmium**	Ho	164.94	....
922	sulfate	$Ho_2(SO_4)_3\ 8H_2O$	762.19	yel.
923	**Hydrazine**	N_2H_4	32.05	col. lq.
924	azoimide	$N_2H_4 \cdot HN_3$	75.08	delq.

Galena 1102
Gerhardite 744
Germanium potassium fluoride 1688
Giallioline 1045.1
Gibbsite 24
Glass liquor 2141
Glass-makers' soap 1269
Glauber's salt 2149
Goslarite 2581
Goulard's powder 1041
Graham's salt 2125
Graphite 495
Green copperas 865
Greenockite 408
Green vitriol 865
Guanajuatite 341
Gypsum 483
Hafnia 919
Hafnium potassium fluoride 1689
Hahnem auris mercury 1344

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
880	$4.52^{0°}_{4}$	628	....	s.	s.	....
881	$2.424^{0°}_{4}$	....	....	s.	s.	....
882	2.332	91	....	v. s.	v. s.	....
883	....	$-6H_2O$, 110	....	0.11	....	s. HNO_3
884	$7.407^{15°}_{4}$	....	....	....	....	....
885	$3.503^{16°}$	....	....	s.	s.	s. K_2SO_4
886	3.309	$-8H_2O$, 130	....	s.	s.	....
887	$4.139^{14.6°}$	....	....	$3.98^{0°}$	$2.26^{34.4°}$	....
888	$3.010^{14.6°}$	....	....	$2.9^{20°}$	$2.2^{40°}$	....
889	$5.885^{24°}$	29.75	1700	i.	i.	s. a., alk.
890	....	....	....	s.	s.	....
891	....	164	535	d.	d.	....
892	$2.36^{80°}_{80}$	75.5	215	s.	d.	....
893	....	d.	....	i.	....	s. a., alk.
894	4.2	....	....	s.	s.	....
895	....	d. 110	forms Ga_2O_3, 200	v. s.	v. s.	....
896	....	....	....	i.	....	s. a.
897	....	>red heat	....	i.	....	s. a.
898	....	....	....	v. s.	v. s.	s. al.; i. et.
899	3.5	1250 ±	....	....	....	....
900	$5.36^{20°}$	958.5	2700	i.	i.	s. h. H_2SO_4, aq. reg.
901	$3.132^{25°}_{25}$	26.1	185.9^{760mm}	d.	....	....
902	....	....	....	d.	....	....
903	$1.874^{25°}_{25}$	−49.5	86.5	d.	....	i. h. H_2SO_4
904	lq. 1.93	−71	72	i.	d.	....
905	....	d.	....	s.	s.	....
906	lq. $1.523^{-142°}_{4}$	−165	−90	....	....	sl. s. h. HCl; d. HNO_3
907	$4.322^{26°}_{26}$	144	375	s.	s. d.	d. h. conc. H_2SO_4
908	....	....	....	sl. s.	....	s. HCl; i. alk.
909	$4.703^{18°}$	1100	....	$0.405^{20°}$	$1.07^{100°}$	sl. s. a., alk.
910	....	....	>100	i.	....	s. a.
911	....	....	....	sl. s.	s.	i. al.
912	$3.54^{1100°}$(A)	....	....	0.25	sl. s.	s. HCl, KOH
913	....	d.	....	0.45	sl. s.	s. alk.; d. aq. reg.; i. a.
914	....	....	....	....	....	....
915	$19.3^{20°}$	1063	2600	i.	i.	s. aq. reg., KCN; i. a.
916	....	....	....	s.	....	s. aq. reg., KCN; i. a.
917	....	....	....	....	....	....
918	12.1	>1700	>3200(?)	....	....	....
919	9.68	2812	....	i.	....	....
920	0.1368(A)	< −272.2	−268.9	$0.97^{0°}$cc	$1.08^{50°}$cc	absorbed by Pt
921	....	....	....	....	....	....
922	....	....	....	$8.181^{20°}$	$4.52^{40°}$	....
923	$1.011^{15°}_{4}$	1.4	113.5	∞	∞	s. al.
924	....	65	....	v. s.	v. s.	v. s. al.

Halite	2049
Hartshorn	93
Hartshorn salt	67
Hauerite	1298
Hausmannite	1267
Heavy hydrogen	785
Heavy water	2499
Hematite	824
Hepar calcis	485
Hepatic gas	956
Hermannite	1283
Hessite	2001
Hieratite	1754
Homberg's phosphorus	430
Hopeite	2566
Horn silver	1968
Horn stone	1947
Howard's silver	1312
HTH	444
Humboldtine	858
Hyalite	1947

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Hydrazine			
925	formate	$N_2H_4 \cdot 2HCO_2H$	124.10	cb.
926	hydrate	$N_2H_4 \cdot H_2O$	50.06	col.
927	hydrochloride	$N_2H_4 \cdot HCl$	68.51	yel. lq.
928	hydrochloride, di-	$N_2H_4 \cdot 2HCl$	104.98	wh., cb.
929	nitrate	$N_2H_4 \cdot HNO_3$	95.06	cr.
930	nitrate, di-	$N_2H_4 \cdot 2HNO_3$	158.08	nd.
931	sulfate	$N_2H_4 \cdot \frac{1}{2}H_2SO_4$	81.09	delq. pl.
932	sulfate	$N_2H_4 \cdot H_2SO_4$	130.12	rhb.
933	**Hydrazoic acid** (azoimide)	HN_3	43.03	col. lq.
934	**Hydriodic acid**	HI	127.93	col. gas
935	**Hydriodic acid**	$HI \cdot H_2O$	145.94	col. lq.
936	**Hydriodic acid**	$HI \cdot 2H_2O$	163.96	col. lq.
937	**Hydriodic acid**	$HI \cdot 3H_2O$	181.98	col. lq.
938	**Hydriodic acid**	$HI \cdot 4H_2O$	199.99	col. lq.
939	**Hydrobromic acid**	HBr	80.92	col. gas; 1.325 (lq.)
940	**Hydrobromic acid**	$HBr \cdot H_2O$	98.94	col. lq.
941	**Hydrobromic acid**	HBr (47.8% in H_2O)	80.92	col. lq.
942	**Hydrobromic acid**	$HBr \cdot 2H_2O$	116.96	wh. cr.
943	**Hydrochloric acid**	HCl*	36.47	col. gas; 1.256 (lq.)
944	**Hydrochloric acid**	HCl (45.2% in H_2O)	36.47	col. lq.
945	**Hydrochloric acid**	$HCl \cdot 2H_2O$	72.50	col. lq.
946	**Hydrochloric acid**	$HCl \cdot 3H_2O$	90.51	col. lq.
947	**Hydrocyanic acid** (prussic acid)	HCN	27.03	poisonous gas or col. lq., 1.254
948	**Hydroferricyanic acid**	$H_3Fe(CN)_6$	214.98	gn.-brn., delq. nd.
949	**Hydroferrocyanic acid**	$H_4Fe(CN)_6$	215.99	wh.
950	**Hydrofluoric acid**	HF	20.01	gas or col. lq.
951	**Hydrofluoric acid**	HF (35.35% in H_2O)	20.01	col. lq.
952	**Hydrogen**	H_2	2.016	col. gas or cb.
953	peroxide	H_2O_2†	34.02	col. lq., 1.333
954	persulfide	H_2S_2	66.14	col. lq.
955	selenide	H_2Se	81.22	col. gas
956	sulfide	H_2S	34.08	col. gas
957	telluride	H_2Te	129.63	col. gas
958	**Hydroxylamine**	NH_2OH	33.03	rhb., delq.
959	hydrochloride	$NH_2OH \cdot HCl$	69.50	col., mn.
960	nitrate	$NH_2OH \cdot HNO_3$	96.05	col. cr.
961	sulfate	$NH_2OH \cdot \frac{1}{2}H_2SO_4$	82.07	col., mn.
962	**Hypobromous acid**	$HBrO$	96.92	yel.
963	**Illinium**	Il	146 (?)	....
964	**Indium**	In	114.76	soft, tet. met.
965	bromide	$InBr_3$	354.51	delq. cr.
966	chloride, mono-	$InCl$	150.22	dark red cr., delq.
967	chloride, di-	$InCl_2$	185.67	col. cr., delq.
968	chloride, tri-	$InCl_3$	221.13	wh. pl.
969	cyanide	$In(CN)_3$	192.81	....

* Usual commercial form about 31%.

† Usual commercial forms 3% or 30%.

Hydrocerussite 1055
Hydrocyanite 759
Hydrofluosilicic acid 875
Hydrogen, heavy 785
Hydrogen bromide 939
Hydrogen chloride 943
Hydrogen fluoride 950
Hydrogen iodide 934
Hydrogen oxide 2498
Hydrogen phosphide 1540
Hydrolith 442
Hydromagnesite 1188
Hydrophane 1947

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
925	....	128	....	s.	....	....
926	$1.03^{21°}$	−40	$118.5^{739.5mm}$	∞	∞	∞ al.; i. et.
927	....	....	....	v. s.	v. s.	sl. s. al.
928	1.42	198	....	s.	v. s.	s. al.
929	....	70.7	subl. 140	$174.9^{10°}$	v. s.	....
930	....	104	d.	v. s.	....	....
931	....	85	....	v. s.	....	i. al.
932	1.378	254	....	$3.055^{22°}$	$27.65^{60°}$	v. sl. s. abs. al.
933	....	−80	37	∞	∞	∞al.
934	$4.4^{0°}$ (A)	−50.8	−35.5	$42500^{10°}$cc	v. s.	s. al.
935	$1.7^{15°}$	....	127^{774mm}	∞	....	∞al.
936	....	−43	....	∞	....	s. al.
937	....	−48	....	∞	....	s. al.
938	....	−36.5	....	∞	....	s. al.
939	$2.71^{0°}$(A)	−86	−67	$221^{0°}$	$130^{100°}$	s. al.
940	1.78	....	....	....	....	stable at −15.5° and 1 atm., and at −11.3° and 2.5 atm.
941	1.486	....	126	∞	....	s. al.
942	$2.11^{-15°}$	−11	....	s.	s.	....
943	$1.268^{0°}$(A)	−111	−85	$82.3^{0°}$	$56.1^{60°}$	s. al., ot.
944	1.48	−15.35	....	∞	....	s. al.
945	$1.46^{-18.8°}_{4}$	0	d.	∞	....	s. al.
946	....	−24.4	d.	∞	....	s. al.
947	$0.697^{18°}$	−14	26	∞	....	∞al., et.
948	....	d.	....	s.	s.	s. al.
949	....	....	....	s.	s.	s. al.; i. et.
950	$0.988^{13.6°}$	−83	19.4	∞0° to 19.4°	v. s.	....
951	1.15	−35	120	v. s.	....	....
952	lq. $0.0709^{-252.7°}$ 0.06948(A)	−259.1	−252.7	$2.1^{0°}$cc	$0.85^{80°}$cc	sl. s. Fe, Pd, Pt
953	$1.438^{20°}_{4}$	−0.89	151.4^{760mm}	∞	....	s. a.., et.; i. petr. et
954	$1.376^{15°}$	−88	74.5	d.	....	s. bz., CS_2; i. al.
955	$2.12^{-42°}$	−64	−42	$377^{4°}$cc	$270^{22.5°}$cc	s. CS_2, $COCl_2$
956	1.1895(A)	−82.9	−59.6	$437^{0°}$cc	$186^{40°}$cc	$9.54^{15°}$cc al.; s. CS_2
957	$2.57^{-20°}_{4}$	−48	−1.8	sl. s.	....	s. alk.
958	$1.35^{18°}$	34	56.5^{22mm}	s.	d.	s. a., al.
959	$1.67^{17°}$	151	d.	$83.3^{17°}$	v. s.	s. al.; i. et.
960	....	48	d. <100	v. s.	d.	v. s. abs. al.
961	....	170 d.	....	$32.9^{0°}$	$68.5^{90°}$	v. sl. s. al.; i. et., abs. al.
962	....	....	40^{50mm}	s.	d.	....
963	....	....	....	....	....	....
964	$7.3^{20°}$	155	1450	i.	i.	s. a.
965	....	....	....	v. s.	v. s.	....
966	....	....	....	d.	d.	....
967	....	....	....	d.	d.	....
968	4.0	....	subl. 440	s.	v. s.	sl. s. al., et.
969	....	....	....	i.	....	s. HCN

Hydrophilite 430
Hydrosilicofluoric acid 875
Hydrosulfite 2074
Hypo (photographic) 2166
Hypophosphorous acid 1552

Ice 2498
Ice stone 34
Iceland spar 428
Imperial green 718
Indian red 824

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Indium			
970	fluoride	$In_2F_6 \cdot 18H_2O$	667.81	wh. nd.
971	hydroxide	$In(OH)_3$	165.78	gel.
972	iodate	$In(IO_3)_3$	639.52	cr.
973	iodide	InI_3	495.52	yel. cr., delq.
974	nitrate	$In(NO_3)_3 \cdot 4\frac{1}{2}H_2O$	381.86	delq. nd.
975	oxide, mono-	InO	130.76	bk.
976	oxide, sesqui-	In_2O_3	277.52	yel., amor. or trig.
977	perchlorate	$In(ClO_4)_3 \cdot 8H_2O$	557.26	col., delq.
978	sulfate	$In_2(SO_4)_3$	517.70	wh. cr., delq.
979	sulfide	In_2S_3	325.70	yel.
980	sulfite	$2In_2O_3 \cdot 3SO_2 \cdot 8H_2O$	891.35	wh. cr.
981	**Iodic acid**	HIO_3	175.93	col., rhb.
982	**Iodine**	I_2	253.84	blue-bk., rhb.
984	chloride, mono-(α)	ICl	162.38	red, cb.
985	chloride, mono- (β)	ICl	162.38	red-brn., rhb.
986	chloride, tri-	ICl_3	233.29	yel. or red-brn., rhb.
987	fluoride	IF_5	221.92	col. lq.
988	oxide, di-	IO_2	158.92	yel. cr.
989	oxide, penta-	I_2O_5	333.84	wh., trimetric
990	**Iodoplatinic acid**	$H_2PtI_6 \cdot 9H_2O$	1120.91	brn., delq. mn.
991	**Iridium**	Ir	193.10	wh. met., cb.
992	bromide, tri-	$IrBr_3 \cdot 4H_2O$	504.91	olive gn. cr.
993	bromide, tetra-	$IrBr_4$	512.76	blue, delq.
994	chloride, di-	$IrCl_2$(?)	264.01	bk.-gn. cr.
995	chloride, tri-	$IrCl_3$	299.47	olive gn.
996	chloride, tetra-	$IrCl_4$	334.93	dark red, delq.
997	hydroxide, di-	$IrO_2 \cdot 2H_2O$	261.13	dark blue
998	hydroxide, sesqui-	$Ir_2O_3 \cdot 3H_2O$	488.25	bk.
999	iodide, tri-	IrI_3	573.86	bk. cr.
1000	iodide, tetra-	IrI_4	700.78	bk. cr.
1001	oxide, di-	IrO_2	225.10	bk.
1002	oxide, sesqui-	Ir_2O_3(?)	434.20	blue-bk.
1003	sulfide, mono-	IrS(?)	225.16	blue-bk.
1004	sulfide, sesqui-	Ir_2S_3	482.38	brn.-bk.
1005	sulfide, di-	IrS_2	257.22	bk.
1006	**Iron,** cast †	Fe	55.85	gray
1007	pure	Fe	55.85	silv. met., cb.
1008	steel	Fe	55.85	silv. gray
1009	white pig	Fe	55.85	gray
1010	wrought	Fe	55.85	gray
1011	**Iron** arsenide	$FeAs$	130.76	silv. gray
1012	arsenide, di-(arsenoferrite)	$FeAs_2$	205.67	silv., cb.
1013	boride	FeB	66.67	yel.-gray
1014	carbide (cementite)	Fe_3C	179.56	pseudo hex.
1015	carbonyl	$Fe(CO)_5$	195.90	pa. yel. lq.
1016	nitride	Fe_2N	125.71	gray
1017	phosphide	FeP	96.83	....

† See also a table of alloys.

Infusible white precipitate 1362

Iodic (acid) anhydride 989

Iodine bromide 362

Iodyrite 1980

Iridium ammonium chloride 72

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
970	....	d.	....	sl. s.	d.	s. HCl, HNO_3; i. al., et.
971	....	$-H_2O$, >150	....	i.	....	s. a., alk.; i. NH_4OH
972	....	....	d.	$0.067^{20°}$	....	s. dil. H_2SO_4, HNO_3
973	....	199	....	s.	s.	s. al., chl.
974	....	$-4\frac{1}{2}H_2O$, 100	d.	v. s.	v. s.	s. abs. al.
975	....	....	....	i.	....	s. a.
976	7.179	....	sl. volt. 900	i.	....	amor. s. a.; cr. i. a., NH_3
977	....	80	d. 200	s.	d. 40°	s. abs. al.; sl. s. et.
978	3.438	....	....	s.	v. s.	....
979	4.9	....	....	....	....	d. a.; s. $(NH_4)_2S$
980	....	$-3H_2O$, 100	$-8H_2O$, 260	i.	....	s. a.
981	$4.629^{0°}$	110 d.	....	$286^{0°}$	$576^{101°}$	v. s. 87% al.; i. abs. al, et., chl.
982	$4.93^{20°}$	113.5	184.35	$0.016^{20°}$	$0.09566^{60°}$	s. al., KI, et.
984	$3.182^{0°}$	27.2	97	d.	....	s. HCl, al., et.
985	$3.24_{34}^{34°}$	13.9	97	d.	....	s. HCl, al., et.
986	$3.117^{15°}$	33	77 d.	s. d.	....	s. CCl_4, bz.; s. d. al., et.
987	3.5	-8	97	d.	....	d. a.
988	$4.2_{10}^{10°}$	d. 130	....	d.	....	s. H_2SO_4; i. al., et.
989	$4.799_{4}^{25°}$	d. 300	....	$187.4^{13°}$	....	i. abs. al., et., chl.
990	....	....	....	s. d.	....	....
991	$22.4^{20°}$	2350	>4800	i.	i.	sl. s. aq. reg., aq. Cl_2
992	....	$-3H_2O$, 100	....	s.	....	i. al., et.
993	....	d.	....	s.	....	s. al.
994	....	d. 773	....	s.	....	i. a., alk.
995	5.30	d. 763	....	i.	....	i. a., alk.
996	....	d.	....	s.	d.	s. al., dil. HCl
997	....	$-2H_2O$, 350	....	s.	....	s. alk., HCl
998	....	....	....	i.	....	i. a.
999	....	....	....	sl. s.	s.	i. al.
1000	....	d. 360	....	i.	i.	s. KI; i. a.
1001	....	....	....	$0.0002^{20°}$	....	i. a., alk.
1002	....	$-O$, 400	....	i.	....	s. h. HCl, H_2SO_4; i. alk.
1003	....	d.	....	i.	....	s. K_2S; i. a.
1004	....	d.	....	sl. s.	....	s. K_2S, HNO_3
1005	....	d.	....	i.	....	s. K_2S; i. a.
1006	7.03	1275	....	i.	i.	s. a.; i. alk.
1007	$7.86^{20°}$	1535	3000	i.	i.	s. a.; i. alk.
1008	7.6 to 7.8	1375	....	i.	i.	s. a.; i. alk.
1009	7.6 to 7.8	1075	....	i.	i.	s. a.; i. alk.
1010	7.86	1505	....	i.	i.	s. a.; i. alk.
1011	7.83	1020	....	....	....	....
1012	7.38	990	....	i.	....	sl. s. HNO_3; i. HCl
1013	$7.15^{18°}$	....	....	i.	....	s. HNO_3; s. h. H_2SO_4
1014	7.4	1837	....	i.	i.	s. a.
1015	$1.457^{21°}$	-21	102.5^{760mm}	i.	....	s. al., H_2SO_4, alk.
1016	6.35	d. >560	....	d.	....	s. HCl, H_2SO_4
1017	$5.2_{4}^{20°}$	....	....	....	....	....

Iron alum 46
Iron copperas nitrate 830
Iron ethiops 835
Iron mordant 829

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Iron			
1018	phosphide	Fe_2P	142.68	gray cr.
1019	silicide	$FeSi$	83.91	yel.-gray, oct.
1020	sulfide, di- (marcasite)	FeS_2	119.97	yel., rhb.
1021	sulfide, di- (pyrite)	FeS_2	119.97	yel., cb.
1022	sulfide (pyrrhotite)	Fe_7S_8	647.43	hex.
1023	**Cf.** also under ferric and ferrous	....	......	....
1024	**Krypton**	Kr	83.70	col. gas
1025	**Lanthanum**	La	138.92	lead gray
1026	bromate	$La_2(BrO_3)_6 \cdot 18H_2O$	1369.62	hex.
1027	bromide	$LaBr_3 \cdot 7H_2O$	504.78	col. cr.
1028	carbide	LaC_2	162.94	yel. cr.
1029	carbonate (lanthanite)	$La_2(CO_3)_3 \cdot 8H_2O$	602.00	wh., trimetric
1030	chloride	$LaCl_3$	245.29	wh., delq.
1031	chloride	$LaCl_3 \cdot 7H_2O$	371.40	wh., tri., hyg.
1032	molydate	$La_2(MoO_4)_3$	757.69	tet.
1033	nitrate	$La(NO_3)_3 \cdot 6H_2O$	433.04	wh., tri., delq.
1034	oxalate	$La_2(C_2O_4)_3 \cdot 9H_2O$	704.04	wh., tet.
1035	oxide	La_2O_3	325.84	wh., amor. or rhb.
1036	sulfate	$La_2(SO_4)_3$	566.02	wh. pd.
1037	sulfate	$La_2(SO_4)_3 \cdot 9H_2O$	728.16	col., hex., 1.564
1038	sulfide	La_2S_3	374.02	red-yel. cr.
1039	**Lead**	Pb	207.21	silv. met., cb.
1040	acetate	$Pb(C_2H_3O_2)_2$	325.30	wh. cr.
1041	acetate (sugar of lead)	$Pb(C_2H_3O_2)_2 \cdot 3H_2O$*	379.35	wh., mn.
1042	acetate	$Pb(C_2H_3O_2)_2 \cdot 10H_2O$	505.46	wh., rhb.
1043	acetate, basic	$Pb_2(C_2H_3O_2)_3OH$	608.56	wh.
1044	acetate, basic	$Pb(C_2H_3O_2)_2 \cdot Pb(OH)_2 \cdot H_2O$	584.54	wh. nd.
1045	acetate, basic	$Pb(C_2H_3O_2)_2 \cdot 2Pb(OH)_2$	807.75	wh. nd.
1045.1	antimonate	$Pb_3(SbO_4)_2$	993.15	or.-yel. pd.
1046	arsenate, monobasic	$PbH_4(AsO_4)_2$	489.06	tri., 1.82
1047	arsenate, dibasic (schultenite)	$PbHAsO_4$	347.13	wh., mn., 1.9097
1048	arsenate, meta-	$Pb(AsO_3)_2$	453.03	hex.
1049	arsenate, pyro-	$Pb_2As_2O_7$	676.24	rhb., 2.03
1050	azide	PbN_6	291.26	col. nd.
1051	borate, meta-	$Pb(BO_2)_2 \cdot H_2O$	310.87	wh. cr.
1052	bromate	$Pb(BrO_3)_2 \cdot H_2O$	481.06	col., mn.
1053	bromide	$PbBr_2$	367.05	col., rhb.
1054	carbonate (cerussite)	$PbCO_3$	267.22	wh., rhb., 2.0763
1055	carbonate, basic (hydrocerussite; white lead)	$2PbCO_3 \cdot Pb(OH)_2$*	775.67	wh., hex.
1056	chlorate	$Pb(ClO_3)_2 \cdot H_2O$	392.14	delq., mn.
1057	chloride (cotunnite)	$PbCl_2$	278.12	wh., rhb., 2.2172

* Usual commercial form.

Iron perchloride 813
Iron protochloride 846
Iron pyrites 1021
Iron true nitrate 822
Iron vitriol 865
Japanese antimony 158
Jaune brilliant 408
Jeweler's borax 2036
Jeweler's rouge 824
Kaiser green 718
Kalinite 44
Kernite 2034
Kidney ore 824
King's gold 188
King's green 718
King's yellow 188 or 1060
Kleinite 1324

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1018	5.74	1290	....	i.	i.	s. HNO_3+HF, aq. reg.; i. a.
1019	$6.1^{20^\circ}_{4}$	....	....	i.	i.	i. aq. reg.
1020	4.87	tr. 450	d.	0.00049	....	i. dil. a.
1021	5.0	1171	d.	0.0005	....	i. dil. a.
1022	$4.6^{20^\circ}_{4}$	d. >700	....	i	....	....
1023	....	....	....	....	....	....
1024	2.818(A)	−169	−151.8	11.05^{0°cc	3.57^{60°cc	sl. s. al., bz.
1025	6.15^{20°	826	1800	d.	....	s. a.
1026	....	37.5	$-14H_2O$, 100	416^{25°	....	i. al.
1027	....	....	....	v. s.	....	v. s. al.; i. et.
1028	5.02^{20°	....	....	d.	....	s. H_2SO_4; i. conc. HNO_3
1029	2.6 to 2.7	....	....	i.	....	s. a.; sl. s. aq. CO_2; i. ac.
1030	$3.947^{18^\circ}_{4}$	907	....	v. s.	d.	v. s. al.; i. act.
1031	....	d. 91	....	v. s.	v. s.	v. s. al.
1032	$4.77^{16^\circ}_{16}$	1181	....	0.00179^{25°	0.00332^{85°	....
1033	....	40	126	151^{25°	v. s.	v. s. al.; s. act.
1034	....	d.	....	0.0002^{25°	....	sl. s. a.
1035	6.51^{15°	2000	4200	sl. s., forms	$La(OH)_2$	s. a., al., NH_4Cl; i. act.
1036	3.60^{15°	d. 1150	....	3.0^{0°	0.69^{100°	sl. s. al.; i. act.
1037	2.821	d.	....	3.9^{0°	0.89^{100°	sl. s. HCl; i. al.
1038	4.911^{11°	>1000	....	i.	d.	s. dil. a.
1039	$11.337^{20^\circ}_{20}$	327.5	1620	i.	i.	s. HNO_3; i. c. HCl, H_2SO_4
1040	$3.251^{20^\circ}_{4}$	280	....	19.7^{0°	221^{50°	s. gly.; v. sl. s. al.
1041	2.55	$-3H_2O$, 75	....	45.64^{15°	200^{100°	s. gly.; sl. s. al.
1042	1.689	22	....	s.	s.	....
1043	....	....	....	v. s.	....	sl. s. al.
1044	....	....	....	v. s.	....	s. al.
1045	....	....	....	5.55	18.2	s. al.
1045.1	....	....	....	i.	i.	i. dil. a.
1046	4.46^{15°	d. 140	....	d.	....	s. HNO_3
1047	5.94	d. >200	$-H_2O$, 280	i.	sl. s.	s. HNO_3, NaOH
1048	6.42^{15°	....	....	d.	....	s. HNO_3
1049	$6.85^{15^\circ}_{15}$	802	....	i.	d.	s. HCl, HNO_3; i. ac.
1050	....	expl. 350	....	i.	0.05^{100°	v. s. ac.; i. NH_4OH
1051	5.598(anh.)	....	$-H_2O$, 160	i.	i.	s. a.; i. al.
1052	5.53	d. 180	....	1.38^{20°	....	....
1053	6.66	373	918	0.4554^{0°	4.75^{100°	s. a., KBr.; sl. s. NH_3; i. al.
1054	6.6	d. 315	....	0.00011^{20°	d.	s. a., alk.; i. NH_3, al.
1055	6.14	d. 400	....	i.	i.	s ac.; sl. s. aq. CO_2
1056	4.037	d. 110	....	151^{18°	171^{80°	....
1057	5.80	501	954^{760mm}	0.673^{0°	3.34^{100°	sl. s. dil. HCl, NH_3; i. al.

Koettigite 2535
Kontrastin 2598
Koronium bromide 2211
Krome flake 617
Kryolith 34
Kupfernickel 1409
Labarraque's solution 2077
Lanarkite 1101
Land plaster 483
Lanthanite 1029
Lapis caustic(us) 1681 or 1697
Laughing gas 1478
Lautarite 447
Lawrencite 846
Lead ammonium chloride 77
Lead azoimide 1050
Lead bichromate 1064
Lead bisulfate 1100

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Lead			
1058	chloride, tetra-	$PbCl_4$	349.04	yel. lq.
1059	chlorite	$Pb(ClO_2)_2$	342.12	yel., mn.
1060	chromate (crocoite)	$PbCrO_4$	323.22	yel., mn., 2.42
1061	chromate, basic	$PbCrO_4 \cdot PbO$	546.43	or.-yel. nd.
1062	cyanate	$Pb(CNO)_2$	291.25	wh. cr.
1063	cyanide	$Pb(CN)_2$	259.25	wh. cr.
1064	dichromate	$PbCr_2O_7$	423.23	red cr.
1065	dithionate	$PbS_2O_6 \cdot 4H_2O$	439.39	col., trig., 1.6351
1066	ferricyanide	$Pb_3[Fe(CN)_6]_2 \cdot 6H_2O$	1153.64	red cr.
1067	ferrocyanide	$Pb_2Fe(CN)_6 \cdot 3H_2O$	680.43	yel.-wh. pd.
1068	fluoride	PbF_2	245.21	wh., rhb.
1069	formate	$Pb(HCO_2)_2$	297.25	wh., rhb.
1070	hydroxide	$3PbO \cdot H_2O$	687.65	cb.
1071	hydroxide	$Pb(OH)_2$	241.23	wh.
1072	iodate	$Pb(IO_3)_2$	557.05	wh.
1073	iodide	PbI_2	461.05	yel., hex.
1074	molybdate (wulfenite)	$PbMoO_4$	367.16	yel., tet., 2.40
1075	nitrate	$Pb(NO_3)_2$	331.23	col., cb. or mn., 1.7815
1076	oxalate	PbC_2O_4	295.23	wh.
1077	oxide, sub-	Pb_2O	430.42	bk., amor.
1078	oxide, mono-(litharge)	PbO	223.21	yel., tet.
1079	oxide, mono- (massicotite)	PbO	223.21	yel., rhb., 2.61
1080	oxide, mono-	PbO	223.21	amor.
1081	oxide, red (minium)	Pb_3O_4	685.63	red, amor.
1082	oxide, sesqui-	Pb_2O_3	462.42	red-yel., amor.
1083	oxide, di- (plattnerite)	PbO_2	239.21	brn., tet., 2.229
1084	oxychloride (matlockite)	$PbCl_2 \cdot PbO$	501.33	wh., tet., 2.15
1085	oxychloride (mendipite)	$PbCl_2 \cdot 2PbO$	724.54	col. or yel., rhb., 2.27
1086	oxychloride	$PbCl_2 \cdot 3PbO$	947.75	yel.
1087	oxychloride (cossel yellow)	$PbCl_2 \cdot 7PbO$	1840.59	yel. cr.
1088	perchlorate	$Pb(ClO_4)_2 \cdot 3H_2O$	460.17	wh., rhb.
1089	periodate	$PbHIO_5$	415.14	cr.
1090	periodate	$PbHIO_5 \cdot H_2O$	433.15	amor.
1091	persulfate	$PbS_2O_8 \cdot 3H_2O$	453.38	delq. cr.
1092	phosphate, ortho-	$Pb_3(PO_4)_2$	811.59	col., hex., 1.9702
1093	phosphite	$PbHPO_3$	287.20	wh. cr.
1094	pyrophosphate	$Pb_2P_2O_7$	588.38	rhb.
1095	pyrophosphate	$Pb_2P_2O_7 \cdot H_2O$	606.40	rhb.
1096	selenate	$PbSeO_4$	350.17	wh., rhb.
1097	selenide (clausthalite)	$PbSe$	286.17	gray, cb.
1098	silicate	$PbSiO_3$	283.27	col., mn., 1.961
1099	sulfate (anglesite)	$PbSO_4$	303.27	wh., mn. or rhb 1.8823
1100	sulfate, acid	$Pb(HSO_4)_2 \cdot H_2O$	419.36	cr.
1101	sulfate, basic (lanarkite)	$PbSO_4 \cdot PbO$	526.48	col., mn.
1102	sulfide (galena)	PbS	239.27	lead gray, cb., 3.912
1103	sulfite	$PbSO_3$	287.27	wh. pd.
1104	sulfochloride	$3PbS \cdot PbCl_2$	995.93	red
1105	telluride	$PbTe$	334.82	tin wh., cb.

Lead chlorosulfide 1104
Lead monoxide, hydrated 1070
Lead nitride 1050
Lead oxide, brown 1083
Lead oxide, yellow 1078
Lead potassium chloride 1746
Lead subacetate 1043
Lead sulfocyanate 1106
Lead sulfocyanide 1106

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1058	$3.18_{4}^{0^\circ}$	−15	expl. 105	d.	....	s. conc. HCl
1059	....	expl. 126	....	v. sl. s.	sl. s.	s. aq. KOH
1060	6.12	844	d.	0.00007^{20°	i.	s. a., alk.; i. NH_3, ac.
1061	....	....	....	i.	i.	s. a., alk.
1062	....	d.	....	i.	sl. s.	....
1063	....	....	....	v. sl. s.	sl. s.	s. aq. KCN
1064	....	....	....	d.	....	s. a., alk.
1065	3.24	d.	....	$1{,}15^{20.5^\circ}$	v. s.	....
1066	....	d.	....	sl. s.	s.	s. HNO_3, alk.
1067	....	d.	....	i.	....	sl. s. H_2SO_4
1068	8.24	855	1290	0.064^{20°	....	s. HNO_3; i. NH_3, HF, act.
1069	4.56	d. 190	....	1.6^{16°	18^{100°d.	i. al.
1070	7.592	$-H_2O$, 130	....	0.014	....	s. a., alk.
1071	....	d. 145	....	0.016^{20°	sl. s.	s. a., alk.; i. act.
1072	....	d. 300	....	0.0012^{2°	0.003^{25°	sl. s. HNO_3; i. NH_3
1073	6.16	402	954	0.044^{20°	0.436^{100°	s. KI; i. al.
1074	$6.7^{17.5^\circ}$	1068	....	i.	....	s. a.
1075	4.53	d. 470	....	38.8^{0°	138.8^{100°	8.8^{22° al.
1076	5.28	d. 300	....	0.00016^{18°	....	s. HNO_3, KOH; i. al.
1077	8.34	d. red heat	....	i.	i.	s. a., alk.
1078	9.53	888	....	0.0068^{18°	....	s. alk., PbAc, NH_4Cl, $CaCl_2$
1079	8.0	....	....	....	....	....
1080	9.2 to 9.5	....	....	i.	i.	s. alk., PbAc, NH_4Cl, $CaCl_2$
1081	9.1	d. 500	....	i.	i.	s. ac., h. HCl
1082	....	d. 360	....	i.	d.	s. a., alk.
1083	9.375	d. 290	....	i.	i.	s. ac., h. alk.; i. al.
1084	7.21	524 d.	....	i.	i.	s. alk.
1085	7.08	693	....	i.	i.	s. alk.
1086	....	....	....	0.0056^{18°	0.07^{74°	....
1087	....	....	....	i.	....	....
1088	2.6	d. 100	....	s.	....	s. al.
1089	....	d. 130	....	i.	i.	s. dil. HNO_3
1090	....	$-H_2O$, 110	....	i.	i.	s. dil. HNO_3
1091	....	....	....	v. s.	v. s.	d. alk.
1092	6.9 to 7.3	1014	....	0.000014^{20°	i.	s. HNO_3, alk.; i. ac., al.
1093	....	d.	....	i.	i.	s. HNO_3
1094	5.8^{20°	815 d.	....	i.	d	s. a., KOH; i. act.
1095	....	....	....	i.	d.	s. HNO_3, KOH, $Na_4P_2O_7$
1096	$6.37_{4}^{20^\circ}$	d.	....	i.	i.	s. conc. a.
1097	8.10^{15°	1065	....	i.	i.	s. HNO_3, h. conc. HCl
1098	6.49	766	....	i.	....	s. a.
1099	6.2	1170	....	0.0028^{0°	0.0056^{40°	s. conc. a., NH_4 salts; i. al.
1100	....	d.	....	0.0001^{18°	....	sl. s. H_2SO_4
1101	6.92	977	....	0.0044^{18°	....	sl. s. H_2SO_4
1102	7.5	1120	....	0.00009^{18°	i.	s. a.; i. alk.
1103	....	d.	....	i.	i.	s. HNO_3
1104	....	....	....	i.	d.	i. dil. a.
1105	$8.16_{4}^{20^\circ}$	917	....	....	....	....

Lead tetraethyl, cf. table of organic compounds.
Lead white 1055
Le Chatelierite 1949
Leipzig yellow 1060
Lemon, essential salt of 1721
Lemon chrome 233
Lemon yellow 1060
Lencogen 2031

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Lead			
1106	thiocyanate	$Pb(CNS)_2$	323.37	col., mn
1107	thiosulfate	PbS_2O_3	319.33	wh. pd.
1108	tungstate (raspite)	$PbWO_4$	455.13	mn.
1109	tungstate (stolzite)	$PbWO_4$	455.13	col., tet., 2.269
1110	**Lithium**	Li	6.94	silv. met. cb.
1111	acetate	$LiC_2H_3O_2\cdot 2H_2O$	102.02	wh., rhb.
1112	aluminate	$LiAlO_2$	65.91	wh. pd.
1113	amide	$LiNH_2$	22.96	col., cb.
1114	antimonide	Li_3Sb	142.58	....
1115	arsenate	Li_3AsO_4	159.73	....
1116	benzoate	$LiC_7H_5O_2$	128.05	wh. leaflets
1117	bicarbonate	$LiHCO_3$	67.96	in soln. only
1118	borate, meta-	$LiBO_2$	49.76	tri.
1119	borate, tetra-	$Li_2B_4O_7\cdot 5H_2O$	259.24	wh.
1120	bromide	$LiBr$	86.86	wh., delq., cb., 1.784
1121	bromide	$LiBr\cdot 2H_2O$	122.89	wh. pr.
1122	carbide	Li_2C_2	37.90	wh. cr.
1123	carbonate	Li_2CO_3	73.89	col., mn., 1.567
1124	chlorate	$LiClO_3$	90.40	col.
1125	chlorate	$LiClO_3\cdot \frac{1}{2}H_2O$	99.40	delq., tet.
1126	chloride	$LiCl$	42.40	wh., delq., cb., 1.662
1127	chloroplatinate	$Li_2PtCl_6\cdot 6H_2O$	529.95	or.-red, hex.
1128	chromate	$Li_2CrO_4\cdot 2H_2O$	165.92	yel., rhb.
1129	citrate	$Li_3C_6H_5O_7\cdot 4H_2O$	281.98	wh. cr.
1130	dichromate	$Li_2Cr_2O_7\cdot 2H_2O$	265.93	delq., yel.-red
1131	dithionate	$Li_2S_2O_6\cdot 2H_2O$	210.03	rhb., 1.5602
1132	fluoride	LiF	25.94	wh., cb., 1.3915
1133	fluosulfonate	$LiSO_3F$	106.00	wh.
1134	formate	$LiHCO_2\cdot H_2O$	69.97	col., rhb.
1135	hydride	LiH	7.95	wh., cb.
1136	hydroxide	$LiOH$	23.95	wh. cr.
1137	hydroxide	$LiOH\cdot H_2O$	41.96	col., mn.
1138	iodide	LiI	133.86	delq., cb., 1.955
1139	iodide	$LiI\cdot 3H_2O$	187.91	wh., mn.
1140	nitrate	$LiNO_3$	68.95	col., trig., 1.735
1141	nitrate	$LiNO_3\cdot 3H_2O$	123.00	col.
1142	nitride	Li_3N	34.83	bk.
1143	nitrite	$LiNO_2\cdot H_2O$	70.96	wh. nd.
1144	oxalate	$Li_2C_2O_4$	101.90	col. cr.
1145	oxalate, acid	$LiHC_2O_4\cdot H_2O$	113.98	col.
1146	oxide	Li_2O	29.88	col., 1.644
1147	perchlorate	$LiClO_4$	106.40	delq.
1148	perchlorate	$LiClO_4\cdot 3H_2O$	160.45	hex.
1149	permanganate	$LiMnO_4$	125.87	cr.
1150	phosphate, monobasic	LiH_2PO_4	103.94	col.
1151	phosphate, tribasic	Li_3PO_4	115.80	wh., rhb.
1152	phosphate, tribasic	$Li_3PO_4\cdot 12H_2O$	331.99	wh., trig.
1153	salicylate	$LiC_7H_5O_3$	144.05	col.
1154	silicate, meta-	Li_2SiO_3	89.94	col., rhb., 1.548

* Usual commercial form.

Ley 2075

Lime, burnt 459

Lime, quick 459

Lime, slaked 443

Lime, sulfurated 485

Lime, unslaked 459

Lime saltpeter 455

Liquid arsenic, fuming 178

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1106	3.82	d. 190	....	0.05^{20°	s.	s. KCNS, HNO_3
1107	5.18	d.	....	0.03	d. 100°	s. $Na_2S_2O_3$
1108	8.46	1123	....	i.	i.	d. h. HNO_3; i. NH_4OH
1109	8.23	....	....	....	....	....
1110	0.53^{20°	186	1336±5	d.	d.	s. a., NH_3
1111	....	70	d.	300^{15°	v. s.	21.5 al.
1112	$2.554^{25.1^\circ}_{4}$	>1625	....	i.	....	....
1113	$1.178^{18.5^\circ}$	390	430	d.	....	i. et., bz.
1114	3.2^{17°	>950	....	....	....	....
1115	3.07	....	....	s.	s.	....
1116	....	....	....	33^{25°	40^{100°	7.7^{25°, 10^{78° al.
1117	....	....	....	s.	....	....
1118	....	843	....	0.9^{0°	16^{45°	....
1119	....	$-2H_2O$, 200	....	v. s.	....	i. al.
1120	$3.464^{25^\circ}_{4}$	547	1265	143^{0° ($2H_2O$)	266^{100° ($1H_2O$)	s. al., act.
1121	....	44	....	246^{20°	....	s. al.
1122	1.65^{18°	....	....	d.	....	s. a.
1123	2.11^{0°	618	d.	1.54^{0°	0.72^{100°	s. dil. a.; i. al., act., NH_3
1124	....	129	d. 270	313.5^{18°	v. s.	....
1125	....	65	$-\frac{1}{2}H_2O$, 90	s.	∞	v. s. al.
1126	$2.068^{25^\circ}_{4}$	614	1360	67^{0°	127.5^{100°	2.48^{15° al.; s. et.
1127	....	$-6H_2O$, 180	....	s.	s.	s. al.; i. et.
1128	....	$-2H_2O$, 130	....	111^{20°	100^{30°	....
1129	....	d.	....	61.2^{15°	66.7^{100°	sl. s. al., et.
1130	$2.34^{30^\circ}_{4}$	$-2H_2O$, 110	....	124^{0°	188^{100°	....
1131	2.158	d.	....	v. s.	....	....
1132	$2.295^{21.5^\circ}$	870	1670	0.12^{0°	0.135^{35°	s. HF; i. act.
1133	....	360	....	s.	s.	s. al., et.
1134	1.46	$-H_2O$, 94	....	49.2^{0°	346.6^{104°	sl. s. al., et.
1135	0.820	680	....	d.	....	i. et.
1136	2.54	445	925±	12.7^{0°	17.5^{100°	sl. s. al.
1137	1.83	....	d.	22.3^{10°	26.8^{80°	sl. s. al.
1138	$4.061^{25^\circ}_{4}$	446	1190	151^{0°	481^{100°	251^{25° al.; v. s. NH_3
1139	3.5	73	$-3H_2O$, 300	s.	s.	s. abs. al., act.
1140	2.38	261	....	53.4^{0°	194^{70°	s. al., NH_3
1141	....	29.88	....	v. s.	∞	....
1142	....	845	....	d. to NH_3 $+LiOH$	....	....
1143	1.615^{0°	<100	d.	125^{0°	459^{50°	v. s. abs. al.
1144	$2.121^{17.5^\circ}$	d.	....	$8^{19.5^\circ}$	s.	i. al., et.
1145	....	d.	....	8^{17°	....	....
1146	$2.013^{25^\circ}_{4}$	....	subl. <1000	forms LiOH	....	....
1147	2.43	236	d. 410	42^{0°	233^{93°	v. s. al., m. al.; 11.4 et.
1148	1.84	95	$-2H_2O$,100; $-3H_2O$, 150	s.	s.	v. s. al., m. al.; 0.196^{25° et.
1149	2.06	d. 190	....	71.43^{16°	....	d. alk.
1150	2.461	>100	....	....	....	....
1151	$2.537^{17.5^\circ}$	837	....	0.034^{18°	v. sl. s.	s. a., NH_4Cl; i. act.
1152	1.645	100	....	v. sl. s.	v. sl. s.	....
1153	....	d.	....	128^{25°	....	v. s. al.
1154	$2.52^{25^\circ}_{4}$	1201	....	i.	s. d.	s. dil. HCl

Litharge 1078
Lithia 1146
Lithium bichromate 1130
Lithium binoxalate 1145
Lithium bisulfate 1160
Lithium carbonate, acid 1117
Lithium fluosilicate 1157
Liver ore 1334

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Lithium			
1155	silicate, ortho-	Li_4SiO_4	119.82	col., rhb., 1.60±
1156	silicide	Li_6Si_2	97.76	blue cr.
1157	silicofluoride	$Li_2SiF_6 \cdot 2H_2O$	191.97	mn.
1158	sulfate	Li_2SO_4	109.94	col., mn., 1.465
1159	sulfate	$Li_2SO_4 \cdot H_2O$*	127.96	col., mn., 1.477
1160	sulfate, acid	$LiHSO_4$	104.01	pr.
1161	sulfide	Li_2S	45.94	wh. or red-yel.; amor. or cb.
1162	sulfite	Li_2SO_3	93.94	wh. pd.
1163	urate	$LiHC_5H_2N_4O_3$	174.05	wh. pd.
1164	**Lutecium**	Lu	174.99	....
1165	chloride	$LuCl_3$	281.36	....
1166	sulfate	$Lu_2(SO_4)_3 \cdot 8H_2O$	782.29	....
1167	**Magnesium**	Mg	24.32	silv. met., hex.
1168	acetate	$Mg(C_2H_3O_2)_2$	142.41	wh.
1169	acetate	$Mg(C_2H_3O_2)_2 \cdot 4H_2O$*	214.47	wh., mn. pr., 1.491
1170	aluminate (spinel)	$MgO \cdot Al_2O_3$	142.26	col., cb., 1.718-23
1171	ammonium arsenate	$MgNH_4AsO_4 \cdot 6H_2O$	289.37	wh., rhb. or tet.
1172	ammonium chloride	$MgCl_2 \cdot NH_4Cl \cdot 6H_2O$	256.83	wh., rhb., delq.
1173	ammonium chromate	$MgCrO_4 \cdot (NH_4)_2CrO_4 \cdot 6H_2O$	400.52	yel., mn.
1174	ammonium phosphate (struvite)	$MgNH_4PO_4 \cdot 6H_2O$	245.44	col., rhb., 1.496
1175	ammonium sulfate (boussingaultite)	$MgSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	360.62	col., mn.
1176	antimonide	Mg_3Sb_2	316.48	met.
1177	arsenate, acid (roesslerite)	$MgHAsO_4 \cdot 7H_2O$	290.35	mn.
1178	arsenite, ortho-	$Mg_3(AsO_3)_2$	318.78	....
1179	benzoate	$Mg(C_7H_5O_2)_2 \cdot 3H_2O$	320.59	wh. pd.
1180	bismuthide	Mg_3Bi_2	490.96	met.
1181	borate, meta-	$Mg(BO_2)_2 \cdot 8H_2O$	254.09	col., tet.
1182	bromate	$Mg(BrO_3)_2 \cdot 6H_2O$	388.25	col., cb., 1.5136
1183	bromide	$MgBr_2$	184.15	wh., delq.
1184	bromide	$MgBr_2 \cdot 6H_2O$*	292.25	col., hex., delq.
1185	bromoplatinate	$MgPtBr_6 \cdot 12H_2O$	915.24	trig.
1186	carbonate (magnesite)	$MgCO_3$	84.33	wh., trig., 1.700
1187	carbonate (nesquehonite)	$MgCO_3 \cdot 3H_2O$	138.38	col., rhb., 1.501
1188	carbonate, basic (hydromagnesite)	$3MgCO_3 \cdot Mg(OH)_2 \cdot 3H_2O$	365.37	wh., rhb., 1.530
1189	chlorate	$Mg(ClO_3)_2 \cdot 6H_2O$	299.33	wh., delq.
1190	chloride (chloromagnesite)	$MgCl_2$	95.23	col., hex., 1.675
1191	chloride (bischofite)	$MgCl_2 \cdot 6H_2O$*	203.33	wh., delq., mn., 1.507
1192	chloropalladate	$MgPdCl_6 \cdot 6H_2O$	451.86	hex.
1193	chloroplatinate	$MgPtCl_6 \cdot 6H_2O$	540.39	trig.
1194	chlorostannate	$MgSnCl_6 \cdot 6H_2O$	463.86	trig.
1195	chromate	$MgCrO_4 \cdot 7H_2O$	266.44	yel., rhb., 1.5500
1196	citrate, dibasic	$MgHC_6H_5O_7 \cdot 5H_2O$	304.51	wh.
1197	ferrocyanide	$Mg_2Fe(CN)_6 \cdot 12H_2O$	476.79	pa. yel.
1198	fluoride (sellaite)	MgF_2	62.32	col., tet., 1.378

* Usual commercial form.

Lodestone 835
Lollingite 1012
Lunar caustic 1981
Lunar cornea 1968
Lye 2075
Macquer's salt 1637
Magister of bismuth 328
Magnesia 1207

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Cold Water	Hot Water	Other Reagents
1155	2.28	1256	....	i.	d.	d. a.
1156	1.12	ign. in air	d. >500	d.	....	d. a.
1157	$2.3^{12\circ}$	$-2H_2O$, 100	d.	$73^{17\circ}$	....	s. al.; i. et., act.
1158	2.22	860	....	$35.34^{0\circ}$	$29.9^{100\circ}$	i. act., 80% al.
1159	2.06	$-H_2O$, 130	....	$43.6^{0\circ}$	$35^{100\circ}$	i. 80% al.
1160	$2.123^{13\circ}$	170.5	....	d.	....	....
1161	1.66	....	....	v. s.	v. s.	v. s. al.
1162	....	455 d.	....	s.	....	sl. s. al.
1163	....	....	....	$0.27^{20\circ}$	$2.5^{100\circ}$	....
1164	....	....	....	....	....	....
1165	3.98	892	....	....	....	....
1166	....	....	....	$66^{20\circ}$	$22^{40\circ}$	....
1167	$1.74^{20\circ}$	651	1110	i.	sl. s. d.	s. a., NH_4 salts
1168	1.42	323	....	v. s.	v. s.	$5.25^{15\circ}$ m. al.
1169	1.454	80°	....	v. s.	v. s.	v. s. al.
1170	3.6	2135	....	i.	....	v. sl. s. dil. HCl; i. dil. HNO_3
1171	$1.932^{15\circ}$	d.	....	$0.0339^{0\circ}$	$0.0237^{80\circ}$	s. a.; i. al.
1172	1.456	$-4H_2O$, 195	....	16.7	s.	....
1173	$1.84^{16\circ}$	d.	....	v. s.	v. s.	....
1174	1.715	d. 100	....	$0.0231^{0\circ}$	$0.0195^{80\circ}$	s. a.; i. al.
1175	1.72	>120	....	$16.86^{0\circ}$	$130^{100\circ}$	....
1176	....	961	....	i.	....	....
1177	$3.155^{15\circ}$	$-5H_2O$, 100	....	d.	....	....
1178	....	d.	....	s.	v. s.	s. a., NH_4Cl; i. NH_4OH
1179	....	$-3H_2O$, 110	....	$4.5^{25\circ}$(anh.)	s.	s. act.
1180	....	715	....	....	....	....
1181	2.30	....	....	i.	i.	s. a.
1182	2.29	$-6H_2O$, 200	d.	$71.5^{7\circ}$	v. s.	....
1183	3.72	700	....	$99.3^{10\circ}$	$125.4^{100\circ}$	s. HBr; sl. s. et.
1184	....	165 d.	....	$310^{0\circ}$	v. s.	s. al., act.; sl. s. NH_3
1185	2.802	....	....	....	....	....
1186	3.037	d. 350	....	0.0106	....	s. a., aq. CO_2; i. act., NH_3
1187	1.852	$-H_2O$, 100	....	$0.1518^{19\circ}$	d.	s. a., aq. CO_2
1188	2.16	d.	....	0.04	0.011	s. a., NH_4 salts; i. al.
1189	$1.80^{25\circ}$	35	d. 120	$494^{0\circ}$	v. s.	sl. s. al.
1190	$2.325^{25\circ}$	712	1412	$52.8^{0\circ}$	$73^{100\circ}$	50 al.
1191	1.56	118 d.	d.	$281^{0\circ}$	$918^{100\circ}$	50 al.
1192	2.12	d.	....	....	....	....
1193	2.437	d.	....	....	....	....
1194	2.08	d. 100	....	....	....	....
1195	1.695	$-3H_2O$, 120	....	$211.5^{18\circ}$	v. s.	....
1196	....	....	....	$20^{25\circ}$	s.	i. al.
1197	....	....	....	33	....	....
1198	3.0	1396	....	$0.0076^{18\circ}$	i.	s. HNO_3; i. al.

Magnesia alba 1186
Magnesia usta 1207
Magnesia white 1186 or 1207
Magnesite 1186
Magnesium calcium carbonate 451
Magnesium calcium silicate 452
Magnesium fluosilicate 1224

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Magnesium			
1199	formate	$Mg(HCO_2)_2 \cdot 2H_2O$	150.39	col., rhb.
1200	hydroxide (brucite)	$Mg(OH)_2$	58.34	wh., trig., 1.5617
1201	hypophosphite	$Mg(H_2PO_2)_2 \cdot 6H_2O$	262.41	wh., tet., eff.
1202	iodate	$Mg(IO_3)_2 \cdot 4H_2O$	446.22	mn.
1203	iodide	MgI_2	278.16	wh., delq.
1204	nitrate	$Mg(NO_3)_2 \cdot 6H_2O$	256.43	col., delq., mn.
1205	nitride	Mg_3N_2	100.98	gn.-yel., amor.
1206	oxalate	$MgC_2O_4 \cdot 2H_2O$	148.37	wh. pd.
1207	oxide (magnesia; periclase)	MgO	40.32	col., cb., 1.7364
1208	perchlorate	$Mg(ClO_4)_2$*	223.23	wh., delq.
1209	perchlorate	$Mg(ClO_4)_2 \cdot 6H_2O$	331.33	wh., hyg.
1210	permanganate	$Mg(MnO_4)_2 \cdot 6H_2O$	370.28	purple, delq. nd.
1211	phosphate, dibasic (newberyite)	$MgHPO_4 \cdot 3H_2O$	174.36	wh., rhb., 1.5196
1212	phosphate, dibasic	$MgHPO_4 \cdot 7H_2O$	246.42	wh., mn.
1213	phosphate, tribasic	$Mg_3(PO_4)_2 \cdot 4H_2O$	334.98	wh., mn.
1214	phosphate, tribasic (bobierite)	$Mg_3(PO_4)_2 \cdot 8H_2O$	407.05	mn. pr.
1215	phosphate, pyro-	$Mg_2P_2O_7$	222.60	col., mn., 1.604
1216	phosphate, pyro-	$Mg_2P_2O_7 \cdot 3H_2O$	276.65	wh., amor.
1217	phosphite, ortho-	$MgHPO_3 \cdot 3H_2O$	158.36	....
1218	potassium chloride (carnallite)	$MgCl_2 \cdot KCl \cdot 6H_2O$	277.88	delq., rhb., 1.475
1219	potassium sulfate (picromerite)	$MgSO_4 \cdot K_2SO_4 \cdot 6H_2O$	402.73	mn., 1.4629
1220	selenate	$MgSeO_4 \cdot 6H_2O$	275.38	col., mn., 1.4892
1221	silicate (talc)	$Mg_3Si_4O_{11} \cdot H_2O$	379.22	wh., mn. or rhb., 1.589
1222	silicide	Mg_2Si	76.70	slate blue, cb.
1223	silicide	Mg_5Si_3	205.78	....
1224	silicofluoride	$MgSiF_6 \cdot 6H_2O$	274.48	col., trig., 1.3439
1225	sodium chloride	$MgCl_2 \cdot NaCl \cdot H_2O$	171.70	col.
1226	stearate	$Mg(C_{17}H_{35}CO_2)_2$	591.24	wh
1227	sulfate	$MgSO_4$	120.38	col.
1228	sulfate (epsom salt; epsomite)	$MgSO_4 \cdot 7H_2O$*	246.49	col., rhb., 1.4554
1229	sulfide	MgS	56.38	pa. red, cb., 2.268
1230	sulfite	$MgSO_3 \cdot 6H_2O$	212.47	wh., trig. pd.
1231	tartrate	$MgC_4H_4O_6 \cdot 5H_2O$	262.47	mn.
1232	thiosulfate	$MgS_2O_3 \cdot 6H_2O$	244.54	wh., rhb. pr.
1233	**Manganese**	Mn	54.93	gray-pink met.
1234	acetate	$Mn(C_2H_3O_2)_2$	173.02	....
1235	acetate	$Mn(C_2H_3O_2)_2 \cdot 4H_2O$*	245.08	pa. pink, mn.
1236	ammonium arsenate	$MnNH_4AsO_4 \cdot 6H_2O$	319.98	red pd.
1237	ammonium phosphate	$MnNH_4PO_4 \cdot H_2O$	185.97	wh. cr.
1238	ammonium sulfate	$MnSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	391.23	pa. red, mn.
1239	arsenate, acid	$MnHAsO_4 \cdot H_2O$	212.86	....
1240	benzoate	$Mn(C_7H_5O_2)_2 \cdot 3H_2O$	351.20	flat pr.

* Usual commercial form.

Magnesium phosphate, tertiary 1213

Magnesium phosphite, hypo- 1201

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1199	....	....	....	14^{0°(anh.)	24^{100° (anh.)	i. al., et.
1200	2.4	d.	....	0.0009^{18°	....	s. NH_4 salts, dil. a.
1201	1.59^{13°	d. 100	....	20^{25°	....	sl. s. al.; d. HNO_3
1202	$3.3^{13.5^\circ}$	$-4H_2O$, 210	d.	8.8^{0°	29.9^{100°	....
1203	4.25^{25°	d.	....	120.8^{0°	173.2^{40°	s. al., et., NH_3
1204	1.464	95	$-5H_2O$, 330°	223^{0°	∞	s. al.
1205	....	d.	....	i.	d.	s. a.; i. al.
1206	....	d.	....	0.07^{16°	0.08^{100°	s. a., alk. oxalates
1207	3.65	2800	3600	0.00062	....	s. a., NH_4 salts; i. al.
1208	2.60^{25°	d.	....	99.6^{25°	v. s.	24^{25° al., 51.8^{25° m. al., 0.29 et.
1209	$1.970^{25^\circ}_{4}$	147	$-6H_2O$, 250	s.	....	s. al.
1210	....	d.	....	v. s.	d.	s. ac., m. al.
1211	2.10	....	....	0.025	....	s. a.
1212	....	$-3H_2O$, 100	forms $Mg_2P_2O_7$	0.31	0.20	s. a., i. al.
1213	1.64^{15°	....	....	0.02	....	s. a.; i. NH_3, NH_4 salts
1214	2.41	$-5H_2O$, 120°	$-8H_2O$, 400°	i.	....	s. HNO_3, NH_4 citrate
1215	2.598^{22°	1383	....	i.	i.	s. a.; i. alk.
1216	2.56	$-3H_2O$, 100	....	i.	sl. s.	s. a.; i. al.
1217	....	....	....	0.25	....	s. a.
1218	$1.60^{19.4^\circ}_{4}$	265	....	64.5^{19° d.	d.	d. al.
1219	2.15	d. 72	....	19.26^{0°	81.7^{75°	....
1220	1.928	....	....	s.	s.	....
1221	2.6-2.8	....	....	i.	i.	i. a.
1222	2	1102	....	d.	....	d. HCl
1223	....	1102	....	i.	d.	d. a., NH_4Cl
1224	$1.788^{17.5^\circ}_{4}$	d.	....	$64.8^{17.5^\circ}$	s.	d. HF
1225	....	....	....	s.	s.	....
1226	....	88.5	....	0.003^{15°	0.008^{50°	0.02^{25° abs. al.; 0.003^{25° et.; d. a.
1227	2.66	1185	....	26.9^{0°	68.3^{100°	s. al.
1228	1.68	70 d.	....	72.4^{0°	178^{40°	s. al.
1229	2.80	d.	....	d.	....	s. a.
1230	....	$-6H_2O$, 200	d.	1.25	0.833	i. al., NH_3
1231	1.67	d.	....	0.8^{18°	1.4^{90°	....
1232	1.818^{24°	$-3H_2O$, 100	d.	v. s.	v. s.	s. al.
1233	7.2^{20°	1260	1900	d.	....	s. dil. a.
1234	$1.74^{20^\circ}_{4}$	....	....	s.	s.	....
1235	1.589	....	....	s.	64.5^{50°	s. al., m. al.
1236	....	d.	....	i.	....	s. a.; i. al.
1237	....	....	....	0.0031	0.005	i. al., NH_4 salts
1238	1.831	....	....	51.3^{25°	v. s.	....
1239	....	$-H_2O$, 140	....	0.013	d.	s. a.
1240	....	....	....	6.55^{15°	....	s. al.

Magnetic oxide of iron 835
Magnetite 835
Malachite 728
Manganese alum 47
Manganese black 1269

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Manganese			
1241	boride	MnB_2	76.57	gray-vl.
1242	bromide	$MnBr_2$	214.76	rose-red, delq.
1243	bromide	$MnBr_2{\cdot}4H_2O$	286.83	red, delq., mn.
1244	bromoplatinate	$MnPtBr_6{\cdot}12H_2O$	945.85	trig.
1245	carbide	Mn_3C	176.80	tet.
1246	carbonate (rhodocrosite)	$MnCO_3$	114.94	rose, trig., 1.817
1247	chloride (scacchite)	$MnCl_2$	125.84	rose, delq., cb.
1248	chloride	$MnCl_2{\cdot}4H_2O$*	197.91	rose red, delq., mn. 1.575
1249	chloride, per-	$MnCl_4$	196.76	gn.
1250	chloroplatinate	$MnPtCl_6{\cdot}6H_2O$	571.00	trig.
1251	dithionate	$MnS_2O_6{\cdot}6H_2O$	323.15	rose, tri.
1252	ferrocyanide	$Mn_2Fe(CN)_6{\cdot}7H_2O$	447.93	gn.-wh. pd.
1253	fluoride (ous)	MnF_2	92.93	red pr.
1254	fluoride (ic)	MnF_3	111.93	cr.
1255	formate	$Mn(HCO_2)_2{\cdot}2H_2O$	181.00	rhb.
1256	hydroxide (ous) (pyrochroite)	$Mn(OH)_2$	88.95	wh., trig.
1257	hydroxide (ic) (manganite)	$Mn_2O_3{\cdot}H_2O$	175.88	brn., rhb., 2.24
1258	hypophosphite	$Mn(H_2PO_2)_2{\cdot}H_2O$	202.94	rose red, mn.
1259	iodide	MnI_2	308.77	wh., pink, or brn.
1260	iodide	$MnI_2{\cdot}4H_2O$	380.83	rose red, mn.
1261	iodoplatinate	$MnPtI_6{\cdot}9H_2O$	1173.82	trig.
1262	lactate	$Mn(C_3H_5O_3)_2{\cdot}3H_2O$	287.12	pa. red, mn.
1263	nitrate	$Mn(NO_3)_2{\cdot}6H_2O$	287.04	rose red, mn.
1264	oxalate	MnC_2O_4	142.95	....
1265	oxalate	$MnC_2O_4{\cdot}2\frac{1}{2}H_2O$	187.99	wh.
1266	oxide (ous) (manganosite)	MnO	70.93	gray-gn., cb., 2.16
1267	oxide (ous-ic) (hausmannite)	Mn_3O_4	228.79	brn.-bk., tet., 2.46
1268	oxide (ic)	Mn_2O_3	157.86	brn.-bk., cb.
1269	oxide, di- (pyrolusite; polianite)	MnO_2*	86.93	bk., rhb.
1270	oxide, tri-	MnO_3	102.93	red, delq.
1271	oxide, hepta-	Mn_2O_7	221.86	red oil
1272	perchlorate	$Mn(ClO_4)_2{\cdot}8H_2O$	397.97	....
1273	phosphate (ous), monobasic	$Mn(H_2PO_4)_2{\cdot}2H_2O$	284.95	pr.
1274	phosphate (ous), dibasic	$MnHPO_4{\cdot}3H_2O$	204.97	pink, rhb., 1.656
1275	phosphate (ous), tribasic	$Mn_3(PO_4)_2{\cdot}7H_2O$	480.86	red, amor.
1276	phosphate (ic), tribasic	$MnPO_4{\cdot}H_2O$	167.93	gray cr. pd.
1277	phosphate, pyro-	$Mn_2P_2O_7$	283.82	brn.-pink, mn., 1.704
1278	phosphate, pyro-	$Mn_2P_2O_7{\cdot}3H_2O$	337.87	wh., amor. pd.
1279	phosphide	MnP	85.91	gray
1280	phosphite	$MnHPO_3{\cdot}H_2O$	152.93	red-wh.
1281	selenate	$MnSeO_4{\cdot}2H_2O$	233.92	rhb.
1282	selenide	$MnSe$	133.89	gray, cb.
1283	silicate (hermannite; rhodonite)	$MnSiO_3$	130.99	pink, tri., 1.700
1284	silicide	$MnSi$	82.99	tetrahedral
1285	silicide, di-	$MnSi_2$	111.05	gray, oct.

* Usual commercial form.

Manganese dioxide 1269
Manganese fluosilicate 1287
Manganese green 258
Manganese peroxide 1269

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1241	6.9	....	....	d.	....	s. a.
1242	$4.39^{25^{\circ}}_{4}$	d.	....	$127.3^{0^{\circ}}$	$228^{100^{\circ}}$	i. NH_3
1243	....	64.3 d.	....	$296.7^{0^{\circ}}$	$985^{70^{\circ}}$	s. al.
1244	$2.759^{20^{\circ}}_{4}$	....	....	....	....	....
1245	$6.89^{17^{\circ}}$	....	....	d.	....	s. a.
1246	3.125	d	....	$0.0065^{25^{\circ}}$	....	s. aq. CO_2, dil. a., i. NH_3, al.
1247	$2.977^{25^{\circ}}_{4}$	650	1190	$63.4^{0^{\circ}}$	$123.8^{106^{\circ}}$	s. al.; i. et., NH_3
1248	2.01	58.0	$-H_2O$, 106; $-4H_2O$, 200	$151^{8^{\circ}}$	∞	s. al.; i. et.
1249	....	....	....	s.	s.	s. al., et.
1250	2.692	d.	....	....	....	....
1251	$1.757^{20^{\circ}}_{4}$	....	....	s.	....	....
1252	....	....	....	i.	....	s. HCl; i. NH_4 salts
1253	3.98	856	....	$1.2^{20^{\circ}}$	$0.5^{100^{\circ}}$	s. a.; sl. s. NH_3; i. al., et.
1254	3.54	d.	....	d.	....	s. a.
1255	1.953	d.	....	s.	s.	....
1256	$3.258^{13^{\circ}}$	d.	....	$0.002^{20^{\circ}}$	i.	s. a., NH_4 salts; i. alk.
1257	3.258	d.	....	i.	i.	s. h. H_2SO_4
1258	....	$-H_2O$, 150	d.	$15.2^{25^{\circ}}$	16.6	i. al.
1259	5.01	d. 80	....	v. s.	....	s. NH_3
1260	....	d.	....	v. s.	v. s.	s. al.
1261	$3.604^{20^{\circ}}_{4}$	d.	....	....	....	....
1262	....	d.	....	$10^{25^{\circ}}$	v. s.	s. al.
1263	$1.82^{21^{\circ}}$	25.8	129.5	$426^{0^{\circ}}$	∞	v. s. al.
1264	$2.43^{21.7^{\circ}}$	d.	....	v. sl. s.	v. sl. s.	....
1265	$2.453^{20^{\circ}}$	d. 150	....	$0.03^{25^{\circ}}$	$0.08^{100^{\circ}}$	s. dil. a.
1266	5.18	1650	....	i.	i.	s. a., NH_4Cl
1267	4.718	1705	....	i.	i.	s. HCl, H_2SO_4
1268	4.81	$-O$, 1080	....	i.	i.	s. a.; i. act.
1269	5.026	$-O$, >230	....	i.	i.	s. HCl; i. HNO_3, act.
1270	....	d.	....	s.	d.	s. H_2SO_4; d. et.
1271	2.4	<-20	expl.	v. s.	d.	s. conc. H_2SO_4
1272	$1.99^{20^{\circ}}_{4}$	....	....	....	....	....
1273	....	....	....	s.	....	i. al.
1274	....	$-3H_2O$, 200	d.	sl. s.	d. 100	s. a.; i. al.
1275	....	....	....	v. sl. s.	....	s. a., ac.; i. al.
1276	....	$-H_2O$, 300	d.	i.	....	s. h. conc. H_2SO_4, conc. H_3PO_4
1277	$3.707^{25^{\circ}}_{4}$	1196	....	i.	....	s. a.
1278	....	....	....	i.	....	s. aq. $K_4P_2O_7$, H_2SO_3; i. act.
1279	$5.39^{21^{\circ}}_{4}$	1190	....	i.	i.	s. HNO_3; i. HCl
1280	....	$-H_2O$, 200	....	sl. s.	....	s. aq. $MnCl_2$, aq. $MnSO_4$
1281	$2.949^{20^{\circ}}_{4}$	....	....	s.	s.	....
1282	$5.59^{15^{\circ}}$	....	....	i.	d.	d. dil. a.
1283	$3.48^{25^{\circ}}_{4}$	1273	....	i.	i.	i. HCl
1284	$5.90^{15^{\circ}}$	1280	....	i.	i.	s. HF; v. sl. s. a.
1285	$5.24^{15^{\circ}}$	....	....	i.	i.	s. alk., HF; i. a.

No	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Manganese			
1286	silicide (ous)	Mn_2Si	137.92	gray pr.
1287	silicofluoride	$MnSiF_6\cdot 6H_2O$	305.09	pink, trig., 1.3570
1288	sulfate (ous)	$MnSO_4$	150.99	red-wh.
1289	sulfate (ous) (szmikite)	$MnSO_4\cdot H_2O$	169.01	pa. pink, mn., 1.595
1290	sulfate (ous)	$MnSO_4\cdot 2H_2O$	187.02	....
1291	sulfate (ous)	$MnSO_4\cdot 3H_2O$	205.04	....
1292	sulfate (ous)	$MnSO_4\cdot 4H_2O$*	223.05	pink, rhb. or mn., 1.518
1293	sulfate (ous)	$MnSO_4\cdot 5H_2O$	241.07	pink, tri., 1.508
1294	sulfate (ous)	$MnSO_4\cdot 6H_2O$	259.09	....
1295	sulfate (ous)	$MnSO_4\cdot 7H_2O$	277.10	pink, mn. or rhb.
1296	sulfate (ic)	$Mn_2(SO_4)_3$	398.04	gn., delq. cr.
1297	sulfide (ous) (alabandite)	MnS	86.99	gn. or pink, cb., 2.70
1298	sulfide (ic) (hauerite)	MnS_2	119.05	bk., cb., 2.69
1299	thiocyanate	$Mn(CNS)_2\cdot 3H_2O$	225.13	col., delq.
1300	**Manganocyanhydric acid**	$H_4Mn(CN)_6$	215.07	....
1301	**Masurium**	Ma	98–99.5	....
1302	**Mercuric** acetate	$Hg(C_2H_3O_2)_2$	318.70	wh. pl.
1303	arsenate	$Hg_3(AsO_4)_2$	879.65	yel., mn.
1304	bromate	$Hg(BrO_3)_2\cdot 2H_2O$	492.47	wh. cr.
1305	bromide	$HgBr_2$	360.44	wh., rhb.
1306	carbonate, basic	$HgCO_3\cdot 2HgO$	693.84	brn.-red
1307	chlorate	$Hg(ClO_3)_2$	357.52	nd.
1308	chloride (corrosive sublimate)	$HgCl_2$	271.52	wh., rhb., 1.859
1309	chromate	$HgCrO_4$	316.62	red, rhb.
1310	cyanide	$Hg(CN)_2$	252.65	wh., tet., 1.645
1311	fluoride	HgF_2	238.61	transparent, cb.
1312	fulminate	$Hg(CNO)_2$	284.65	cb.
1313	hydroxide	$Hg(OH)_2$	234.63	....
1314	iodate	$Hg(IO_3)_2$	550.45	wh., amor. pd.
1315	iodide, red	HgI_2	454.45	red, tet., 2.748
1316	iodide, yellow	HgI_2	454.45	yel., rhb.
1317	iodobromide	$HgIBr$	407.45	yel., rhb.
1318	iodochloride	$HgICl$	362.99	red., rhb.
1319	nitrate	$Hg(NO_3)_2\cdot \frac{1}{2}H_2O$	333.63	transparent cr.
1320	nitride	Hg_3N_2	629.85	brn. pd.
1321	oxalate	HgC_2O_4	288.63	pd.
1322	oxide (montroydite)	HgO	216.61	yel. or red, rhb., 2.5
1323	oxybromide	$HgBr_2\cdot 3HgO$	1010.27	yel. cr.

* Usual commercial form.

Manganese sulfocyanate 1299
Manganese sulfocyanide 1299
Manganese white 1246
Manganite 1257
Manganosite 1266
Marcasite 1020
Marshite 774
Mascagnite 121
Massicot(ite) 1079
Matlockite 1084
Meadow green 718

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1286	$6.20^{15°}$	1316	....	i.	i.	s. HCl, alk.
1287	$1.904^{17.5°}$	d.	....	$140^{18°}$	v. s.	s. al.
1288	3.235	700	d. 850	$53^{0°}$	$73^{50°}$	s. al.; i. et.
1289	2.87	stable 57 to 117	....	$98.47^{48°}$	$79.77^{100°}$	....
1290	$2.526^{15°}$	stable 40 to 57	....	$85.27^{35°}$	$106.8^{55°}$	....
1291	$2.356^{15°}$	stable 30 to 40	....	$74.2^{25°}$	$99.31^{57°}$	....
1292	2.107	stable 18 to 30	$-4H_2O$, 450	$136^{16°}$	$169^{50°}$	i. al.
1293	$2.103^{15°}$	stable 8 to 18	....	$142^{5°}$	$200^{35°}$	....
1294	....	stable −5 to +8	....	$204^{0°}$	$247^{9°}$	....
1295	2.092	stable −10 to −5; 19 d.	$-7H_2O$, 280	$176^{0°}$	$251^{14°}$	....
1296	3.24	d. 160	....	v. s.	d.	s. HCl, dil. H_2SO_4; i. conc. H_2SO_4, HNO_3
1297	3.99-4.04	1620 (vac.); d. in air	....	0.0007	i.	s. dil. a; i. $(NH_4)_2S$
1298	3.463	d.	....	i.	i.	d. HCl
1299	....	$-3H_2O$, 160	....	s.	v. s.	s. al.
1300	....	d.	....	i.	....	sl. s. al.; i. et.
1301	11.5	2300 (?)	....	....	....	....
1302	3.270	d.	....	$25^{10°}$	$100^{100°}$	s. al. sl. d.
1303	....	d. red heat	....	....	v. sl. s.	s. HCl, HNO_3
1304	....	d. 130	....	0.154	1.56	s. HNO_3, $Hg(NO_3)_2$; d. HCl
1305	6.053	237	322	$0.5^{20°}$	$25^{100°}$	$25.2^{0°}$ al.; v. sl. s. et.
1306	....	....	....	i.	....	s. aq. CO_2, NH_4Cl
1307	4.998	d.	....	25	....	....
1308	5.44	277	304	$3.6^{0°}$	$61.3^{100°}$	$33^{25°}$ 99% al.; 33 et.
1309	....	d.	....	sl. s.	d.	s. NH_4Cl; i. act.; d. a.
1310	4.00	d.	....	$9.3^{13.5°}$	$53^{100°}$	$10^{20°}$ al.; s. NH_3; i. bz.
1311	$8.95^{15°}$	645 d.	....	d.	....	s. HF, dil. HNO_3
1312	4.42	expl.	....	sl. s.	....	s. NH_4OH, al.
1313	....	$-H_2O$, 175	....	i.	i.	s. a.
1314	....	....	....	i.	....	s. HCl, NH_4Cl; i. HNO_3
1315	6.283	tr. 127; 259	354	$0.006^{25°}$	....	$1.8^{25°}$ abs. al.; s. $Na_2S_2O_3$ alk. salts
1316	6.271	259	354	i.	....	....
1317	....	229	360	....	....	s. al., et.
1318	....	153	315	i.	sl. s.	s. al.; sl. s. dil. HCl
1319	4.3	79	d.	v. s.	d.	s. HNO_3, NH_3, act.; i. al.
1320	....	expl.	....	d.	....	s. NH_4OH, NH_4 salts; d. a.
1321	....	d. 165	expl.	$0.0107^{20°}$	v. sl. s.	s. HCl; sl. s. HNO_3
1322	11.14	d. 100	....	$0.0052^{25°}$	$0.041^{100°}$	s. a.; i. al.
1323	....	....	....	i.	sl. s.	s. al.

Meat salt 87
Melanterite 865
Mendipite 1085
Mercuric bromoiodide 1317
Mercuric cesium bromide 558
Mercuric cesium chloride 559
Meruric chloroiodide, 1318
Mercuric fluosilicate, basic 1331
Mercuric oxycarbonate 1306
Mercuric oxysulfate 1333

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Mercuric			
1324	oxychloride (kleinite)	$HgCl_2 \cdot 3HgO$	921.35	yel., hex.
1325	oxycyanide	$Hg(CN)_2 \cdot HgO$	469.26	wh. nd.
1326	oxyfluoride	$HgF_2 \cdot HgO \cdot H_2O$	473.24	yel. cr.
1327	oxyiodide	$HgI_2 \cdot 3HgO$	1104.28	yel.-brn.
1328	phosphate	$Hg_3(PO_4)_2$	791.79	yel.-wh.
1329	potassium iodide	$2HgI_2 \cdot 2KI \cdot 3H_2O$	1294.98	yel., delq.
1330	selenide (tiemannite)	$HgSe$	279.57	gray, cb. pl.
1331	silicofluoride, basic	$HgSiF_6 \cdot HgO \cdot 3H_2O$	613.33	yel. nd.
1332	sulfate	$HgSO_4$	296.67	wh., rhb.
1333	sulfate, basic (turpeth)	$HgSO_4 \cdot 2HgO$	729.89	yel., tet.
1334	sulfide (cinnabar)	HgS (α)	232.67	red, hex., 2.854
1335	sulfide	HgS	232.67	bk., amor.
1336	thiocyanate	$Hg(CNS)_2$	316.77	col.
1337	**Mercurous** acetate	$HgC_2H_3O_2$	259.65	wh. sc.
1338	arsenate	Hg_3AsO_4	740.74	or., rhb.
1339	arsenate, acid	Hg_2HAsO_4	541.14	yel.-red
1340	bromate	$HgBrO_3$	328.53	yel.-wh.
1341	bromide	$HgBr$	280.53	wh., tet.
1342	carbonate	Hg_2CO_3	461.23	yel. pd.
1343	chlorate	$HgClO_3$	284.07	wh., rhb.
1344	chloride (calomel)	$HgCl$	236.07	wh., tet., 1.9733
1345	chromate	Hg_2CrO_4	517.23	red, rhb.
1346	fluoride	HgF	219.61	yel., cb.(?)
1347	formate	$HgHCO_2$	245.63	shiny sc.
1348	iodate	$HgIO_3$	375.53	yellowish
1349	iodide	HgI	327.53	yel., tet.
1350	nitrate	$HgNO_3 \cdot H_2O$	280.63	wh., mn.
1351	nitride, tri-	HgN_3	242.63	wh. cr.
1352	nitrite	$HgNO_2$	246.62	yel.
1353	oxalate	$Hg_2C_2O_4$	489.24	cr.
1354	oxide	Hg_2O	417.22	bk.
1355	phosphate	Hg_3PO_4	696.81	wh. cr.
1356	silicofluoride	$Hg_2SiF_6 \cdot 2H_2O$	579.31	pr.
1357	sulfate	Hg_2SO_4	497.28	wh., mn.
1358	sulfide	Hg_2S	433.28	bk.
1359	thiocyanate	$HgCNS$	258.69	wh.
1360	**Mercury**‡	Hg	200.61	silv. lq. or hex.(?)
1361	**Mercury-ammonium compounds**	....	....	....
1362	Dimercuri-diammonium chloride (infusible white precipitate)	$Hg_2NCl \cdot NH_4Cl$	504.18	cr.
1363	Dimercuri-tetrammonium chloride (fusible white precipitate)	$Hg_2NCl \cdot 3NH_4Cl$	611.18	reddish cr.

‡ See also special tables.

Mercuric sulfocyanate 1336
Mercuric sulfocyanide 1336
Mercurous fluosilicate 1356
Mercurous sulfocyanate 1359
Mercurous sulfocyanide 1359
Mercury bichloride 1308
Mercury chloride, mild, 1344
Mercury red precipitate 1322
Metabisulfite 2088
Metaphosphoric acid 1549
Metastannic acid 2173
Metavanadic acid 2469
Metavariscite 26
Metso 2138
Microcline 29.1
Microcosmic salt 2011
Mild alkali 2042

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1324	7.93	d. 260	....	i.	d.	s. HCl
1325	$4.437^{19\circ}$	expl.	....	1.3	s.	....
1326	....	d. 100	....	d.	....	s. dil. HNO_3
1327	....	....	....	d.	....	s. HI
1328	....	d.	....	i.	sl. s.	s. a., NH_4Cl; i. al.
1329	$4.289^{23.5\circ}$	....	....	d.	....	s. al., et., KI
1330	7.1-8.5	subl.	....	i.	....	s. aq. reg.; i. HCl
1331	....	....	....	d.	....	s. a.
1332	6.47	d.	....	d.	....	s. a.; i. al., act., NH_3
1333	6.44	....	....	0.005	$0.167^{100\circ}$	s. a.; i. al.
1334	8.10	subl. 580	....	i.	i.	s. K_2S, aq. reg.; i. HNO_3
1335	7.67	subl. 446	....	$0.000\,01^{18\circ}$	i.	s. K_2S, aq. reg.; i. HNO_3
1336	....	d.	....	$0.07^{25\circ}$	sl. s.	s. NH_3, NH_4 salts; sl. s. al.
1337	....	d.	....	$0.75^{13\circ}$	d.	s. H_2SO_4, HNO_3; i. al.
1338	....	d.	....	i.	....	s. HNO_3; i. ac.
1339	....	d.	....	i.	....	s. HNO_3; i. ac., NH_4OH
1340	....	d.	....	d.	....	sl. s. HNO_3
1341	7.307	subl. 345	....	7×10^{-9}	i.	s. a.; i. al., act.
1342	....	d. 130	....	i.	d.	s. NH_4Cl
1343	6.409	expl. 250	....	s.	d.	s. al., ac.
1344	7.150	302	383.7	$0.0001^{40\circ}$	$0.0007^{43\circ}$	s. aq. reg., $Hg(NO_3)_2$; sl. s. HNO_3, HCl; i. al., et.
1345	....	d.	....	v. sl. s.	sl. s.	s. HNO_3, KCN; i. act.
1346	8.73	570	....	forms Hg_2O	....	....
1347	....	d.	....	$0.4^{17\circ}$	d.	i. al.
1348	....	volt. 250	....	v. sl. s.	v. sl. s.	s. dil. HCl; i. c. HNO_3
1349	7.70	290 d.	subl. 140; 310 d.	2×10^{-8}	v. sl. s.	s. KI; i. al.
1350	$4.785^{3.9\circ}$	70	expl.	v. s.	d.	s. HNO_3; i. al., et.
1351	....	expl. 245	....	0.025	....	....
1352	$7.33^{20\circ}_{4}$	d. 100	....	d.	....	....
1353	....	....	....	i.	i.	sl. s. HNO_3
1354	9.8	d. 100	....	i.	0.0007	s. h. ac.; i. alk., dil. HCl, NH_3
1355	....	d.	....	i.	d.	s. HNO_3, $HgNO_3$; i. H_3PO_4
1356	....	....	....	sl. s.	....	i. HCl
1357	7.56	d.	....	$0.055^{16.5\circ}$	$0.092^{100\circ}$	s. H_2SO_4, HNO_3
1358	....	d. 0	....	i.	....	i. a., $(NH_4)_2S$
1359	....	d.	....	i.	....	s. HCl, KCNS, $Hg(NO_3)_2$
1360	$13.546^{20\circ}$	−38.87	356.9	i.	i.	s. HNO_3; i. HCl
1361	....	....	....	....	....	....
1362	5.70	....	....	0.14	d.	s. a.; i. al.
1363	....	300	....	i.	d.	s. a., KI

Mild lime	427
Millerite	1463
Minasragrite	2497
Mineral butter	143
Mineral green	724 or 727
Mineral orange	1081
Mineral red	1081
Mineral white	284
Minium	1081
Mirabilite	2149
Misenite	1649
Mitis green	718
Mohr's salt	839
Moissanite	1933
Molybdenite	1387

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
1364	**Molybdenum**	Mo	95.95	gray, cb.
1365	bromide, di-	$MoBr_2$	255.78	yel.-red
1366	bromide, tri-	$MoBr_3$	335.70	bk.-gn. nd.
1367	bromide, tetra-	$MoBr_4$	415.61	bk., delq. nd.
1368	bromohydroxide	$Mo_3Br_4(OH)_2$	641.53	red pd.
1369	carbide	MoC	107.96	gray pr.
1370	chloride, di-	$MoCl_2$	166.85	yel., amor.
1371	chloride, tri-	$MoCl_3$	202.32	dark red pd.
1372	chloride, tetra-	$MoCl_4$	237.78	brn., delq.
1373	chloride, penta-	$MoCl_5$	273.24	bk. cr.
1374	chlorohydroxide	$Mo_3Cl_4(OH)_2 \cdot 2H_2O$	499.71	yel., amor.
1375	fluoride, hexa-	MoF_6	209.95	wh. cr.
1376	oxide, sesqui-	Mo_2O_3	239.90	bk.
1377	oxide, di-	MoO_2	127.95	blue-bk., tet.
1378	oxide, tri- (molybdite)	MoO_3	143.95	col., rhb.
1379	oxybromide	MoO_2Br_2	287.78	yel., delq.
1380	oxychloride	$MoOCl_4$	253.78	gn., delq.
1381	oxychloride	MoO_2Cl_2	198.86	yel.-wh.
1382	oxychloride	$MoOCl_3$	218.32	gn.
1383	oxychloride	$Mo_2O_3Cl_5$	417.19	dark brn., delq.
1384	oxyfluoride	$MoOF_4$	187.95	blue-wh.
1385	phosphate, meta-	$Mo(PO_3)_3$	332.89	....
1386	phosphide	Mo_2P_2	253.94	gray cr.
1387	sulfide, di- (molybdenite)	MoS_2	160.07	bk., hex., 4.7
1388	sulfide, tri-	MoS_3	192.13	red-brn.
1389	sulfide, tetra-	MoS_4	224.19	brn. pd.
1390	**Molybdic acid**	H_2MoO_4	161.97	yel.-wh., hex.
1391	**Molybdic acid**	$H_2MoO_4 \cdot H_2O$	179.98	yel., mn.
1392	**Neodymium**	Nd	144.27	yellowish
1393	bromate	$Nd_2(BrO_3)_6 \cdot 18H_2O$	1380.32	red, hex.
1394	carbide	NdC_2	168.29	yel., hex.
1395	chloride	$NdCl_3$	250.64	vl. pr.
1396	chloride	$NdCl_3 \cdot 6H_2O$	358.74	red, rhb.
1397	molybdate	$Nd_2(MoO_4)_3$	768.39	tet.
1398	oxide	Nd_2O_3	336.54	blue
1399	sulfate	$Nd_2(SO_4)_3 \cdot 8H_2O$	720.85	mn., 1.5505
1400	sulfide	Nd_2S_3	384.72	olive gn.
1401	**Neon**	Ne	20.18	col. gas

Molybdenum hydroxybromide 1368
Molybdenum hydroxychloride 1374
Molybdic (acid) anhydride 1378
Molybdite 1378
Molysite 813
Monazite 533
Monoammonium phosphate 111
Monobasic cadmium phosphate 396
Monocalcium phosphate 462
Monopotassium phosphate 1734
Monosodium phosphate 2119

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1364	10.2	2620 ± 10	3700	i.	i.	s. h. conc. H_2SO_4; i. HCl, HF, NH_3, dil. H_2SO_4, Hg
1365	....	infusible	....	i.	i.	s. alk.; i. a., aq. reg.
1366	....	d.	....	i.	i.	i. a.; d. alk.
1367	....	d.	....	v. s.	....	d. alk.
1368	....	....	....	....	....	s. alk.
1369	8.48^{20°	2570	....	i.	i.	s. HNO_3, HF, h. H_2SO_4
1370	$3.714^{25^\circ}_{4}$	d.	....	i.	i.	s. HCl, H_2SO_4, NH_4OH, al., et.
1371	$3.578^{25^\circ}_{4}$	d.	....	i.	d.	s. HNO_3, H_2SO_4; v. sl. s. al., et.
1372	....	volt.	d.	s.	d.	s. HNO_3, H_2SO_4; sl. s. al., et.
1373	$2.928^{25^\circ}_{4}$	194	268	s.	d.	s. HNO_3, H_2SO_4; abs. al., et.
1374	....	....	....	i.	....	s. a.; i. al.
1375	....	17	35	sl. s. d.	d.	d. NH_3 gas
1376	....	....	....	i.	i.	i. a., alk.
1377	6.44	....	....	i.	i.	sl. s. H_2SO_4, $KHC_4H_4O_6$; i. alk., HCl
1378	$4.50^{19.5^\circ}$	795	subl.	0.107^{18°	2.106^{79°	s. a., NH_4OH
1379	....	subl.	....	s.	....	....
1380	....	<100	subl. <100	s.	d.	....
1381	....	subl.	....	s.	....	s. al., et.
1382	....	subl. <100	....	d.	....	....
1383	....	subl.	....	s.	s.	....
1384	3.001	98	180	s.	....	s. al.
1385	3.28^{0°	....	....	....	....	....
1386	6.17	d.	....	i.	....	s. h. HNO_3
1387	4.80^{14°	1185	....	i.	i.	s. H_2SO_4, aq. reg.
1388	....	d.	....	sl. s.	s.	s. alk. sulfides
1389	....	d.	....	i.	i.	s. alk. sulfides; i. NH_3
1390	....	d. 115	....	v. sl. s.	sl. s.	s. NH_4OH, H_2SO_4; i. NH_3
1391	3.124^{15°	$-H_2O$, 70	$-2H_2O$, 200	0.133^{18°	2.13^{70°	s. a., NH_4OH, NH_4, salts
1392	6.9^{20°	840	....	d.	....	....
1393	....	66.7	$-18H_2O$, 150	146^{25°	....	....
1394	5.15	d.	....	d.	....	s. H_2SO_4, dil. a.; i. conc. HNO_3
1395	$4.134^{25^\circ}_{4}$	784	....	96.7^{13°	140.4^{100°	s. al.; i. et., chl.
1396	$2.282^{16.5^\circ}_{4}$	124	$-5H_2O$, 105; $-6H_2O$, 160	246^{13°	511.6^{100°	s. al.
1397	$5.14^{18^\circ}_{18}$	1176	....	0.0019^{28°	0.003^{75°	....
1398	7.24	1900 ±	....	i.	i.	s. HCl
1399	2.850	....	....	16^{0°	1.5^{100°	....
1400	5.179^{11°	d.	....	i.	d.	s. dil. a.
1401	lq. $1.204^{-245.9^\circ}$ 0.674(A)	−248.67	−245.9	2.6^{0°cc	1.1^{45°cc	s. lq. O_2, al., act., bz.

Montroydrite 1322
Mordant salt 3
Morenosite 1462
Mosaic gold 2188
Moss green 718
Mountain green 727
Muriate cf. chloride
Muriatic acid 946
Muscovite 28
Nantokite 768
Natron 2042
Naumannite 1994
Needle (of) antimony 158

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
1402	**Neptunium**	Np^{239}	239	....
1403	**Nickel**	Ni	58.69	silv. met., cb.
1404	acetate	$Ni(C_2H_3O_2)_2$	176.78	gn. pr.
1404.1	acetate	$Ni(C_2H_3O_2)_2 \cdot 4H_2O$	248.84	gn.
1405	ammonium chloride	$NiCl_2 \cdot NH_4Cl \cdot 6H_2O$	291.20	gn., delq., mn.
1406	ammonium sulfate	$NiSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	394.99	blue-gn., mn., 1.5007
1407	antimonide	$NiSb$	180.45	hex.
1408	arsenate (xanthiosite)	$Ni_3(AsO_4)_2$	453.89	yel., amor.
1409	arsenide (nicollite)	$NiAs$	133.60	hex.
1410	arsenide	Ni_3As_2	325.89	met., tet.
1411	boride	NiB	69.51	bright pr.
1412	bromate	$Ni(BrO_3)_2 \cdot 6H_2O$	422.62	gn., cb.
1413	bromide	$NiBr_2$	218.52	yel., delq.
1414	bromide	$NiBr_2 \cdot 3H_2O$	272.57	gn., delq.
1415	bromide, ammonia	$NiBr_2 \cdot 6NH_3$	320.71	vi. pd.
1416	bromoplatinate	$NiPtBr_6 \cdot 6H_2O$	841.51	trig.
1417	carbonate	$NiCO_3$	118.70	lt. gn., rhb.
1418	carbonate, basic	$2NiCO_3 \cdot 3Ni(OH)_2 \cdot 4H_2O$	587.58	lt. gn.
1419	carbonyl	$Ni(CO)_4$	170.73	lq.
1420	chlorate	$Ni(ClO_3)_2 \cdot 6H_2O$	333.70	gn. cr.
1421	chloride	$NiCl_2$	129.60	yel., delq.
1422	chloride	$NiCl_2 \cdot 6H_2O$*	237.70	gn., delq., mn., 1.57±
1423	chloride, ammonia	$NiCl_2 \cdot 6NH_3$	231.80	....
1424	chloropalladate	$NiPdCl_6 \cdot 6H_2O$	486.23	hex.
1425	chloroplatinate	$NiPtCl_6 \cdot 6H_2O$	574.76	trig.
1426	cyanide	$Ni(CN)_2 \cdot 4H_2O$	182.79	gn. pl.
1427	dimethylglyoxime	$NiC_8H_{14}O_4N_4$	288.91	scarlet red cr.
1428	dithionate	$NiS_2O_6 \cdot 6H_2O$	326.91	gn., tri.
1429	ferrocyanide	$Ni_2Fe(CN)_6 \cdot 11H_2O$	527.51	gn.-wh.
1430	fluoride	NiF_2	96.69	gn.
1431	fluoride, acid	$NiF_2 \cdot 5HF \cdot 6H_2O$	304.83	blue-gn., trig.
1432	formate	$Ni(HCO_2)_2 \cdot 2H_2O$	184.76	gn. cr.
1433	hydroxide (ic)	$Ni(OH)_3$	109.71	bk.
1434	hydroxide (ous)	$Ni(OH)_2 \cdot \frac{1}{4}H_2O$	97.21	lt. gn.
1435	hypophosphite	$Ni(H_2PO_2)_2 \cdot 6H_2O$	296.78	gn., cb.
1436	iodate	$Ni(IO_3)_2$	408.53	yel. nd.
1437	iodate	$Ni(IO_3)_2 \cdot 4H_2O$	480.59	hex.
1438	iodide	NiI_2	312.53	bk., delq.
1439	iodide, ammonia	$NiI_2 \cdot 6NH_3$	414.72	....
1440	nitrate	$Ni(NO_3)_2 \cdot 6H_2O$	290.80	gn., mn.
1441	nitrate, ammonia	$Ni(NO_3)_2 \cdot 4NH_3 \cdot 2H_2O$	286.87	....
1442	oxalate	NiC_2O_4	146.71	....
1443	oxide, mono- (bunsenite)	NiO	74.69	gn.-bk., cb., 2.37
1444	oxide, sesqui-	Ni_2O_3	165.38	bk.
1445	oxide (ous-ic)	Ni_3O_4	240.07	gray
1446	oxide (ous-ic)	$Ni_3O_4 \cdot 2H_2O$	276.10	....
1447	oxyiodide	$NiI_2 \cdot 9NiO \cdot 15H_2O$	1254.98	....
1448	perchlorate	$Ni(ClO_4)_2 \cdot 5H_2O$	347.68	blue-gn., hex.
1449	perchlorate	$Ni(ClO_4)_2 \cdot 6H_2O$	365.70	blue-gn., hex., 1.55±

* Usual commercial form.

Neodymia 1398
Nesquehonite 1187
Newberyite 1211
New green 718
Nickel bifluoride 1431
Nickel black 1444
Nickel bromide, hexammine 1415

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1402	....	Produced by Neutron bombardment of U^{238}				....
1403	8.90^{20°	1452	2900	i.	i.	s. dil. HNO_3; sl. s. H_2SO_4, HCl; i. NH_3
1404	1.798	d.	....	16.6	....	i. al.
1404.1	1.744	d.	....	s.	....	s. al.
1405	1.645	....	....	150^{25°	v. s.	....
1406	1.923	....	....	$2.5^{3.5^\circ}$	39.2^{85°	v. sl. s. $(NH_4)_2SO_4$
1407	7.70^{0°	1158	d. 1400	....	....	....
1408	4.982	....	....	i.	....	s. a.
1409	7.57^{0°	968	....	i.	i.	s. aq. reg.
1410	7.86^{0°	1000	....	....	....	....
1411	7.39^{18°	....	....	d.	....	s. HNO_3, aq. reg.
1412	2.575	d.	....	28	....	s. NH_4OH
1413	$4.64^{28^\circ}_{4}$	d.	....	112.8^{0°	156^{100°	s. al., et., NH_4OH
1414	....	$-3H_2O$, 200	....	199^{0°	316^{100°	s. al., et., NH_4OH
1415	1.837	....	....	v. s.	d.	i. c. NH_4OH
1416	3.715	....	....	....	....	....
1417	....	d.	....	0.0093^{25°	i.	s. a.
1418	....	d.	....	i.	d.	s. a., NH_4 salts
1419	1.31^{17°	−25	$43^{751\,mm}$	$0.018^{9.8^\circ}$	i.	s. aq. reg., HNO_3, al., et
1420	2.07	80 d.	....	352^{0°	v. s.	....
1421	3.544	subl.	973	53.8^{0°	87.6^{100°	s. NH_4OH, al.; i. NH_3
1422	....	....	....	180	v. s.	v. s. al.
1423	....	....	....	s.	d.	s. NH_4OH; i. al.
1424	2.353	....	....	....	....	....
1425	2.798	....	....	....	....	....
1426	....	$-4H_2O$, 200	d.	i.	i.	s. KCN; i. dil. KCl
1427	....	subl. 250	....	i.	i.	s. abs. al., a.; i. ac., NH_4OH
1428	1.908	d.	....	....	....	....
1429	....	....	....	i.	....	s. KCN, NH_4OH; i. HCl
1430	4.63	....	....	2.6^{20°	2.6^{90°	i. a., al., NH_3, et.
1431	2.132	....	....	s.	....	s. dil. a.; d. NH_4OH
1432	2.154	d.	....	s.	....	....
1433	....	d.	....	i.	i.	s. a., NH_4OH, NH_4Cl
1434	4.36	d.	....	v. sl. s.	v. sl. s.	s. a., NH_4OH; i. alk.
1435	1.824	d. 100	....	s.	....	....
1436	5.07	....	....	1.1^{30°	1.0^{90°	....
1437	....	d. 100	....	1.4^{30°	1.1^{90°	....
1438	5.834	subl.	....	124.2^{0°	188^{90°	s. al.
1439	2.101	d.	....	d.	....	s. NH_4OH
1440	2.05	56.7	136.7	243.0^{0°	$\infty^{56.7^\circ}$	s. NH_4OH; i. abs. al.
1441	....	....	....	v. s.	....	i. al.
1442	2.235	....	....	0.0003	....	....
1443	7.45	forms Ni_2O_3 at 400		i.	i.	s. a., NH_4OH
1444	4.83^{16°	forms NiO at 600		i.	i.	s. HCl, NH_4OH
1445	....	....	....	i.	i.	s. a.
1446	3.412^{32°	....	....	i.	i.	s. a.
1447	....	....	....	i.	....	s. HNO_3; i. NH_4OH
1448	....	149	....	223^{0°	274^{45°	s. al.; i. chl.
1449	....	149	....	s.	s.	s. al.

Nickel chloride, hexammine 1423
Nickel fluosilicate 1459
Nickel iodide, hexammine 1439
Nickel nitrate, tetrammine 1441

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Nickel			
1450	phosphate	$Ni_3(PO_4)_2\cdot 7H_2O$	492.14	gn.
1451	phosphate, pyro-	$Ni_2P_2O_7\cdot 6H_2O$	399.44	gn.
1452	phosphide	Ni_3P_2	238.03	gray-wh.
1453	phosphide	Ni_2P	148.36	gray cr.
1454	potassium cyanide	$Ni(CN)_2\cdot 2KCN\cdot H_2O$	258.97	red-yel., mn.
1455	potassium sulfate	$NiK_2(SO_4)_2\cdot 6H_2O$	437.10	gn., mn.
1456	selenate	$NiSeO_4\cdot 6H_2O$	309.75	gn., tet., or mn. 1.5393
1457	selenide	$NiSe$	137.65	silv. wh., cb.
1458	silicide	Ni_2Si	145.44	....
1459	silicofluoride	$NiSiF_6\cdot 6H_2O$	308.85	gn., trig., 1.391
1460	sulfate	$NiSO_4$	154.75	yel., cb.
1461	sulfate	$NiSO_4\cdot 6H_2O$*	262.85	gn. mn. or blue, tet., 1.5109
1462	sulfate (morenosite)	$NiSO_4\cdot 7H_2O$	280.86	gn., rhb., 1.4893
1463	sulfide, mono- (beyrichite, millerite)	NiS	90.75	bk., trig.; yel., hex.
1464	sulfide (ous-ic) (polydymite)	Ni_3S_4	304.31	gray-bk., cb.
1465	sulfide, sub-	Ni_2S	149.44	yel. cr.
1466	sulfite	$NiSO_3\cdot 6H_2O$	246.85	gn., tetrahedral
1467	**Niobium** cf. Columbium	....	......	....
1468	**Nitric acid**	HNO_3	63.02	col. lq.
1469	**Nitric acid**	$HNO_3\cdot H_2O$	81.03	col. lq.
1470	**Nitric acid**	$HNO_3\cdot 3H_2O$	117.06	col. lq.
1471	**Nitro acid sulfite**	NO_2HSO_3	127.08	col., rhb.
1472	**Nitrogen**	N_2	28.02	col. gas or cb. cr.
1473	bromophosphide	$NPBr_2$	204.82	col., rhb.
1474	chloride	NCl_3	120.38	yel. oil
1475	chlorophosphide	$(NPCl_2)_3$	347.71	rhb.
1476	iodide	NI_3	394.77	bk.
1477	iodoazoimide	NH_3NI_3	411.80	red, rhb.
1478	oxide, mono- (ous)	N_2O	44.02	col. gas
1479	oxide, di- (ic)	NO or $(NO)_2$	30.01 (60.02)	col. gas
1480	oxide, tri-	N_2O_3	76.02	red-brn. gas or blue lq. or solid
1481	oxide, tetra- (per- or di-)	NO_2 or $(NO_2)_2$	46.01 (92.02)	yel. lq., col. solid, red-brn. gas
1482	oxide, penta-	N_2O_5	108.02	wh., rhb.
1483	oxybromide	$NOBr$	109.92	brn. lq.
1484	oxychloride	$NOCl$	65.47	red-yel. lq. or gas
1485	oxyfluoride	NOF	49.01	col. gas
1486	sulfide	N_4S_4	184.27	or.-red, mn.
1487	sulfide, penta-	N_2S_5	188.32	red lq.

* Usual commercial form.

Nickel phosphite, hypo- 1435
Nickel tetracarbonyl 1419
Nicolite 1409
Nil alba 2560
Niter 1714
Niter cake 2030
Niton 1810
Nitratine 2097

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1450	....	....	....	i.	i.	s. a., NH_4 salts
1451	3.93^{25° (anh.)	....	....	i.	....	s. a., NH_4OH
1452	5.99	....	....	i.	i.	s. HNO_3; i. HCl
1453	6.3^{15°	1112	....	i.	....	s. HNO_3+HF; i. a.
1454	1.875^{11°	$-H_2O$, 100	....	s.	....	d. a.
1455	2.237	d. < 100	....	7^{0°	60.8^{75°	....
1456	2.314	....	....	s.	....	....
1457	8.46	red heat	....	i.	....	s. aq. reg., HNO_3; i. HCl
1458	7.2^{17°	1309	....	i.	....	i. a.
1459	2.134	d.	....	v. s.	....	....
1460	3.68	$-SO_3$, 840	....	27.2^{0°	76.7^{100°	i. al., et., act.
1461	2.07	tr. 53.3	$-6H_2O$, 280	131^{50°	280^{100°	v. s. NH_4OH, al.
1462	1.948	98-100	$-6H_2O$, 103	63.5^{0°	117.8^{30°	s. al.
1463	4.60	797	....	0.00036^{18°	d.	s. aq. reg., HNO_3
1464	4.7	....	....	i.	....	s. HNO_3
1465	5.52	....	....	i.	....	s. HNO_3
1466	....	....	....	i.	....	s. HCl, H_2SO_3
1467	....	....	....	....	....	....
1468	1.502	−42	86	∞	∞	expl. with al.
1469	....	−38	....	∞	∞	d. al.
1470	....	−18.5	....	263^{-20°	∞	d. al.
1471	....	73 d.	....	d.	....	s. H_2SO_4
1472	$1.026^{-252.5^\circ}$ $0.808^{-195.8^\circ}$ 12.5^{0°(D)	−209.86	−195.8	2.35^{0°cc	1.55^{20°cc	sl. s. al.
1473	....	190	....	..i.	....	s. et., chl., CS_2
1474	1.653	expl. 93	<71	i.	d.	s. chl., PCl_3, CS_2
1475	1.98	114	127^{13mm}	i.	d.	s. al., et., chl., $POCl_3$
1476	....	expl.	....	i.	d.	s. aq. $Na_2S_2O_3$, KCNS
1477	3.5	d. >20	expl.	d.	....	s. HCl, $Na_2S_2O_3$, KCN; i. abs. al.
1478	lq. 1.226^{-89° 1.530(A)	−102.3	−90.7	130.52^{0°cc	60.82^{24°cc	s. H_2SO_4, al.
1479	lq. $1.269^{-150.2^\circ}$ 1.0367(A)	−161	−151	7.34^{0°cc	0.0^{100°	26.6cc al.; 3.5cc H_2SO_4; s. aq. $FeSO_4$
1480	1.447^{2°	−102	3.5	s.	....	s. a., et.
1481	1.448^{20°	−9.3	21.3	d.	....	s. HNO_3, H_2SO_4, chl., CS_2
1482	1.63^{18°	30	47	s.	forms HNO_3	....
1483	>1.0	−55.5	−2	d.	....	....
1484	1.417^{-12° 2.31(A)	−64.5	−5.5	d.	....	s. fuming H_2SO_4
1485	1.68(A)	−134	−56	d.	....	....
1486	2.22^{15°	178	subl. 135	i.	d.	s. chl., CS_2; sl. s. al., et.
1487	$1.901^{18^\circ}_{4}$	11	d.	i.	....	s. CS_2; sl. s. al., et.

Nitric acid anhydride 1482
Nitrobarite 260
Nitrocalcite 454
Nitrogen dioxide 1481
Nitrogen peroxide 1481
Nitrogen phosphide 1575
Nitrogen phosphobromide 1473
Nitrogen phosphochloride 1475
Nitrogen selenide 1909

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
1488	**Nitroso tribromide**	$NOBr_3$	269.76	brn. lq.
1489	**Nitroxyl chloride**	NO_2Cl	81.47	yel.-brn. gas
1490	**Nitroxyl fluoride**	NO_2F	65.01	col. gas
1491	**Osmium**	Os	190.2	blue, hex.
1492	ammonium trichloride	$2(OsCl_3 \cdot 2NH_4Cl) \cdot 3H_2O$	861.18	red-brn. cr.
1493	chloride, di-	$OsCl_2$	261.11	gn., delq.
1494	chloride, tri-	$OsCl_3$	296.57	brn., cb.
1495	chloride, tetra-	$OsCl_4$	332.03	red-yel. nd.
1496	oxide, mono-	OsO	206.20	bk. pd.
1497	oxide, sesqui-	Os_2O_3	428.40	bk. pd.
1498	oxide, di-	OsO_2	222.20	copper red
1499	oxide, tetra-	OsO_4*	254.20	col., mn.
1500	potassium trichloride	$2(OsCl_3 \cdot 3KCl) \cdot 6H_2O$	1148.56	red cr.
1501	potassium tetrachloride	$OsCl_4 \cdot 2KCl$	481.13	red, cb.
1502	sulfide, di-	OsS_2	254.32	brn.-yel.
1503	sulfide, tetra-	OsS_4	318.44	brn.-bk.
1504	sulfite (ous)	$OsSO_3$	270.26	blue-bk.
1505	**Oxygen**	O_2	32.00	col. gas or hex. solid
1506	**Ozone**	O_3	48.00	col. gas
1507	**Palladium**	Pd	106.70	silv. met., cb.
1508	bromide(ous)	$PdBr_2$	266.53	brn.
1509	chloride	$PdCl_2$	177.61	brn., cb.
1510	chloride	$PdCl_2 \cdot 2H_2O$	213.65	brn. pr.
1511	cyanide	$Pd(CN)_2$	158.74	yel.
1512	fluoride	PdF_2	144.70	brn.
1513	hydride	Pd_2H	214.41	met.
1514	hydroxide	$Pd(OH)_2$	140.72	brn.
1515	iodide	PdI_2	360.54	bk.
1516	nitrate	$Pd(NO_3)_2$	230.72	yel.-brn., delq., rhb.
1517	oxide, sub-	Pd_2O	229.40	bk.
1518	oxide, mono-	PdO	122.70	bk.
1519	oxide, di-	PdO_2	138.70	bk.
1520	potassium chloride (ic)	$PdCl_4 \cdot 2KCl$	397.60	red-brn. red cr.
1521	potassium chloride (ous)	$PdCl_2 \cdot 2KCl$	326.72	red-brn. cr.
1522	selenide	PdSe	185.66	dark gray
1523	silicide	PdSi	134.76	....
1524	sulfate	$PdSO_4 \cdot 2H_2O$	238.79	delq., brn.
1525	sulfide, mono-	PdS	138.76	bk.
1526	sulfide, di-	PdS_2	170.82	brn.
1527	sulfide, sub-	Pd_2S	245.46	gray

* Usual commercial form.

Nitrogen tri-iodide ammine 1477
Nitro-lime 435
Nitrosyl bromide 1483
Nitrosyl chloride 1484
Nitrosyl fluoride 1485
Nitrosyl sulfuric acid 1471
Nitrous acid anhydride 1480
Nitryl chloride 1489
Nitryl fluoride 1490
Norbide 348
Norge niter 455
Norway saltpeter 100
Norwegian saltpeter 455
Octahedrite 2399
Oil green 603
Oil of tartar 1659
Oil of vitriol 2277

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1488	2.637	−40	32 d.	d.	....	....
1489	lq. $1.32^{14°}$	<−30	5	d.	....	....
1490	2.24(A)	−139	−63.5	d.	....	d. al., et.
1491	$22.48^{20°}$	2700	>5300	i.	i.	sl. s. aq. reg., HNO_3; i. NH_3
1492	....	....	....	v. s.	d.	v. s. al.; i. et.
1493	....	....	....	s. d.	....	s. NaCl, al., et.
1494	....	d. 560-600	....	sl. s.	....	s. a., alk., al.; sl. s. et.
1495	....	....	....	s. d.	....	s. HCl, al.
1496	....	....	....	i.	i.	i. a.
1497	....	....	....	i.	i.	i. a.
1498	7.91	....	....	i.	i.	i. a.
1499	4.91	40	135	$5.88^{15°}$	....	s. al., d.
1500	....	$-6H_2O$, 150	....	v. s.	....	v. s. al.; i. et.
1501	....	d.	....	sl. s.	....	i. HCl, al.
1502	....	....	....	sl. s.	....	i. alk.
1503	....	d.	....	i.	....	s. dil. HNO_3; i. alk.
1504	....	d. in air	....	i.	....	s. dil. HCl
1505	$1.14^{-183°}$ $1.426^{-252.5°}$ 1.1053(A)	−218.4	−183	$4.89^{0°}$cc	$2.6^{30°}$cc $1.7^{100°}$cc	sl. s. al., s. fused Ag
1506	$1.71^{-183°}$ $3.03^{-80°}$ 1.658(A)	−251	−112	$0.494^{0°}$cc	$0^{60°}$cc	s. oil turp., oil cinn.
1507	$12.0^{20°}$ $11^{1550°}$	1555	2200	i.	i.	s. aq. reg., h. H_2SO_4; i. NH_3
1508	....	....	....	i.	i.	s. HBr
1509	....	500 d.	....	s.	s.	s. HCl, act., al.
1510	....	....	....	s.	s.	s. HCl, act., al.
1511	....	d.	....	i.	i.	s. HCN, KCN, NH_4OH; i. dil. a.
1512	....	....	....	sl. s..	....	s. HF
1513	11.06	d.	....	....	....	....
1514	....	....	....	i.	i.	i. a., alk., NH_4Cl, $Na_2B_4O_7$
1515	....	d. 350	....	i.	i.	s. excess KI; i. dil. HCl al., et.
1516	....	d.	....	s. d.	....	s. HNO_3
1517	....	d.	....	i.	....	i. a.
1518	....	d. 877	....	i.	....	sl. s. h. a.
1519	....	−O, 200	....	i.	i.	v. sl. s. a.
1520	....	....	....	....	....	i. al., s. h. dil. HCl
1521	....	....	....	s.	....	....
1522	....	<960	....	i.	....	....
1523	$7.31^{15°}$	....	....	i.	....	....
1524	....	....	....	v. s.	d.	....
1525	....	950	....	i.	i.	s. HCl; i. $(NH_4)_2S$
1526	....	d.	....	i.	i.	s. aq. reg., d. HNO_3
1527	7.3	800 d.	....	i.	i.	sl. s. aq. reg.; i., a.

Oldhamite 485
Oleum 2280
Opal 1947
Orange cadmium 408
Orient yellow 408
Orpiment 188
Orthoclase 29
Orthophosphoric acid 1550
Orthophosphorous acid 1553
Orthosil 2140
Osmic acid 1499
Osmium ammonium chloride 103
Oxalic acid, cf. organic table.
Oxone 2113
Oxygen powder 2113
Ozogen 953
Palladium ammonium
  chloride 73

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
1528	**Palladous** dichlorodiammine	$Pd(NH_3)_2Cl_2$	211.68	red or yel., tet.
1529	dihydroxydiammine	$Pd(NH_3)_2(OH)_2$	174.78	cr., yel., octahedral
1530	**Perchloric acid**	$HClO_4$	100.46	unstable, col. lq.
1531	**Perchloric acid**	$HClO_4 \cdot H_2O$	118.48	fairly stable nd.
1532	**Perchloric acid**	$HClO_4 \cdot 2H_2O$‡ (73.6% anh.)	136.50	stable lq. ,col.
1533	**Periodic acid**	HIO_4	191.93	wh. cr.
1534	**Periodic acid**	$HIO_4 \cdot 2H_2O$	227.96	delq., mn.
1535	**Permanganic acid**	$HMnO_4$	119.94	exists only in solution
1536	**Permolybdic acid**	$HMoO_4 \cdot 2H_2O$	196.99	wh. cr.
1537	**Persulfuric acid**	$H_2S_2O_8$	194.14	hyg. cr.
1538	**Phosphamic acid**	$PONH_2 \cdot (OH)_2$	97.02	cb.
1539	**Phosphatomolybdic acid**	$H_7P(Mo_2O_7)_6 \cdot 28H_2O$	2365.88	yel. cb.
1540	**Phosphine**	PH_3	34.00	col. gas
1541	**Phosphine**	$(PH_2)_2$	65.99	lq.
1542	**Phosphine**	$(P_4H_2)_3$	377.81	yel. solid
1543	**Phosphomolybdic acid**	$20MoO_3 \cdot 2H_3PO_4 \cdot 48H_2O$	3939.8	yel. cr.
1544	**Phosphonium** bromide	PH_4Br	114.93	gas or col. cb.
1545	chloride	PH_4Cl	70.47	wh., cb.
1546	iodide	PH_4I	161.93	transparent, tet.
1547	sulfate	$(PH_4)_2SO_4$	166.08	wh. cr.
1548	**Phosphoric acid,** hypo-	$H_4P_2O_6$	161.99	cr.
1549	**Phosphoric acid,** meta-	HPO_3	79.99	vitreous, delq.
1550	**Phosphoric acid,** ortho-	H_3PO_4†	98.00	col., rhb.
1551	**Phosphoric acid,** pyro-	$H_4P_2O_7$	177.99	wh. nd.
1552	**Phosphorous acid,** hypo-	H_3PO_2	66.00	syrupy
1553	**Phosphorous acid,** ortho-	H_3PO_3	82.00	col.
1554	**Phosphorous acid,** pyro-	$H_4P_2O_5$	145.99	nd.
1555	**Phosphorus,** black	P_4	123.92	rhombohedral
1556	**Phosphorus,** red	P_4	123.92	red, cb.
1557	**Phosphorus,** violet	P_4	123.92	vl., mn.
1558	**Phosphorus,** yellow	P_4	123.92	yel., hex., 2.1168
1559	**Phosphorus,** bromide, tri-	PBr_3	270.73	col., fuming lq.
1560	bromide, penta-	PBr_5	430.56	yel., rhb.
1561	bromodichloride, hepta-	PBr_7Cl_2	661.31	pr.
1562	bromofluoride	PBr_2F_3	247.81	brn. lq.
1563	bromonitride	PBr_2N	204.82	col., rhb.
1564	bromotetrachloride, mono-	$PBrCl_4$	252.72	yel. cr.
1565	bromotrichloride, di-	PBr_2Cl_3	297.18	or. cr.
1566	bromotrichloride, octa-	PBr_8Cl_3	776.68	brn. nd.
1567	chloride, tri-	PCl_3	137.35	col., fuming lq.

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‡ One commercial form 70-72%

† Common commercial form 85% H_3PO_4 in aq. soln.

Paper-makers' alum 37
Para-hopeite 2568
Paramelaconite 748
Paris blue 815
Paris green 718, cf. also organic table.
Paris red 1081
Paris yellow 1045.1 or 1060
Paris white 427
Parrot green 718
Patgreen 718

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1528	2.5	....	....	s.	....	s. a., NH_4OH
1529	....	stable <105	....	s.	d.	....
1530	$1.768^{22°}_{4}$	−112	16^{18mm}	s.	....	....
1531	1.88	50	d.	s.	....	....
1532	$1.71^{25°}_{4}$	−17.8	200	v. s.	....	s. al.
1533	....	d. 138	subl. 110	s.	....	....
1534	....	d. 110	....	v. s.	v. s.	sl. s. al., et.
1535	....	....	....	v. s.	d.	d. al.
1536	....	....	....	v. s.	v. s.	....
1537	....	<60	....	v. s.	d.	....
1538	....	d.	....	v. s.	v. s. d.	i. al.
1539	....	78	−25 H_2O, 140	s.	....	s. HNO_3
1540	lq. $0.746^{-90°}$ 1.146(A)	−132.5	−85	$26^{17°}$ cc	i.$^{100°}$	s. Cu_2Cl_2, al., et.
1541	1.012	< −10	58	i.	....	s. al., turpentine
1542	$1.83^{19°}$	....	ign. 200	i.	i.	s. P, P_2H_4; i. al.
1543	....	....	....	250	....	v. s. al., et.
1544	1.906(A)	....	30 d.	d.	....	d. $COCl_2$
1545	....	$28^{46 atm}$	subl.	d.	....	....
1546	2.86	....	80	d.	....	d. al.
1547	....	....	....	d.	....	....
1548	....	55	d. 70	s.	$450^{62°}$	....
1549	2.2-2.5	subl.	....	s.	forms H_3PO_4	i. lq. CO_2
1550	$1.834^{18.2°}$	42.35	$-\frac{1}{2}HO$, 213	$2340^{26°}$	v. s.	s. al.
1551	....	61	....	$800^{23°}$	forms H_3PO_4	v. s. al., et.
1552	$1.493^{18.8°}$	26.5	d.	∞	∞	....
1553	$1.651^{21.2°}$	74	d. 200	$307.3^{0°}$	$730^{40°}$	....
1554	....	38	d. 130	d.	....	....
1555	2.69	....	ign. in air, 400	i.	i.	i. CS_2
1556	$2.20^{20°}$	$590^{43 atm}$	ign. in air, 725	i.	i.	s. alk.; i. CS_2, NH_3, et.
1557	2.36	593	....	i.	i.	i. a., al., et.
1558	$1.82^{20°}$; lq. $1.745^{44.5°}$	44.1; ign. 34	280	0.0003	sl. s.	0.4 al.; $1000^{10°}$ CS_2; $1.5^{0°}$, $10^{81°}$ bz.; s. NH_3
1559	$2.852^{15°}_{4}$	−40	175.3^{760mm}	d.	....	s. CS_2, et., chl.; d. al.
1560	....	<100	106 d.	d.	....	d. al.
1561	....	....	....	d.	....	s. PCl_3
1562	....	−20	d. 15	d.	....	attacks glass
1563	....	190	....	i.	....	s et.; sl. s. chl., CS_2
1564	....	....	....	d.	....	....
1565	....	d. 35	....	d.	....	d. ac.
1566	....	25	....	d.	....	s. CS_2
1567	$1.574^{20.8°}_{4}$	−111.8	75.95^{760mm}	d.	....	s. et., chl., CS_2

Pearl ash 1659
Pearl white 337
Perborax 2106
Perborin 2106
Perchloron 444
Periclase 1207
Permanent white 284
Perosmic acid 1499
Peroxydol 2106
Persian red 1061
Philosopher's wool 2560
Phosgene 501
Phosphate rock 464
Phosphoric (acid) anhydride 1578

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Phosphorus			
1568	chloride, penta-	PCl_5	208.27	delq., tet.
1569	chlorofluoride	PCl_2F_3	158.89	col. gas
1570	fluoride, tri-	PF_3	87.98	col. gas
1571	fluoride, penta-	PF_5	125.98	col. gas
1572	iodide, di-	P_2I_4	569.64	or., tri.
1573	iodide, tri-	PI_3	411.74	red, delq., hex.
1574	iodochloride	PI_2Cl_3	391.19	red, hex.
1575	nitride	P_3N_5	162.98	wh., amor.
1576	oxide, tri-	P_2O_3	109.96	wh., delq., mn.
1577	oxide, tetra-	P_2O_4	125.96	wh., delq., rhb.
1578	oxide, penta-	P_2O_5	141.96	wh., delq., amor.
1579	oxybromide	$POBr_3$	286.73	col. plates
1580	oxybromodichloride	$POBrCl_2$	197.81	tablets, or yel. lq.
1581	oxychloride	$POCl_3$	153.35	col., fuming lq.
1582	oxyfluoride	POF_3	103.98	gas
1583	oxyiodide	$P_3O_8I_6$	982.46	red cr.
1584	oxynitride	PON	60.99	wh., amor.
1585	selenide, mono-	P_2Se	140.92	red
1586	selenide, tri-	P_2Se_3	298.84	dark red
1587	selenide, penta-	P_2Se_5	456.76	red, nd.
1588	selenide, sub-	P_4Se	202.88	yel. lq.
1589	sulfide, sesqui-	P_4S_3	220.10	yel., rhb.
1590	sulfide, di-	P_3S_6	285.30	yel. nd.
1591	sulfide, tri-	P_4S_6	316.28	gray-yel.
1592	sulfide, penta-	P_2S_5	222.26	yel., delq.
1593	sulfoxide	$P_4O_6S_4$	348.16	col., delq., tet.
1594	thioamide	$PS(NH_2)_3$	111.11	yel. or wh., amor.
1595	thiobromochloride	$PSBrCl_2$	213.87	col. or yel. lq.
1596	thiobromide	$PSBr_3$	302.79	yel., cb.
1597	thiochloride	$PSCl_3$	169.41	col., delq.
1598	thiocyanate	$P(CNS)_3$	205.21	lq.
1599	thiofluoride	PSF_3	120.04	col. gas
1600	**Phosphotungstic acid**	$P_2O_5 \cdot 12WO_3 \cdot 42H_2O$	3681.67	yel.-gn. cr.
1601	**Platinum**	Pt	195.23	silv. met., cb.
1602	bromide (ic)	$PtBr_4$	514.89	dark brn.
1603	bromide (ous)	$PtBr_2$	355.06	brn.
1604	chloride (ic)	$PtCl_4$	337.06	brn.
1605	chloride (ous)	$PtCl_2$	266.14	brn.
1606	chloride (ic)	$PtCl_4 \cdot 8H_2O$	481.19	red, mn.
1607	cyanide (ous)	$Pt(CN)_2$	247.27	yel.-brn.
1608	fluoride (ic)	PtF_4	271.23	brn., delq.

Phosphorus hydride 1540
Phosphorus oxysulfide 1593
Phosphorus pentoxide 1578
Phosphorus salt 2011
Phosphorus sulfocyanate 1598
Phosphorus sulfocyanide 1598
Phosphorus trichloride 1567
Phosphoryl cf. phosphorus oxy-
Photophor 468
Pickle alum 36
Pickling acid 2277
Picromerite 1219

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1568	solid 1.6; 3.60$^{295°}$ (A)	148 under pressure	subl. 160	d.	....	s. CS_2, C_6H_5COC
1569	5.4(A)	....	−8	d.	....	s. d. al.
1570	3.022(A)	−160	−95	forms P+HF	....	s. al., d. alk.
1571	4.49(A)	−83	−75	d.	....	d. alk.
1572	....	110	....	d.	....	s. CS_2; d. AgCl
1573	....	61	d.	d.	....	v. s. CS_2
1574	....	d. 259	....	d.	....	s. CS_2
1575	2.51$^{18°}$	d.	....	i.	v. sl. s. d.	i. any solvent
1576	2.135$^{21°}_{4}$	22.5	173.1^{760mm}	forms H_3PO_4	....	s. CS_2, et., chl.
1577	2.537$^{22.6°}_{4}$	>100	180	s.	forms H_3PO_3	....
1578	2.387	subl. 250	....	forms H_3PO_4	v. s.	s. H_2SO_4; i. NH_3, act.
1579	2.822	56	189.5^{774mm}	d.	....	s. et., bz., CS_2, H_2SO_4
1580	lq. 2.104$^{14°}$	13	137.6	d.	....	....
1581	1.675	2	107.2^{760mm}	d.	....	d. al.
1582	3.69(A)	−68	−40	d.	....	d. al.
1583	....	140	d.	s.	....	s. al., et.
1584	....	red heat	....	i.	i.	i. a., alk.
1585	....	....	....	d.	....	v. s. CS_2; i. al., et.
1586	....	d.	....	....	d.	s. KOH; i. CS_2
1587	....	burns in air	....	d.	....	s. CCl_4; i. CS_2
1588	....	−7	ign.	d.	....	s. CS_2; i. et.; d. al.
1589	2.03$^{17°}$	172.5	408^{760mm}	i.	d.	100$^{17°}$ CS_2, s. bz., PCl_3
1590	....	298	337$^{10.5mm}$	....	....	v. sl. s. CS_2
1591	....	290	490	d.	....	s. alk., al., et.; v. sl s. CS_2
1592	2.03	276	530	d.	....	0.22 CS_2; s. alk.
1593	....	102	295	d.	....	50 CS_2
1594	1.7$^{13°}$	d. 200	....	sl. s.	d.	sl. s. al., et., CS_2
1595	2.12$^{0°}$	−30	d. 150	d.	....	....
1596	2.85$^{17°}$	38	d. 175	d.	....	s. et., CS_2, PBr_3, PCl_3
1597	1.635	−38	125	d.	....	s. bz., CS_2, CCl_4
1598	1.625$^{18°}$	< −20	265	d.	....	s. al., et., bz., CS_2
1599	....	−148.8	−52.3	d.	....	sl. s. et.; i. bz., CS_2
1600	....	....	....	s.	....	s. al., et.
1601	21.45$^{20°}$; lq. 19$^{1755°}$	1755	4300	i.	i.	s. aq. reg., fused alk.
1602	....	d. 180	....	0.41$^{20°}$	sl. s.	s. HBr; sl. s. al.
1603	....	d. 300	....	i.	i.	s. HBr; sl. s. KBr
1604	....	d. 370	....	140$^{25°}$	v. s.	s. al., act.; sl. s. NH_3; i. et.
1605	5.87$^{11°}$	d. 581	....	i.	i.	s. HCl, NH_4OH; sl. s. NH_3; i. al., et.
1606	2.43	$-4H_2O$, 100	....	v. s.	v. s.	s. al., et.
1607	....	....	....	i.	i.	i. alk.
1608	....	d.	....	s. d.	....	....

Pink salt 78
Pitchblende 2446
Plaster of Paris 482
Platinic acid, bromo- 363
Platinic acid, chloro- 586
Platinic acid, iodo- 990
Platinum ammonium chloride 75
Platinum ammonium iodide 97
Plattnerite 1083

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Platinum			
1609	hydroxide (ous)	$Pt(OH)_2$	229.25	bk.
1610	hydroxide (ous)	$Pt(OH)_2 \cdot 2H_2O$	265.28	yel.
1611	hydroxide (ic)	$Pt(OH)_4$	263.26	red-brn.
1612	iodide (ous)	PtI_2	449.07	bk.
1613	iodide (ic)	PtI_4	702.91	brn.-bk., amor.
1614	oxide (ic)	PtO_2	227.23	bk.
1615	oxide (ic)	$PtO_2 \cdot H_2O$	245.25	bk.
1616	oxide (ic)	$PtO_2 \cdot 2H_2O$	263.26	brn.
1617	oxide (ic)	$PtO_2 \cdot 3H_2O$	281.28	ocher
1618	oxide (ic)	$PtO_2 \cdot 4H_2O$	299.29	yel. nd.
1619	oxide (ous)	PtO	211.23	vl.-bk.
1620	oxide (ous-ic)	Pt_3O_4	649.69	bk.
1621	pyrophosphate (ic)	PtP_2O_7	369.19	gn.-yel.
1622	silicide (ic)	$PtSi$	223.29	....
1623	sulfate (ic)	$Pt(SO_4)_2 \cdot 4H_2O$	459.41	yel. pl.
1624	sulfide (ic)	PtS_2	259.35	bk. or gray nd.
1625	sulfide (ous) (cooperite)	PtS	227.29	bk., tet.
1626	sulfide (sesqui)	Pt_2S_3	486.64	gray
1627	**Plutonium**	Pu	238	....
1628	**Plutonium**	Pu	239	....
1629	**Potassium**	K	39.10	silv. met., cb.
1630	acetate	$KC_2H_3O_2$	98.14	wh. pd.
1631	acetate, acid	$KH(C_2H_3O_2)_2$	158.19	delq. nd. or pl.
1632	aluminate	$K_2(AlO_2)_2 \cdot 3H_2O$	250.18	cr.
1633	amide	KNH_2	55.12	yel.-grn.
1634	antimonate, meta-	$KSbO_3$	208.86	col. cr.
1635	antimonate, acid pyro-	$K_2H_2Sb_2O_7 \cdot 4H_2O$	507.79	wh. cr.
1636	antimonide	K_3Sb	239.05	yel.-gn.
1637	arsenate (monobasic)	KH_2AsO_4	180.02	col., tet., 1.5674
1638	arsenate (dibasic)	$K_2HAsO_4 \cdot H_2O$	236.13	trig.
1639	arsenate (tribasic)	K_3AsO_4	256.20	delq. cr.
1640	arsenite (meta)	$KAsO_2$	146.01	wh. pd.
1641	arsenite, acid meta-	$KH(AsO_2)_2 \cdot H_2O$	271.94	....
1642	aurate	$KAuO_2 \cdot 3H_2O$	322.34	yel. nd.
1643	auricyanide	$KAu(CN)_4 \cdot 1.5H_2O$	367.39	pl.
1644	aurocyanide	$KAu(CN)_2$	288.33	rhb.
1645	azide	KN_3	81.12	tet.
1646	benzoate	$KC_7H_5O_2 \cdot 3H_2O$	214.25	wh. pd.
1647	bicarbonate	$KHCO_3$	100.11	mn., 1.482
1648	bifluoride	KHF_2	78.10	col., cb.
1649	bisulfate	$KHSO_4$	136.16	rhb., or mn., 1.480
1650	borate, meta-	$K_2B_2O_4$	163.83	mn.
1651	borate, tetra-	$K_2B_4O_7 \cdot 5H_2O$	323.55	wh., hex.
1652	borotartrate	$KC_4H_4BO_7$	213.99	wh. cr.
1653	bromate	$KBrO_3$	167.01	trig.
1654	bromide	KBr	119.01	col., cb., 1.5594
1655	bromaurate	$KAuBr_4$	555.96	brn., mn.
1656	bromaurate	$KAuBr_4 \cdot 2H_2O$	591.99	dark brn., rhb.

Plessy's green 604
Plumbago 495
Plumbo 1081
Polianite 1269
Polishing powder 2182
Polydymite 1464
Potash 1659
Potash, caustic 1697
Potash alum 44
Potash lye 1697
Potassium acid fluoride 1648
Potassium acid oxalate 1721
Potassium acid phthalate 1741
Potassium acid sulfate 1649
Potassium acid sulfite 1769
Potassium acid tartrate 1771
Potassium alum 44
Potassium aluminum silicate 28

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts: Cold Water	Hot Water	Other Reagents
1609	....	d.	....	i.	i.	s. HCl, HBr, alk.
1610	....	$-2H_2O$, 100	....	i.	i.	s. a., alk.
1611	....	d.	....	i.	i.	s. aq. reg., HCl
1612	....	d. 325	....	i.	i.	sl. s. Na_2SO_3; i. a., al., act.
1613	....	d. 100	....	i.	....	v. s. NH_3; s. HI, KI, alk.
1614	....	430	....	i.	i.	i. aq. reg., a.
1615	....	$-H_2O$, 100	....	i.	i.	s. NaOH; i. ac.
1616	....	$-2H_2O$, 100	....	i.	i.	s. NaOH; i. ac.
1617	....	d. 300	....	i.	i.	i. aq. reg., a.
1618	....	d.	....	i.	i.	i. a.
1619	....	555	....	i.	i.	s. HCl, H_2SO_3
1620	....	d.	....	i.	i.	i. aq. reg., a.
1621	$4.856^{20°}_{4}$	d. >600	....	v. sl. s.	....	....
1622	$11.63^{15°}_{4}$	1100	....	i.	i.	s. aq. reg., i. a.
1623	....	....	....	s.	d.	s. a., al., et.
1624	5.27	d.	....	i.	i.	s. aq. reg., $(NH_4)_2S$
1625	8.897	d.	....	i.	i.	s. aq. reg., $(NH_4)_2S$; i. a.
1626	5.52	d.	....	i.	....	slowly s. aq. reg.; i. a.
1627	produced	by deuteron b	ombardment	on U^{238}		
1628	produced	by neutron b	ombardment	on U^{238}		
1629	$0.86^{20°}$; lq. $0.83^{62°}$	62.3	760	d.	forms KOH	s. a., al., Hg
1630	1.8	292	....	$217^{0°}$	$396^{90°}$	33 al.; i. et.
1631	....	148	d. 200	d.	....	s. ac.
1632	....	....	....	s.	d.	s. alk.; i. al.
1633	....	338	subl. 400	d.	....	d. al.; $3.6^{25°}$ NH_3
1634	....	....	....	i.	sl. s.	s. h. KOH; i. CS_2
1635	....	....	....	s.	....	....
1636	....	812	....	d.	....	d. in air
1637	2.867	288	....	$18.87^{6°}$	v. s.	i. al.
1638	....	$-H_2O$, 110	....	s.	....	....
1639	....	....	....	v. s.	v. s.	4 al.
1640	....	....	....	s.	....	sl. s. al.
1641	....	....	....	s.	....	sl. s. al.
1642	....	d.	....	v. s.	d.	s. al.
1643	....	d. 200	....	s.	v. s.	s. al.
1644	....	....	....	14.3	$200^{100°}$	sl. s. al.; i. et.
1645	....	....	....	$46.5^{10.5°}$	$100^{100°}$	$0.1375^{16°}$ al.
1646	....	$-3H_2O$, 110	....	$124^{17.5°}$	$161^{50°}$	s. al.
1647	2.17	d. 100-200	....	$22.4^{0°}$	$60^{60°}$	i. satd. K_2CO_3, al.
1648	....	d.	....	$41^{21°}$	$114^{80°}$	s. $KC_2H_3O_2$
1649	2.35	210	d.	$36.3^{0°}$	$121.6^{100°}$	d. al.
1650	....	947	....	$14.7^{0°}$	v. s.	....
1651	1.74(anh.)	d.	....	$40^{35°}$	v. s.	....
1652	1.832	....	....	sl. s.	....	....
1653	$3.27^{17.5°}$	370 d.	....	$3.11^{0°}$	$49.75^{100°}$	sl. s. al.; i. act.
1654	$2.75^{25°}$	730	1380	$53.5^{0°}$	$104^{100°}$	sl. s. al., et.
1655	....	d.	....	s.	....	s. al.
1656	....	....	....	$19.5^{15°}$	$204^{67°}$	s. KBr; d. et.

Potassium aluminum sulfate 44
Potassium aluminum tartrate 30
Potassium antimonyl tartrate 161
Potassium auribromide 1655
Potassium aurichloride 1664
Potassium beryllium fluoride 308
Potassium biborate 1651
Potassium bichromate 1681
Potassium binoxalate 1721
Potassium biphthalate 1741
Potassium bisulfite 1769
Potassium bisulfite, meta- 1712
Potassium bitartrate 1771
Potassium borofluoride 1685
Potassium bromostannate 1759

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Potassium			
1657	bromoplatinate	K_2PtBr_6	752.92	red, cb.
1658	bromoplatinite	K_2PtBr_4	593.09	brn., rhb.
1659	carbonate	K_2CO_3	138.20	wh., delq. pd., 1.531
1660	carbonate	$K_2CO_3 \cdot 2H_2O$	174.23	rhb.
1661	carbonate	$2K_2CO_3 \cdot 3H_2O$	330.45	mn.
1662	chlorate	$KClO_3$	122.56	col., mn., 1.5167
1663	chloride (sylvite)	KCl	74.56	col., cb., 1.4904
1664	chloraurate	$KAuCl_4$	378.12	yel., mn.
1665	chlorochromate	$KOClCrO_2$	174.56	red, mn.
1666	chloroiridate	K_2IrCl_6	484.03	bk., cb.
1667	chloropalladate	K_2PdCl_6	397.63	red, cb.
1668	chloropalladite	K_2PdCl_4	326.72	yel., cb.
1669	chloroplatinate	K_2PtCl_6	486.16	yel., cb., 1.825±
1670	chloroplatinite	K_2PtCl_4	415.25	red-brn., tet., 1.64
1671	chlororhodite	$K_3RhCl_6 \cdot 3H_2O$	486.99	red, tri.
1672	chlorostannate	K_2SnCl_6	409.63	col., cb.
1673	chromate (tarapacaite)	K_2CrO_4	194.20	yel., rhb., 1.7261
1674	citrate	$K_3C_6H_5O_7 \cdot H_2O$	324.40	col. cr.
1675	cobalticyanide	$K_3Co(CN)_6$	332.34	yel., mn.
1676	cobaltinitrite	$6KNO_2 \cdot 2Co(NO_2)_3 \cdot 3H_2O$	958.60	yel., tet.
1677	cobaltocyanide	$K_4Co(CN)_6$	371.43	vl.
1678	cobaltosulfate	$K_2Co(SO_4)_2 \cdot 6H_2O$	437.35	mn. pl., 1.4865
1679	cyanate	$KCNO$	81.11	wh., tet.
1680	cyanide	KCN	65.11	wh., cb., delq., 1.410
1681	dichromate	$K_2Cr_2O_7$	294.21	red, tri.
1682	dithionate	$K_2S_2O_6$	238.31	col., trig., 1.4550
1683	ferricyanide	$K_3Fe(CN)_6$	329.25	red, mn. pr., 1.5689
1684	ferrocyanide	$K_4Fe(CN)_6 \cdot 3H_2O$	422.39	yel., mn., 1.5772
1685	fluoborate	KBF_4	125.92	col., cb. or rhb., 1.3245
1686	fluoride	KF	58.10	col., cb., 1.352
1687	fluoride	$KF \cdot 2H_2O$*	94.13	mn. pr., 1.352
1688	fluogermanate	K_2GeF_6	264.79	wh., hex.
1689	fluohafniate	K_2HfF_6	370.79	mn.
1690	fluostannate	$K_2SnF_6 \cdot H_2O$	328.91	wh., mn.
1691	fluosulfonate	KSO_3F	138.16	wh.
1692	fluotitanate	$K_2TiF_6 \cdot H_2O$	258.11	wh., mn.
1693	fluozirconate	K_2ZrF_6	283.41	col., mn., 1.465
1694	formate	$KHCO_2$	84.11	col., rhb.
1695	hydride	KH	40.10	cb., 1.453
1696	hydrosulfide	KHS	72.16	wh., delq., rhb.
1697	hydroxide	KOH	56.10	wh., delq., rhb.
1698	hypochlorite	$KClO$	90.55	exists only in soln.
1699	hypophosphite	KH_2PO_2	104.09	delq., hex.
1700	iodate	KIO_3	214.02	col., mn.
1701	iodate, acid	$KH(IO_3)_2$	389.94	rhb., or mn.
1702	iodide	KI	166.02	wh., cb., 1.6670
1703	iodide, tri-	KI_3	419.86	dark blue, delq., mn.
1704	iodobromide	$KBr \cdot IBr$	325.85	rhb.
1705	iodochloride	$KCl \cdot ICl$	236.93	mn.

* Usual commercial form.

Potassium cadmium iodide 399
Potassium calcium sulfate 472
Potassium carbonate, acid 1647
Potassium chloroplumbate 1746
Potassium chromium sulfate 45
Potassium cobaltous carbonate 685
Potassium cupric chloride 755

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1657	$4.66^{24°}_{4}$	>400 d.	....	$2.07^{10°}$	$10^{100°}$	i. al.
1658	....	....	....	v. s.	v. s.	....
1659	2.29	891	d.	$105.5^{0°}$	$156^{100°}$	i. al.
1660	2.043	....	....	$183^{0°}$	$331^{100°}$	....
1661	2.13	....	....	$129.4^{0°}$	$268^{100°}$	....
1662	2.32	368	d. 400	$3.3^{0°}$	$57^{100°}$	0.83 al.; s. alk.
1663	1.988	790	1500	$27.6^{0°}$	$56.7^{100°}$	s. al., alk.
1664	....	357	....	$38^{10°}$	$400^{60°}$	25, 98% al.
1665	$2.497^{39°}$	d.	....	s. d.	....	s. a., act.
1666	3.546	d.	....	$1.25^{19°}$	$6.67^{100°}$	i. al., KCl, NH_3
1667	2.738	d.	....	sl. s.	d.	sl. s. HCl; i. al.
1668	2.67	d.	....	s.	v. s.	s. NH_4OH, KCl; i. al.
1669	3.499	d. 250	....	$0.74^{0°}$	$5.2^{100°}$	i. al., et.
1670	3.30	....	....	16.6	s.	i. al.
1671	3.3	d.	....	sl. s.	d.	i. al.
1672	2.70	d.	....	s.	....	....
1673	$2.732^{18°}$	975	....	$58.0^{0°}$	$75.6^{100°}$	i. al.
1674	1.98	d. 230	....	$167^{15°}$	$200^{31°}$	sl. s. al.
1675	1.906	d.	....	v. s.	v. s.	i. al.
1676	....	d. 200	....	$0.09^{0°}$	sl. s.	i. al., et.
1677	....	....	....	s.	....	i. al., et.
1678	2.218	....	....	$8.5^{0°}$	$47.8^{80°}$	....
1679	2.048	....	....	s.	d.	v. sl. s. al.
1680	$1.52^{16°}$	634.5	....	s.	$122.2^{103.3°}$	s. gly.; $0.9^{19.5°}$ al.; 1.3 h. al.
1681	2.69	398	d.	$4.9^{0°}$	$80^{100°}$	i. al.
1682	2.278	d.	....	$6.06^{16°}$	$63.3^{100°}$	i. al.
1683	1.84	d.	....	$33^{4.4°}$	$77.5^{100°}$	s. act.; sl. s. al.; i. NH_3
1684	$1.853^{17°}$	$-3HO_2$, 70	....	$27.8^{12.2°}$	$90.6^{96.3°}$	s. act.; i. NH_3, al., et.
1685	$2.50^{20°}$	529.5	d.	$0.44^{20°}$	$6.27^{100°}$	s. alk.; i. c. al.; sl. s. h. al.
1686	2.48	880	1500	$92.3^{18°}$	$150^{80°}$	s. HF; sl. s. al.
1687	2.454	41	....	v. s.	v. s.	s. HF; i. al.
1688	....	730	835	$180^{18°}$	$36^{100°}$	....
1689	....	....	....	$3.1^{20°}$	....	$37.4^{20°}$ in 0.125 N HF
1690	3.053	....	....	$6.7^{18°}$	$43.9^{100°}$	i. al., NH_3
1691	....	311.1	....	s.	s.	s. m. al.; d. excess alk.
1692	2.992	$-H_2O$, 100	....	$0.6^{0°}$	$1.3^{20°}$	s. HCl
1693	3.58	....	....	$0.78^{0°}$	$26^{100°}$	i. NH_3
1694	1.91	167.5	d.	$331^{18°}$	$657^{90°}$	sl. s. al.; i. et.
1695	0.80	d.	....	d.	....	i. et., bz., CS_2
1696	2.0	455	....	s.	s. d.	s. al.
1697	2.044	380	1320	$97^{0°}$	$178^{100°}$	v. s. al.; i. et., NH_3
1698	....	d.	....	v. s.	v. s. d.	....
1699	....	ign.	....	$200^{25°}$	330	$14.3^{25°}$ al.; sl. s. NH_3; i. et.
1700	3.89	560	....	$4.73^{0°}$	$32.2^{100°}$	s. KI; i. al., NH_3
1701	....	....	....	$1.33^{15°}$	....	i. al.
1702	3.13	723	1330	$127.5^{0°}$	$208^{100°}$	$4^{20°}$ al.; s. NH_3; sl. s. et.
1703	3.498	45	d. 225	v. s.	....	s. KI, al.
1704	....	60	d. 180	d.	....	....
1705	....	60	d. 215	d.	....	....

Potassium dioxide 1729
Potassium ferric oxalate 826
Potassium ferric sulfate 46
Potassium ferrous oxalate 862
Potassium fluoride, acid 1648
Potassium fluosilicate 1754
Potassium gadolinium sulfate 885
Potassium germanium fluoride 911

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Potassium			
1706	iodochloride	$KCl \cdot ICl_3$	307.84	yel., mn.
1707	iodoiridite	K_3IrI_6	1071.91	gn. cr.
1708	iodoplatinate	K_2PtI_6	1034.94	cb.
1709	manganate	K_2MnO_4	197.12	gn., rhb.
1710	manganicyanide	$K_3Mn(CN)_6$	328.33	red, mn.
1711	manganocyanide	$K_4Mn(CN)_6 \cdot 3H_2O$	421.47	blue
1712	metabisulfite	$K_2S_2O_5$	222.31	mn., pl.
1713	molybdate	K_2MoO_4	238.14	wh. pd., delq.
1714	nitrate (saltpeter)	KNO_3	101.10	col., rhb., 1.5038
1715	nitrate	KNO_3	101.10	col., trig.
1716	nitrite	KNO_2	85.10	pr.
1717	nitroprusside	$K_2Fe(CN)_5 \cdot NO \cdot 2H_2O$	330.17	red, mn.
1718	osmate	$K_2OsO_4 \cdot 2H_2O$	368.42	vl., cb.
1719	osmocyanide	$K_4Os(CN)_6 \cdot 3H_2O$	556.74	col., mn., 1.6071
1720	oxalate	$K_2C_2O_4 \cdot H_2O$	184.23	wh., mn.
1721	oxalate, acid	KHC_2O_4*	128.12	mn., 1.545
1722	oxalate, acid	$KHC_2O_4 \cdot \frac{1}{2}H_2O$	137.13	trimetric
1723	oxalate, tetra-	$KH_3(C_2O_4)_2 \cdot 2H_2O$	254.19	tri.
1724	oxide	K_2O	94.19	wh., cb.
1725	perchlorate	$KClO_4$	138.55	col., rhb., 1.4737
1726	perchromate	K_3CrO_8	297.30	brn., cb.
1727	periodate	KIO_4	230.02	tet., 1.6205
1728	permanganate	$KMnO_4$	158.03	purple, rhb.
1729	peroxide	K_2O_2	110.19	wh., delq., amor.
1730	perrhenate	$KReO_4$	289.41	wh., tet., 1.643
1731	perruthenate	$KRuO_4 \cdot H_2O$	222.81	bk., tet.
1732	persulfate	$K_2S_2O_8$	270.31	wh., tri., 1.4669
1733	peruranate	$K_2UO_5 \cdot 3H_2O$	450.31	red cr
1734	phosphate, monobasic	KH_2PO_4	136.09	col., delq., tet., 1.5095
1735	phosphate, dibasic	K_2HPO_4	174.18	wh., delq.
1736	phosphate, tribasic	K_3PO_4	212.27	wh., rhb.
1737	phosphate, meta-	KPO_3	118.08	col., 1.458, 1.487
1738				
1739	phosphate, pyro-	$K_4P_2O_7 \cdot 3H_2O$	384.39	delq.
1740	phosphite, ortho-	K_2HPO_3	158.18	wh. pd., delq.
1741	phthalate, acid	$KHC_8H_4O_4$	204.22	wh. cr.
1742	platinate	$K_2PtO_3 \cdot 3H_2O$	375.47	yel., rhb.
1743	platinocyanide	$K_2Pt(CN)_4 \cdot 3H_2O$	431.54	yel., rhb., 1.62 ±
1744	platinonitrite	$K_2Pt(NO_2)_4$	457.45	mn.
1745	plumbate	$K_2PbO_3 \cdot 3H_2O$	387.45	col., tet. or trig.
1746	plumbichloride	K_2PbCl_6	498.14	cb.
1747	ruthenate	$K_2RuO_4 \cdot H_2O$	261.91	bk., rhb.
1748	selenate	K_2SeO_4	221.15	rhb., 1.5390
1749	selenide	K_2Se	157.15	....
1750	selenocyanide	$KSeCN$	144.07	delq.
1751	selenocyanoplatinate	$K_2Pt(SeCN)_6$	903.29	rhb.
1752	silicate	K_2SiO_3	154.25	hyg., 1.521 ±
1753	silicate, tetra-	$K_2Si_4O_9 \cdot H_2O$	352.45	rhb., 1.530

* Usual commercial form.

Potassium magnesium chloride 1218
Potassium magnesium sulfate 1219
Potassium manganese sulfate 47
Potassium mercuric iodide 1329
Potassium nickel cyanide 1454
Potassium nickel sulfate 1455
Potassium nitride 1645
Potassium nitroferrocyanide 1717
Potassium osmium chloride 1500
Potassium oxide, tera- 1774
Potassium palladium chloride 1520
Potassium pentathionate 1782

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1706	1.176^{45°	d.	....	d.	....	d. et.
1707	....	....	....	v. s.	v. s.	i. al.
1708	5.18	....	....	s.	....	....
1709	....	d. 190	....	d.	....	s. KOH
1710	....	....	....	s.	....	....
1711	....	....	....	s.	....	....
1712	....	d. 150	....	25^{0°	120^{94°	sl. s. al.; i. et.
1713	lq. $2.342^{964^\circ}_{4}$	919	....	184.6^{25°	v. s.	i. al.
1714	$2.11^{10.6^\circ}$	tr. 129; 333	d. 400	13.3^{0°	246^{100°	0.1^{30° al.; i. et.
1715	....	333	d. 400	....	....	....
1716	1.915	297	d. 350	281^{0°	413^{100°	v. s. NH_3; sl. s. al.
1717	....	....	....	100^{16°	....	s. al.
1718	....	$-H_2O$, >100	....	sl. s.	s.	i. al., et.
1719	....	d.	....	sl. s.	s.	i. al., et.
1720	2.13	d.	....	28.7^{0°	83.2^{100°	....
1721	2.0	d.	....	14.3^{50°	48.1^{100°	....
1722	....	d.	....	2.2^{0°	51.5^{100°	....
1723	1.836	d.	....	1.8^{13°	....	....
1724	$2.32^{20^\circ}_{4}$	....	....	forms KOH	v. s.	s. al., et.
1725	$2.524^{11^\circ}_{4}$	d. 400	....	0.75^{0°	21.8^{100°	0.105^{25° m. al.; i. et.
1726	....	d. 170	....	sl. s.	....	i. al., et.
1727	3.618	582	$-O$, 300	0.66^{13°	s.	v. sl. s. KOH
1728	2.703	d. <240	....	2.83^{0°	32.35^{75°	s. H_2SO_4; d. al.
1729	....	....	d.	d.	....	d. al.
1730	4.887	350	....	1.21^{20°	14^{100°	v. sl. s. al.
1731	....	d. 400 (vac.)	....	sl. s.	....	....
1732	....	d. <100	....	1.77^{0°	10^{40°	i. al.
1733	....	d. 100	....	d.	....	d. HCl
1734	2.338	256	....	14.8^{0°	83.5^{90°	i. al.
1735	....	d.	....	33^{25°	v. s.	sl. s. al.
1736	2.564^{17°	1340	....	193.1^{25°	v. s.	i. al.
1737	2.393^{25°	807	....	v. sl. s.	sl. s.	i. al.
1738						
1739	2.33	$-2H_2O$, 180	$-3H_2O$, 300	s.	v. s.	i. al.
1740	....	d.	....	v. s.	v. s.	i. al.
1741	1.63	d.	....	10.2^{25°	36	....
1742	....	d.	....	s.	....	i. al.
1743	2.45^{16°	....	....	sl. s.	v. s.	s. al., et.
1744	....	d.	....	3.8^{15°	....	....
1745	....	d.	....	d.	....	s. KOH; d. al.
1746	....	d. 190	....	....	....	s. h. HCl
1747	....	$-H_2O$, 200	....	v. s.	....	....
1748	$3.066^{20^\circ}_{4}$	....	....	110.5^{0°	122.2^{100°	....
1749	2.851	....	....	s.	....	....
1750	....	d. 100	....	s.	s.	s.al.; d. a.
1751	$3.378^{12.5^\circ}$	d. 80	....	....	....	....
1752	....	976	....	s.	s.	i. al.
1753	2.417	d. 400	....	s.	s.	i. al.

Potassium peroxychromate 1726
Potassium phosphate, dihydrogen 1734
Potassium phosphate, primary 1734
Potassium phosphate, secondary 1735
Potassium phosphate, tertiary 1736
Potassium phosphite, hypo- 1699
Potassium praseodymium sulfate 1802
Potassium prussiate, red 1683
Potassium prussiate, yellow 1684
Potassium pyroantimonate 1635
Potassium pyrosulfate 1761
Potassium pyrosulfite 1712

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Potassium			
1754	silicofluoride (hieratite)	K_2SiF_6	220.25	col., hex., or cb., 1.34-1.39
1755	silver cyanide	$KAg(CN)_2$	199.01	cb., 1.625
1756	sodium carbonate	$KNaCO_3{\cdot}6H_2O$	230.20	col., mn.
1757	sodium cobaltinitrite	$K_2NaCo(NO_2)_6{\cdot}H_2O$	454.19	yel.
1758	stannate	$K_2SnO_3{\cdot}3H_2O$	298.94	col., trig.
1759	stannibromide	K_2SnBr_6	676.39	....
1760	sulfate (arcanite)	K_2SO_4	174.25	col., rhb., 1.4947
1761	sulfate, pyro-	$K_2S_2O_7$	254.31	col.
1762	sulfide, mono-	K_2S	110.25	brn., delq.
1763	sulfide, mono-	$K_2S{\cdot}5H_2O$	200.33	rhb., delq.
1764	sulfide, di-	K_2S_2	142.31	red-yel.
1765	sulfide, tri-	K_2S_3	174.37	yel.-brn.
1766	sulfide, tetra-	K_2S_4	206.43	red-brn.
1767	sulfide, penta-	K_2S_5	238.49	orange
1768	sulfite	$K_2SO_3{\cdot}2H_2O$	194.28	wh., rhb.
1769	sulfite, acid	$KHSO_3$	120.16	wh., mn.
1770	tartrate	$K_2C_4H_4O_6{\cdot}\frac{1}{2}H_2O$	235.27	col., mn., 1.526
1771	tartrate, acid	$KHC_4H_4O_6$*	188.18	col., rhb.
1772	tellurate	$K_2TeO_4{\cdot}5H_2O$	359.88	delq., rhb.
1773	tellurite	K_2TeO_3	253.80	wh., delq.
1774	tetroxide	K_2O_4	142.19	or.-yel.
1775	thioantimonate	$2K_3SbS_4{\cdot}9H_2O$	896.72	yel. cr.
1776	thioarsenate	K_3AsS_4	320.44	delq. cr.
1777	thioarsenite	K_3AsS_3	298.38	....
1778	thiocarbonate	K_2CS_3	186.38	red-brn., cr.
1779	thiocyanate	$KCNS$	97.17	col.,delq., mn., 1.660±
1780	thionate, tri-	$K_2S_3O_6$	270.37	rhb., 1.5641
1781	thionate, tetra-	$K_2S_4O_6$	302.43	mn.
1782	thionate, penta-	$2K_2S_5O_6{\cdot}3H_2O$	723.03	col., rhb., 1.63±
1783	thioplatinate, tetra-	$K_2Pt_4S_6$	1051.47	blue-gray cr.
1784	thiostannate	$K_2SnS_3{\cdot}3H_2O$	347.12	dark brn. oil
1785	thiosulfate	$K_2S_2O_3$	190.31	col., cb.
1786	thiosulfate	$3K_2S_2O_3{\cdot}H_2O$	588.95	delq., mn.
1787	tungstate, ortho-	$K_2WO_4{\cdot}2H_2O$	362.14	mn.
1788	tungstate, meta-	$K_2W_4O_{13}{\cdot}8H_2O$	1166.00	cb.
1789	tungstate, para-	$K_6W_7O_{24}{\cdot}6H_2O$	2014.11	rhb.
1790	uranate	K_2UO_4	380.26	or.-yel., rhb.
1791	xanthogenate	$KS_2COC_2H_5$	160.29	pr.
1792	**Praseodymium**	Pr	140.92	yel.
1793	ammonium sulfate	$Pr_2(SO_4)_3{\cdot}(NH_4)_2SO_4{\cdot}8H_2O$	846.29	cr.
1794	bromate	$Pr_2(BrO_3)_6{\cdot}18H_2O$	1373.62	gn., hex.
1795	carbide	PrC_2	164.94	yel. cr.
1796	carbonate	$Pr_2(CO_3)_3{\cdot}8H_2O$	606.00	gn. pl.
1797	chloride	$PrCl_3$	247.29	gn. nd.
1798	chloride	$PrCl_3{\cdot}7H_2O$	373.40	gn. cr.
1799	oxalate	$Pr_2(C_2O_4)_3{\cdot}10H_2O$	726.06	mn. pr.

* Usual commercial form.

Potassium sodium tartrate 2133
Potassium sulfate, acid 1649
Potassium sulfhydrate 1696
Potassium sulfite, metabi- 1712
Potassium sulfite, pyro- 1712
Potassium sulfocyanate 1779
Potassium sulfocyanide 1779
Potassium tetroxalate 1723
Potassium uranyl carbonate 2465
Praseodymia 1800
Printers' acetate 3
Printers' salt 3
Prunella 1714
Prussian blue 815
Prussian green 834
Prussic acid 947

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1754	3.08 hex.; $2.665^{17\circ}$	d.	....	$0.12^{17.5\circ}$	$0.95^{100\circ}$	s. HCl; i. al., NH_3
1755	....	....	....	$25^{20\circ}$	100	4, 85% al.
1756	1.633	$-6H_2O$, 100	....	$133^{12.5\circ}$	$185^{15\circ}$	....
1757	$1.633^{25\circ}_{4}$	d. 135	....	$0.07^{25\circ}$	....	i. al.
1758	3.197	$-3H_2O$, 140	....	$106.7^{10\circ}$	$110.5^{20\circ}$	v. sl. s. KOH; i. al., act.
1759	3.783	....	....	....	....	....
1760	2.662	tr. 588	....	$7.35^{0\circ}$	$24.1^{100\circ}$	i. al., act., CS_2
1761	2.277	300	....	s.	d.	....
1762	1.805	471	....	s.	v. s.	s. al., gly., NH_3; i. et.
1763	....	60	$-3H_2O$, 150	s.	....	s. al., gly.; i. et.
1764	....	471	....	s.	d.	s. al.
1765	....	252	....	s.	d.	s. al.
1766	....	>145	d. 850	s.	....	s. al.
1767	....	206	....	v. s.	v. s.	s. al.
1768	....	d.	....	100	>100	sl. s. al.; i. NH_3
1769	....	d. 190	....	$45.5^{15\circ}$	$91.5^{75\circ}$	i. abs. al.
1770	1.98	....	d.	$12.5^{17.5\circ}$	$278^{100\circ}$	sl. s. al.
1771	1.956	....	....	$0.37^{0\circ}$	$6.1^{100\circ}$	s. a., alk.; i. al., ac.
1772	....	$-H_2O$, 200	$-O$, 200	$0.32^{0\circ}$	$6.95^{100\circ}$	sl. s. KOH; i. al.
1773	....	$+O$, 470	....	v. s.	v. s.	....
1774	....	>280	....	s. d.	....	....
1775	....	....	....	$300^{0\circ}$	$400^{80\circ}$	i. al.
1776	....	d.	....	v. s.	....	i. al.
1777	....	d.	....	s.	....	i. al.
1778	....	....	....	v. s.	....	sl. s. al.
1779	1.886	172.3	d. 500	$177^{0\circ}$	$217^{20\circ}$	$20.8^{22\circ}$ act.; s. al.
1780	2.304	....	....	v. s.	d.	i. al.
1781	$2.296^{20\circ}_{4}$	....	....	v. s.	....	i. al.
1782	$2.112^{20\circ}_{4}$	d.	....	50	d.	i. al.
1783	$6.44^{15\circ}$	ign.	....	i.	....	d. HCl
1784	$1.847^{18\circ}_{4}$	$-3H_2O$, 100	....	s.	....	i. al.
1785	....	d. 400	....	$96.1^{0\circ}$	$311.2^{90\circ}$	....
1786	2.23	$-H_2O$, 180	d.	....	....	i. al.
1787	$3.113^{925\circ}$	tr. 388; 921	tr. 555	51.5	151.5	i. al.
1788	....	....	....	s.	v. s.	....
1789	....	d.	....	2.15	$6.6^{100\circ}$	i. al.
1790	....	....	....	i.	i.	v. s. a.
1791	$1.558^{21.5\circ}$	d. >200	....	v. s.	....	20 al.; i. et.
1792	$6.5^{20\circ}$	940	....	d.	....	....
1793	$2.531^{16.5\circ}$	$-8H_2O$, 170	....	sl. s.	....	....
1794	....	56.5	$-14H_2O$, 100	$190^{25\circ}$	$430^{45\circ}$	....
1795	5.10	d.	....	d.	....	s. dil. a.
1796	....	$-6H_2O$, 100	....	i.	....	s. a.
1797	$4.020^{25\circ}_{4}$	823	not volt. at 1000	$103.9^{14\circ}$	$\infty^{100\circ}$	s. al.; i. et., chl.
1798	$2.251^{16\circ}_{4}$	115	....	$334^{14\circ}$	$\infty^{100\circ}$	s. HCl
1799	....	....	....	$0.02^{25\circ}$	....	s. a.

Pseudowollastonite 475
Pthoric acid 950
Pure scarlet 1315
Purple salt 1728
Putty powder 2182
Pyrite(s) 1021
Pyrochroite 1256
Pyrolusite 1269
Pyrophosphoric acid 1551
Pyrophosphorous acid 1554
Pyrovanadic acid 2470
Pyrrhotite 1022
Quartz 1950
Quick lime 459
Quicksilver 1360
Quicksilver vermilion 1334

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Praseodymium			
1800	oxide, sesqui-	Pr_2O_3	329.84	yel.-gn.
1801	oxide, tetra-	PrO_4	204.92	bk.
1802	potassium sulfate	$Pr_2(SO_4)_3 \cdot 3K_2SO_4 \cdot H_2O$	1110.82	cr.
1803	selenate	$Pr_2(SeO_4)_3$	710.72	....
1804	sulfate	$Pr_2(SO_4)_3$	570.02	lt. gn.
1805	sulfate	$Pr_2(SO_4)_3 \cdot 8H_2O$	714.15	gn., mn.
1806	sulfide	Pr_2S_3	378.02	brn.
1807	**Radium**	Ra	226.05	wh., met.
1808	bromide	$RaBr_2$	385.88	wh., mn.
1809	chloride	$RaCl_2$	296.96	yel., mn.
1810	**Radon** (Niton)	Rn	222.0	gas
1811	**Rhenium**	Re	186.31	hex.
1812	oxide, tetra-	ReO_4	250.31	wh. globules
1813	oxide, hepta-	Re_2O_7	484.62	yel. cr.
1814	**Rhodium**	Rh	102.91	gray-wh., cb.
1815	chloride	$RhCl_3$	209.28	red
1816	chloride	$RhCl_3 \cdot 4H_2O$	281.35	dark red
1817	hydrosulfide	$Rh(SH)_3$	202.11	brn.-bk.
1818	hydroxide, tri-	$Rh(OH)_3$	153.93	bk., gelatinous
1819	hydroxide, tetra-	$Rh(OH)_4$	170.94	gn.
1820	nitrate	$Rh(NO_3)_3 \cdot 2H_2O$	324.97	red, delq.
1821	oxide, mono-	RhO	118.91	gray
1822	oxide, sesqui-	Rh_2O_3	253.82	gray cr.
1823	oxide, di-	RhO_2	134.91	brn.
1824	sulfate	$Rh_2(SO_4)_3 \cdot 12H_2O$	710.19	lt. yel. cr.
1825	sulfide, mono-	RhS	134.97	blue-wh.
1826	sulfide, sesqui-	Rh_2S_3	302.00	bk. pl.
1827	sulfite	$Rh_2(SO_3)_3 \cdot 6H_2O$	554.10	yel. cr.
1828	**Rubidium**	Rb	85.48	silv. wh.
1829	bicarbonate	$RbHCO_3$	146.50	wh., rhb.
1830	bromate	$RbBrO_3$	213.40	....
1831	bromide	RbBr	165.40	cb., 1.5528
1832	bromide, tri-	$RbBr_3$	325.23	rhb.
1833	carbonate	Rb_2CO_3	230.97	wh., delq.
1834	chlorate	$RbClO_3$	168.94	trimetric
1835	chloride	RbCl	120.94	cb., 1.4936
1836	chloroplatinate	Rb_2PtCl_6	578.93	yel., cb.
1837	chromate	Rb_2CrO_4	286.97	yel., rhb., 1.71 ±
1838	dichromate	$Rb_2Cr_2O_7$	386.98	red, tri.; or yel., mn.
1839	fluoride	RbF	104.48	wh., cb., 1.396
1840	hydride	RbH	86.49	pr. nd.
1841	hydroxide	RbOH	102.49	wh., delq.
1842	iodate	$RbIO_3$	260.40	mn. or cb.

Radium emanation 1810
Raspite 1108
Realgar 175
Red arsenic glass 175
Red copper oxide 775
Red iron oxide 824
Red lead 1081
Red oxide 824
Red oxide of mercury 1322
Red precipitate 1322
Red prussiate of potash 1683
Red stone 824
Rhodochrosite 1246
Rhodonite 1283

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1800	6.87^{15°	d.	....	0.0002	....	....
1801	$5.978^{20^\circ}_{4}$	....	....	....	....	....
1802	3.275^{16°	....	....	sl. s.	....	s. HCl, HNO_3
1803	4.30^{15°	....	....	36^{0°	3^{92°	....
1804	3.720^{16°	....	....	20^{0°	3.5^{80°	....
1805	$2.82^{13.2^\circ}$	....	....	s.	sl. s.	....
1806	5.042^{11°	d.	....	i.	d.	s. dil. a.
1807	5?	960	1140	d. $+H_2$	....	d. a.
1808	5.79	728	subl. 900	70^{20°	s.	s. al.
1809	4.91	1000	....	25	s.	....
1810	lq. 5.5; 111 (D)	−71	−62	51^{0° cc	8.5^{60°cc	....
1811	....	3440	....	....	....	i. HF, HCl; s. H_2SO_4, HNO_3
1812	8.4	150 d.	....	s.	....	s. a., alk.; v. sl. s. et.
1813	8.2^{20°	220	450 subl.	s.	....	s. al.; sl. s. et.
1814	12.5	1955	>2500	i.	i.	sl. s. aq. reg., a.
1815	....	d. 450	subl. 800±	i.	i.	v. sl. s. alk.; i. aq. reg., a.
1816	....	....	....	v. s.	....	s. HCl, al.; i. et.
1817	....	....	....	i.	d.	s. aq. Br_2, aq. reg.; i. a., Na_2S
1818	....	d.	....	i.	....	sl. s. HCl
1819	....	d.	....	i.	....	s. HCl
1820	....	....	....	s.	s.	i. al.
1821	....	....	....	i.	i.	i. a.
1822	....	d. >1100	....	i.	i.	i. aq. reg., a., alk.
1823	....	....	....	i.	i.	i. a., alk.
1824	....	....	....	v. s.	d.	i. al.
1825	....	d.	....	i.	i.	i. aq. reg., a.
1826	....	d.	....	i.	i.	i. aq. Br_2, aq. reg., a.
1827	....	d.	....	s.	....	i. al.
1828	lq.$1.475^{38.5}$; 1.53^{20°	38.5	700	d.	....	s. a., al.
1829	....	d. 175	....	110^{20°	....	s. al.
1830	3.68	430	....	2.92^{25°	5.08^{40°	....
1831	3.35	682	1340	98^{5°	$205^{113.5^\circ}$	sl. s. act.
1832	....	d. 140	....	....	....	....
1833	....	837	d. 740	450^{20°	s.	0.74 abs. al.
1834	3.19	....	....	2.1^{40°	62.8^{99°	....
1835	2.76	715	1390	77^{0°	139^{100°	0.08^{25° al.; sl. s. NH_3 at 0°
1836	$3.94^{17.5^\circ}$	d.	....	0.014^{0°	0.331^{00°	i. al.
1837	3.518	....	....	62^{0°	96^{60°	....
1838	3.021(mn.) 3.125 (tri.)	....	....	5.42^{18° (mn.) 4.96^{18° (tri.)	28.1^{60° (mn.) 27.3^{60° (tri.)	....
1839	2.88^{820°	760	1410	130.6^{18°	....	s. dil. HF; i. et., NH_3
1840	2.0	d. 300	....	d.	....	d. a.
1841	3.203^{11°	300	....	180^{15°	v. s.	s. al.
1842	$4.33^{19.5^\circ}$	d.	....	2.1^{23°	....	s. HCl

Rochelle salt 2133
Rock crystal 1950
Rock salt 2049
Roesslerite 1177
Roman vitriol 760
Rose vitriol 692
Rosenstiehl's green 258
Rubidium alum 48
Rubidium aluminum sulfate 48
Rubidium bichromate 1838
Rubidium bitartrate 1859
Rubidium carbonate, acid 1829
Rubidium fluosilicate 1854

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Rubidium			
1843	iodide	RbI	212.40	col., cb.
1844	iodide, tri-	RbI_3	466.24	rhb.
1845	nitrate	$RbNO_3$	147.49	hex., cb., tri., or rhb., 1.52
1846	oxide, mono-	Rb_2O	186.96	yel., cb.
1847	oxide, di- or per-	Rb_2O_2	202.96	yel., cb.
1848	oxide, tri-	Rb_2O_3	218.96	bk.
1849	oxide, tetra-	Rb_2O_4	234.96	yel.
1850	perchlorate	$RbClO_4$	184.94	rhb., 1.4701
1851	periodate	$RbIO_4$	276.40	col., tet.
1852	permanganate	$RbMnO_4$	204.41	cr.
1853	selenate	Rb_2SeO_4	314.16	col., rhb.
1854	silicofluoride	Rb_2SiF_6	313.02	cb.
1855	sulfate	Rb_2SO_4	267.02	rhb., 1.5133
1856	sulfide	Rb_2S	203.02	red, delq.
1857	sulfide	$Rb_2S \cdot 4H_2O$	275.08	delq. cr.
1858	sulfide, penta-	Rb_2S_5	331.26	red, delq., rhb.
1859	tartrate, acid	$RbHC_4H_4O_6$	234.56	rhb. pr.
1860	**Ruthenium**	Ru	101.70	bk., porous
1861	**Ruthenium**	Ru	101.70	gray, hex.
1862	chloride, di-	$RuCl_2$	172.61	bk. cr.
1863	chloride, tri-	$RuCl_3$	208.07	brn., delq.
1864	chloride, tetra-	$RuCl_4$	243.53	....
1865	hydroxide	$Ru(OH)_3$	152.72	bk. pd.
1866	nitrate	$Ru(NO_3)_3 \cdot 6H_2O$	395.82	pa. yel., tri.
1867	oxide, sesqui-	Ru_2O_3	251.40	blue-bk.
1868	oxide, di-	RuO_2	133.70	vl., tet.
1869	oxide, tetra-	RuO_4	165.70	yel., rhb.
1870	oxide, penta-	Ru_2O_5	283.40	bk. cr.
1871	oxide, non-	Ru_4O_9	550.80	bk. cr.
1872	silicide	$RuSi$	129.76	met. pr.
1873	**Samarium**	Sm (also Sa)	150.43	....
1874	acetate	$Sm(C_2H_3O_2)_3 \cdot 4H_2O$	399.63	yel. cr.
1875	bromate	$Sm_2(BrO_3)_6 \cdot 18H_2O$	1392.64	yel., hex.
1876	bromide	$SmBr_3 \cdot 6H_2O$	498.27	yel., delq.
1877	carbide	SmC_2	174.45	yel., hex.
1878	chloride	$SmCl_3$	256.80	gn.-yel. cr.
1879	chloride	$SmCl_3 \cdot 6H_2O$	364.90	gn., tri.
1880	fluoride	$SmF_3 \cdot \frac{1}{2}H_2O$	216.44	gelatinous
1881	formate	$Sm(HCO_2)_3$	285.48	col.
1882	hydroxide	$Sm(OH)_3$	201.45	pa. yel.
1883	oxide	Sm_2O_3	348.86	yel.-wh. pd.
1884	peroxide	Sm_4O_9	745.72	....
1885	phosphate	$SmPO_4$	245.41	....

Rubidium peroxide 1847
Ruby 22
Ruby arsenic 175
Rutherfordine 2456
Rutile 2401
Sal acetosellae 1721
Sal amarum 1228
Sal ammoniac 71
Sal catharticum 1228
Sal chalybdis 865
Sal culinaris 2049
Sal de duobus 1760
Sal enixium 1649
Saleratus 2025
Salimac 71
Sal polychrestum 1760
Sal prunella 1714
Sal soda 2045
Sal vegetal 1770
Sal volatile 66 or 71
Salt, common 2049
Salt cake 2145
Salt of hartshorn 66
Salt of lemery 1760

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Cold Water	Hot Water	Other Reagents
1843	3.55	642	1300	$137.5^{6.9°}$	$163^{25°}$	i. $AsBr_3$
1844	$4.03^{22°}$	190	....	v. s.	....	....
1845	3.11	tr. 161.4; 219; 310	....	$19.5^{0°}$	$452^{100°}$	v. s. HNO_3; s. act.
1846	3.72	d. 400	....	s. d.	s. d.	....
1847	$3.65^{0°}$	600	....	d.	d.	....
1848	$3.53^{0°}$	470	....	d.	....	....
1849	$3.05^{0°}$	280	−O, 500	d.	....	....
1850	2.9	....	d.	$0.8^{0°}$	$20^{100°}$	i. al.; 0.06 m. al.; 0.095 act.; i. et.
1851	$3.918_{4}^{16°}$	....	....	$0.65^{13°}$	....	....
1852	$3.235^{10.4°}$	d. 295	....	$0.46^{2°}$	$4.91^{60°}$	....
1853	3.90	....	....	$158.9^{12°}$	....	....
1854	3.332	....	....	$0.16^{20°}$	$1.36^{100°}$	s. a.; i. alk.
1855	$3.613_{4}^{20°}$	1060	....	$36.4^{0°}$	$81.8^{100°}$	....
1856	2.912	....	....	v. s.	v. s.	....
1857	....	$-4H_2O$, 200	....	v. s.	v. s.	....
1858	$2.618^{15°}$	225	....	d.	....	s. 70% al.; i. et., chl.
1859	2.399	d.	....	$1.18^{25°}$	$11.7^{100°}$	....
1860	8.6	>1950	....	i.	i.	sl. s. aq. reg., a.
1861	$12.2^{20°}$	2450	>2700	i.	i.	....
1862	....	....	....	i.	....	i. aq. reg., a., alk.
1863	....	....	....	s.	d.	sl. s. abs. al.> i. a., CS_2
1864	....	....	....	s.	....	s. al.
1865	....	....	....	v. sl. s.	....	s. a.; i. alk.
1866	2.375	....	....	v. s.	....	....
1867	....	....	....	i.	i.	i. a.
1868	7.2	....	....	i.	i.	s. fused KOH; i. a.
1869	$5.77^{100°}$	25.5	100.8^{183mm}	sl. s.	d.	s. alk.
1870	....	−½O, 360	....	i.	....	s. HCl
1871	....	−O, 440	....	i.	....	s. HCl
1872	5.4	....	....	i.	i.	s. HNO_3+HF
1873	7.7	1350	....	....	....	....
1874	1.94	....	....	$15^{25°}$	....	....
1875	....	75	$-14H_2O$, 100; $-18H_2O$, 150	$114^{25°}$	$214^{45°}$	v. sl. s.
1876	$2.971^{22°}$	....	....	....	....	....
1877	5.86	....	....	d.	....	s. a. d.
1878	$4.46_{4}^{18°}$	686	....	$92^{10°}$	$110^{50°}$	6.4 C_5H_5N; v. s. abs. al.
1879	2.383	....	....	s.	....	....
1880	....	....	....	i.	....	i. dil. a.
1881	3.733	....	....	....	....	....
1882	....	....	....	i.	....	s. a.; i. alk.
1883	$7.43^{15°}$	....	....	i.	....	v. s. a.
1884	....	....	....	i.	....	....
1885	$5.83^{17.5°}$	....	....	....	....	....

Salt of lemon(s) 1721
Salt of phosphorus 2011
Salt of Saturn 1041
Salt of Seignette 2133
Salt of soda 2042-2045
Salt of sorrel 1721
Salt of tartar 1659
Salt of tin 2191
Salt of Venus 760
Salt of vitriol 2581
Saltpeter 1714
Saltpeter, Bengal 1714
Saltpeter, Chile 2097
Saltpeter lime 455
Saltpeter, Norway 101
Saltpeter, Norwegian 455
Saltpeter rot 455
Saltpeter, wall 455
Salufer 2142
Samaria 1883
Sand acid 875
Sassolite 354
Satinite 481
Saturn red 1081

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Samarium			
1886	sulfate	$Sm_2(SO_4)_3{\cdot}8H_2O$	733.17	mn., 1.5519
1887	sulfide	Sm_2S_3	397.04	yel.
1888	**Scandium**	Sc	45.10	....
1889	bromide	$ScBr_3$	284.85	....
1890	chloride	$ScCl_3$	151.47	wh. pl.
1891	nitrate	$Sc(NO_3)_3$	231.12	col.
1892	oxide	Sc_2O_3	138.20	wh. pd.
1893	sulfate	$Sc_2(SO_4)_3$	378.38	....
1894	**Selenic acid**	H_2SeO_4	144.98	hex. pr.
1895	**Selenic acid**	$H_2SeO_4{\cdot}H_2O$	162.99	nd.
1896	**Selenous acid**	H_2SeO_3	128.98	hex.
1897	**Selenium**	Se_8	631.68	red pd., amor., 2.92
1898	**Selenium**	Se_8	631.68	gray, trig., 3.00; red, hex.
1899	**Selenium**	Se_8	631.68	steel gray
1900	bromide, mono-	Se_2Br_2	317.75	br.-red lq.
1901	bromide, tetra-	$SeBr_4$	398.62	or. cr.
1902	bromochloride, tri-	$SeBr_3Cl$	354.17	or. cr.
1903	bromotrichloride	$SeBrCl_3$	265.25	yel.-brn. cr.
1904	chloride, mono-	Se_2Cl_2	228.83	red lq.
1905	chloride, tetra-	$SeCl_4$	220.79	yel. or wh. delq. cr.
1906	fluoride, tetra-	SeF_4	154.96	col. lq.
1907	iodide, mono-	Se_2I_2	411.76	steel gray cr.
1908	iodide, tetra-	SeI_4	586.64	dark gray cr.
1909	nitride	Se_4N_4	371.87	or.-yel.
1910	oxide, di-	SeO_2	110.96	wh., tet., >1.76
1911	oxybromide	$SeOBr_2$	254.79	yel. cr.
1912	oxychloride	$SeOCl_2$	165.87	yel. lq.
1913	sulfide	SeS	111.02	or.-yel. sc.
1914	sulfoxide	$SeSO_3$	159.02	gn. pr.
1915	**Silicic acid,** meta-	H_2SiO_3	78.08	amor., 1.41
1916	**Silicic acid,** ortho-	H_4SiO_4	96.09	amor.
1917	**Silico**-bromoform	$SiHBr_3$	268.82	col. lq.
1918	chloroform	$SiHCl_3$	135.44	col. lq.
1919	fluoroform	$SiHF_3$	86.07	gas
1920	iodoform	$SiHI_3$	409.83	col. lq.
1921	oxalic acid	$Si_2O_2(OH)_2$	122.14	wh., amor.
1922	**Silicon,** crystalline	Si	28.06	gray, cb., 3.736
1923	**Silicon,** graphitic	Si	28.06	cr.
1924	**Silicon,** amorphous	Si	28.06	brn., amor.
1925	**Silicon** boride, tri-	SiB_3	60.52	bk., rhb.
1926	boride, hexa-	SiB_6	92.98	bk. cr.
1927	bromide, tri-	Si_2Br_6	535.62	wh., rhb.
1928	bromide, tetra-	$SiBr_4$	347.72	col. lq., 1.579

Scacchite 1247
Scandia 1892
Scheele's green 724
Scheele's mineral 724
Scheelite 491
Schlippe's salt 2159
Schultenite 1047
Schweinfurth green 718
Scorodite 809
Seignette salt 2133
Selenite 483

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1886	2.930	$-3H_2O$, 105 $-8H_2O$, 450	....	2.1^{25°	....	....
1887	3.7	....	....	....	....	....
1888	2.5?	1200	2400	....	....	....
1889	3.91	subl. >1000	....	....	....	....
1890	....	939	....	v. s.	v. s.	i. abs. al.
1891	....	150	....	s.	....	....
1892	3.864	....	....	i.	i.	s. h. HNO_3, h. HCl; sl. s. c. a.
1893	2.579	....	....	39.9^{25°	v. s.	i. al.
1894	$2.950_{4}^{15^\circ}$	58	260	1300^{30°	∞^{60°	s. H_2SO_4; d. al.; i. NH_3
1895	$2.627_{4}^{15^\circ}$	26	205	v. s.	....	....
1896	$3.004_{4}^{15^\circ}$	d.	....	90^{0°	400^{90°	v. s. al.; i. NH_3
1897	4.26^{25°	50	688	i.	i.	s. CS_2, H_2SO_4, CH_2I_2
1898	4.80; 4.50	220	688	i.	i.	s. CS_2, H_2SO_4
1899	4.8^{25°	217	688	i.	i.	i. CS_2; s. H_2SO_4
1900	3.604^{15°	....	d. 225	i.	d.	s. CS_2; sl. s. chl., C_2H_5Br
1901	....	d. 75	....	s.	d.	s. CS_2, chl., C_2H_5Br
1902	....	d.	....	....	....	v. sl. s. CS_2
1903	....	190	....	....	....	i. CS_2
1904	$2.906_{4}^{17.5^\circ}$	-85	145	d.	....	v. s. CS_2, chl., CCl_4
1905	....	subl.	d. 288	d.	....	s. $POCl_3$; v. sl. s. CS_2; d. H_2S
1906	....	-80	100	d.	....	....
1907	....	70	d. 100	d.	....	....
1908	....	80	$-4I$, 100	d.	....	....
1909	....	expl. 200	....	i.	i.	v. sl. s. CS_2, ac.; i. al., et.
1910	$3.954_{15}^{15^\circ}$	340	subl. 317	38.4^{14°	v. s.	v. s. al., ac.; sl. s. act.
1911	3.38^{50°	41.7	217^{740mm}	s. d.	....	s. H_2SO_4, CS_2, CCl_4, bz.
1912	2.44^{22°	8.5	179.4	d.	....	d. H_2S
1913	3.056^{0°	d.	....	i.	i.	s. CS_2; i. et.
1914	....	$-SO_2$, 40	....	d.	....	s. H_2SO_4
1915	2.1-2.3	....	....	i.	i.	s. alk.; i. NH_4Cl
1916	1.576^{17°	....	....	sl. s.	sl. s.	s. alk.; i. NH_4Cl
1917	2.7^{17°	<-60	110	d.	....	d. NH_3
1918	1.34	-134	33^{758mm}	d.	....	∞ CS_2, CCl_4, chl.
1919	2.98^{0°(A)	-110	-80.2	d.	....	s. $C_6H_4CH_3$; d. alk., al. et
1920	3.314^{20°	8	220	d.	....	∞ CS_2, bz.
1921	....	d.	....	i.	....	....
1922	2.4^{20°	1420	2600	i.	i.	s. HNO_3+HF, Ag; sl. s. Pb, Zn; i. HF
1923	2.0-2.5	....	2600	i.	i.	s. HNO_3+HF, fused alk.; i. HF.
1924	2	....	2600	i.	i.	s. HF, KOH
1925	2.52	....	....	i.	....	sl. s. HNO_3; d. H_2SO_4, KOH
1926	2.47	....	....	i.	....	s. HNO_3; i. KOH; d. H_2SO_4
1927	....	95	240	d.	....	d. KOH
1928	$2.82_{4}^{0^\circ}$	5	153	d.	....	..d. H_2SO_4

Selenium phosphide 1585
Sellaite 1198
Senarmontite 151
Siderite 844
Siderotilate 864
Silane 1939
Silica 1947
Silicoethane 1940
Silicofluoric acid 875

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Silicon			
1929	bromohydride	$SiBrH_3$	111.00	col. gas
1930	bromotrichloride	$SiBrCl_3$	214.35	....
1931	bromodichloride	$SiBr_2Cl_2$	258.81	lq.
1932	bromochloride, tri-	$SiBr_3Cl$	303.27	col., fuming lq.
1933	carbide	SiC	40.07	blue-bk., trig., 2.654
1934	chloride, tri-	Si_2Cl_6	268.86	lf. or lq.
1935	chloride, tetra-	$SiCl_4$	169.89	col., fuming lq., 1.412
1936	chlorohydride	$SiClH_3$	66.54	gas
1937	chlorohydrosulfide	$SiCl_3SH$	167.50	col., fuming lq.
1938	fluoride	SiF_4	104.06	gas
1939	hydride (silane)	SiH_4	32.09	col. gas
1940	hydride (silicoethane)	Si_2H_6	62.17	col. gas
1941	hydride (trisilane)	Si_3H_8	92.24	col. lq.
1942	hydride (tetrasilane)	Si_4H_{10}	122.32	col. lq.
1943	iodide, di-	SiI_2	281.90	....
1944	iodide, tri-	Si_2I_6	817.64	col., hex. pl.
1945	iodide, tetra-	SiI_4	535.74	col., cb.
1946	iodotrichloride	$SiICl_3$	261.35	col., fuming lq.
1947	oxide, di- (opal)	$SiO_2 \cdot xH_2O$	......	iridescent, amor.
1948	oxide, di- (cristobalite)	SiO_2	60.06	col., cb. or tet., 1.487
1949	oxide, di- (lechatelierite)	SiO_2	60.06	....
1950	oxide, di- (quartz)	SiO_2	60.06	hex., 1.5442
1951	oxide, di- (tridymite)	SiO_2	60.06	trig., rhb., 1.469
1952	oxide, di- ,hydrate	$3SiO_2 \cdot H_2O$	198.20	wh., amor.
1953	oxychloride	Si_2OCl_6	284.86	col., fuming lq.
1954	sulfide, mono-	SiS	60.12	yel. nd.
1955	sulfide, di-	SiS_2	92.18	wh. or gray cr.
1956	sulfobromide	$SiSBr_2$	219.95	col. pl.
1957	sulfochloride	$SiSCl_2$	131.03	wh. pr.
1958	**Silicotungstic acid**	$H_8SiW_{12}O_{42}$	2915.2	yel. cr.
1959	**Silver**	Ag	107.88	silv. met., cb.
1960	acetate	$AgC_2H_3O_2$	166.92	nd.
1961	arsenate	Ag_3AsO_4	462.55	dark red, cb.
1962	arsenite	Ag_3AsO_3	446.55	yel.
1963	borate, meta-	$AgBO_2$	150.70	....
1964	bromate	$AgBrO_3$	235.80	wh., tet., 1.8466
1965	bromide (bromyrite)	$AgBr$	187.80	pa. yel., cb., 2.252
1966	carbonate	Ag_2CO_3	275.77	yel. pd.
1967	chlorate	$AgClO_3$	191.34	wh., tet.
1968	chloride (cerargyrite)	$AgCl$	143.34	wh., cb., 2.071
1969	chromate	Ag_2CrO_4	331.77	dark red cr.
1970	citrate	$Ag_3C_6H_5O_7$	512.74	nd.
1971	cyanate	$AgCNO$	149.90	wh. cr.
1972	cyanide	$AgCN$	133.90	wh., 1.685±
1973	dichromate	$Ag_2Cr_2O_7$	431.78	red, tri.
1974	dithionate	$Ag_2S_2O_6 \cdot 2H_2O$	411.91	rhb., 1.662±

Silicon tetrachloride 1935 Silicon tetrafluoride 1938 Silver azide 1982

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1929	lq. $1.533^{0^\circ}_{4}$	−94	1.9	d.	....	....
1930	....	< -60	80	d.	....	....
1931	....	< -60	104	d.	....	....
1932	2.432	−39	140.5	d.	....	....
1933	3.17	>2700	subl. 2200	i.	i.	s. fused alk.; i. a.
1934	1.58^{0°	−1	144^{760mm}	d.	....	d. alk.
1935	1.50	−70	57.6	d.	....	d. conc. H_2SO_4, al.
1936	lq. $1.145^{-113^\circ}_{4}$	−118	−10	....	....	....
1937	1.45	....	100	d.	....	d. al.
1938	3.57 (A)	−95.7	-65^{1810mm}	v. s. d.	....	s. HNO_3, al., et.
1939	lq. 0.68^{-185°	−185	-112^{760mm}	i.	....	i. al., et.; d. KOH
1940	lq. 0.69^{-25°	−132.5	-15^{670mm}	sl. s. d.	....	s. CS_2, al., bz.
1941	lq. 0.743^{0°	−117	53	d.	....	ign. in air
1942	0.825^{0°	−90	109	d.	....	ign. in air
1943	....	expl. in air	....	d.	....	i. CS_2, chl., bz.
1944	....	250.........	d.	d.	....	19^{19°, $26^{27^\circ}CS_2$
1945	....	120.5	290	d.	....	$2.2^{27^\circ}CS_2$
1946	....	< -60	113.5	d.	....	adds to NH_3
1947	2.2	1600-1750	subl. 1750	i.	i.	s. HF, h. alk., fused $CaCl_2$
1948	2.32	1710	2230	i.	i.	s. HF; i. alk.
1949	2.20	....	2230	i.	i.	s. HF; i. alk.
1950	2.650^{20°	tr. <1425	2230	i.	i.	s. HF, i. alk.
1951	2.26	tr. 1670	2230	i.	....	s. HF; i. alk.
1952	....	$-H_2O$, 1200	....	v. sl. s.	v. sl. s.	0.2^{18°, 3N NH_3
1953	10.05 (A)	−33	137	d.	....	∞CS_2, CCl_4, chl.; d. al.
1954	$1.853^{15^\circ}_{4}$	....	subl. 940^{20mm}	d.	....	s. dil. alk.; d. al.
1955	....	....	....	d.	ign. in air	d. HNO_3, al., et.
1956	....	93	$150^{18.3mm}$	d.	....	s. CS_2, bz.
1957	....	75	185	d.	....	s. CS_2
1958	....	....	....	960^{18°	....	....
1959	10.5^{20°	960.5	1950	i.	i.	s. HNO_3, h. H_2SO_4; i. alk.
1960	3.259^{15°	d.	....	0.7^{20°	2.52^{80°	....
1961	$6.657^{25^\circ}_{4}$	d.	....	0.00085^{20°	....	s. ac., NH_4OH, NH_4 salts
1962	....	150 d.	....	0.00115^{20°	i.	s. ac., NH_4OH, NH_4 salts
1963	....	....	....	9.05^{25°	....	....
1964	5.206	d.	....	0.16^{20°	1.3^{90°	s. NH_4OH; sl. s. HNO_3
1965	$6.473^{25^\circ}_{4}$	434	d. 700	0.00002^{20°	0.00037^{100°	0.5^{180° NH_4OH; s. KCN, $Na_2S_2O_3$
1966	6.077	218 d.	....	0.003^{20°	0.05^{100°	s. NH_4OH, $Na_2S_2O_3$; i. al.
1967	4.430	230	d. 270	10^{15°	50^{80°	s. al.
1968	5.56	455	1550	0.000089^{10°	0.00217^{100°	s. NH_4OH, KCN; sl. s. HCl
1969	5.625^{25°	....	....	0.0014^{0°	0.011^{100°	s. NH_4OH, KCN, a.
1970	....	d.	....	0.028^{18°	d. 100	s. NH_4OH, KCN; i. al.
1971	4.00	d.	....	0.006^{16°	v. sl. s.	s. NH_4OH, KCN, HNO_3
1972	3.95	$-(CN)_2$, 320	....	0.000022^{20°	....	s. NH_4OH, KCN, HNO_3
1973	4.77	d.	....	0.0083^{15°	d.	v. s. HNO_3, NH_4OH, KCN
1974	3.61	....	....	....	....	....

Silver bichromate 1973 Silver fluosilicate 1995

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Silver			
1975	ferricyanide	$Ag_3Fe(CN)_6$	535.60	or.
1976	ferrocyanide	$Ag_4Fe(CN)_6 \cdot H_2O$	661.49	yel.
1977	fluoride	AgF	126.88	yel., delq., cb.
1978	hyponitrite	$Ag_2(NO)_2$	275.78	bright yel.
1979	iodate	$AgIO_3$	282.80	rhb.
1980	iodide (iodyrite)	AgI	234.80	yel., hex., 2.218
1981	nitrate (lunar caustic)	$AgNO_3$	169.89	col., rhb., 1.744
1982	nitride (azide)	AgN_3	149.90	wh. pr.
1983	nitrite	$AgNO_2$	153.89	wh., rhb.
1984	nitroprusside	$Ag_2Fe(CN)_5NO$	431.71	pink-wh.
1985	oxalate	$Ag_2C_2O_4$	303.78	wh. cr.
1986	oxide	Ag_2O	231.76	brn., cb.
1987	perchlorate	$AgClO_4$	207.34	wh., delq.
1988	permanganate	$AgMnO_4$	226.81	dark vl., mn.
1989	peroxide	Ag_2O_2	247.76	bk. pd.
1990	phosphate, ortho-	Ag_3PO_4	418.62	yel., cb.
1991	phosphate, dibasic	Ag_2HPO_4	311.75	wh., trig., 1.8036
1992	phosphate, meta-	$AgPO_3$	186.86	col.
1993	phosphate, pyro-	$Ag_4P_2O_7$	605.48	wh.
1994	selenide (naumannite)	Ag_2Se	294.72	gray, cb.
1995	silicofluoride	$Ag_2SiF_6 \cdot 4H_2O$	429.88	wh., cb.
1996	sulfate	Ag_2SO_4	311.82	wh., rhb.
1997	sulfide (acanthite)	Ag_2S	247.82	bk., rhb.
1998	sulfide (argentite)	Ag_2S	247.82	bk., cb.
1999	sulfite	Ag_2SO_3	295.82	wh. cr.
2000	tartrate	$Ag_2C_4H_4O_6$	363.83	white scales
2001	telluride (hessite)	Ag_2Te	343.37	gray, cb.
2002	thiocyanate	$AgCNS$	165.96	wh. curds
2003	thiosulfate	$Ag_2S_2O_3$	327.88	wh. pd.
2004	tungstate	Ag_2WO_4	463.68	pa. yel. cr.
2005	vanadate, pyro-	$Ag_4V_2O_7$	645.42	....
2006	**Sodium**	Na	22.997	silv. met., cb.
2007	acetate	$NaC_2H_3O_2$	82.04	wh., mn., 1.464
2008	acetate	$NaC_2H_3O_2 \cdot 3H_2O$	136.09	wh., mn.
2009	aluminate	$NaAlO_2$	81.97	amor.
2010	amide	$NaNH_2$	39.02	olive gn.
2011	ammonium phosphate	$NaNH_4HPO_4 \cdot 4H_2O$	209.09	col., mn.
2012	antimonate, meta-	$2NaSbO_3 \cdot 7H_2O$	511.63	cb.
2013	antimonate, pyro-	$Na_2H_2Sb_2O_7 \cdot H_2O$	421.55	col. cr.
2014	antimonide	Na_3Sb	190.75	deep blue
2015	antimonite, meta-	$NaSbO_2 \cdot 3H_2O$	230.81	col., rhb.
2016	arsenate	$Na_3AsO_4 \cdot 12H_2O$	424.09	hex., 1.4589

Silver nitrite, hypo- 1978
Silver nitrosyl 1978
Silver potassium cyanide 1755
Silver sulfocyanate 2002
Silver sulfocyanide 2002
Single nickel salt 1461
Slaked lime 443
Smithsonite 2539
Soap dust 2577
Soda, baking 2025
Soda, caustic 2075
Soda, washing 2045
Soda alum 49
Soda ash 2042
Soda crystals 2045
Soda lye 2075
Sodamide 2010
Soda niter 2097

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
1975	....	....	....	$0.000066^{20\circ}$	....	s. NH_4OH, h. $(NH_4)_2CO_3$
1976	....	....	....	i.	i.	s. KCN; i. NH_4OH
1977	$5.852^{15.5\circ}$	435	....	$182^{15.5\circ}$	$205^{108\circ}$	sl. s. NH_3
1978	$5.75^{30\circ}_{4}$	d. 110	....	v. sl. s.	....	d. HNO_3, H_2SO_4
1979	$5.525^{16.5\circ}$	>200	d.	$0.003^{10\circ}$	$0.018^{60\circ}$	s. HNO_3, KI; i. NH_3
1980	5.67	d. 552	....	3×10^{-7}	3×10^{-6}	s. KCN, $Na_2S_2O_3$, NH_3; i. NaCl
1981	$4.352^{19\circ}_{4}$	212	444 d.	$122^{0\circ}$	$952^{100\circ}$	s. gly.; v. sl. s. al.
1982	....	250	expl. 297	i.	$0.01^{100\circ}$	s. KCN, dil. HNO_3; sl. s. NH_4OH
1983	$4.453^{26\circ}$	d. 140	....	$0.155^{0\circ}$	$1.363^{60\circ}$	v. s. NH_3; s. act.; i. al.
1984	....	....	....	i.	....	s. NH_4OH; i. HNO_3, al.
1985	$5.029^{4\circ}$	expl. 140	....	$0.0034^{18\circ}$	....	s. KCN, NH_4OH
1986	$7.143^{16.6\circ}$	d. 300	....	$0.00174^{20\circ}$	$0.0055^{80\circ}$	s. KCN, NH_4OH; i. NH_3
1987	$2.806^{25\circ}$	d. 486	....	$525^{20\circ}$	$625^{35\circ}$	s. al.
1988	....	d.	....	$0.55^{0\circ}$	d.	....
1989	7.44	d. >100	....	i.	....	s. NH_4OH, HNO_3, H_2SO_4
1990	$6.37^{25\circ}_{4}$	849	....	$0.00065^{19.5\circ}$	....	s. NH_4OH, KCN, a.; i. NH_3
1991	....	d. 110	....	....	....	....
1992	6.370	482	....	....	....	....
1993	$5.306^{7.5\circ}$	585	....	i.	i.	s. NH_4OH, KCN, HNO_3, H_2SO_4
1994	8.0	880	....	i.	....	s. h. HNO_3
1995	....	100 d.	....	v. s.	....	....
1996	$5.45^{29.2\circ}_{4}$	652	d.	$0.57^{0\circ}$	$1.41^{100\circ}$	s. NH_4OH, HNO_3, H_2SO_4; i. al.
1997	7.326	825	d.	1.3×10^{-16}	....	s. HNO_3; i. dil. HCl
1998	7.317	tr. 175	d.	i.	i.	s. HNO_3
1999	....	d. 100	....	v. sl. s.	d.	s. NH_4OH; i. HNO_3
2000	$3.432^{15\circ}$	d.	....	$0.2^{18\circ}$	$0.2^{25\circ}$	s. NH_4OH, KCN; i. al.
2001	8.5	955	....	i.	....	s. HNO_3, KCN
2002	....	d. >120	....	$0.00002^{25\circ}$	$0.00064^{100\circ}$	s. NH_4OH; i. dil. a.
2003	....	d.	....	sl. s.	....	s. NH_4OH, $Na_2S_2O_3$
2004	....	....	....	$0.05^{15\circ}$	....	s. NH_4OH, KCN; s. d. HNO_3
2005	....	383	....	....	....	....
2006	$0.97^{20\circ}$	97.5	880	d., forms NaOH	....	i. bz.; d. al.
2007	1.528	324	....	$46.5^{20\circ}$	$170^{100\circ}$	$2.1^{18\circ}$ al.
2008	1.45	58	$-3H_2O$, 120	v. s.	v. s.	$7.8^{25\circ}$ abs. al.
2009	....	1650	....	s.	v. s.	i. al.
2010	....	210	400	d.	....	d. al.
2011	1.574	79 d.	....	16.7	100	i. al.
2012	....	....	....	$0.031^{12.3\circ}$	....	sl. s. al., NH_4 salts; i. ac.
2013	....	....	....	$0.03^{12.3\circ}$	$0.3^{100\circ}$	$0.007^{12.3\circ}$, 26% al.
2014	....	856	....	d.	....	....
2015	2.864	d.	....	d.	....	....
2016	1.759	86.3	....	$26.7^{17\circ}$	....	1.67 al., $50^{15\circ}$ gly.

Soda niter saliter 2097
Soda saltpeter 2097
Sodium acid carbonate 2025
Sodium acid fluoride 2026
Sodium acid oxalate 2103
Sodium acid pyrophosphate 2128
Sodium acid sulfate 2030
Sodium acid sulfite 2031
Sodium acid tartrate 2158
Sodium alum 49
Sodium aluminum chloride 33
Sodium aluminum fluoride 34

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Sodium			
2017	arsenate, acid (monobasic)	$NaH_2AsO_4 \cdot H_2O$	181.94	rhb., 1.5535
2018	arsenate, acid (dibasic)	$Na_2HAsO_4 \cdot 7H_2O$*	312.02	col., mn., 1.4658
2019	arsenate, acid (dibasic)	$Na_2HAsO_4 \cdot 12H_2O$	402.10	mn., 1.4496
2020	arsenite, acid	Na_2HAsO_3	169.91	col.
2021	arsenite, meta-	$NaAsO_2$	129.91	wh.-gray pd., hyg.
2022	aurosulfide	$NaAuS \cdot 4H_2O$	324.32	col., mn.
2023	azide	NaN_3	65.02	wh., hex.
2024	benzoate	$NaC_7H_5O_2$	144.11	col. cr.
2025	bicarbonate	$NaHCO_3$	84.01	wh., mn., 1.500
2026	bifluoride	$NaHF_2$	62.00	col. cr.
2027	bismuth thioglycollate	$Na_3Bi(SCH_2COO)_3$	548.28	yel., hyg.
2028	bismuthate	$NaBiO_3$	280.00	yel.-brn. pd.
2029	bismuthide	Na_3Bi	277.99	blue-vl.
2030	bisulfate	$NaHSO_4$	120.06	col., tri.
2030.1	bisulfate	$NaHSO_4 \cdot H_2O$	138.08	col., delq., mn.
2031	bisulfite	$NaHSO_3$	104.06	col., mn., 1.526
2032	borate, meta-	$Na_2B_2O_4$	131.63	hex. pr.
2033	borate, meta-	$Na_2B_2O_4 \cdot 4H_2O$	203.70	mn.
2034	borate, tetra-	$Na_2B_4O_7$	201.27	....
2035	borate, tetra	$Na_2B_4O_7 \cdot 5H_2O$	291.35	col., rhb., 1.461
2036	borate, tetra- (borax)	$Na_2B_4O_7 \cdot 10H_2O$*	381.43	wh., mn., 1.4694
2037	bromate	$NaBrO_3$	150.91	col., cb.
2038	bromide	$NaBr$	102.91	col., cb., 1.6412
2039	bromide	$NaBr \cdot 2H_2O$	138.95	col., mn.
2040	bromoplatinate	$Na_2PtBr_6 \cdot 6H_2O$	828.82	dark red, tri.
2041	carbide	Na_2C_2	71.01	brn. pd.
2042	carbonate (soda ash)	Na_2CO_3	106.00	wh. pd., 1.535
2043	carbonate	$Na_2CO_3 \cdot H_2O$	124.02	wh., rhb., 1.506-1.509
2044	carbonate	$Na_2CO_3 \cdot 7H_2O$	232.12	rhb. or trig.
2045	carbonate (sal soda)	$Na_2CO_3 \cdot 10H_2O$	286.16	wh., mn., 1.425
2046	carbonate, sesqui- (trona)	$Na_3H(CO_3)_2 \cdot 2H_2O$	226.05	wh., mn., 1.5073
2047	chlorate	$NaClO_3$	106.45	wh., cb., or trig., 1.5151
2048	chloraurate	$NaAuCl_4 \cdot 2H_2O$	398.06	or.-yel., rhb., 1.6 ±
2049	chloride	$NaCl$	58.45	col., cb., 1.5443
2050	chloroiridate	$Na_2IrCl_6 \cdot 6H_2O$	559.93	red, tri.
2051	chloroplatinate	$Na_2PtCl_6 \cdot 6H_2O$	562.06	red, tri.
2052	chloroplatinite	$Na_2PtCl_4 \cdot 4H_2O$	455.12	red
2053	chromate	Na_2CrO_4	162.00	yel., rhb.
2054	chromate	$Na_2CrO_4 \cdot 10H_2O$	342.16	yel., delq., mn.
2055	citrate	$Na_3C_6H_5O_7 \cdot 2H_2O$	294.06	wh.
2056	citrate	$2Na_3C_6H_5O_7 \cdot 11H_2O$	714.36	wh., rhb.
2057	cobaltinitrite	$Na_3Co(NO_2)_6$	403.98	yel. to yel. brn. cr. pd.
2058	cyanide	$NaCN$	49.02	wh., cb., 1.452
2059	dichromate	$Na_2Cr_2O_7 \cdot 2H_2O$	298.05	red, mn., 1.6994
2060	dithionate	$Na_2S_2O_6 \cdot 2H_2O$	242.15	col., rhb., 1.4953

* Usual commercial form.

Sodium aluminum silicate 35
Sodium aluminum sulfate 49
Sodium beryllium fluoride 310
Sodium biborate 2034
Sodium bichromate 2059
Sodium binoxalate 2103
Sodium biphosphate 2119
Sodium bisulfide 2072

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2017	2.535	d. 100	....	s.	....	....
2018	1.871	125	$-7H_2O$, 100	$61^{15°}$	v. s.	sl. s. al.
2019	1.72	28	$-12H_2O$,100	$5.59^{0.1°}$	$140.7^{30°}$	sl. s. al.
2020	1.87	....	....	v. s.	....	....
2021	....	....	....	s.	....	sl. s. al.
2022	....	d.	....	s.	....	s. al.
2023	....	....	....	$39^{0°}$	$55^{100°}$	sl. s. al., bz.
2024	....	....	....	$62.5^{25°}$	$76.9^{100°}$	$2.3^{25°}$, $8.3^{78°}$ al.
2025	2.20	$-CO_2$, 270	....	$6.9^{0°}$	$16.4^{60°}$	i. al.
2026	....	d.	....	$3.7^{20°}$	s.	....
2027	....	....	....	s. d.	....	....
2028	....	....	....	i.	d.	d. a.
2029	....	775	....	d.	....	....
2030	2.742	>315	d., $-H_2O$	$50^{0°}$	$100^{100°}$	d. al.; i. NH_3
2030.1	....	58.5	d.	100	v. s.	d. al.
2031	1.48	d.	....	sl. s.	s.	i. al., act.
2032	....	966	1400	$26^{20°}$	$36^{35°}$	....
2033	....	57	....	s.	v. s.	....
2034	2.367	741	....	$1.3^{0°}$	$8.79^{40°}$	i. al.
2035	1.815	....	....	$22^{62°}$ (anh.)	$52.3^{100°}$ (anh.)	....
2036	1.73	75	$-10H_2O$, 200	$1.3^{0.5}$(anh).	$20.3^{60°}$ (anh.)	s. gly.; i. abs. al.
2037	$3.339^{17.5°}$	381	....	$27.5^{0°}$	$90.9^{100°}$	i. al.
2038	$3.205^{17.5°}$	755	1390	$90^{20°}$	$121^{100°}$	sl. s. al.
2039	2.176	50.7	....	$79.5^{0°}$ (anh.)	$118.3^{80°}$ (anh.)	sl. s. al.
2040	3.323	d.	....	v. s.	....	v. s. al.
2041	$1.575^{15°}$	forms Na_2CO_3	....	d.	....	s. a.; d. al.
2042	2.533	851	d.	$7.1^{0°}$	$48.5^{104°}$	i. al., et.
2043	1.55	$-H_2O$, 100	....	s.	s.	s. gly.; i. al., et.
2044	1.51	d. 35.1	....	s.	s.	....
2045	1.46	....	....	$21.5^{0°}$	$238^{30°}$	i. al.
2046	2.112	d.	....	$13^{0°}$	$42^{100°}$	....
2047	$2.490^{15°}$	248	d.	$79^{0°}$	$230^{100°}$	s. al.
2048	....	d.	d.	$150^{10°}$	$990^{60°}$	v. s. abs. al.
2049	2.163	800.4	1413	$35.7^{0°}$	$39.8^{100°}$	sl. s. al.; i. conc. HCl
2050	....	d.	d.	$34^{15°}$	$307^{85°}$	s. al.
2051	2.50	$-6H_2O$, 100	....	v. s.	v. s.	s. al., aq. Cl_2;i. et.
2052	....	100 d.	....	....	....	....
2053	2.723	392	....	$32^{0°}$	$126^{100°}$	....
2054	1.483	19.9	....	v. s.	∞	sl. s. al.
2055	....	$-2H_2O$, 150	....	$77^{25°}$	$170^{100°}$	i. al.
2056	$1.857^{23.5°}_{4}$	$-11H_2O$, 150	d.	$91^{25°}$	$250^{100°}$	i. al.
2057	....	....	....	s. d.	....	s. dil. ac.
2058	....	563.7	1496	$48^{10°}$	$82^{35°}$	s. NH_3; sl. s. al.
2059	$2.52^{13°}$	$-2H_2O$, 84.6; 356 (anh.)	d. 400	$238^{0°}$	$508^{80°}$	....
2060	2.189	....	....	$47.6^{16°}$	$90.9^{100°}$	i. al., conc. HCl

Sodium bisulfite, meta- 2088
Sodium bitartrate 2158
Sodium borofluoride 2066
Sodium calcium sulfate 480
Sodium carbonate, acid 2025
Sodium dihydrogen phosphate 2119
Sodium dioxide 2113

No.	Name	Formula	Formula Weight	Color, Crystalline For and Refractive Index
	Sodium			
2061	ethylate	$NaOC_2H_5$	68.06	wh.
2062	ferricyanide	$Na_3Fe(CN)_6 \cdot H_2O$	298.97	red, delq.
2063	ferric oxalate	$Na_3Fe(C_2O_4)_3 \cdot 5\frac{1}{2}H_2O$	487.99	gn., mn.
2064	ferrite	$Na_2Fe_2O_4$	221.69	....
2065	ferrocyanide	$Na_4Fe(CN)_6 \cdot 10H_2O$	484.11	yel., mn.
2066	fluoborate	$NaBF_4$	109.82	wh., rhb.
2067	fluoride (villiaumite)	NaF	42.00	tet., 1.3258
2068	formaldehyde sulfoxylate	$NaO_3SCH_3 \cdot 2H_2O$	154.12	wh. cr.
2069	formate	$NaHCO_2$	68.01	wh., mn.
2070				
2071	hydride	NaH	24.005	silv. nd., 1.470
2072	hydrosulfide	$NaSH \cdot 2H_2O$	92.10	col., delq., nd.
2073	hydrosulfide	$NaSH \cdot 3H_2O$	110.11	rhb.
2074	hydrosulfite	$Na_2S_2O_4 \cdot 2H_2O$	210.15	col. cr.
2075	hydroxide	$NaOH$	40.00	wh., delq.
2076	hydroxide	$NaOH \cdot 3\frac{1}{2}H_2O$	103.06	mn.
2077	hypochlorite	$NaOCl$	74.45	pa. yel., in soln. only
2078	hyponitrite	$Na_2(NO)_2$	106.01	....
2079	hypophosphate	$Na_4P_2O_6 \cdot 10H_2O$	430.11	mn.
2080	hypophosphate, acid	$Na_2H_2P_2O_6 \cdot 6H_2O$	314.07	col., mn.
2081	hypophosphite	$NaH_2PO_2 \cdot H_2O$	106.04	col., mn.
2082	iodate	$NaIO_3$	197.92	col., rhb.
2083	iodide	NaI*	149.92	col., cb., 1.7745
2084	iodide	$NaI \cdot 2H_2O$	185.95	col., mn.
2085	iodoplatinate	$Na_2PtI_6 \cdot 6H_2O$	1110.84	mn. (?)
2086	lactate	$NaC_3H_5O_3$	112.07	col., amor.
2087	manganate	$Na_2MnO_4 \cdot 10H_2O$	345.08	gn., mn.
2088	metabisulfite	$Na_2S_2O_5$	190.12	wh. pd.
2089	methylate	$NaOCH_3$	54.03	wh. pd.
2090	molydate	Na_2MoO_4	205.94	wh.
2091	molybdate	$Na_2MoO_4 \cdot 2H_2O$*	241.98	pl.
2092	molybdate, di-	$Na_2Mo_2O_7$	349.89	nd.
2093	molybdate, tri-	$Na_2Mo_3O_{10} \cdot 7H_2O$	619.96	nd.
2094	molybdate, tetra-	$Na_2Mo_4O_{13} \cdot 6H_2O$	745.89	nd.
2095	molybdate, octa-	$Na_2Mo_8O_{25} \cdot 4H_2O$	1285.61	pd.
2096	molybdate, deca-	$Na_2Mo_{10}O_{31} \cdot 12H_2O$	1717.69	wh. cr.
2097	nitrate (soda niter)	$NaNO_3$	85.01	col., trig., 1.5874
2098	nitride	Na_3N	83.00	gray
2099	nitrite	$NaNO_2$	69.01	pa. yel., rhb.
2100	nitroprusside	$Na_2Fe(CN)_5NO \cdot 2H_2O$	297.97	red, rhb.
2101	oleate	$NaOOCC_{17}H_{33}$	304.44	wh. pd.
2102	oxalate	$Na_2C_2O_4$	134.01	wh. cr.
2103	oxalate, acid	$NaHC_2O_4 \cdot H_2O$	130.04	tri.
2104	oxide	Na_2O	61.99	wh., delq,
2105	perborate	$NaBO_3 \cdot H_2O$	99.83	wh. pd.

* Usual commercial form.

Sodium ethoxide 2061
Sodium fluoride, acid 2026
Sodium fluosilicate 2142
Sodium hyposulfite (improper) 2165
Sodium magnesium chloride 1225
Sodium metaborate 2032
Sodium metaphosphate 2125
Sodium metaphosphate, hexa- 2070

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2061	....	....	....	d.	d.	s. abs. al.
2062	....	....	....	$18.9^{0°}$	$67^{100°}$	i. al.
2063	$1.973^{17.5°}$	$-4H_2O$, 100	$-5\frac{1}{2}H_2O$, 200	$32.5^{0°}$	$182^{100°}$	....
2064	....	....	....	d.	....	v. s. dil. HCl
2065	1.458	....	....	$17.9^{20°}$ (anh.)	$63^{98.5°}$ (anh.)	i. al.
2066	$2.47^{20°}$	384 sl. d.	d.	$108^{26.5°}$	$210^{100°}$	sl. s. al., d. H_2SO_4
2067	2.79	992	....	$4^{0°}$	$5^{100°}$	v. sl. s. al.
2068	....	65	d.	s.	....	v. s. gly., s. al., d. dil. a.
2069	1.919	253	....	$44^{0°}$	$160^{100°}$	sl. s. al.; i. et.
2070						
2071	0.92	d. 800	....	d.	....	i. bz., CS_2, CCl_4, NH_3
2072	....	d.	....	s.	s.	s. al.; d. a.
2073	....	22	d.	s.	s.	s. al.; d. a.
2074	....	d.	....	$22^{20°}$	d.	i. al.
2075	2.130	318.4	1390	$42^{0°}$	$347^{100°}$	v. s. al., gly.; i. et., act.
2076	....	15.5	....	s.	v. s.	....
2077	....	d.	....	$26^{0°}$	$158^{56°}$	....
2078	$2.466^{30°}$	300, d.	....	s.	....	....
2079	1.832	....	....	$3^{25°}$	$6^{50°}$	....
2080	1.849	$-6H_2O$, 100; 250 (anh.)	....	2.2	20	s. NH_4OH; i. al.
2081	....	$-H_2O$, 200	....	$100^{25°}$	830	v. s. al.; sl. s. NH_3
2082	4.277	d.	....	$2.5^{0°}$	$34^{100°}$	s. ac.; i. al.
2083	$3.667^{0°}$	651	1300	$158.7^{0°}$	$302^{100°}$	v. s. al., act.
2084	2.448	....	....	v. s.	v. s.	v. s. NH_3
2085	3.707	....	....	....	....	....
2086	....	d.	....	v. s.	v. s.	s. al.; i. et.
2087	....	17	....	s.	d.	....
2088	....	d., $-SO_2$	....	v. s.	v. s.	s. gly., sl. s. al.
2089	....	....	....	d.	d.	s. al.
2090	lq., $2.590^{1026°}$	687	....	$44^{0°}$	$90^{100°}$	....
2091	3.28	....	....	$56.2^{0°}$	$115.5^{100°}$	i. MeOAc
2092	....	612	....	sl. s.	s.	....
2093	....	$-6H_2O$, 120	....	$16^{30°}$	....	....
2094	....	....	....	$28.4^{21°}$	v. s.	....
2095	....	....	....	i.	i.	....
2096	....	....	....	sl. s.	sl. s.	....
2097	2 257	308	d. 380	$73^{0°}$	$180^{100°}$	s. NH_3; sl. s. gly., al.
2098	....	d.	....	d.	....	....
2099	$2.168^{0°}$	271	d. 320	$72.1^{0°}$	$163.2^{100°}$	$0.3^{20°}$ et.; 0.3 abs. al.; $4.4^{20°}$ m. al.; v. s. NH_3
2100	1.72	....	....	$40^{16°}$	....	....
2101	....	....	....	10	....	5 al.
2102	2.27	....	....	$3.7^{20°}$	$6.33^{100°}$	....
2103	....	....	....	$1.7^{15°}$	$21^{100°}$	....
2104	2.27	subl.	....	forms NaOH	....	d. al.
2105	....	d. 40	....	sl. s.	d.	s. gly., alk.

Sodium metasilicate 2138
Sodium methoxide 2089
Sodium monohydrogen phosphate 2121
Sodium nitroferrocyanide 2100
Sodium nitrosyl 2078
Sodium orthosilicate 2140
Sodium peroxychromate 2109

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Sodium			
2106	perborate	$NaBO_2 \cdot 3H_2O \cdot H_2O_2$	153.88	transparent, mn.
2107	perchlorate	$NaClO_4$	122.45	rhb., 1.4617
2108	perchlorate	$NaClO_4 \cdot H_2O$	140.47	hex.
2109	perchromate	Na_3CrO_8	249.00	or. pl.
2110	periodate	$NaIO_4$	213.92	tet.
2111	periodate	$NaIO_4 \cdot 3H_2O$	267.97	trig.
2112	permanganate	$NaMnO_4 \cdot 3H_2O$	195.98	purple, delq.
2113	peroxide	Na_2O_2*	77.99	yel.-wh. pd.
2114	peroxide	$Na_2O_2 \cdot 8H_2O$	222.12	wh., hex.
2115	perrhenate	$NaReO_4$	273.31	col. pl.
2116	perruthenate	$NaRuO_4 \cdot H_2O$	206.71	bk. cr.
2117	persulfate	$Na_2S_2O_8$	238.11	wh. cr.
2118	peruranate	$Na_2UO_5 \cdot 5H_2O$	454.14	red cr.
2119	phosphate, monobasic	$NaH_2PO_4 \cdot H_2O$*	138.01	col., rhb., 1.4852
2120	phosphate, monobasic	$NaH_2PO_4 \cdot 2H_2O$	156.03	col., rhb., 1.4629
2120.1	phosphate, dibasic	Na_2HPO_4	141.98	wh., hyg.
2121	phosphate, dibasic	$Na_2HPO_4 \cdot 7H_2O$	268.09	col., mn., 1.4424
2122	phosphate, dibasic	$Na_2HPO_4 \cdot 12H_2O$	358.17	col., mn., 1.4361
2123	phosphate, tribasic	Na_3PO_4	163.97	wh.
2124	phosphate, tribasic	$Na_3PO_4 \cdot 12H_2O$*	380.16	wh., trig., 1.4458
2125	phosphate,meta-(glass)	$NaPO_3$	101.98	col., hyg., 1.485
2125.1	phosphate, meta-(sol.)	$NaPO_3$	101.98	col., 1.478
2125.2	phosphate, meta-(insol.)	$NaPO_3$	101.98	col., 1.510
2126	phosphate, pyro-	$Na_4P_2O_7$*	265.95	wh.
2127	phosphate, pyro-	$Na_4P_2O_7 \cdot 10H_2O$	446.11	mn., 1.4525
2128	phosphate (pyrodisodium)	$Na_2H_2P_2O_7$	221.97	col., mn., 1.510
2129	phosphate (pyrodisodium)	$Na_2H_2P_2O_7 \cdot 6H_2O$	330.07	col., mn., 1.4645
2130	phosphite, ortho-	$Na_2HPO_3 \cdot 5H_2O$	216.06	delq., rhb.
2131	phosphite, acid	$2NaH_2PO_3 \cdot 5H_2O$	298.07	mn. pr.
2132	platinate	$Na_2PtO_3 \cdot 3H_2O$	343.27	yel.
2133	potassium tartrate	$NaKC_4H_4O_6 \cdot 4H_2O$	282.23	rhb., 1.493
2134	salicylate	$NaC_7H_5O_3$	160.11	wh. cr.
2135	selenate	Na_2SeO_4	188.95	rhb.
2136	selenate	$Na_2SeO_4 \cdot 10H_2O$	369.11	mn.
2137	selenide	Na_2Se	124.95	delq. cr.
2138	silicate, meta-	Na_2SiO_3	122.05	col., rhb., 1.520
2139	silicate, meta-	$Na_2SiO_3 \cdot 9H_2O$	284.20	rhb.
2140	silicate, ortho-	Na_4SiO_4	184.05	col., hex., 1.530
2141	silicate	$Na_2Si_4O_9$	302.23	amor.
2142	silicofluoride	Na_2SiF_6	188.05	wh., hex., 1.312
2143	stannate	$Na_2SnO_3 \cdot 3H_2O$	266.74	hex. tablets
2144	stearate	$NaOOCC_{17}H_{35}$	306.36	wh. soap
2145	sulfate (thenardite)	Na_2SO_4	142.05	col., rhb., 1.477
2146	sulfate	Na_2SO_4	142.05	col., mn.
2147	sulfate	Na_2SO_4	142.05	col., hex.
2148	sulfate	$Na_2SO_4 \cdot 7H_2O$	268.17	tet.
2149	sulfate (Glauber's salt)	$Na_2SO_4 \cdot 10H_2O$	322.21	col., mn., 1.396
2150	sulfide, mono-	Na_2S	78.05	pink or wh., amor.
2151	sulfide, mono-	$Na_2S \cdot 9H_2O$	240.19	col., delq., cr.

* Usual commercial form.

Sodium phenolsulfonate 2156

Sodium phosphate, hexameta- 2070

Sodium phosphate, hypo- 2079

Sodium phosphate, primary 2119

Sodium phosphate, secondary 2121

Sodium phosphate, tertiary 2123

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2106	....	d. >60	....	$3.9^{15°}$	$5.7^{32°}$	s. a.
2107	....	482 d.	....	$170^{0°}$	$320^{100°}$	s. al.; 51 m. al.; 52 act.; i. et.
2108	2.02	d. 130	....	$209^{15°}$	$284^{50°}$	s. al.
2109	....	d. 115	....	$400^{0°}$	$600^{100°}$	i. al., et.
2110	$3.865^{16°}$	d. 300	....	$4^{6°}$	$37^{50°}$	....
2111	$3.219^{18°}_{4}$	d.	....	s.	s.	....
2112	2.46	d. 170	....	v. s.	v. s.	s. NH_3; d. alk.
2113	2.805	d.	....	s. d.	d.	s. dil. a.
2114	....	d. 30	....	s. d.	d.	....
2115	....	300	....	$33^{20°}$	s.	s. al.
2116	....	....	....	sl. s.	....	....
2117	....	....	d.	s.	s.	d. al.
2118	....	d. 100	....	d.	....	d. HCl
2119	2.040	$-H_2O$, 100	d. 200	$71^{0°}$	$390^{83°}$	i. al.
2120	1.91	60	....	$91.1^{0°}$	$308^{40°}$	....
2120.1	....	....	d.	$1.63^{0°}$	$12.14^{25°}$	i. al.
2121	1.679	d.	....	$185^{40°}$	$2000^{100°}$	....
2122	1.52	34.6	$-12H_2O$, 180	$4.3^{0°}$	$76.7^{30°}$	i. al.
2123	$2.537^{17.5°}$	1340	....	$4.5^{0°}$	$77^{100°}$	....
2124	1.62	73.4	$-11H_2O^{100°}$	$28.3^{15°}$	∞	i. CS_2
2125	$2.484^{20°}$	cr. >300	....	v. s.	v. s.	i.
2125.1	2.476	627.6	....	21	s.	i.
2125.2	....	tr. 500	....	i.	v. sl. s.	i.
2126	2.45	988	....	$2.26^{0°}$	$45^{96°}$	d. a.
2127	1.82	d.	....	$5.4^{0°}$	$93^{100°}$	i. al., NH_3
2128	1.862	d. 220	....	$4.5^{0°}$	$21^{40°}$	....
2129	1.848	....	....	$6.9^{0°}$	$36^{40°}$	....
2130	....	53	$-5H_2O$, 120	$400^{0°}$	$1100^{43°}$	i. al.
2131	....	42	$-5H_2O$, 100	$56^{0°}$	$193^{42°}$	....
2132	....	....	$-3H_2O$, 150	s.	....	i. al.
2133	1.790	70 to 80	$-4H_2O$, 215	$26^{0°}$	$66^{26°}$	sl. s. al.
2134	....	....	....	$111^{15°}$	$125^{25°}$	$17^{15°}$ al.
2135	3.098	....	....	$83.4^{35°}$	$72.8^{100°}$	....
2136	1.58	....	....	$29.8^{0°}$	$340^{100°}$	....
2137	$2.625^{10°}$	>875	....	d.	....	i. NH_3
2138	....	1088	....	s.	s. d.	i. Na or K salts, al.
2139	....	47	$-6H_2O$, 100	v. s.	v. s.	$29^{18°}$, ½N NaOH
2140	....	1018	....	s.	s.	....
2141	....	....	....	s.	s.	i. Na or K salts, al.
2142	2.679	d.	....	$0.44^{0°}$	$2.45^{100°}$	i. al.
2143	....	d. 140	....	$50^{0°}$	$67^{50°}$	i. al., act.
2144	....	....	d.	sl. s.	s.	sl. s. al.
2145	2.698	tr. 100 to mn.	....	$5^{0°}$	$42^{100°}$	i. al.
2146	....	tr. 500 to hex.	....	$48.8^{40°}$	$42.5^{100°}$	d. HI; s. H_2SO_4
2147	....	884	....	$19.4^{20°}$	$45.3^{60°}$	....
2148	....	....	....	$44.9^{0°}$	$202.6^{26°}$	....
2149	1.464	32.4	$-10H_2O$, 100	$36^{15°}$	$412^{34°}$	i. al.
2150	1.856	....	....	$15.4^{10°}$	$57.3^{90°}$	sl. s. al.; i. et.
2151	....	50	d.	$125^{25°}$	....	s. al.; d. a.

Sodium phosphite, hypo- 2081
Sodium potassium carbonate 1756
Sodium potassium cobaltinitrite 1757
Sodium prussiate, red 2062
Sodium prussiate, yellow 2065
Sodium pyrophosphate 2126
Sodium pyrosulfite 2088
Sodium sulfate, acid 2030
Sodium sulfhydrate 2072

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Sodium			
2152	sulfide, tetra-	Na_2S_4	174.23	yel., cb.
2153	sulfide, penta-	Na_2S_5	206.29	yel.
2154	sulfite	Na_2SO_3	126.05	hex. pr., 1.565
2155	sulfite	$Na_2SO_3 \cdot 7H_2O$	252.17	mn.
2156	sulfocarbolate	$NaO_3SC_6H_4OH \cdot 2H_2O$	250.21	wh. cr.
2157	tartrate	$Na_2C_4H_4O_6 \cdot 2H_2O$	230.10	rhb.
2158	tartrate, acid	$NaHC_4H_4O_6 \cdot H_2O$	191.09	wh. cr.
2159	thioantimonate (Schlippe's salt)	$Na_3SbS_4 \cdot 9H_2O$	481.14	yel., cb.
2160	thioarsenate	$Na_3AsS_4 \cdot 8H_2O$	416.27	mn., 1.6802
2161	thioarsenate	$2Na_3AsS_4 \cdot 15H_2O$	814.52	yel. or col., mn.
2162	thiocarbonate	$Na_2CS_3 \cdot H_2O$	172.20	yel.
2163	thiocyanate	$NaCNS$	81.08	delq., rhb., 1.625±
2164	thioplatinate	$Na_4Pt_3S_6$	870.04	red, rhb.
2165	thiosulfate	$Na_2S_2O_3$	158.11	mn.
2166	thiosulfate (hypo)	$Na_2S_2O_3 \cdot 5H_2O$*	248.19	mn. pr., 1.5079
2167	tungstate	Na_2WO_4	293.91	wh., rhb.
2168	tungstate	$Na_2WO_4 \cdot 2H_2O$*	329.95	wh., rhb.
2169	tungstate, para-	$Na_6W_7O_{24} \cdot 16H_2O$	2097.68	wh., tri.
2170	uranate	Na_2UO_4	348.06	yel.
2171	vanadate	$Na_3VO_4 \cdot 16H_2O$	472.20	col. nd.
2172	vanadate, pyro-	$Na_4V_2O_7$	305.89	hex.
2173	**Stannic acid,** meta- (α)	H_2SnO_3	168.72	wh., amor.
2174	**Stannic acid,** meta- (β)	$H_{10}Sn_5O_{15}$	843.58	....
2175	**Stannic acid,** thio-	H_2SnS_3	216.90	gray
2176	**Stannic** ammonium chloride	$SnCl_4 \cdot (NH_4Cl)_2$	367.52	pink, cb.
2177	bromide	$SnBr_4$	438.36	wh., delq., rhb.
2178	chloride	$SnCl_4$	260.53	col., fuming lq.
2179	chloride	$SnCl_4 \cdot 5H_2O$	350.61	col., mn.
2180	fluoride	SnF_4	194.70	wh. cr.
2181	iodide	SnI_4	626.38	red, rhb., or cb., 2.106
2182	oxide (cassiterite)	SnO_2	150.70	wh., tet., 1.9968
2183	oxychloride	$SnOCl_2$	205.61	....
2184	phosphate	$2SnO_2 \cdot P_2O_5 \cdot 10H_2O$	623.52	....
2185	phosphide	SnP	149.68	silv. wh.
2186	selenide	$SnSe_2$	276.62	wh. or brn.
2187	sulfate	$Sn(SO_4)_2 \cdot 2H_2O$	346.85	col., delq., hex.
2188	sulfide (mosaic gold)	SnS_2	182.82	soft, yel., hex. pl.
2189	**Stannous** bromide	$SnBr_2$	278.53	yel., rhb.
2190	chloride	$SnCl_2$	189.61	wh., rhb.
2191	chloride (tin salt)	$SnCl_2 \cdot 2H_2O$*	225.65	wh., tri.
2192	ferricyanide	$Sn_3[Fe(CN)_6]_2$	780.02	....

* Usual commercial form.

Sodium sulfite, acid 2031
Sodium sulfite, metabi- 2088
Sodium sulfocarbonate 2162
Sodium sulfocyanate 2136
Sodium sulfocyanide 2163
Sodium tetraborate 2034
Sodium thioaurite 2022
Sodium uranyl carbonate 2466
Soluble tartar 1771
Sorensen's phosphate 2124

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2152	....	275	....	s.	s.	s. al.
2153	....	251.8	....	s.	s.	s. al.
2154	$2.633_{4}^{15\circ}$	d.	....	$13.9^{0\circ}$	$28.3^{84\circ}$	i. al., NH_3
2155	1.561	$-7H_2O$, 150	d.	$34.7^{2\circ}$	$67.8^{18\circ}$	i. al.
2156	....	....	....	$24^{25\circ}$	125^{100}	$0.7^{25\circ}$, $7.5^{76\circ}$ al.; $20^{25\circ}$ gly.
2157	1.818	....	....	$29^{6\circ}$	$66^{43\circ}$	i. al.
2158	....	....	....	11	50	sl. s.
2159	1.839	....	....	$21.6^{0\circ}$	$600^{80\circ}$	i. al.
2160	....	d.	....	s.	....	....
2161	....	d.	....	v. s.	....	i. al.
2162	....	d.	....	s.	d.	....
2163	....	287	....	$110^{10\circ}$	$225^{100\circ}$	v. s. al.
2164	....	d.	....	i.	d.	....
2165	1.667	....	....	$50^{0\circ}$	$231^{80\circ}$	....
2166	1.685	d. 48.0	....	$74.7^{0\circ}$	$301.8^{60\circ}$	s. NH_3; v. sl. s. al.
2167	4.179	692	....	$57.58^{0\circ}$	$97^{100\circ}$	....
2168	3.245	$-2H_2O$, 100	....	$88^{0\circ}$	$123.5^{100\circ}$	sl. s. NH_3; i. a., al.
2169	$3.987^{14\circ}$	$-16H_2O$, 300	....	8	d.	....
2170	....	....	....	i.	i.	s. alk. carb., dil. a.
2171	....	866 (anh.)	....	v. s.	d.	i. al.
2172	....	654	....	s.	....	i. al.
2173	....	....	....	i.	i.	s. a.
2174	....	....	....	i.	i.	s. KOH; i. a.
2175	....	....	....	i.	....	....
2176	2.4	d.	....	$33.3^{15\circ}$	....	....
2177	lq., $3.34^{35\circ}$	31.0	202	s.	d.	s. H_2SO_4, $AsBr_3$, PCl_3, act.
2178	2.226	−30.2	114.1	s.	d.	s. abs. al., act., NH_3; s. ∞ CS_2
2179	....	....	....	s.	s.	s. al.
2180	$4.78_{4}^{19\circ}$	....	705	v. s.	forms SnO_2	....
2181	4.46	143.5	340	v. s.	forms SnO_2	$145^{15\circ}$ CS_2; s. al., et., act., bz., CCl_4
2182	7.0	1127	....	i.	i.	s. conc. H_2SO_4; i. alk., NH_4OH, NH_3
2183	....	....	....	s.	....	....
2184	3.98 (anh.)	....	....	i.	i.	i. HNO_3
2185	6.56	forms Sn_4P_3 at 415	....	i.	....	s. HCl; i. HNO_3
2186	5.0	650	....	i.	....	s. alk., h. H_2SO_4; i. dil. a.
2187	....	....	....	v. s.	d.	s. dil. H_2SO_4, HCl; d. abs. al.
2188	4.5	d.	....	0.00002	i.	s. aq. reg., h. alk.; i. HCl, HNO_3
2189	$5.12^{17\circ}$	215.5	620	s.	d.	s. C_6H_5N
2190	....	246.8	623	$83.9^{0\circ}$	$269.8^{15\circ}$	s. alk., abs. al., et.
2191	$2.71^{15.5\circ}$	37.7	d.	$118.7^{0\circ}$	∞	s. tart. a., alk., al.
2192	....	d.	....	i.	....	s. HCl

Spanish white 328 or 428
Spanish whiting 328 or 428
Spelter 2530
Sphalerite 2583
Spherocobaltite 659
Spinel 1170
Spirit of salt 943
Stannic ammonium chloride 78
Stearic acid, cf. organic table.
Steinbuhl yellow 233
Stercorite 2011
Stibiated tartar 161

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Stannous			
2193	ferrocyanide	$Sn_2Fe(CN)_6$	449.36	....
2194	fluoride	SnF_2	156.70	wh., mn.
2195	hydroxide	$Sn(OH)_2$	152.72	yel., amor.
2196	iodide	SnI_2	372.54	red, rhb., or mn.
2197	oxalate	SnC_2O_4	206.72	wh. pd.
2198	oxide	SnO	134.70	bk., cb.
2199	oxychloride	$SnO\cdot SnCl_2\cdot 3H_2O$	378.36	wh.
2200	selenide	$SnSe$	197.66	steel gray pr.
2201	sulfide	SnS	150.76	brn.-bk., rhb.
2202	sulfate	$SnSO_4$	214.76	wh. cr.
2203	telluride	$SnTe$	246.31	gray cr.
2204	**Strontium**	Sr	87.63	silv. met.
2205	acetate	$Sr(C_2H_3O_2)_2$	205.72	wh. cr.
2206	arsenate, acid	$SrHAsO_4\cdot H_2O$	245.56	rhb. nd.
2207	borate	$SrB_4O_7\cdot 4H_2O$	314.97	....
2208	boride	SrB_6	152.55	bk. cr.
2209	bromate	$Sr(BrO_3)_2\cdot H_2O$	361.48	mn.
2210	bromide	$SrBr_2$	247.46	wh. nd.
2211	bromide	$SrBr_2\cdot 6H_2O$	355.56	col. cr.
2212	carbide	SrC_2	111.65	bk. cr.
2213	carbonate (strontianite)	$SrCO_3$	147.64	wh., rhb., 1.664
2214	chlorate	$Sr(ClO_3)_2$	254.54	wh., rhb., 1.6047
2215	chlorate	$Sr(ClO_3)_2\cdot 8H_2O$	398.67	wh. nd.
2216	chloride	$SrCl_2$	158.54	wh., cb., 1.6499
2217	chloride	$SrCl_2\cdot 6H_2O$*	266.64	wh., rhb., 1.5364
2218	chromate	$SrCrO_4$	203.64	yel., mn.
2219	cyanide	$Sr(CN)_2\cdot 4H_2O$	211.73	delq. cr.
2220	dichromate	$SrCr_2O_7\cdot 3H_2O$	357.70	red, mn., 1.7174
2221	dithionate	$SrS_2O_6\cdot 4H_2O$	319.81	trig., 1.5296
2222	ferrocyanide	$Sr_2Fe(CN)_6\cdot 15H_2O$	657.46	yel., mn.
2223	fluoride	SrF_2	125.63	wh., cb., 1.438
2224	formate	$Sr(HCO_2)_2$	177.67	rhb., 1.574
2225	formate	$Sr(HCO_2)_2\cdot 2H_2O$	213.70	rhb., 1.521
2226	hydrosulfide	$Sr(SH)_2$	153.77	col. cr.
2227	hydroxide	$Sr(OH)_2$	121.65	wh., delq.
2228	hydroxide	$Sr(OH)_2\cdot 8H_2O$*	265.77	col., tet., 1.499
2229	iodate	$Sr(IO_3)_2$	437.47	tri.
2230	iodide	SrI_2	341.47	col. pl.
2231	iodide	$SrI_2\cdot 6H_2O$	449.57	col. cr.
2232	lactate	$Sr(C_3H_5O_3)_2\cdot 3H_2O$	319.82	wh. pd.
2233	molybdate	$SrMoO_4$	247.58	tet.
2234	nitrate	$Sr(NO_3)_2$*	211.65	col., cb., 1.5878
2235	nitrate	$Sr(NO_3)_2\cdot 4H_2O$	283.71	wh., mn.
2236	nitrite	$Sr(NO_2)_2$	179.65	....

* Usual commercial form.

Stibine 147

Stibnite 158

Stolzite 1109

Strengite 825

Strontia 2239

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2193	....	....	....	i.	....	s. h. HCl
2194	....	d. in air to $SnOF_2$	....	v. s.	....	....
2195	....	forms $SnO > 160$	....	$0.0002^{25°}$	forms SnO	s. alk., dil. a.; i. NH_4OH
2196	$5.21^{\frac{15°}{15}}$	320	720	$1.3^{21°}$	$4.0^{100°}$	s. dil. HCl, alk.
2197	$3.56^{\frac{18°}{4}}$	....	....	....	i.	....
2198	6.95	d.	....	i.	i.	s. a.; v. sl. s. NH_4Cl; i. alk., NH_3
2199	....	....	....	i.	i.	s. dil. a., al.
2200	$6.18^{0°}$	861	....	i.	....	s. aq. reg., alk. sulfides
2201	$5.080^{0°}$	880	1230	$0.000002^{18°}$	i.	s. HCl, $(NH_4)_2S_n$
2202	....	$-SO_2$, 360	....	$19^{19°}$	$18^{100°}$	s. H_2SO_4
2203	6.48	780	....	....	i.	i. HCl
2204	2.6	800	1150	d.	forms $Sr(OH)_2$	s. al., a.
2205	2.099	....	d.	$36.9^{0°}$	$36.4^{97°}$	$0.26^{15°}$ m. al.
2206	$3.606^{15°}$	$-H_2O$, 130	$-1\frac{1}{2}H_2O$, 360	$0.284^{15.5°}$	d.	s. a.
2207	....	....	....	....	$77^{100°}$	s. HNO_3, NH_4 salts
2208	3.3	....	....	i.	i.	s. HNO_3
2209	3.773	$-H_2O$, 120	d. 240	$33^{16°}$	....	....
2210	$4.216^{\frac{24°}{4}}$	643	d.	$85.2^{0°}$	$222.5^{100°}$	s. al., amyl al.
2211	$2.358^{18°}$	88	$-6H_2O$, >180	$195^{0°}$	∞	....
2212	3.19	....	....	d.	....	d. a.
2213	3.70	$1497^{60\,atm}$	$-CO_2$, 1350	$0.0011^{18°}$	$0.065^{100°}$	s. a., NH_4 salts, aq. CO_2
2214	3.152	120 d.	....	$174.9^{18°}$	v. s.	s. al.; i. abs. al.
2215	....	....	....	s.	v. s.	s. al.
2216	3.052	873	....	$43.5^{0°}$	$100.8^{100°}$	v. sl. s. act., abs. al.; i. NH_3
2217	$1.933^{17°}$	$-4H_2O$, 61	$-6H_2O$, 100	$104^{0°}$	$198^{40°}$	....
2218	$3.895^{15°}$	....	....	$0.088^{15°}$	$0.043^{100°}$	s. HNO_3, HCl, ac., NH_4 salts
2219	....	d.	....	v. s.	....	....
2220	....	....	d. 110	....	....	....
2221	2.373	d.	$-4H_2O$, 78	$22^{16°}$	$67^{100°}$	i. al.
2222	....	....	....	50	100	....
2223	2.44	1400	....	$0.011^{0°}$	$0.012^{27°}$	s. h. HCl; i. HF
2224	2.695	71.9	....	$9.1^{0°}$	$34.4^{100°}$	....
2225	2.25	d.	....	s.	s.	....
2226	....	d.	....	s.	d.	....
2227	3.625	375	....	$0.41^{0°}$	$21.83^{100°}$	s. NH_4Cl
2228	1.90	$-7H_2O$ in dry air	....	$0.90^{0°}$	$47.7^{100°}$	s. NH_4Cl; i. act.
2229	$5.045^{15°}$	....	....	$0.03^{15°}$	$0.8^{100°}$	....
2230	$4.549^{\frac{25°}{4}}$	402	d.	$165.3^{0°}$	$383^{100°}$	sl. s. abs. al.
2231	4.415	....	....	$456^{0°}$	∞	....
2232	....	$-3H_2O$, 120	....	30	200	sl. s. al.
2233	4.145	....	....	$0.0104^{17°}$	....	....
2234	2.986	570	....	$40^{0°}$	$100^{89°}$	s. NH_3; 0.012 abs. al.
2235	2.2	....	....	$62.2^{0°}$	$124^{20°}$	i. HNO_3
2236	$2.867^{27°}$	....	....	$53^{0°}$	$138^{98°}$	....

Strontianite 2213
Strontium bichromate 2220
Strontium bisulfate 2250
Strontium fluosilicate 2248

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Strontium			
2237	nitrite	$Sr(NO_2)_2 \cdot H_2O$	197.66	col. cr.
2238	oxalate	$SrC_2O_4 \cdot H_2O$	193.67	col. cr.
2239	oxide (strontia)	SrO	103.63	col., cb., 1.870
2240	perchlorate	$Sr(ClO_4)_2$	286.54	col. cr.
2241	permanganate	$Sr(MnO_4)_2 \cdot 3H_2O$	379.54	purple, cb.
2242	peroxide	SrO_2	119.63	wh. pd.
2243	peroxide	$SrO_2 \cdot 8H_2O$	263.76	wh. cr.
2244	phosphate, dibasic	$SrHPO_4$	183.62	rhb., 1.62±
2245	salicylate	$Sr(C_7H_5O_3)_2 \cdot 2H_2O$	397.88	col. cr.
2246	selenate	$SrSeO_4$	230.59	rhb.
2247	silicate	$SrSiO_3$	163.69	col., hex., 1.599
2248	silicofluoride	$SrSiF_6 \cdot 2H_2O$	265.72	mn.
2249	sulfate (celestite)	$SrSO_4$	183.69	col., rhb., 1.6237
2250	sulfate, acid	$Sr(HSO_4)_2$	281.77	col., granular
2251	sulfide, mono-	SrS	119.69	wh. or gray, cb., 2.107
2252	sulfide, tetra-	$SrS_4 \cdot 6H_2O$	323.97	red-wh. cr.
2253	sulfite	$SrSO_3$	167.69	wh. cr.
2254	tartrate	$SrC_4H_4O_6 \cdot 4H_2O$	307.77	mn.
2255	thiocyanate	$Sr(CNS)_2 \cdot 3H_2O$	257.83	delq.
2256	thiosulfate	$SrS_2O_3 \cdot 5H_2O$	289.83	mn.
2257	tungstate	$SrWO_4$	335.55	wh., tet.
2258	**Sulfamic acid**	NH_2SO_3H	97.09	wh., rhb.
2259	**Sulfur,** amorphous	S	32.06	pa. yel. pd., 2.0-2.9
2260	**Sulfur,** monoclinic	S_8	256.48	pa.yel., mn.
2261	**Sulfur,** rhombic	S_8	256.48	pa. yel., rhb.
2262	**Sulfur** bromide, mono-	S_2Br_2	223.95	red, fuming lq.
2263	chloride, mono-	S_2Cl_2	135.03	red-yel. lq.
2264	chloride, di-	SCl_2	102.97	dark red fuming lq.
2265	chloride, tetra-	SCl_4	173.89	yel.-brn. lq.
2266	chloroiodide	SCl_7I	407.18	red-yel. pr.
2267	fluoride, hexa-	SF_6	146.06	col. gas
2268	iodide, hexa-	SI_6	793.58	gray-bk. cr.
2269	oxide, sesqui-	S_2O_3	112.12	blue-gn. cr.
2270	oxide, di-	SO_2	64.06	col. gas
2271	oxide, tri-(α)	SO_3	80.06	col. pr.
2272	oxide, tri-(β)	$(SO_3)_2$	160.12	col., silky nd.
2273	oxide, hepta-	S_2O_7	176.12	nd. or lq.
2274	oxytetrachloride, mono-	S_2OCl_4	221.95	dark red lq.
2275	oxydichloride, penta-	$SO_3 \cdot SO_2Cl_2$	215.03	col. lq.
2276	oxytetrachloride, tri-	$S_2O_3Cl_4$	253.95	rhb.
2277	**Sulfuric acid**	H_2SO_4*	98.08	col., viscous lq.
2278	**Sulfuric acid**	$H_2SO_4 \cdot H_2O$	116.09	pr. or lq.
2279	**Sulfuric acid**	$H_2SO_4 \cdot 2H_2O$	134.11	col. lq.
2280	**Sulfuric acid,** pyro-	$H_2S_2O_7$	178.14	cr.
2281	**Sulfuric** oxychloride	SO_2Cl_2	134.97	col. lq.
2282	oxyfluoride	SO_2F_2	102.06	col. gas

* Usual commercial form.

Strontium sulfhydrate 2226
Strontium sulfocyanate 2255
Strontium sulfocyanide 2255
Strontium white 2249
Struvite 1174
Sugar of lead 1041
Sulfurated lime 485
Sulfur dioxide 2270

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2237	$2.408_{0}^{0°}$	$-H_2O$, >100	d. 240	$58.9^{0°}$	$182^{100°}$	$0.42^{20°}$, 90% al.
2238	....	$-H_2O$, 150	....	$0.005^{18°}$	$5^{100°}$	s. HCl, HNO_3
2239	4.7	2430	....	forms $Sr(OH)_2$	....	sl. s. al.; i. et.
2240	....	....	....	$310^{25°}$	v. s.	212 m. al.; 181 al; i. et.
2241	....	d.	....	$270^{0°}$	$291^{18°}$	....
2242	....	d.	....	$0.008^{20°}$	d.	s. al., NH_4Cl; i. act.
2243	....	$-8H_2O$, 100	d.	$0.018^{20°}$	d.	s. al.; i. NH_4OH
2244	$3.544^{15°}$	....	....	i.	i.	s. a., NH_4 salts
2245	....	d.	....	$5.6^{25°}$	$28.6^{100°}$	$1.5^{25°}$, $9.5^{78°}$ al.
2246	4.25	....	....	i.	i.	s. h. HCl; i. c. HNO_3
2247	$3.65_{4}^{25°}$	1580	....	i.	i.	....
2248	$2.99^{17.5°}$	d.	....	$3.2^{15°}$	d.	$0.06^{15°}$, 50% al.; s. HCl
2249	3.96	1580 d.	....	$0.0113^{0°}$	$0.0114^{32°}$	sl. s. a.; i. dil. H_2SO_4, al.
2250	....	d.	....	d.	....	$14^{70°}$ H_2SO_4
2251	$3.70^{15°}$	....	....	s. d.	....	s. al.; i. act.; d. a.
2252	....	25	....	s.	....	s. al.
2253	....	d.	....	$0.0033^{17°}$	....	v. s. H_2SO_3
2254	$1.966_{4}^{20°}$	....	....	$0.11^{0°}$	$0.76^{85°}$	....
2255	....	$-3H_2O$, 100	d. 160	v. s.	....	v. s. al.
2256	$2.17^{17°}$	$-4H_2O$, 100	....	$9.5^{0°}$	$57^{100°}$	i. al.
2257	6.184	d.	....	$0.14^{15°}$	....	....
2258	$2.03_{4}^{12°}$	205 d.	....	$20^{0°}$	$40^{70°}$	sl. s. al., act.; i. et.
2259	2.046	120	444.6	i.	i.	sl. s. CS_2
2260	1.96	119.0	444.6	i.	i.	s. CS_2, al.
2261	2.07	112.8	444.6	i.	i.	$24^{0°}$, $181^{55°}$ CS_2
2262	2.635	−46	$54^{0.18mm}$	d.	....	....
2263	1.687	−80	138	d.	....	s. CS_2, et., bz.
2264	$1.621_{15}^{15°}$	−78	59	d.	....	d. al.
2265	....	−30	d. > −20	d.	....	....
2266	....	d.	....	d.	....	....
2267	lq., $1.79^{-39°}$; $5.11^{20°}$(A)	−50.8 (under press.)	subl. −63.5	v. sl. s.	....	s. KOH; sl. s. al.
2268	....	....	....	....	d.	s. CS_2
2269	....	d. 70	....	d.	....	d. al., et.
2270	lq., $1.434^{0°}$; 2.264(A)	−75.5	−10.0	$22.8^{0°}$	$4.5^{50°}$	s. H_2SO_4; al., ac.
2271	lq., 1.923; 2.75(A)	16.83	44.6	d.	....	s. H_2SO_4
2272	$1.97^{20°}$	50	....	forms H_2SO_4	....	s. H_2SO_4
2273	....	0	subl. 10	d.	....	s. H_2SO_4
2274	$1.656^{0°}$	....	60	d.	....	d. al., HCl
2275	1.837	−37.5	153^{752mm}	d.	....	d. HBr. HI
2276	....	57 d.	subl.	d.	....	....
2277	$1.834_{4}^{18°}$	10.49	d. 340	∞	∞	d. al.
2278	$1.842_{4}^{15°}$	8.62	290	∞	∞	d. al.
2279	$1.650_{4}^{0°}$	−38.9	167	∞	∞	d. al.
2280	$1.9^{20°}$	35	d.	d.	....	d. al.
2281	$1.667_{4}^{20°}$	−54.1	69.1^{760mm}	d.	....	s. ac.; d. al.
2282	....	−120	−52	$10^{9°}$	....	s. alk.; i. conc. H_2SO_4

Sulfuret 485
Sulfuretted hydrogen 956
Sulfur gold 159
Sulfuric (acid) anhydride 2271
Sulfur monochloride 2263
Sulfurous oxide 2270
Sulfur subchloride 2263
Sulfur trioxide 2271

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
2283	**Sulfurous** oxybromide	$SOBr_2$	207.89	or.-yel. lq.
2284	oxychloride	$SOCl_2$	118.97	col. lq.
2285	oxyfluoride	SOF_2	86.06	col. gas
2286	**Tantalum**	Ta	180.88	bk.-gray, cb.
2287	bromide	$TaBr_5$	580.46	yel. cr.
2288	chloride	$TaCl_5$	358.17	lt. yel. pr.
2289	fluoride	TaF_5	275.88	tet.
2290	nitride	Ta_3N_5	612.68	red, amor.
2291	oxide, di-	Ta_2O_2(?)	393.76	brn. pd.
2292	oxide, tetra-	Ta_2O_4	425.76	dark gray
2293	oxide, penta-	Ta_2O_5	441.76	wh., rhb.
2294	sulfide	Ta_2S_4	490.00	dark gray
2295	**Telluric acid**	H_2TeO_4	193.63	wh.
2296	**Telluric acid**	$H_2TeO_4 \cdot 2H_2O$	229.66	col., cb. or mn.
2297	**Tellurium**	Te	127.61	met., hex.
2298	bromide, di-	$TeBr_2$	287.44	gray nd.
2299	bromide, tetra-	$TeBr_4$	447.27	or. pr.
2300	chloride, di-	$TeCl_2$	198.52	bk. cr.
2301	chloride, tetra-	$TeCl_4$	269.44	yel., delq.
2302	hydride	TeH_2	129.63	col. gas
2303	hydroxide	$Te(OH)_6$	229.66	cb.
2304	iodide, di-	TeI_2	381.45	bk. cr.
2305	iodide, tetra-	TeI_4	635.29	gray cr.
2306	nitrate, basic	$4TeO_2 \cdot N_2O_5 \cdot 1\frac{1}{2}H_2O$	773.48	rhb.
2307	oxide, mono-	TeO	143.61	bk., amor.
2308	oxide, di- (tellurite)	TeO_2	159.61	wh., tet. or rhb.
2309	oxide, tri-	TeO_3	175.61	or. cr.
2310	oxysulfate	$(TeO_2)_2SO_3$	399.28	rhb.
2311	**Tellurous acid**	H_2TeO_3	177.63	wh., rhb. or mn.
2312	**Terbium**	Tb	159.20	....
2313	chloride	$TbCl_3$	265.57	col. nd.
2314	nitrate	$Tb(NO_3)_3 \cdot 6H_2O$	453.32	mn.
2315	oxide	Tb_2O_3	366.40	or., amor.
2316	**Thallium**	Tl	204.39	blue-wh., tet.
2317	acetate	$TlC_2H_3O_2$	263.43	silky nd.
2318	azide (ous) (nitride)	TlN_3	246.41	pa. yel., tet.
2319	bromide, mono-	TlBr	284.31	pa. yel., cb., 2.4–2.8
2320	bromide, di-	$TlBr_2$	364.22	yel. nd.
2321	bromide, tri-	$TlBr_3 \cdot 4H_2O$	516.20	yel., delq.
2322	carbonate	Tl_2CO_3	468.79	wh., mn.
2323	chlorate	$TlClO_3$	287.85	nd.
2324	chloride, mono-	TlCl	239.85	wh., cb.
2325	chloride, sesqui-	Tl_2Cl_3	515.15	yel., hex.
2326	chloride, tri-	$TlCl_3$	310.76	hex. pl.
2327	chloride, tri-	$TlCl_3 \cdot 4H_2O$	382.83	nd.
2328	chloroplatinate	Tl_2PtCl_6	816.75	pa. or.

Sulfuryl chloride 2281
Sulfuryl fluoride 2282
Superphosphate 462
Swedish green 724
Syeporite 693
Sylvine 1663
Sylvite 1663
Syngenite 472
Szmikite 1289
Table salt 2049
Tabular spar 476
Talc(um) 1221
Tarapacaite 1673
Tarcanum sal de duobus 1760
Tartar 1771
Tartar, neutral 1770
Tartar, soluble 1770
Tartar emetic 161
Tartar salt 1659
Tartaric acid, cf. organic table
Tartarus 1770

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2283	$2.68^{18°}$	−50	68^{40mm}	d.	....	s. bz., CS_2, CCl_4; d. act.
2284	1.638	−104.5	78.8	d.	....	s. bz., chl.
2285	lq., 2.93	−110	−30	d.	....	s. bz., et., $AsCl_3$
2286	16.6	2850	>4100	i.	i.	s. fused alk., HF; i. HCl, HNO_3, H_2SO_4
2287	4.67	240	320	d.	....	s. al., m. al.
2288	$3.68^{27°}$	221	242	d.	....	s. abs. al.; d. H_2SO_4
2289	4.74	96.8	229.5^{760mm}	s.	....	s. HF, HCl
2290	....	ign.	....	i.	....	s. HNO_3+HF; i. a.
2291	7.35	oxidizes	....	i.	....	i. HNO_3+HF, a.
2292	....	oxidizes	....	i.	....	i. a.
2293	$8.735^{61.3°}_{4}$	1470 d.	....	i.	i.	s. fused $KHSO_4$; i. a.
2294	....	oxidizes	....	i.	i.	sl. s. HF, HNO_3; i. HCl
2295	$3.44^{19.2°}$	d. 160	....	slowly s.	s.	i. c. a., alk.
2296	3.06	$-2H_2O$, 130	....	$19.7^{0°}$	$258.5^{100°}$	s. a., alk.; i. al.
2297	(α) 6.24; (β) 6.00	452	1390	i.	i.	s. H_2SO_4, HNO_3, KCN, KOH, aq. reg.; i. CS_2
2298	....	280	339	d.	....	sl. s. tart. a.
2299	$4.31^{15°}_{4}$	380	421	v. s.	d. excess aq.	s. aq. tart. a.
2300	7.05	175	324	d.	....	d. a., alk.
2301	$2.56^{232°}$; $9.2^{441°}$(A)	224	414	d.	....	s. dil. HCl; i. CS_2
2302	$2.57^{-20°}_{4}$	−48	0^{760mm}	s.	....	s. alk., al.
2303	$3.053^{20°}_{4}$	....	....	....	....	....
2304	....	....	....	i.	i.	d. HCl, NH_4Cl
2305	$8.403^{15°}_{4}$	259	....	sl. s.	d.	s. HI; d. al.
2306	....	−NO, 190	....	d.	....	s. HNO_2
2307	....	oxidizes	....	i.	i.	s. HCl, H_2SO_4
2308	tet. $5.66^{0°}$; rhb. $5.89^{0°}$	....	subl. 450	0.00067	....	s. a., alk.; i. CS_2
2309	$5.08^{10.5°}$	d.	....	i.	i.	s. h. conc. KOH; i. a.
2310	4.7	d. 500	....	d.	....	....
2311	3.05	$-H_2O$, 40	....	sl. s.	d.	s. a., alk.
2312	....	....	....	....	....	....
2313	$4.35^{0°}_{4}$	588	....	s.	....	s. al.
2314	....	89.3	....	s.	....	....
2315	....	....	....	i.	....	s. dil. a.
2316	11.85	303.5	1650	i	i.	s. HNO_3, H_2SO_4; i. NH_3
2317	3.68	110	....	v. s.	....	v. s. al.
2318	....	334	expl. 430	sl. s.	s.	....
2319	$7.557^{17.3°}_{4}$	460	815	$0.024^{0°}$	$0.25^{70°}$	i. act.
2320	....	....	....	d.	....	....
2321	....	40	d. in air	s.	v. s.	v. s. al.
2322	7.11	272	....	$4.2^{15.5°}$	$27.2^{100°}$	i. et., act., abs. al.
2323	$5.047^{9°}$	....	....	$2.8^{0°}$	$57.3^{100°}$	....
2324	7.00	430	806	$0.21^{0°}$	$1.8^{100°}$	sl. s. HCl; i. al., NH_4OH
2325	5.9	400-500	d.	$0.26^{15°}$	$1.9^{100°}$	....
2326	....	25	d.	v. s.	....	s. al., et.
2327	....	37	$-4H_2O$, 100	$86.2^{17°}$	d.	s. al., et.
2328	$5.76^{17°}$	....	....	$0.0064^{15°}$	$0.05^{100°}$	....

Tasteless salt 2119
Tellurite 2308
Tenorite 749
Terbia 2315
Terra alba 483
Tertiary potassium phosphate 1736
Tertiary sodium phosphate 2123
Tetraethyl lead cf. table of organic compounds.
Tetrapotassium pyrophosphate 1739
Tetrasilane 1942
Tetrasodium pyrophosphate 2126
Thallium alum 50
Thallium aluminum sulfate 50
Thallium bichromate 2331
Thallium bisulfate 2356

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Thallium			
2329	chromate	Tl_2CrO_4	524.79	yel. cr.
2330	cyanide	$TlCN$	230.41	pl.
2331	dichromate	$Tl_2Cr_2O_7$	624.80	red cr.
2332	dithionate	$Tl_2S_2O_6$	568.90	mn.
2333	ferrocyanide	$Tl_4Fe(CN)_6 \cdot 2H_2O$	1065.55	yel., tri.
2334	fluoride, mono-	TlF	223.39	col., cb.
2335	fluoride, tri-	TlF_3	261.39	olive gn.
2336	hydroxide, meta- (ic)	$TlO \cdot OH$	237.40	red-brn. cr.
2337	hydroxide (ic)	$Tl(OH)_3$	255.41	brn., hex.
2338	hydroxide (ous)	$TlOH$	221.40	pa. yel.
2339	iodide, mono-	TlI	331.31	yel., rhb.; red, cb. 2.78
2340	iodide, sesqui-	Tl_2I_3	789.54	bk. nd.
2341	iodide, tri-	TlI_3	585.15	bk., rhb.
2342	nitrate (ic)	$Tl(NO_3)_3 \cdot 3H_2O$	444.46	col. cr.
2343	nitrate (ous) (α)	$TlNO_3$	266.40	cb.
2344	nitrate (ous) (β)	$TlNO_3$	266.40	trig.
2345	nitrate (ous) (γ)	$TlNO_3$	266.40	rhb., 1.82 ±
2346	oxide (ic)	Tl_2O_3	456.78	bk. or brn., hex.
2347	oxide (ous)	Tl_2O	424.78	yel., delq.
2348	perchlorate	$TlClO_4$	303.85	rhb.
2349	phosphate	Tl_3PO_4	708.19	wh. nd.
2350	phosphate, pyro-	$Tl_4P_2O_7$	991.52	mn.
2351	selenate	Tl_2SeO_4	551.74	rhb., 1.9592
2352	selenide	Tl_2Se	487.74	dark gray leaflets
2353	silicofluoride	$Tl_2SiF_6 \cdot 2H_2O$	586.87	cb.
2354	sulfate (ic)	$Tl_2(SO_4)_3 \cdot 7H_2O$	823.07	lf.
2355	sulfate (ous)	Tl_2SO_4	504.84	col., rhb., 1.8671
2356	sulfate, acid	$TlHSO_4$	301.46	trimorphous
2357	sulfide (ic)	Tl_2S_3	504.96	bk., amor.
2358	sulfide (ous)	Tl_2S	440.84	blue-bk., tet.
2359	sulfite (ous)	Tl_2SO_3	488.84	pa. yel. cr.
2360	telluride (ous)	Tl_2Te	536.39	....
2361	thiocyanate	$TlCNS$	262.47	tet. nd.
2362	vanadate	$TlVO_3$	303.34	dark gray cr.
2363	vanadate, pyro-	$Tl_4V_2O_7$	1031.46	....
2364	**Thio** cf. sulfo or sulfur	....	......	....
2365	**Thorium**	Th	232.12	cb.
2366	boride	ThB_4	275.40	yel. pr.
2367	boride	ThB_6	297.04	vl., amor.
2368	bromide	$ThBr_4$	551.78	wh. cr.
2369	carbide	ThC_2	256.14	yel. cr.
2370	chloride	$ThCl_4$	373.95	col., delq., rhb.
2371	fluoride	$ThF_4 \cdot 4H_2O$	380.18	wh. pd.
2372	hydroxide	$Th(OH)_4$	300.15	wh. pd. or gelatinous

Thallium fluosilicate 2353
Thallium nitride 2318
Thallium sulfocyanate 2361
Thallium sulfocyanide 2361
Thenardite 2145
Thermonatrite 2043
Thio-bismol 2027
Thionyl bromide 2283
Thionyl chloride 2284

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2329	....	....	....	$0.03^{60\circ}$	$0.2^{100\circ}$	sl. s. a., alk.; i. ac.
2330	....	d.	....	$16.8^{28.5\circ}$	....	....
2331	....	....	....	i.	....	d. a., aq. $Na_2S_2O_3$
2332	$5.57^{20\circ}_{4}$	d.	....	$41.8^{18.5\circ}$	....	....
2333	4.641	....	....	$0.37^{18\circ}$	$3.93^{101\circ}$	....
2334	....	....	298 ±	$80^{15\circ}$	v. s.	sl. s. al.; i. NH_3
2335	....	....	....	i.	....	i. c. HCl
2336	....	$-H_2O$, 115	....	i.	....	s. a., NH_4 salts; i. alk.
2337	....	>340	....	i.	....	v. s. dil. a.
2338	....	d. 100	....	$25.4^{0\circ}$	$148.3^{100\circ}$	s. al.
2339	$7.09^{14.7\circ}_{4}$	440	824	$0.002^{0\circ}$	$0.120^{100\circ}$	s. aq. reg.; i. KI, al., act.
2340	....	....	....	i.	....	sl. s. al.
2341	....	....	....	....	....	s. al., et.
2342	....	d. <100	....	s.	d. excess aq.	....
2343	....	206	430	$3.9^{0\circ}$	$414^{100\circ}$	....
2344	....	tr. to α at 145	....	$9.55^{20\circ}$	$30.4^{50\circ}$	....
2345	$5.556^{21.4\circ}_{4}$	tr. to β at 75	....	$3.91^{0\circ}$	$414^{100\circ}$	s. act.; i. al.
2346	bk., $10.19^{22\circ}$ brn., $9.65^{21\circ}$	759	−2O, 875	i.	i.	s. a.; i. alk.
2347	....	300	−O, 1865	v. s.	v. s.	s. al., d. a.
2348	4.89	501	d.	$6^{0\circ}$	$166.6^{100\circ}$	sl. s. al.
2349	$6.89^{10\circ}$	....	....	$0.5^{15\circ}$	$0.67^{100\circ}$	sl. s. NH_4 salts; i. al.
2350	$6.786^{20\circ}_{4}$	>120	....	40	....	....
2351	6.875	>400	....	$2.13^{9.3\circ}$	$10.86^{100\circ}$	i. al., et.
2352	....	340	....	i.	....	i. a.
2353	....	....	....	v. s.	....	d. NH_4OH
2354	....	$-6H_2O$, 200	d.	d.	d.	s. dil. H_2SO_4
2355	6.77	632	d.	$2.70^{0\circ}$	$18.45^{100\circ}$	....
2356	....	115 d.	....	....	....	v. sl. s. dil. H_2SO_4
2357	....	12........	d.	i.	i.	s. H_2SO_4; i. CS_2
2358	8.0	448	d.	$0.022^{20\circ}$	sl. s.	s. a.; i. alk., act.
2359	$6.416^{20\circ}$	....	....	$3.34^{15\circ}$	v. s.	i. al.
2360	....	412	....	i.	....	d. a.
2361	....	....	....	$0.315^{20\circ}$	$0.727^{40\circ}$	i. al.
2362	$6.09^{17\circ}$	424	....	$0.087^{11\circ}$	$0.21^{100\circ}$	....
2363	$8.21^{18.5\circ}_{4}$	454	....	$0.2^{14\circ}$	$0.26^{100\circ}$	....
2364	....	....	....	....	....	....
2365	11.4	1845	>3000	i.	i.	s. HCl, H_2SO; sl. s. HNO_3; i. HF, alk.
2366	$7.5^{15\circ}$	....	....	i.	i.	s. HCl, HNO_3, h. H_2SO_4
2367	$6.4^{15\circ}$	....	....	i.	i.	s. HNO_3; i. HCl, H_2SO_4, HF, aq. alk.
2368	5.67	subl. 610	725	s.	d.	d. F_2
2369	8.96	ign.	5000	d.	....	v. sl. s. conc. a.; d. dil. a.
2370	4.59	820	....	v. s.	v. s.	s. KCl, al., et.
2371	....	$-H_2O$, 100	$-2H_2O$, 150	sl. s.	i.	i. HF
2372	....	d.	....	i.	i.	s. a.; i. $H_2C_2O_4$, HF, NH_4OH, alk.

Thionyl fluoride 2285
Thiophosgene 507
Thiostannic acid 2175

Thorianite 2376
Tiemannite 1330
Tiff 284

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Thorium			
2373	iodide	ThI_4	739.80	unstable, pr.
2373.1	nitrate	$Th(NO_3)_4 \cdot 4H_2O$	552.22	wh., delq. cr.
2374	nitrate	$Th(NO_3)_4 \cdot 12H_2O$	696.34	delq.
2375	oxalate	$Th(C_2O_4)_2$	408.16	wh. cr.
2376	oxide, di- (thorianite)	ThO_2	264.12	wh., cb.
2377	oxide, per-	Th_2O_7	576.24	wh., gelatinous
2378	phosphate, meta-	$Th(PO_3)_4$	548.04	col., rhb.
2379	platinocyanide	$Th[Pt(CN)_4]_2 \cdot 16H_2O$	1118.98	yel.-gn., rhb.
2380	sulfate	$Th(SO_4)_2$	424.24	....
2381	sulfate	$Th(SO_4)_2 \cdot 9H_2O$	586.38	mn. pr.
2382	sulfide	ThS_2	296.24	yel., brn., or bk.
2383	**Thulium**	Tm	169.40	....
2384	**Tin**	Sn	118.70	silv. met., tet.
2385	**Tin**	Sn	118.70	gray, cb.
2386	**Tin salts** cf. stannic and stannous	....	......	....
2387	**Titanic acid**	H_2TiO_3	97.92	wh. pd.
2388	**Titanium**	Ti	47.90	dark gray, cb.
2389	bromide, tetra-	$TiBr_4$	367.56	amber yel., delq.
2390	carbide	TiC	59.91	met., cb.
2391	chloride, di-	$TiCl_2$	118.81	bk., delq.
2392	chloride, tri-	$TiCl_3$	154.27	vl., delq.
2393	chloride, tetra-	$TiCl_4$*	189.73	col. lq.
2394	fluoride, tri-	TiF_3	104.90	vl.-red
2395	fluoride, tetra-	TiF_4	123.90	wh. pd.
2396	iodide, tetra-	TiI_4	555.58	red, cb.
2397	nitrate	$5TiO \cdot N_2O_5 \cdot 6H_2O$	615.61	pl.
2398	oxalate	$Ti_2(C_2O_4)_3 \cdot 10H_2O$	540.02	yel. pr.
2399	oxide, di- (anatase)	TiO_2	79.90	brn. or bk., tet., 2.534–2.564
2400	oxide, di- (brookite)	TiO_2	79.90	brn. or bk., rhb., 2.586
2401	oxide, di- (rutile)	TiO_2	79.90	col. if pure, tet., 2.615
2402	oxide, sesqui-	Ti_2O_3	143.80	bk. or red, trig.
2403	oxide, per-	TiO_3	95.90	yel.
2404	phosphate, pyro-	TiP_2O_7	221.86	col., cb.
2405	phosphide	TiP	78.88	gray met.
2406	sulfate	$Ti_2(SO_4)_3$	383.98	gn., delq.
2407	**Tungsten**	W	183.92	gray-bk., cb.
2408	arsenide	WAs_2	333.74	bk. cr.
2409	boride	WB_2	205.56	octahedral
2410	bromide, di-	WBr_2	343.75	blue-bk. pd.
2411	bromide, penta-	WBr_5	583.50	vl.-brn. nd.
2412	carbide	WC	195.93	gray pd., cb.
2413	carbide	W_2C	379.85	iron gray

* Usual commercial form.

Tin ash 2182
Tin bichloride 2178
Tin crystals 2191
Tin oxide 2182
Tin perchloride 2178
Tin prepare liquor 2143
Tin protochloride 2190
Tin protoxide 2198
Tin salt 2191
Tin tetrachloride 2178
Titanium dioxide 2399
Titanium potassium fluoride 1692
Titanium tetrachloride 2393

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2373	....	d.	....	s.	....	....
2373.1	....	....	....	v. s.	v. s.	v. s. al.
2374	....	....	....	v. s.	....	v. s. al.
2375	$4.637^{16°}$	d.	....	$0.0017^{17°}$	$0.0017^{50°}$	s. h. aq. $(NH_4)_2C_2O_4$
2376	9.69	>2800	4400	i.	....	s. h. H_2SO_4; i. alk.
2377	....	....	....	i.	....	....
2378	$4.08^{16°}$	....	....	....	....	....
2379	2.460	....	....	sl. s.	s.	....
2380	$4.225^{17°}$	....	....	$0.74^{0°}$	$5.22^{50°}$	....
2381	2.77	$-9H_2O$, 400	....	sl. s.	sl. s.	....
2382	6.8	d.	ign. in air	i.	i.	s. h. aq. reg.; sl. s. a.
2383	....	....	....	i.	i.	....
2384	7.31	231.85	2260	i.	i.	s. HCl, H_2SO_4, dil. HNO_3, h. aq. KOH
2385	5.750	stable −163 to +18	2260	i.	i.	s. a., h. alk. solns.
2386	....	....	....	....	....	....
2387	....	....	....	i.	i.	s. alk.; v. sl. s. dil. a.; i. al.
2388	$4.50^{17.5°}$	1800	>3000	i.	d.	s. a.
2389	2.6	39	230	d.	....	s. abs. al., abs. et.
2390	$4.25^{20°}_{4}$	3180	4300	....	....	s. HNO_3; i. HCl
2391	....	unstable in air	....	d.	....	i. CS_2, et., chl.
2392	....	d. 440	....	s.	s.	....
2393	lq., 1.726	−30	136.4	s.	d.	s. dil. HCl
2394	....	....	....	s.	d.	....
2395	$2.798^{20.5°}$	....	284	s.	....	s. H_2SO_4, pyr., al.; i. et.
2396	....	150	>360	v. s.	d.	HI forms H_2TiI_6
2397	....	....	....	s.	d.	....
2398	....	....	....	s.	s.	i. al., et.
2399	3.84	....	....	i.	i.	sl. s. alk.
2400	4.17	....	....	i.	i.	....
2401	4.26	1640 d.	<3000	i.	i.	s. H_2SO_4, alk.
2402	4.6	2130	oxidizes	i.	i.	s. H_2SO_4; i. HCl, HNO_3
2403	....	....	....	....	....	s. a.
2404	3.106	....	....	....	....	....
2405	$3.95^{25°}_{4}$	....	....	i.	i.	i. a.
2406	....	....	....	i.	i.	s. dil. a.; i. al., et.
2407	19.3	3370	5900	i.	i.	s. h. conc. KOH; sl. s. NH_3, HNO_3, aq. reg.
2408	$6.9^{18°}$	....	....	i.	i.	d. h. HNO_3, h. H_2SO_4
2409	10.8	....	....	i.	i.	s. aq. reg.
2410	....	d. 400	....	forms WO_2	....	....
2411	....	276	333	d.	....	s. HCl, alk., abs. al., et., chl.
2412	$15.7^{18°}$	2777	6000	i.	i.	s. F_2; i. a.
2413	$16.06^{18°}$	2877	6000	i.	i.	s. h. HNO_3; sl. s. HCl, H_2SO_4

Tricalcium phosphate 464
Tripolite 1947
Tripotassium phosphate 1736
Trisilane 1941
Trisodium phosphate 2123, 2124
Trona 2046
Trydimite 1951
Tschermigite 39
TSP 2124
TSPP 2126
Tungstenite 2431
Tungsten white 292

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Tungsten			
2414	chloride, di-	WCl_2	254.83	gray, amor.
2415	chloride, tetra-	WCl_4	325.75	gray brn., delq.
2416	chloride, penta-	WCl_5	361.21	dark gn., delq.
2417	chloride, hexa-	WCl_6	396.66	dark blue, cb.
2418	fluoride	WF_6	297.92	col. gas
2419	iodide	WI_2	437.76	brn. pd.
2420	oxide, di-	WO_2	215.92	brn., cb.
2421	oxide, tri-	WO_3	231.92	yel., rhb.
2422	oxydibromide	WO_2Br_2	375.75	red pr.
2423	oxydichloride	WO_2Cl_2	286.83	yel. tablets
2424	oxytetrabromide	$WOBr_4$	519.58	bk., delq.
2425	oxytetrachloride	$WOCl_4$	341.75	red nd.
2426	oxytetrafluoride	WOF_4	275.92	col. pl.
2427	phosphide	W_4P_2	797.64	dark gray
2428	phosphide	WP	214.90	gray pr.
2429	phosphide	WP_2	245.88	bk. cr.
2430	silicide	W_2Si_3	452.02	gray, met.
2431	sulfide, di- (tungstenite)	WS_2	248.04	dark gray cr.
2432	sulfide, tri-	WS_3	280.10	bk. pd.
2433	**Tungstic acid** (tungstite)	H_2WO_4	249.94	yel., rhb., 2.24
2434	**Uranic acid**	H_2UO_4	304.09	yel. pd.
2435	**Uranium**	U	238.07	wh. cr.
2436	bromide, tri-	UBr_3	477.82	dark brn. nd.
2437	bromide, tetra-	UBr_4	557.73	bk., delq.
2438	carbide	U_2C_3	512.14	cr.
2439	chloride, tri-	UCl_3	344.44	dark red nd.
2440	chloride, tetra-	UCl_4	379.90	gray, delq., cb.
2441	chloride, penta-	UCl_5	415.36	gray, delq. nd.
2442	fluoride, tetra-	UF_4	314.07	gn. pd.
2443	fluoride, hexa-	UF_6	352.07	yel., mn.
2444	iodide, tetra-	UI_4	745.75	bk. nd.
2445	oxide, di- (uraninite)	UO_2	270.07	bk., rhb.
2446	oxide (pitchblende)	U_3O_8	842.21	olive gn.
2447	oxide, tri-	UO_3	286.07	yel. pd.
2448	oxide, per-	$UO_4 \cdot 2H_2O$	338.10	yel. cr., hyg.
2449	sulfate (ous)	$U(SO_4)_2 \cdot 4H_2O$	502.25	gn., rhb.
2450	sulfide, di-	US_2	302.19	gray
2451	sulfide, sesqui-	U_2S_3	572.32	gray-bk.
2452	**Uranyl** acetate	$UO_2(C_2H_3O_2)_2 \cdot 2H_2O$	424.19	yel., rhb.
2453	ammonium carbonate	$UO_2CO_3 \cdot 2(NH_4)_2CO_3$	522.26	yel., mn., 1.62 ±
2454	ammonium pentafluoride	$UO_2(NH_4)_3F_5$	419.19	tet., 1.495
2455	bromide	UO_2Br_2	429.90	yel.-gn. nd.

Tungstic (acid) anhydride 2421
Tungstite 2433
Turnbull's blue 849
Turpeth 1333
Tutia 2539
Ultramarine yellow 233

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2414	....	unstable in air	....	d.	....	....
2415	4.624	d.	....	d.	....	....
2416	3.875	248	275.6	forms W_2O_5	....	v. sl. s. CS_2
2417	3.52	275	346.7	....	d.$^{60^\circ}$	v. s. CS_2, $POCl_3$
2418	149 (D)	2.5	19.5	d.	....	....
2419	6.9^{18°	....	....	i.	d.	s. alk. carb.; i. al., CS_2; d. fused KOH
2420	12.11	ign. in air	....	i.	i.	s. a., KOH
2421	7.16	>2130	....	i.	i.	s. alk.; i. a.
2422	....	....	d.	....	....	....
2423	....	266	....	s.	d.	s. alk.; d. NH_3
2424	....	277	327	d.	....	....
2425	11.92 (A)	211	227.5	d.	....	s. CS_2, S_2Cl_2; sl. s. bz.
2426	....	110	187	d.	....	....
2427	5.21	oxidizes at red heat	....	....	....	s. fused $Na_2CO_3+NaNO_3$; i. a., aq. reg.
2428	8.5	ign. in air	....	i.	....	s. HNO_3+HF; i. HCl, alk.
2429	5.8	d.	....	i.	i.	s. HNO_3+HF, aq. reg.; i. HCl, HF, al., et.
2430	10.9	....	....	i.	....	i. a.; d. Cl_2
2431	7.5^{10°	d. 1250	....	....	....	s. fused alk., HNO_3+HF
2432	....	....	....	sl. s.	s.	s. alk., alk. sulfides
2433	5.5	$-\frac{1}{2}H_2O$, 100; 1473	....	i.	sl. s.	s. HF, alk., NH_3
2434	5.926^{15°	$-H_2O$, 250 to 300	....	i.	i.	s. a., alk. carb.; i. alk.
2435	18.90^{25°	1150	3500	i.	i.	s. a.; i. alk.
2436	....	....	volt.	s.	....	....
2437	4.838^{21°	....	volt.	s.	s.	s. act.; i. al., et.
2438	11.28	2400	....	d.	....	d. a.
2439	$5.440^{25^\circ}_{4}$	....	....	v. s.	d.	s. HCl, ac.
2440	$4.725^{25^\circ}_{4}$	....	....	v. s.	d.	s. act., al., NH_4Cl; i. et.
2441	....	d. 120	....	d.	....	s. act., abs. al., a.; i. et., bz.
2442	....	1000	....	i.	....	s. conc. a.; i.dil. a.
2443	4.68^{21°	$69.2^{2\,atm}$	56.2^{765mm}	s.	....	s. chl., CCl_4; i. CS_2
2444	5.6^{15°	volt. at 500 in vac.	....	s.	s. d.	....
2445	10.9	2176	....	i.	i.	s. HNO_3, conc. H_2SO_4
2446	7.31	d.	....	i.	i.	s. HNO_3, H_2SO_4
2447	7.29	d.	....	i.	....	s. HNO_3; i. K tart.
2448	....	d. 115	....	0.0006^{20°	0.008^{90°	d. HCl
2449	....	$-4H_2O$, 300	....	23^{11°	9^{63°	s. dil. a.
2450	....	>1100	oxidizes	d.	....	s. con. HCl; d. HNO_3
2451	....	ign.	....	....	....	oxidized by aq. reg.; i. HCl, dil. HNO_3
2452	2.89^{15°	$-2H_2O$, 110	....	9.2^{17°	d.	s. al., act.
2453	....	d.	....	$5.55^{18.6^\circ}$	d.	s. $(NH_4)_2CO_3$, aq. SO_2
2454	3.186^{20°	volt.	....	s.	....	....
2455	....	....	....	s.	....	s. al., et.

Unslaked lime 459
Uraninite 2445
Uranium acetate 2452
Uranium nitrate 2462
Uranium oxide (improper) 2170

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Uranyl			
2456	carbonate (rutherfordine)	UO_2CO_3	330.08	tet.
2457	chloride	UO_2Cl_2	340.98	yel., delq.
2458	formate	$UO_2(HCO_2)_2 \cdot H_2O$	378.12	....
2459	iodate	$UO_2(IO_3)_2 \cdot H_2O$	637.93	rhb.
2460	iodate	$UO_2(IO_3)_2$	619.91	yel., rhb.
2461	iodide	UO_2I_2	523.91	red, delq.
2462	nitrate	$UO_2(NO_3)_2 \cdot 6H_2O$	502.18	yel., rhb., 1.4967
2463	perchlorate	$UO_2(ClO_4)_2 \cdot 4H_2O$	541.05	....
2464	phosphate	$UO_2(HPO_4) \cdot 4H_2O$	438.12	yel., tet.
2465	potassium carbonate	$UO_2CO_3 \cdot 2K_2CO_3$	606.50	yel. cr.
2466	sodium carbonate	$UO_2CO_3 \cdot 2Na_2CO_3$	542.09	yel. cr.
2467	sulfate	$UO_2SO_4 \cdot 3H_2O$	420.18	yel. cr.
2468	sulfide	UO_2S	302.13	bk., tet.
2469	**Vanadic acid,** meta-	HVO_3	99.96	yel. scales
2470	**Vanadic acid,** pyro-	$H_4V_2O_7$	217.93	pa. yel., amor.
2471	**Vanadium**	V	50.95	lt. gray, cb.
2472	bromide, tri-	VBr_3	290.70	dark gray, delq.
2473	carbide	VC	62.96	cr. mass
2474	chloride, di-	VCl_2	121.86	gn., hex., delq.
2475	chloride, tri-	VCl_3	157.23	pink, tabular, delq.
2476	chloride, tetra-	VCl_4	192.78	red lq.
2477	fluoride, tri-	VF_3	107.95	gn., rhb.
2478	fluoride, tri-	$VF_3 \cdot 3H_2O$	162.00	dark gn., rhb.
2479	fluoride, penta-	VF_5	145.95	col. or yel.
2480	nitride	VN	64.96	brn.
2481	oxide, di-	V_2O_2	133.90	lt. gray cr.
2482	oxide, tri-	V_2O_3	149.90	bk. cr.
2483	oxide, tetra-	V_2O_4	165.90	blue cr.
2484	oxide, penta-	V_2O_5	181.90	red-yel., rhb.
2485	oxychloride, mono-	$VOCl$	102.41	brn. pd.
2486	silicide	VSi_2	107.07	met. pr.
2487	silicide	V_2Si	129.96	silv. pr.
2488	sulfide, di-	V_2S_2	166.02	bk. pl.
2489	sulfide, tri-	V_2S_3	198.08	bk. pl.
2490	sulfide, penta-	V_2S_5	262.20	bk. pd.
2491	**Vanadyl** bromide, mono-	$VOBr$	146.87	vl., octahedral
2492	bromide, di-	$VOBr_2$	226.78	yel.- brn., delq.
2493	bromide, tri-	$VOBr_3$	306.70	red lq.
2494	chloride	$(VO)_2Cl$	169.36	yel. cr.
2495	chloride, di-	$VOCl_2$	137.86	gn., delq.
2496	chloride, tri-	$VOCl_3$	173.32	yel. lq.
2497	sulfate (minasragrite)	$V_2O_4(SO_3)_3 \cdot 16H_2O$	694.34	blue, mn., 1.530
2498	**Water**†	H_2O	18.016	col. lq., $1.33300^{20°}$; hex. solid, 1.309

† Cf. special tables on water and steam.

Valentinite 150

Vanadyl chloride, mono- 2485

Variscite 27

Venetian red 824

Venus crystals 716

Verdigris, blue or green 717

Vermilion 1334

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2456	5. 6	....	....	....	....	....
2457	....	....	d.	320^{18°	v. s.	s. al., et.
2458	3.69^{19°	d. 110	....	8.2^{15°	....	....
2459	5.05^{18°	....	....	0.1214^{18°	0.237^{100°	sl. s. dil. HNO_3
2460	5.2	d. 250	....	s.	s.	i. HNO_3
2461	....	d. in air	....	....	....	s. al., et., bz.
2462	2.807	60.2	118	170.3^{0°	∞^{60°	v. s. ac., al., et.; i. dil. alk.
2463	....	110 d.	....	....	....	....
2464	....	....	....	i.	i.	s. aq. Na_2CO_3; i. ac.
2465	....	$-CO_2$, 300	....	7.4^{15°	d.	s. aq. K_2CO_3; i. al.
2466	....	....	....	sl. s.	....	i. al.
2467	$3.28^{16.5^\circ}$	d. 100	....	$18.9^{13.2^\circ}$	230^{25°	4 al.; s. a.
2468	....	d. 40 to 50	oxidizes in air >180	sl. s.	s. d.	s. al., dil. a.; i. abs. al.; d. aq. alk.
2469	....	....	....	i.	....	s. a., alk.; i. NH_3
2470	....	....	....	i.	....	s. a., alk., NH_4OH
2471	5.96	1710	3000	i.	i.	s. HNO_3, H_2SO_4; i. aq. alk.
2472	....	oxidizes	....	s.	....	s. al., et.; i. HBr
2473	5.36	2830	3900	i.	....	s. HNO_3, fused KNO_3; i. HCl, H_2SO_4
2474	3.23^{18°	....	....	s.	d.	s. al., et.
2475	3.00^{18°	d.	....	s.	d.	s. abs. al., et.
2476	1.816^{30°	−109	148.5^{755mm}	s. d.	....	s. abs. al., et., chl., ac.
2477	3.363^{19°	>800	subl.	v. sl. s.	sl. s.	i. al., chl., CS_2
2478	....	$-3H_2O$, 130	....	s.	v. s. d.	i. abs. al.
2479	2.177^{19°	....	111.2	s.	....	s. al., chl.; i. CS_2
2480	5.63	2050 d.	....	i.	....	....
2481	3.64	ign.	....	i.	i.	s. a.
2482	$4.87^{18^\circ}_{4}$	1970	....	sl. s.	s.	s. HNO_3, HF, alk.
2483	4.399	1967	....	i.	i.	s. a., alk.
2484	$3.357^{18^\circ}_{4}$	800	d. 1750	0.8^{20°	....	s. a., alk.; i. abs. al.
2485	2.824	....	....	i.	....	v. s. HNO_3
2486	4.42	1655	....	i.	i.	s. HF; i. a., alk., al., et.
2487	5.48^{17°	....	....	i.	i.	s. HF; i. al., et., a.
2488	4.20	oxidizes	....	....	....	s. HNO_3, h. H_2SO_4; sl. s. KSH; i. alk.
2489	4.7^{21°	oxidizes	....	....	....	s. h. conc. H_2SO_4, alk. sulf.; sl. s. alk.
2490	3.00	oxidizes	....	....	....	s. alk., alk. sulf., dil. HNO_3
2491	4.00^{18°	d. 480	....	v. sl. s.	....	....
2492	....	d. 360	....	s.	....	....
2493	$2.933^{14.5^\circ}$	d. 180	130^{100mm}	s.	....	....
2494	3.64	d. in air	....	i.	....	s. HNO[illegible]
2495	2.88^{13°	....	....	d.	....	s. abs. al., dil. HNO_3
2496	1.829	< −15	127.19	s. d.	....	s. al., et., ∞Br_2
2497	....	....	....	v. s.	d.	s. al.
2498	1.00^{4° (lq.); 0.915^{0° (ice)	0	100	....	....	∞al.; sl. s. et.

Vert de Mitis 718
Vert de Vienne 718
Vienna green 718

Villiaumite 2067
Vitreous copper ore 779
Vitreous silver ore 1998

Vitriol 2277
Vivianite 861

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
2499	**Water,** heavy	D_2O	20.029	col. lq., $1.32844^{20°}$
2500	**Xenon**	Xe	131.30	col. gas
2501	**Ytterbium**	Yb	173.04	....
2502	acetate	$Yb(C_2H_3O_2)_3 \cdot 4H_2O$	422.24	hex. pl.
2503	carbonate	$Yb_2(CO_3)_3 \cdot 4H_2O$	598.17	gelatinous
2504	chloride	$YbCl_3 \cdot 6H_2O$	387.51	gn., rhb.
2505	nitrate	$Yb(NO_3)_3 \cdot 4H_2O$	431.13	delq. cr.
2506	oxalate	$Yb_2(C_2O_4)_3 \cdot 10H_2O$	790.30	cr.
2507	oxide	Yb_2O_3	394.08	col.
2508	selenate	$Yb_2(SeO_4)_3 \cdot 8H_2O$	919.09	hex. pl.
2509	selenite	$Yb_2(SeO_3)_3$	726.96	....
2510	sulfate	$Yb_2(SO_4)_3$	634.26	....
2511	sulfate	$Yb_2(SO_4)_3 \cdot 8H_2O$	778.39	pr.
2512	**Yttrium**	Y	88.92	dark gray, hex.
2513	bromate	$Y(BrO_3)_3 \cdot 9H_2O$	634.81	hex. pr.
2514	bromide	YBr_3	328.67	....
2515	bromide	$YBr_3 \cdot 9H_2O$	490.81	delq. tablets
2516	carbonate	$Y_2(CO_3)_3 \cdot 3H_2O$	411.92	....
2517	chloride	YCl_3	195.29	wh. pl.
2518	chloride	$YCl_3 \cdot H_2O$	213.31	....
2519	chloride	$YCl_3 \cdot 6H_2O$	303.39	delq., rhb.
2520	fluoride	$YF_3 \cdot \frac{1}{2}H_2O$	154.93	wh., gelatinous
2521	hydroxide	$Y(OH)_3$	139.94	wh., gelatinous
2522	iodide	YI_3	469.68	delq.
2523	molybdate	$Y_2(MoO_4)_3$	657.69	yel., tet., 2.03
2524	nitrate	$Y(NO_3)_3 \cdot 3H_2O$	328.99	pr.
2525	nitrate	$Y(NO_3)_3 \cdot 6H_2O$	383.04	tri.
2526	oxalate	$Y_2(C_2O_4)_3 \cdot 9H_2O$	604.04	wh. pd.
2527	oxide	Y_2O_3	225.84	wh. cr.
2528	sulfate	$Y_2(SO_4)_3$	466.02	col.
2529	sulfate	$Y_2(SO_4)_3 \cdot 8H_2O$	610.15	col., mn., 1.5490
2530	**Zinc**	Zn	65.38	silv. met., hex.
2531	acetate	$Zn(C_2H_3O_2)_2$	183.47	mn.
2532	acetate	$Zn(C_2H_3O_2)_2 \cdot 2H_2O$*	219.50	wh., mn., 1.494
2533	amide	$Zn(NH_2)_2$	97.43	wh., amor.
2534	ammonium sulfate	$ZnSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	401.68	col., mn.
2535	arsenate (koettigite)	$Zn_3(AsO_4)_2 \cdot 8H_2O$	618.09	col., mn., 1.683
2536	arsenide	Zn_3As_2	345.96	cb.
2537	bromate	$Zn(BrO_3)_2 \cdot 6H_2O$	429.31	cb., 1.5452
2538	bromide	$ZnBr_2$	225.21	rhb.
2539	carbonate	$ZnCO_3$	125.39	wh., trig., 1.818
2540	chlorate	$Zn(ClO_3)_2 \cdot 6H_2O$	340.39	mn., delq.
2541	chloride	$ZnCl_2$	136.29	wh., delq., 1.687, uniaxial
2542	chromate	$ZnCrO_4$	181.39	lemon yel. pr.
2543	cyanide	$Zn(CN)_2$	117.42	col., rhb.

* Usual commercial form.

Wall saltpeter 455
Washing soda 2045
White alkali 2042
White arsenic 182
White caustic 2075
White copperas 2581
White lead 1055
White lead, sublimed 1101
White precipitate, fusible 1363
White precipitate, infusible 1362
White vitriol 2581
Witherite 223

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2499	$1.107^{20°}$	3.82	101.42	∞	∞	∞al.; sl. s. et.
2500	lq., $3.06^{-109.1}$ $2.7^{-140°}$ 4.53 (A)	−140	−109.1	$24.2^{0°}$cc	$7.3^{50°}$cc	....
2501	....	1800 ±	....	....	....	....
2502	2.09	$-4H_2O$, 100	....	v. s.	v. s.	....
2503	3.67	....	....	....	....	....
2504	2.575	150 to 155	$-6H_2O$, 180	v. s.	v. s.	s. abs. al.
2505	2.682	....	....	....	....	....
2506	2.644	....	....	$0.00033^{25°}$	....	sl. s. dil. a.
2507	9.175	....	....	i.	i.	s. h. dil. a.
2508	3.30	....	....	s.	....	....
2509	....	....	....	i.	....	....
2510	3.793	d. 900	....	$44.2^{0°}$	$4.67^{100°}$	....
2511	3.286	....	....	$34.78^{20°}$	$22.9^{40°}$	....
2512	5.51	1490	2500	sl. d.	d.	v. s. dil. a., h. KOH
2513	....	74	$-6H_2O$, 100	$168^{25°}$	....	sl. s. al.; i. et.
2514	....	....	....	$64^{0°}$	$130^{95°}$	s. al.; i. et.
2515	....	....	....	v. s.	v. s.	s. al.; i. et.
2516	....	$-H_2O$, 100	$-3H_2O$, 130	i.	....	s. a., aq. $(NH_4)_2CO_3$; sl. s. aq. CO_2
2517	$2.8^{18°}_{4}$	<686	....	$76^{0°}$	$80^{80°}$	$60^{15°}$ al.
2518	....	160	d. 170-180	v. s.	v. s.	....
2519	$2.18^{18°}$	$-5H_2O$, 110	....	v. s.	v. s.	s. al.; i. et.
2520	....	....	....	i.	....	v. sl. s. dil. a.
2521	....	d.	....	i.	i.	s. a., NH_4Cl; i. alk.
2522	....	....	....	v. s.	....	s. al.; sl. s. et.
2523	$4.79^{16°}_{16}$	1347	....	....	....	....
2524	2.682	....	....	$133^{0°}$	$410^{66.5°}$	s. HNO_3
2525	....	$-3H_2O$, 100	....	v. s.	v. s.	v. s. al., et.
2526	....	d.	....	0.000137	....	sl. s. HCl
2527	4.84	2410	4300^{760mm}	i.	i.	s. a.; i. alk.
2528	2.612	d. 1000	....	$7.94^{3.6°}$	$2.03^{95°}$	s. satd. aq. K_2SO_4
2529	2.558	$-8H_2O$, 450	d. 700	$9.76^{20°}$	$4.6^{100°}$	v. sl. s. H_2SO_4; i. al.
2530	7.140	419.4	907	i.	i.	s. a., ac., alk.
2531	1.840	242	subl. in vac.	$30^{25°}$	$44.6^{100°}$	$2.8^{25°}$, $166^{79°}$ al.
2532	1.735	237	$-2H_2O$, 100	$40^{25°}$	$66.6^{100°}$	v. s. al.
2533	....	d. >200	....	d.	....	d. al.; i. et.
2534	1.931	d.	....	$7^{0°}$ (anh.)	$42^{80°}$(anh.)	....
2535	$3.309^{15°}$	$-2H_2O$, 100	....	i.	....	s. H_3AsO_4, HNO_3, alk.
2536	....	1015	....	i.	....	....
2537	2.566	100	$-6H_2O$, 200	100	$\infty^{100°}$	....
2538	$4.219^{4°}$	394	650	$390^{0°}$	$670^{100°}$	v. s. NH_4OH, al., et.
2539	4.42	$-CO_2$, 300	....	$0.001^{15°}$	....	s. a., alk., NH_4 salts; i. act., NH_3
2540	....	60	d.	$652^{0°}$	∞	v. s. al.
2541	$2.91^{25°}_{4}$	283°	732	$432^{25°}$	$615^{100°}$	$100^{12.5°}$ al.; v. s. et.; i. NH_3
2542	5.3	....	....	v. sl. s.	....	....
2543	....	d. 80	....	$0.0005^{18°}$	sl. s.	s. KCN, NH_3, alk.; i. al.

Wollastonite 476
Wool mordant 608, 610, 611
Wulfenite 1074
Wurzite 2582
Xantheosite 1408
Yellow lead oxide 1078
Yellow precipitate 115, 1322
Yellow prussiate of potash 1684
Ytterbia 2507
Yttria 2527
Zinc blende 2584
Zinc chrome 2542

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Zinc			
2544	dithionate	$ZnS_2O_6 \cdot 6H_2O$	333.60	tri.
2545	ferrite	$Zn(FeO_2)_2$	241.08	....
2546	ferrocyanide	$Zn_2Fe(CN)_6 \cdot 3H_2O$	396.77	wh. pd.
2547	fluoride	ZnF_2	103.38	mn., tri. (?)
2548	fluoride	$ZnF_2 \cdot 4H_2O$	175.44	rhb.
2549	formate	$Zn(HCO_2)_2$	155.42	....
2550	formate	$Zn(HCO_2)_2 \cdot 2H_2O$	191.45	mn.
2551	hydroxide	$Zn(OH)_2$	99.40	col., rhb.
2552	iodate	$Zn(IO_3)_2$	415.22	yel.-brn.
2553	iodate	$Zn(IO_3)_2 \cdot 2H_2O$	451.25	....
2554	iodide	ZnI_2	319.22	cb.
2555	nitrate	$Zn(NO_3)_2 \cdot 6H_2O$	297.49	col., tet.
2556	nitride	Zn_3N_2	224.16	gray
2557	oxalate	ZnC_2O_4	153.40	....
2558	oxalate	$ZnC_2O_4 \cdot 2H_2O$	189.43	wh. pd.
2559	oxide (zincite)	ZnO	81.38	wh., hex., 2.004
2560	oxide	ZnO	81.38	wh., amor.
2561	oxysulfide	$ZnO \cdot ZnS$	178.82	yel.
2562	permanganate	$Zn(MnO_4)_2 \cdot 6H_2O$	411.34	dark brn. nd.
2563	peroxide	ZnO_2	97.38	yel.
2564	phosphate, monobasic	$Zn(H_2PO_4)_2 \cdot 2H_2O$	295.40	tri.
2565	phosphate, tribasic	$Zn_3(PO_4)_2$	386.10	col., rhb.
2566	phosphate (α-hopeite)	$Zn_3(PO_4)_2 \cdot 4H_2O$	458.16	col., rhb., 1.591
2567	phosphate (β-hopeite)	$Zn_3(PO_4)_2 \cdot 4H_2O$	458.16	col., rhb., 1.582
2568	phosphate (para-hopeite)	$Zn_3(PO_4)_2 \cdot 4H_2O$	458.16	tri., 1.625
2569	phosphate	$Zn_3(PO_4)_2 \cdot 8H_2O$	530.23	rhb. pl.
2570	phosphate, pyro-	$Zn_2P_2O_7$	304.72	cr. pd.
2571	phosphide	Zn_3P_2	258.10	steel gray, cb.
2572	salicylate	$Zn(C_7H_5O_3)_2 \cdot 3H_2O$	393.65	nd.
2573	selenate	$ZnSeO_4 \cdot 5H_2O$	298.42	tri.
2574	selenide	$ZnSe$	144.34	yel., hex.
2575	silicate	$ZnSiO_3$	141.44	hex. or rhb.; glass, 1.650
2576	silicofluoride	$ZnSiF_6 \cdot 6H_2O$	315.54	col., hex., 1.3824
2577	stearate	$Zn(C_{36}H_{70}O_4)$	632.3	wh. pd.
2578	sulfate (zincosite)	$ZnSO_4$	161.44	wh., rhb., 1.669
2579	sulfate	$ZnSO_4 \cdot H_2O$	179.46	col.
2580	sulfate	$ZnSO_4 \cdot 6H_2O$	269.54	mn.
2581	sulfate (goslarite)	$ZnSO_4 \cdot 7H_2O$*	287.55	rhb., 1.4801
2582	sulfide (α) (wurzite)	ZnS	97.44	wh., hex., 2.356
2583	sulfide (β) (sphalerite)	ZnS	97.44	wh., cb.; glass (?) 2.18-2.25
2584	sulfide (blende)	ZnS	97.44	wh., granular
2585	sulfite	$ZnSO_3 \cdot 2\frac{1}{2}H_2O$	190.48	mn.
2586	sulfocarbolate	$Zn(O_3SC_6H_4OH)_2 \cdot 8H_2O$	555.83	wh. cr.
2587	telluride	$ZnTe$	192.99	dark red, cb., 3.56
2588	**Zirconium**	Zr	91.22	cb., pd. ign. easily
2589	bromide	$ZrBr_4$	410.88	wh., cr. pd.

* Usual commercial form.
Zinc fluosilicate 2576
Zincite 2559
Zinc metasilicate 2575
Zincosite 2578
Zinc phenolsulfonate 2586

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2544	$1.915^{20^\circ}_{4}$	…	…	s.	…	…
2545	$5.33^{20^\circ}_{4}$	…	…	…	…	…
2546	…	d.	…	i.	i.	s. NH_4OH; v. sl. s. NH_3; i. al., HCl
2547	$4.84^{15^\circ}_{4}$	872	…	1.65^{20°	s.	s. h. a.; i. al., NH_3
2548	$2.535^{12^\circ}_{4}$	$-4H_2O$, 100	…	2.8^{20°	s.	s. a., alk., NH_4OH
2549	2.36	d.	…	3.8^{0°	62^{100°	…
2550	2.158^{21°	d. 175	…	4.7^{0°	89^{100°	1.18^{25° abs. al.
2551	3.053	d. 125	…	0.00052^{18°	…	s. a., alk., NH_4OH
2552	$4.98^{20^\circ}_{4}$	d.	…	0.9	1.3	…
2553	…	$-2H_2O$, 200	…	1.0	1.4	s. HNO_3, NH_4OH
2554	$4.666^{14.2^\circ}_{4}$	446	624	430^{0°	510^{100°	s. a., al., NH_3, aq. $(NH_4)_2CO_3$
2555	$2.065^{14^\circ}_{4}$	36.4	$-6H_2O$, 105	324.5	$\infty^{36.4^\circ}$	v. s. al.
2556	4.6	…	…	d.	…	d. a.
2557	$2.58^{17.5^\circ}_{4}$	…	…	$0.00057^{9.76^\circ}$	0.00072^{26°	…
2558	…	d. 100	…	0.0026^{18°	…	s. a., alk.
2559	5.606	>1800	…	0.00042^{18°	…	s. a., alk., NH_4Cl; i. NH_3
2560	5.47	>1800	…	0.00042^{18°	…	…
2561	…	…	…	i.	…	s. HCl
2562	2.47	$-5H_2O$, 100	d.	v. s.	v. s.	d. a., al.
2563	1.571	expl. 212	…	0.0022	…	i. NH_4OH; d. a.
2564	…	100 d.	…	d.	…	s. HCl
2565	$3.998^{15^\circ}_{4}$	900	…	i.	i.	s. a.; i. NH_3
2566	3.04	tr. >105	…	i.	i.	v. s. a., NH_4OH, NH_4 salts
2567	3.03	tr. >140	…	i.	i.	…
2568	…	tr. >163	…	i.	i.	…
2569	3.109^{15°	…	…	i.	…	s. alk.
2570	3.756^{23°	…	…	i.	i.	s. a., alk., NH_4OH; i. ac.
2571	$4.55^{13^\circ}_{4}$	>420	1100	i.	…	s. dil. a.
2572	…	$-2H_2O$, 100	$-3H_2O$, 150	5^{20°	…	s. al.
2573	$2.591^{20^\circ}_{4}$	d. >50	…	s.	…	…
2574	$5.42^{15^\circ}_{4}$	>1100	…	i.	…	d. c. dil. HNO_3
2575	3.52	1437	…	i.	…	…
2576	$2.104^{20^\circ}_{4}$	d.	…	50^{0°	72^{100°	…
2577	…	…	d.	i.	i.	i. al.; d. a.
2578	$3.74^{15^\circ}_{4}$	d. 740	…	42^{0°	61^{100°	sl. s. al., s. gly.
2579	$3.28^{15^\circ}_{4}$	d. 238	…	s.	89.5^{100°	…
2580	$2.072^{15^\circ}_{4}$	$-5H_2O$, 70	…	s.	s.	sl. s. al.; i. act., NH_3
2581	$1.966^{16.5^\circ}$	tr. 39	$-7H_2O$, 280	115.2^{0°	653.6^{100°	sl. s. al.; i. act., NH_3
2582	4.087	$1850^{150\,atm}$	subl. 1185	0.00069^{18°	i.	v. s. a.; i. ac.
2583	$4.102^{25^\circ}_{4}$	tr. 1020	…	i.	i.	s. a.
2584	4.04	…	…	i.	i.	v. s. a.; i. ac.
2585	…	$-2\frac{1}{2}H_2O$, 100	d. 200	0.16	d.	s. H_2SO_3, NH_4OH; i. al.
2586	…	$-8H_2O$, 120	…	60^{25°	250^{100°	55^{25° al.
2587	$5.54^{13^\circ}_{4}$	1238.5	…	i.	…	d. dil. HCl, dil. HNO_3
2588	6.4	1700	>2900	i.	i.	s. HF, aq. reg.; sl. s. a.
2589	…	…	…	d.	…	s. et.; d. al.

Zinc powder 2560
Zinc sulfophenate 2586

Zinc vitriol 2581
Zinc white 2560

Zinc yellow 2542

No.	Name	Formula	Formula Weight	Color, Crystalline Form and Refractive Index
	Zirconium			
2590	carbide	ZrC	103.23	met. gray
2591	chloride	$ZrCl_4$	233.05	wh. cr.
2592	fluoride	ZrF_4	167.22	wh., hex.
2593	hydroxide	$Zr(OH)_4$	159.25	wh., gelatinous
2594	iodide	ZrI_4	598.90	yel. cr. pd.
2595	nitrate	$Zr(NO_3)_4 \cdot 5H_2O$	429.33	delq. pr.
2596	oxalate, basic	$Zr(C_2O_4)_2 \cdot 2Zr(OH)_4$	585.76	....
2597	oxide, di- (baddeleyite)	ZrO_2	123.22	yel. or brn., mn., 2.19
2598	oxide, di- (free from Hf)	ZrO_2	123.22	wh., mn.
2599	oxybromide	$ZrOBr_2 \cdot 8H_2O$	411.18	delq., tet.
2600	oxychloride	$ZrOCl_2 \cdot 8H_2O$	322.26	col., tet., 1.552
2601	oxyiodide	$ZrI(OH)_3 \cdot 3H_2O$	323.21	amor.
2602	oxyiodide	$ZrOI_2 \cdot 8H_2O$	505.19	col. nd.
2603	sulfate	$Zr(SO_4)_2 \cdot 4H_2O$	355.40	rhb.

Zirconium potassium fluoride 1693

Zirkite 2597

No.	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
				Cold Water	Hot Water	Other Reagents
2590	....	....	5100	i.	i.	s. dil. HF, HNO_3
2591	2.8	....	subl. >300	s.	forms $ZrOCl_2$	s. HCl, al., et.; i. lq. Cl_2
2592	4.43	subl.	....	1.39	d.	s. HF
2593	3.25	$-2H_2O$, 550	....	0.02	i.	s. a.; i. al., alk., NH_4OH
2594	....	....	....	s.	s.	s. a., abs. et.; sl. s. bz., CS_2
2595	....	d. 100	....	s.	d.	....
2596	....	d.	....	i.	....	s. $(NH_4)_2C_2O_4$
2597	5.49	2700	....	i.	i.	s. H_2SO_4, HF
2598	5.73	....	4300	i.	i.	s. H_2SO_4, HF
2599	....	d. 100	....	s.	....	s. h. conc. HCl
2600	....	....	....	s.	d.	s. h. conc. HCl, al.
2601	....	....	....	v. s.	....	s. al.
2602	....	d.	....	v. s.	v. s.	v. s. al.
2603	....	$-4H_2O$, 380	....	$110.6^{18°}$	$146^{39.5°}$	s. H_2SO_4; i. al.

SHORT GLOSSARY OF ORGANIC CHEMISTRY NOMENCLATURE

The following rules for naming organic compounds and the examples given in explanation are not intended to cover all of the possible cases. For a more comprehensive and detailed description see Beilstein: *Handbuch der Organischen Chemie*, 4th edition, and Patterson: *Definitive Report of the Commission on the Reform of the Nomenclature of Organic Chemistry, Jour. Am. Chem. Soc. 55, 3905* (1933); *News Edition, Ind. Eng. Chem. 14, 486* (1936).

HYDROCARBONS—The saturated open-chain hydrocarbons (C_nH_{2n+2}) have names ending in *ane*. The first four are: *methane* (CH_4); *ethane* (C_2H_6); *propane* (C_3H_8); and, *butane* (C_4H_{10}). Beginning with *pentane* (C_5H_{12}) the prefix (*e.g. penta*) indicates the number of carbon atoms; for example, octane, C_8H_{18}; nonatriacontane, $C_{39}H_{80}$. See special table of *Numerical Prefixes*. Saturated monocyclic hydrocarbons (C_nH_{2n}) have the corresponding names of the open-chain hydrocarbons (C_nH_{2n+2}) preceded by the prefix *cyclo;* for example, cyclopropane (C_3H_6); cyclopentane (C_5H_{10}). The straight (unbranched) chains are termed *normal* (abbreviated: *n*); the grouping $(CH_3)_2CH-$ in a chain is termed *iso;* for example, $CH_3(CH_2)_2CH_3$ is *n*-butane; $(CH_3)_2CHCH_3$ is *iso*-butane. Branched-chain hydrocarbons are often named as derivatives of some relatively simple hydrocarbon by stating what radicals* are attached to the simple hydrocarbon; for example, $CH_3\mathbf{C}H_2CH_2CH_3$, which is *n*-butane, may also be named: methyl-ethyl-methane since a methyl radical (CH_3) and an ethyl radical (C_2H_5) are replacing the two hydrogen atoms of the original methane molecule, the carbon atom of which is printed in bold face type. Similarly $(CH_3)_2\mathbf{C}HCH_3$, which is *iso*-butane, would be named trimethyl-methane, the carbon atom printed in bold face type being the methane carbon atom corresponding to this name. In this system of naming, a compound might be given any one of several names depending upon which carbon atom is selected; for example, $CH_3CH_2CH_2CH_2CH_3$ might be given any one of the following names: diethyl-methane; methyl-propyl-methane; butyl-methane.

In 1892 an international congress of chemists assembled in Geneva, Switzerland, to devise a uniform and scientific system of nomenclature. This *Geneva system* with modifications proposed at various times is the modern *systematic naming*. According to this system a hydrocarbon is named as a derivative of the normal compound corresponding to the longest chain of carbon atoms in the molecule. The word *normal* is usually omitted, but implied, so that the simple unqualified systematic name always means the compound with the normal constitution; for example, *n*-butane, $CH_3CH_2CH_2CH_3$, is simply butane; iso-butane, $(CH_3)_2CHCH_3$, is 2-methyl-propane. The numeral *2* placed before** the word *methyl* indicates that the methyl radical is attached to the second carbon atom in the longest chain which, in this example, is of three carbons in length and, therefore, a propane. In cases where several different side chains are attached the order of stating them is either according to increasing complexity (e.g., methyl, then ethyl, then propyl, followed by butyl, etc.) or, according to alphabetical order (e.g., butyl, then ethyl, then methyl, followed by propyl, etc.) Where branching occurs in a side chain and for other cases of ambiguity, or if a simpler name would result, then a chain is selected as the fundamental unit which admits of the maximum of substitutions. A detailed discussion of this and other exceptions caused by very complicated structures is beyond the scope of this exposition and the reader is referred to the references given below the title of this section.

UNSATURATED HYDROCARBONS AND UNSATURATION—Hydrocarbons with one double bond (C_nH_{2n}) are named by adding the suffix *ene* to the name of the corresponding alkyl radical (C_nH_{2n+1})*; for example, $CH_2{:}CH_2$ is ethylene; $CH_3CH{:}CH_2$ is propylene. Just as the saturated hydrocarbons may be named as derivatives of methane, so these C_nH_{2n} hydrocarbons may be named as derivatives of ethylene; for example, $CH_3CH{:}CHCH_3$ which is a butylene, may also be named *sym*-dimethyl-ethylene since two methyl radicals (CH_3) are replacing two hydrogen atoms of the original ethylene molecule, the carbon atoms of which are printed in bold face type. Similarly $(CH_3)_2C{:}CH_2$, also a butylene, would be named *uns*-dimethyl-ethylene. The italicized prefixes *sym* and *uns* are abbreviations for *symmetrical* and *unsymmetrical*, respectively, and refer to the symmetrical or unsymmetrical manner in which the two methyl radicals are attached to the ethylene residue.

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*See Radicals in this section and also a special section Names and Formulas of Organic Radicals.

**The numbering is such that the lowest numbers are obtained; e.g., $CH_3CH_2CH_2CH(CH_3)_2$ is 2-methylpentane and not 4-methylpentane. Usage varies as to the position in the word for the numerals not only in the case of the hydrocarbons but also with other types such as alcohols, aldehydes, ketones, etc. Some writers place them before, some after, the parts of the name to which they refer. In Beilstein a combination is used wherein numbers placed after are enclosed in parenthesis and those placed before are not; e.g., primary isobutyl alcohol is named: 2-methyl-butanol-(1).

In the systematic naming, the longest chain is selected as in the case of the saturated hydrocarbons and the compound is named by replacing the *ane* ending of the corresponding saturated hydrocarbon with the ending *ene;* for example, $CH_3CH{:}CHCH_3$ is 2-butene. The numeral 2 indicates that the double bond is between the second and third carbon atoms. Similarly $(CH_3)_2C{:}CH_2$ is 2-methyl-1-propene** or 2-methyl-propene-(1), because a methyl group is on the second carbon atom, and the double bond is between the first and second carbon atoms in a chain of three carbon atoms. Where more than one double bond occurs in the molecule a numerical prefix is added to the ending *ene;* for example, isoprene, $CH_2{:}C(CH_3)CH{:}CH_2$ is 2-methyl-1,3-butadiene because the longest chain contains four carbon atoms with a methyl radical (CH_3) on the second carbon atom and double bonds between the first and second carbon atoms, and between the third and fourth carbon atoms of the four-carbon chain Similarly benzene would be named cyclohexa-1,3,5-triene.

Hydrocarbons with one triple bond (C_nH_{2n-2}) may be named as derivatives of acetylene ($CH{\vdots}CH$); for example, $CH_3C{\vdots}CH$ which is allylene, may also be named methyl-acetylene. In the systematic naming the same scheme is used as with the double bond compounds except that the ending becomes *yne* or *ine*. Thus, allylene is 1-propyne or 1-propine. The Greek letter Δ is often used to indicate unsaturation; the numbers following it indicate the positions of the unsaturated linkings.

Unsaturation in compounds other than the hydrocarbons, such as alcohols, aldehydes, ketones, etc., is indicated in the same general manner by use of *ene*, *diene*, *ine*, etc.; for example, allyl alcohol, $CH_2{:}CHCH_2OH$, is Δ^1 -propenol-(3)***.

ALCOHOLS—Alcohols are commonly named from the radical to which the hydroxyl radical (OH) is attached; for example, CH_3OH is methyl alcohol; $C_6H_5CH_2OH$ is benzyl alcohol. As in the case of the hydrocarbons, a complex alcohol may be named as the derivative of some relatively simple alcohol. When alcohols are named as derivatives of methyl alcohol the latter is commonly given the name of *carbinol;* for example, $(CH_3)_2CHOH$ is dimethyl carbinol because two of the hydrogen atoms in methyl alcohol have been replaced by two methyl radicals; similarly benzyl alcohol, $C_6H_5CH_2OH$, is phenyl carbinol. The adjectives *primary*, *secondary*, and *tertiary* are often used in connection with alcohols and refer to alcohol groupings which are of the type $-CH_2OH$, $=CHOH$, $\equiv COH$, respectively; for example, $C_3H_7CH_2OH$ is a primary butyl alcohol; $CH_3CH(OH)C_2H_5$ is a secondary butyl alcohol; $(CH_3)_3COH$ is a tertiary butyl alcohol.

In the systematic naming the hydroxyl radical is indicated by the ending *ol* and its position of attachment by an arabic numeral; for example, $C_2H_5CH_2CH_2OH$ is 1-butanol; $(CH_3)_3COH$ is 2-methyl-2-propanol because a methyl radical and an hydroxyl radical are both attached to the second carbon atom in a chain of three carbon atoms.** Two, three, etc., hydroxyl radicals in a molecule are indicated by the endings *diol*, *triol*, etc.; for example, glycol, CH_2OHCH_2OH is 1,2-ethandiol.

ETHERS—Ethers are most commonly named by adding the word *ether* to the name of the radicals connected by the ether oxygen atom; for example, $(C_2H_5)_2O$ is ethyl ether or diethyl ether; $CH_3OC_2H_5$ is methyl-ethyl ether. Often the name is such as to designate the presence of an alkoxy (OR) group; for example, $CH_3OC_6H_5$ is methoxy benzene.

ALDEHYDES—Aldehydes are most frequently named by dropping the ending *ic* from the name of the acid to which they are directly oxidizable and adding the suffix *aldehyde;* for example, CH_3CHO is named acetaldehyde because it is directly

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***In this case the final vowel *e* of the ending *ene* has been dropped from the name because it is followed by the vowel *o* of the ending *ol* which is used to indicate the alcoholic hydroxyl radical.

oxidized to acetic acid, CH_3CO_2H; similarly C_6H_5CHO is named benzaldehyde to shov its relationship to benzoic acid. Sometimes aldehydes are named in a manner t show a relationship to some simpler aldehyde such as formaldehyde, $HCHO$; for example, CH_3CHO is methyl formaldehyde because the methyl radical has replaced th hydrogen atom in formaldehyde; similarly C_6H_5CHO is named phenyl formaldehyde In the systematic naming the ending *al* indicates an aldehyde radical (CHO); fo example, CH_3CHO is ethanal; $(CH_3)_2CHCHO$ is 2-methyl-1-propanal.**

KETONES—Ketones are most often named by adding the word *ketone* to th names of the radicals connected to the CO radical; for example, $(CH_3)_2CO$ is dimethy ketone; $CH_3COCH(CH_3)_2$ is methyl-isopropyl ketone. The systematic names of th ketones differ from those of the alcohols and the aldehydes (*q. v.*) only in the termination *one* which is added to the name of the hydrocarbon; for example, $(CH_3)_2CO$ i propanone; $CH_3COCH(CH_3)_2$ is 2-methyl-butanone-(3).**

ACIDS—The common names of the normal carboxylic acids are derived fro words having some relation to their natural occurrence or their properties; for example, formic, from ants (*Formicidae*); butyric, from butter; tannic, from th tanning property. Sometimes acids are named in a manner to show a relationshi to some simpler acid such as acetic, CH_3CO_2H; for example, pivalic acid, $(CH_3)_3CCO_2H$ is tri-methyl-acetic acid because three methyl radicals (CH_3) are replacing the thre hydrogen atoms in acetic acid. The systematic names are derived by adding th suffix *oic* and the word *acid* to the root of the name for the hydrocarbon of the *sam number of carbon atoms;* for example, isovaleric acid, $(CH_3)_2CHCH_2CO_2H$, is 2-methyl butanoic-4-acid; succinic acid, $(CH_2CO_2H)_2$, is butan-1,4-dioic acid. In compound where such a naming would be awkward the carboxyl radical (CO_2H) is considere as a substituting group and the acid named accordingly; for example, citric acid $HO_2CCH_2C(OH)(CO_2H)CH_2CO_2H$, is 2-hydroxy-propan-1,2,3-tricarboxylic acid.**

ESTERS AND SALTS—To the name of the alcoholic (or phenolic) radical, o the metal, is added the name of the acid modified to end in *ate;* for example, th ester of ethyl (C_2H_5) alcohol and acetic acid, $CH_3CO_2C_2H_5$, is ethyl acetate; the sodiu salt of acetic acid, CH_3CO_2Na, is sodium acetate. To emphasize the ester structur they are often named as follows: acetic acid ethyl ester for ethyl acetate; maloni acid diethyl ester for diethyl malonate, $CH_2(CO_2C_2H_5)_2$.

ACID DERIVATIVES—The most common types in this classification are th anhydrides $(RCO)_2O$; halides $ROCl$; amides $RCONH_2$; amidoximes $RC(:NOH)NH_2$ amidines $RC(:NH)NH_2$; imides $R(CO)_2NH$; nitriles RCN. They are named by addin the endings *anhydride*, *chloride* (or other *halide*), *amide*, *amidoxime*, *amidine*, *imide nitrile*, respectively, to the name of the acid or acid radical* (e.g., acetyl, acet, o aceto for the acid radical CH_3CO); for example, acetic anhydride, $(CH_3CO)_2O$; acety chloride, CH_3COCl; acetamide, CH_3CONH_2; acetamidoxime, $CH_3C(:NOH)NH_2$; acetamidine, $CH_3C(:NH)NH_2$; acetonitrile, CH_3CN; succinimide, $(CH_2CO)_2NH$. In compounds where such a naming would be awkward the modified carboxyl group i considered as a substituting group and named carbonamide, carbonamidine, carbonitrile, etc.

AMINES—Amines are most often named by adding the suffix *amine* to the nam of the radical (or radicals) replacing one (or more) hydrogen atoms in ammoni (NH_3); for example, CH_3NH_2 is methylamine; $CH_3NHC_2H_5$ is methyl-ethylamine Sometimes amines are named in a manner to show a relationship to some othe simpler (or well-known) amine; for example, $C_6H_5NHCH_3$ is methylaniline; $C_6H_5N(CH_3)$ is named dimethylaniline to show the relationship to aniline, $C_6H_5NH_2$. In th systematic names the amino (NH_2) or modified amino (NHR, and NR_2) group is considered as a substituting group of the hydrocarbon; for example, $(CH_3)_2CHNH$ is 2-aminopropane; $(CH_3)_2CHCH_2NHCH_3$ is 2-methyl-1-methylamino-propane.

RADICALS—Alkyl radicals (C_nH_{2n+1}) are univalent groups derived by remov of one hydrogen atom from saturated hydrocarbons. They are named by replacin the ending *ane* of the corresponding hydrocarbon with the ending *yl;* for exampl C_2H_5- is ethyl derived from ethane (C_2H_6); $CH_3CH_2CH_2$- is propyl; $(CH_3)_2CH$- is isopropyl.

ORGANIC CHEMISTRY NOMENCLATURE

Univalent radicals derived from unsaturated aliphatic hydrocarbons have the dings *enyl; ynyl; dienyl;* etc.; for example, $CH_2{:}CH$- commonly called *vinyl* is also henyl; $CH{\vdots}C$- is *ethynyl;* $CH_2{:}CH\text{-}CH{:}CH$- is *buta-1,3-dienyl.* In the aromatic series e corresponding *aryl* radicals are named in a similar manner; for example, C_6H_5- *phenyl;* $C_6H_4 =$ is phenylene; $CH_3C_6H_4$- is tolyl.

Bivalent radicals derived by removal of two hydrogen atoms from the *same* *rbon atom* are sometimes named in a manner similar to the corresponding aldehyde; r example, $CH_3CH =$ is acetal; $C_6H_5CH =$ is benzal. In the systematic naming the ding *ylidene* is used to replace the ending *ane* of the corresponding saturated hydrorbon; for example, $CH_3CH =$ is ethylidene; somewhat analogous is $C_6H_5CH =$ when med benzylidene.

Acid radicals, derived by removal of OH from the carboxyl group (COOH), are amed by replacing the ending *ic* of the acid name with the ending *yl;* for example, H_3CO- is acetyl (from acetic) or ethanoyl (from ethanoic).

See also the special table NAMES AND FORMULAS OF ORGANIC RADIALS.

RING COMPOUNDS—Positions of substituting groups on the various rings are sually indicated by a system of numbering. In the benzene series of compounds substitution positions are often indicated by the terms *ortho* (abbreviated *o*) for e 1,2-positions; *meta* (abbreviated *m*) for the 1,3-positions; *para* (abbreviated *p*) r the 1,4-positions. In cases of trisubstitution the terms *vicinal* (*vic*), *unsymmetrial* (*uns*) and *symmetrical* (*sym*) are often employed to indicate the positions 1,2,3; 3,4; and 1,3,5, respectively. In the naphthalene series of compounds, especially the older literature, disubstitution positions are sometimes indicated by the terms *tho, meta,* and *para* with the same significance as in the benzene series, and by the rms *ana* for the 1,5-positions; *epi* for the 1,6-positions; *kata* for the 1,7-positions; *eri* for the 1,8-positions; *amphi* for the 2,6-positions; and *pros* for the 2,7-positions. ee also the special table ORGANIC RING SYSTEMS.

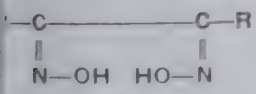
PREFIXES AND SUFFIXES

-al, a suffix indicating the presence of an *aldehyde group* (-CHO), as in chlor*al*, $_3C\cdot CHO$; or penten*al*, $CH_3(CH_2)_3\cdot CHO$.*

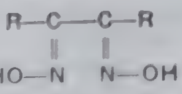
allo-, a prefix indicating the compound to be a close relative, an isomer, or a variety f the compound to the name of which it is prefixed, as *allo*caffeine. In cases of thylenic isomerism it is prefixed to the name of the more stable form into which the mpound can be converted on heating; thus, fumaric acid is *allo*maleic acid since is the stable isomer formed on heating maleic acid.

alpha-, beta-, gamma-, etc., usually written as letters of the Greek alphabet α, β, γ, etc.) to indicate the first, second, third, etc., positions of substitution repectively, as in α-aminopropionic acid for $CH_3\cdot CH(NH_2)\cdot CO_2H$ where the carbon tom attached to the CO_2H group is considered the α-carbon atom. See also the efinition below for *omega* (ω). See also the numbering in the section ORGANIC ING SYSTEMS.

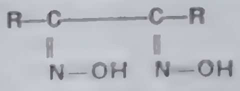
amphi-, a prefix used with disubstitution products of naphthalene to indicate the ,6-positions. It is also used in naming certain stereoisomers of dioximes; thus,



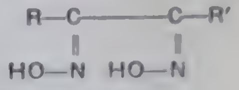
syn-form



anti-form



amphi-form



amphi-form

-ane, a suffix usually indicating a saturated (paraffin) hydrocarbon, C_nH_{2n+2}, as in entane, C_5H_{12}.* It is also used to indicate saturated parent compounds in the cyclic eries, as camph*ane*, $C_{10}H_{18}$; or diox*ane*, $C_4H_8O_2$.

anti-, a term used in certain cases of stereoisomerism to indicate an opposed arangement of groups or atoms, as in *anti*tartaric (mesotartaric) acid. It is often employed to distinguish stereoisomers in the case of oximes and hydrazones. See als *amphi* and *syn*.

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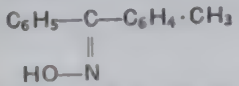
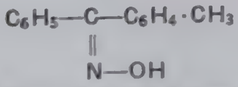
* See this on preceding pages.



$$\begin{array}{l} C_6H_5\text{—}C\text{—}C_6H_4\cdot CH_3 \\ \qquad\;\; \| \\ \quad HO\text{—}N \end{array}$$

syn-Phenyl tolyl ketoxime



$$\begin{array}{l} C_6H_5\text{—}C\text{—}C_6H_4\cdot CH_3 \\ \qquad\;\; \| \\ \qquad\; N\text{—}OH \end{array}$$

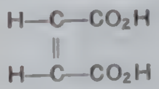
anti-Phenyl tolyl ketoxime

***apo-*,** a prefix indicating a compound which is related to, or formed from, the compound to the name of which it is prefixed, as *apo*morphine.

***-ase*,** a suffix used in forming the name of an enzyme. Usually the suffix is adde to the name, or a part of the name, of a substance upon which the enzyme acts; e.g malt*ase*.

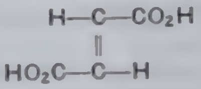
***-ate*,** a suffix used to denote an ester or a salt; e.g., ethyl acet*ate*; or sodium acet*ate*.

***cis*,** a term used in cases of *cis-trans* (i.e., ethylenic) stereoisomerism to indicat that certain elements or groups are on the *same side* of the molecule; e.g.,



$$\begin{array}{l} H\text{—}C\text{—}CO_2H \\ \quad\;\, \| \\ H\text{—}C\text{—}CO_2H \end{array}$$

cis-form



$$\begin{array}{l} \qquad\; H\text{—}C\text{—}CO_2H \\ \qquad\qquad\; \| \\ HO_2C\text{—}C\text{—}H \end{array}$$

trans-form

***d*,** an abbreviation for *dextro* and usually indicating that a compound is *dextrorotatory*. Exceptions to this meaning are to be noted in certain cases of nomenclatur e.g., *d*-fructose, although levorotatory, is so named because of its relation in configuration to *d*-glucose and *d*-mannose; conversely, *l*-fructose, similarly related to *l*-glucos and *l*-mannose, is dextrorotatory.

***-diene*,** a suffix indicating the *unsaturation* of two ethylenic (i.e., two double bond linkages; e.g., a diolefin, C_nH_{2n}, as penta*diene*, $CH_3\cdot CH{:}CH\cdot CH{:}CH_2$.*

***-diine*,** or ***-diyne*,** a suffix indicating the *unsaturation* of two acetylenic (i.e., tw triple bond) linkages; e.g., a diacetylene, C_nH_{2n-6}, as buta*diyne*, $CH{\vdots}C\cdot C{\vdots}CH$.*

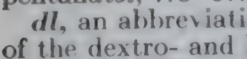
***-dioic*,** a suffix indicating a *dicarboxylic* (two $-CO_2H$) acid; e.g., pentan*dioic* aci $HO_2C\cdot(CH_2)_3\cdot CO_2H$.*

***-diol*,** a suffix indicating the presence of *two alcohol* (two hydroxyl) groups; e.g pentan*diol*, $HO\cdot CH_2\cdot(CH_2)_3\cdot CH_2OH$.*

***dl*,** an abbreviation for *dextro-levo* indicating a substance composed of equal part of the dextro- and levo-optical isomers of a compound.

***-ene*,** a suffix indicating the *unsaturation* of one ethylenic (i.e., one double bond linkage; e.g., an olefin, C_nH_{2n}, as pent*ene*, $CH_2{:}CH\cdot C_3H_7$.* It is often used as a suffi in naming aromatic hydrocarbons; e.g., benz*ene*, tolu*ene*, naphthal*ene*, etc.

***epi-*,** a prefix used with disubstitution products of naphthalene to indicate th 1,6-positions. See *RING COMPOUNDS* preceding. It is also prefixed to the nam of an aldose, or related compound, to indicate an isomer that differs from the aldos only in the arrangement of the group about the α-carbon atom (the carbon atom ne to the aldehyde group); thus, mannose is also called *epi*glucose. It is also used as prefix to indicate a *bridge* or intramolecular connection, as in *epi*chlorohydri



$$\underbrace{O\cdot CH_2\cdot CH}\cdot CH_2Cl.$$

***eso-*,** a prefix indicating that substitution groups are *attached to the ring*, as *es* trinitromesitylene for the 2,4,6-trinitro derivative of mesitylene. See also *exo-*.

***exo-*,** a prefix indicating that substitution groups are *attached to the side chain*, *exo*-nitrotoluene for phenyl-nitromethane, $C_6H_5\cdot CH_2\cdot NO_2$. See also *omega-* and *eso*

***homo-*,** a prefix indicating a homologue of the compound to the name of which is prefixed and usually differing by having one more CH_2 in the formula; e.g., *hom* salicylic acid, $CH_3\cdot C_6H_3(OH)CO_2H$.

***i or in*,** an abbreviation for *inactive* and indicating that the substance exhibits activity towards polarized light. See also *dl*.

***-ic*,** see ***-oic*.**

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* See this on preceding pages.

-in, a suffix used in forming the names of fats (i.e., the glycerides or esters of glycerol), the suffix being used to replace the *ic* ending of the name of the fatty acid forming the glyceride; e.g., tributyr*in*, $(C_3H_7CO)_3C_3H_5O_3$. It is often used as a suffix in the names of proteins and of glucosides; e.g., album*in* and amygdal*in*, resp. See also *i* above.

-ine, a suffix often used in forming the names of basic compounds such as amines, alkaloids, and amino acids; e.g., anil*ine*, quin*ine*, and glyc*ine*, resp. See also *-yne*.

-ite, a suffix used in various ways; thus, for esters of the *ous* acids, e.g., amyl nitr*ite*, $C_5H_{11}O\cdot NO$; for polyhydric alcohols, e.g., mann*ite* (mannitol), $C_6H_8(OH)_6$; for explosives, e.g., cord*ite*, a smokeless powder.

l, an abbreviation for *l(a)evo* and indicating that a compound is levorotatory. See also *d*.

N-, a letter used in the names of certain nitrogen compounds to indicate that the group to which the letter is prefixed has replaced a hydrogen directly attached to a nitrogen atom; e.g., *N*-methylpyrrole, $C_4H_4{:}N\cdot CH_3$. Sometimes the letter is erroneously used to indicate a *normal* compound, as *N*-butane, $CH_3\cdot CH_2\cdot CH_2\cdot CH_3$, instead of a lower case letter for this meaning, as *n*-butane.

N. F., an abbreviation for the publication *National Formulary* which is issued by the *American Pharmaceutical Association* and quoted in Federal and State laws as having equal authority with the *United States Pharmacopoeia*. See also *U. S. P.*

nor-, a prefix indicating the parent compound from which another may be regarded as derived, as *nor*camphor (of which camphor is the 7-methyl derivative). The prefix has also been used to indicate a *normal* compound which is isomeric with the one to the name of which it is prefixed, as *nor*valine which is α-amino-*n*-valeric acid, whereas valine is α-amino-*iso*-valeric acid.

O-, a letter used in names of certain oxygen compounds to indicate that the group to which the letter is prefixed has replaced a hydrogen directly attached to an oxygen atom; e.g., ***O***-ethyl phenol (phenetole), $C_2H_5\cdot O\cdot C_6H_5$.

-oic, a suffix indicating a carboxylic (CO_2H) *acid;* e.g., pentan*oic* acid.* Often the suffix *-ic* is used in forming the name of an acid; e.g., acet*ic* acid.

-ol, a suffix indicating an *hydroxyl group* (OH) as in an alcohol,* e.g., pentan*ol;* or in a phenol, e.g., resorcin*ol*,* $C_6H_4(OH)_2$.

-ole, a suffix used in various ways; thus, for phenolic ethers, e.g., phenet*ole*, $C_2H_5\cdot O\cdot C_6H_5$; for certain aldehydes, e.g., oenanth*ole*, $CH_3(CH_2)_5\cdot CHO$: for five-membered rings, usually heterocyclic, e.g., pyrr*ole*, C_4H_5N, or oxaz*ole*, C_3H_3ON.

omega-, a prefix indicating a substitution group *on the last carbon* of a side chain, as *omega*-nitrostyrene for $C_6H_5\cdot CH{:}CH\cdot NO_2$. It is most often indicated by the Greek letter omega (ω), as ω-nitrostyrene.

-one, a suffix indicating the presence of a *ketone group* ($:CO$), as in propan*one*,* $CH_3\cdot CO\cdot CH_3$; or acetophen*one*, $CH_3\cdot CO\cdot C_6H_5$.

-ose, a suffix usually indicating a *carbohydrate;* e.g., gluc*ose*, $C_6H_{12}O_6$; cellul*ose*, $(C_6H_{10}O_5)_x$. It is also used in naming the primary alteration or hydrolytic products of proteins; e.g., album*ose*.

par(a)-, a prefix or an adjective used to indicate that the substance is related in some way, as a polymer, an isomer, etc., of the compound to whose name it is attached; e.g., *par*aldehyde, *para*lactic acid. See also its significance when used in showing position of substituents in naming *RING COMPOUNDS.**

poly-, a prefix indicating a polymer of the compound to the name of which it is prefixed, as *poly*styrene, $(C_8H_8)_x$.

prim., an abbreviation for *primary* and indicating a replacement to the first degree; e.g., a primary amine ($R\cdot NH_2$) where only one of the three hydrogens in ammonia has been replaced by a group (R) of atoms. It is frequently used in the designation of certain *alcohols.**

pseudo-, a prefix indicating an isomerism with, or some other relation to, the compound to the name of which it is prefixed, as *pseudo*tropine. It is sometimes indicated by the Greek letter *psi* (ψ); e.g., ψ-tropine.

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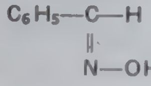
* See this on preceding pages.

***S*-,** a letter used in the names of certain sulfur compounds to indicate that th group to which the letter is prefixed has replaced a hydrogen directly attached to sulfur atom; e.g., *S*-methyl thioglycolic acid, $CH_3 \cdot S \cdot CH_2 \cdot CO_2H$.

***sec.*,** an abbreviation for *secondary* and indicating a replacement to the secon degree; e.g., a secondary amine ($R_2{:}NH$) where two of the hydrogens in ammoni have been replaced by two groups (R_2) of atoms. It is frequently used in the designation of certain *alcohols.**

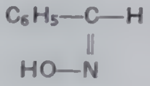
***sym.*,** an abbreviation for *symmetrical* and used to indicate a symmetrical arrangement of substitution on a parent compound. See also under *RING COMPOUNDS.**

***syn-*,** a term used in certain cases of isomerism to indicate that certain groups or atoms are on the same side of the molecule. See also *amphi* and *anti.*



$$\begin{matrix}C_6H_5-C-H\\ \|\\ N-OH\end{matrix}$$

Benz-*syn*-aldoxime



$$\begin{matrix}C_6H_5-C-H\\ \|\\ HO-N\end{matrix}$$

Benz-*anti*-aldoxime

***tert.*,** an abbreviation for *tertiary* and indicating a replacement to the third degree; e.g., a tertiary amine ($R_3{:}N$) where three of the hydrogens in ammonia have been replaced by three groups (R_3) of atoms. It is frequently used in the designation of certain *alcohols.**

***-thiol*,** a suffix indicating a mercaptan or thio-alcohol ($-SH$) group; e.g., pentan*thiol*, $C_5H_{11} \cdot SH$.

***trans*,** a term used in cases of cis-trans stereoisomerism. See also *cis*.

***uns.*,** an abbreviation for *unsymmetrical* and used to indicate an unsymmetrical arrangement of substituents on a parent compound. See also under *RING COMPOUNDS.**

***U. S. P.*,** an abbreviation for *United States Pharmacopoeia* and indicating that a compound conforms to the standards of purity, and other requirements, set by this publication which has been recognized in the United States as a standard in administering laws relating to the Federal Food, Drug and Cosmetic Act (1936, 1939). The Roman numeral often employed with this abbreviation indicates the revision to which reference is being made; e.g., *U. S. P. (XIII)* refers to the 13th revision.

***vic.*,** an abbreviation for *vicinal*. See under *RING COMPOUNDS.**

***x*-,** a symbol for *unknown*. The unknown number of monomers composing a polymeric compound is often indicated by using this symbol as a subscript in the formula; e.g., starch, $(C_5H_{10}O_5)_x$. It is sometimes used to indicate the unknown position of attachment of a substituting group; e.g., in $3,x,3',x'$-tetranitro-4,4′-diphenol where the positions of substitution of two of the four nitro groups are unknown.

***-yl*,** a suffix used in forming the names of radicals, usually univalent radicals; e.g., alkyl, C_nH_{2n+1}; acyl, $R \cdot CO-$.

***-ylene*,** a suffix used in forming the names of unsaturated hydrocarbons *; e.g., eth*ylene*, $CH_2{:}CH_2$. It is frequently used in forming the names of bivalent radicals with the free valences on different carbon atoms; e.g., phen*ylene*, $-C_6H_4-$.

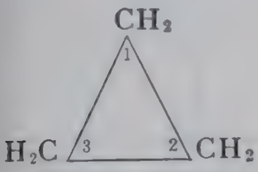
***-yne*,** a suffix indicating *unsaturation* * of one acetylenic (i.e., one triple bond) linkage; e.g., pent*yne*, $CH{\vdots}CH \cdot C_3H_7$. In this sense modern nomenclature prefers this suffix to that of *-ine*.

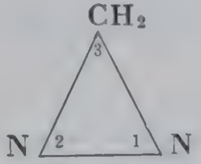
* See this on preceding pages.

ORGANIC RING SYSTEMS

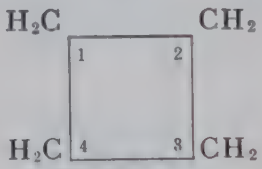
The rings given in the following pages are numbered as in Chemical Abstracts beginning with Volume 31 (1937). In all but a few cases (especially anthracene, phenanthrene and purine) the numberings are in accordance with the "Proposed International Rules for Numbering Organic Ring Systems"; cf. Patterson: Jour. Am. Chem. Soc. 47, 543-61 (1925). For a more complete listing of ring systems see the annual subject index of Chemical Abstracts; and, Richter: Lexikon der Kohlenstoff-Verbindungen, 3d Edition (1910), Volume I, p. 14, published by Leopold Voss, Hamburg and Leipzig: Patterson and Capell: The Ring Index (1940), Reinhold, N. Y.

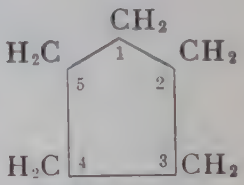
When numbering positions in the case of substitution derivatives of benzoic acid, aniline, phenol, toluene, etc., the characteristic radical of each of these substances (i. e., CO_2H, NH_2, OH, CH_3, etc., respectively) is regarded as in position 1.

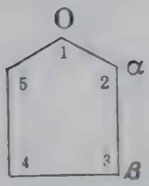

CH₂
1
H₂C
3
2
CH₂
Cyclopropane



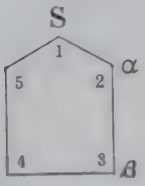
Diazomethane
Azimethylene


H₂C
CH₂
1
2
H₂C
4
3
CH₂
Cyclobutane

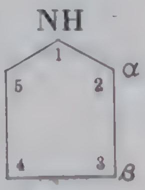

CH₂
H₂C
1
CH₂
5
2
H₂C
4
3
CH₂
Cyclopentane



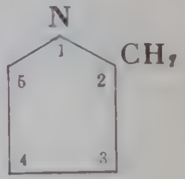
Furan
Furfuran



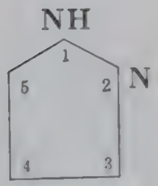
Thiophene
Thiofuran



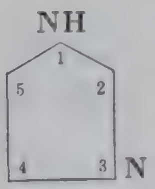
Pyrrole
Azole



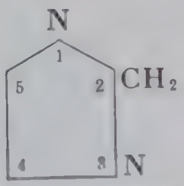
Isopyrrole
Isoazole

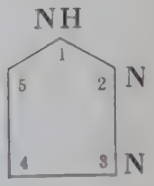


Pyrazole
1,2 -Diazole

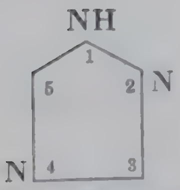


Imidazole
1,3-Diazole
Glyoxaline

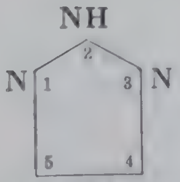

N
1
5
2
CH₂
4
3
N
2-Isoimidazole
1,3-Isodiazole



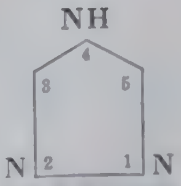
1,2,3-Triazole



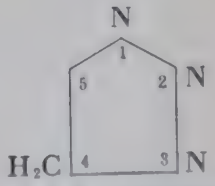
1,2,4-Triazole



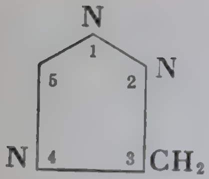
2,1,3-Triazole
Osotriazole
Pyrro[aa_1]diazole



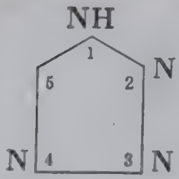
4,1,2-Triazole
Pyrro[bb_1]diazole


N
1
5
2
N
H₂C
4
3
N
1,2,3-Isotriazole

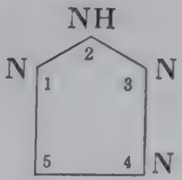
ORGANIC RING SYSTEMS


N
N
N
CH₂
1
2
3
4
5

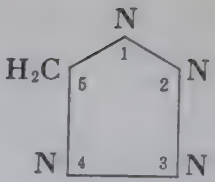
1,2,4-Isotriazole


NH
N
N
N
1
2
3
4
5

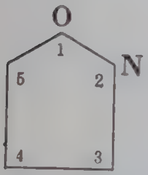
1,2,3,4-Tetrazole


NH
N
N
N
1
2
3
4
5

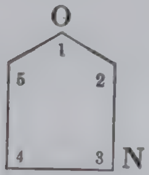
2,1,3,4-Tetrazole


N
H₂C
N
N
N
1
2
3
4
5

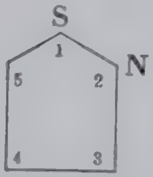
Isotetrazole



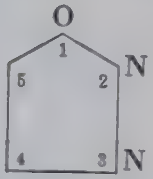
Isoxazole
Furo[*a*]monazole



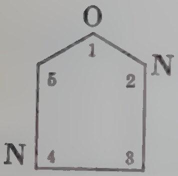
Oxazole
Furo[*b*]monazole



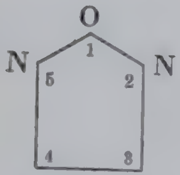
Isothiazole



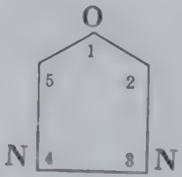
1,2,3-Oxadiazole



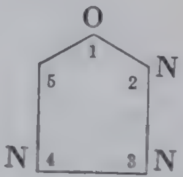
1,2,4-Oxadiazole
Azoxime
Furo[ab_1]diazole



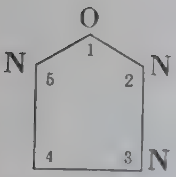
Furazan
1,2,5-Oxadiazole



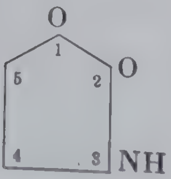
1,3,4-Oxadiazole
Furo[bb_1]diazole



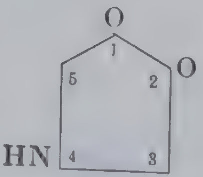
1,2,3,4-Oxatriazole



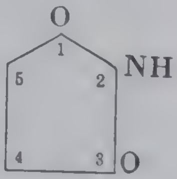
1,2,3,5-Oxatriazole



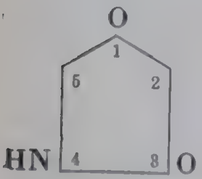
1,2,3-Dioxazole



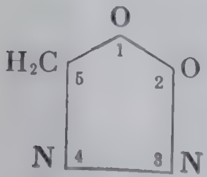
1,2,4-Dioxazole



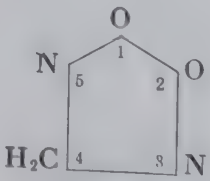
1,3,2-Dioxazole



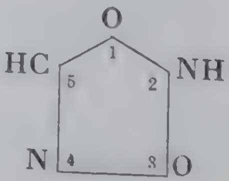
1,3,4-Dioxazole


O
H₂C
O
N
N
1
2
3
4
5

1,2,3,4,5-Dioxadiazole

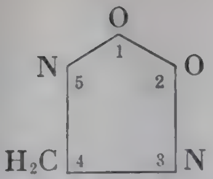

O
N
O
H₂C
N
1
2
3
4
5

1,2,3,5,4-Dioxadiazole

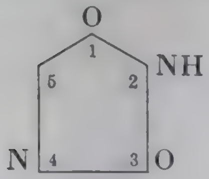

O
HC
NH
N
O
1
2
3
4
5

1,3,2,4-Dioxadiazole

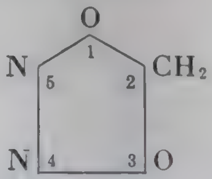
ORGANIC RING SYSTEMS


O
N
O
H₂C
N
1 2 3 4 5

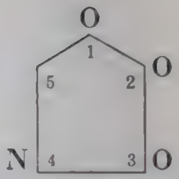
1,2,3,5,4-Dioxadiazole


O
NH
N
O
1 2 3 4 5

1,3,2,4-Dioxadiazole

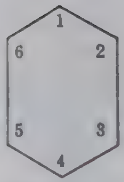

O
N
CH₂
N
O
1 2 3 4 5

1,3,4,5-Dioxadiazole

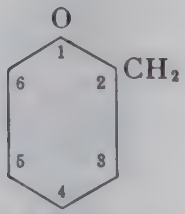


1,2,3,4-Trioxazole

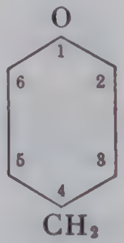
Sulfur replacing oxygen in these five-membered rings forms the corresponding thiazoles; thiatriazoles; dithiazoles; dithiadiazoles; and trithiazoles.



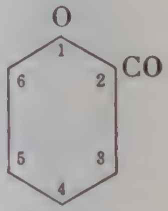
Benzene


O
CH₂
1 2 3 4 5 6

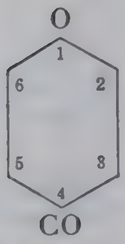
1,2-Pyran


O
CH₂
1 2 3 4 5 6

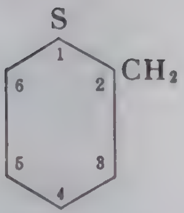
1,4-Pyran



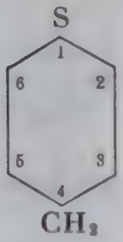
1,2-Pyrone
α-Pyrone
Coumalin



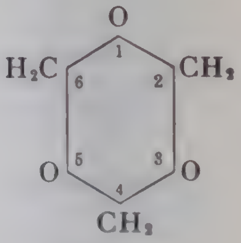
1,4-Pyrone
γ-Pyrone


S
CH₂
1 2 3 4 5 6

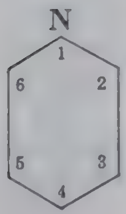
1,2-Thiapyran


S
CH₂
1 2 3 4 5 6

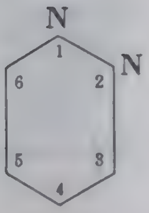
1,4-Thiapyran
Phenanthiophene


O
H₂C
CH₂
O
O
CH₂
1 2 3 4 5 6

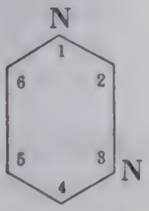
s-Trioxane
1,3,5-Trioxane



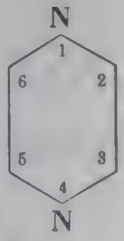
Pyridine
Azine



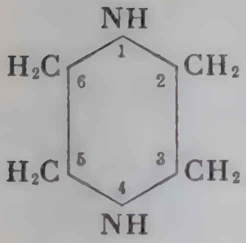
Pyridazine
1,2-Diazine
Orthodiazine



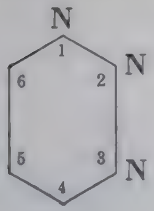
Pyrimidine
1,3-Diazine
Metadiazine
Miazine



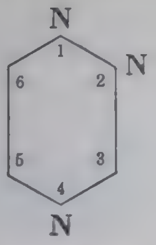
Pyrazine
1,4-Diazine
Paradiazine
Piazine



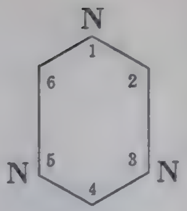
Piperazine
Hexahydro-
1,4-diazine



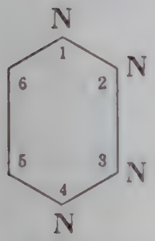
v-Triazine
1,2,3-Triazine



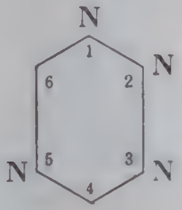
as-Triazine
1,2,4-Triazine



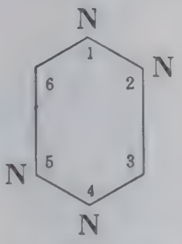
s-Triazine
1,3,5-Triazine
Cyanidine



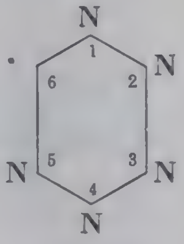
v-Tetrazine
1.2,3,4-Tetrazine



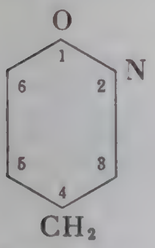
as-Tetrazine
1,2,3,5-Tetrazine



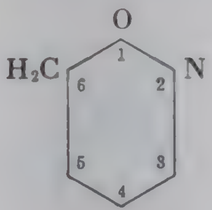
s-Tetrazine
1,2,4,5-Tetrazine



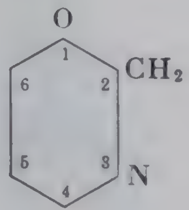
Pentazine



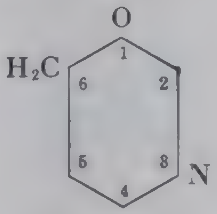
1,2,4-Oxazine



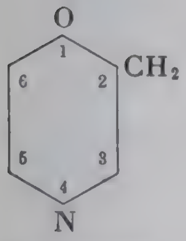
1,2,6-Oxazine



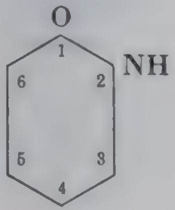
1,3,2-Oxazine



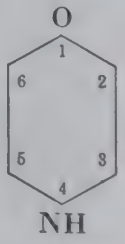
1,3.6-Oxazine
Pentoxazole



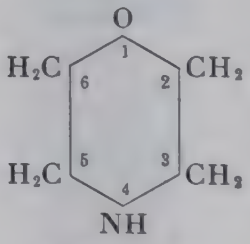
1,4-Oxazine



o-Isoxazine



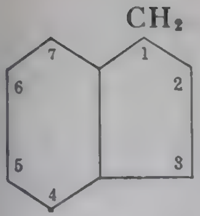
p-Isoxazine



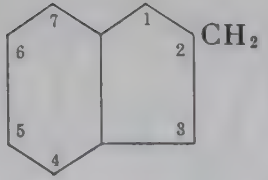
Morpholine
Tetrahydro-
p-isoxazine

In a similar manner are derived:- oxadiazine; oxatriazine; oxatetrazine; dioxazine; dioxadiazine; dioxatriazine; trioxazine; trioxadiazine; tetroxazine. Sulfur replacing oxygen in these rings forms the corresponding thia derivatives.

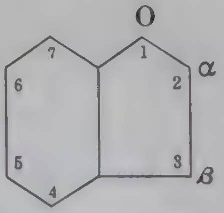
ORGANIC RING SYSTEMS


CH₂
1
2
3
4
5
6
7

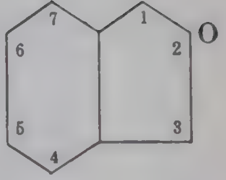
Indene


1
CH₂
2
3
4
5
6
7

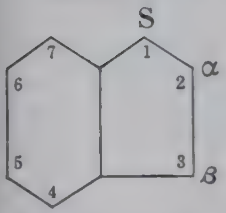
Isoindene


O
1
α
2
3
β
4
5
6
7

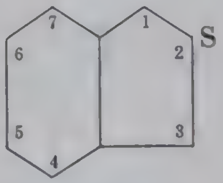
Benzofuran
Coumarone



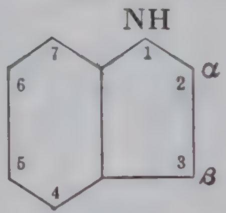
Isobenzofuran


S
1
α
2
3
β
4
5
6
7

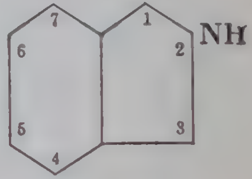
Thionaphthene
Benzothiofuran
Benzothiophene



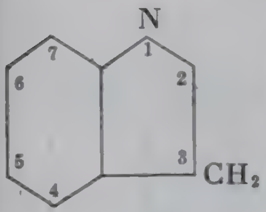
Isothionaphthene
Isobenzothiofuran


NH
1
α
2
3
β
4
5
6
7

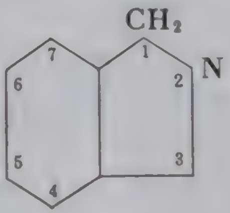
Indole
1-Benzazole
Benzopyrrole



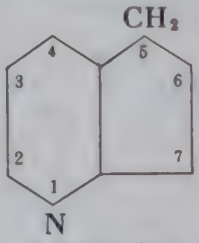
Isoindole
2-Benzazole


N
1
2
3
CH₂
4
5
6
7

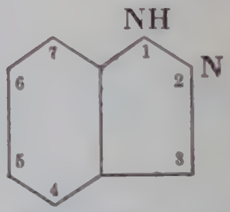
Indolenine
3-Pseudoindole
1-Isobenzazole


CH₂
1
N
2
3
4
5
6
7

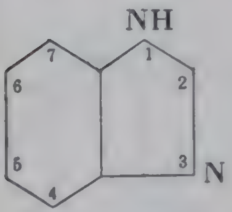
Pseudoisoindole
2-Isobenzazole


CH₂
5
6
7
4
3
2
1
N

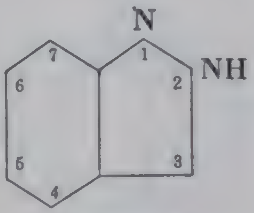
4-Pyrindine
4-Isobenzazole
4-Indenazine


NH
1
N
2
3
4
5
6
7

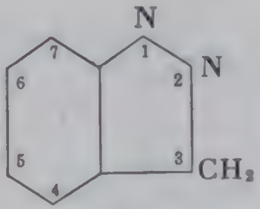
Isoindazole
1,2-Benzodiazole
Benzpyrazole


NH
1
2
3
N
4
5
6
7

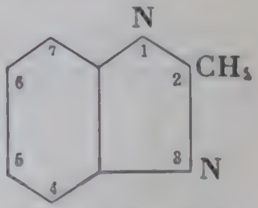
Benzimidazole
1,3-Benzodiazole


N
1
NH
2
3
4
5
6
7

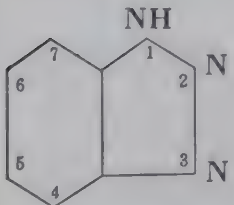
Indazole
2,1-Benzodiazole
Benzopyrazole


N
1
N
2
3
CH₂
4
5
6
7

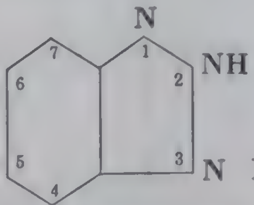
Indiazene
Benzisodiazole


N
1
CH₂
2
3
N
4
5
6
7

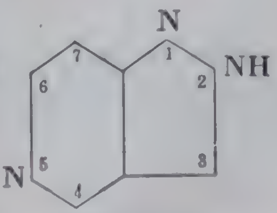
1,3-Benzisodiazole


NH
1
N
2
3
N
4
5
6
7

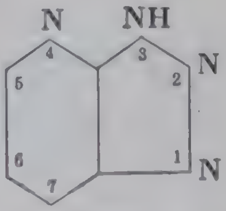
1,2,3-Benzotriazole
Benzisotriazole
Azimidobenzene


N
1
NH
2
3
N
4
5
6
7

2,1,3-Benzotriazole
Pseudoazimido-
benzene

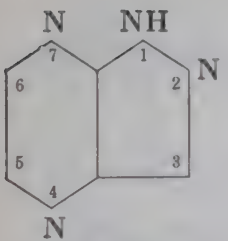

N
1
NH
2
3
N
4
5
6
7

2-Pyrazolo-
[4,3-*c*]-pyridine

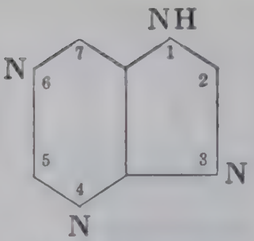

N
NH
4
3
N
2
1
N
5
6
7

3-*v*-Triazolo-
[4,5-*b*]pyridine

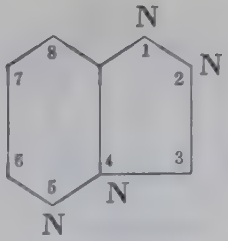
ORGANIC RING SYSTEMS


N
NH
N
N
1
2
3
4
5
6
7

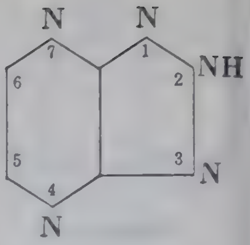
1-Pyrazolo-
[3,4-*b*]pyrazine


NH
N
N
N
1
2
3
4
5
6
7

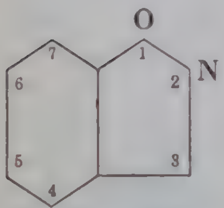
1,3,4,6-Benzotetrazole
See also Purine


N
N
N
N
1
2
3
4
5
6
7
8

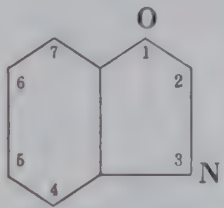
s-Triazolo-
[4,3-*b*]pyridazine


N
N
NH
N
N
1
2
3
4
5
6
7

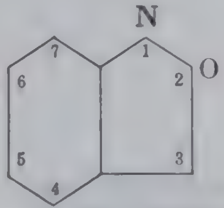
2-*v*-Triazolo-
[4,5-*b*]-pyrazine



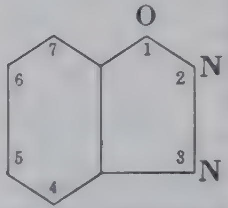
Benzisoxazole
Indoxazine



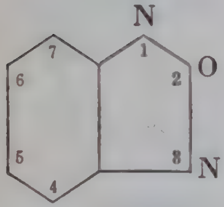
Benzoxazole
Benzothiazole
when S replaces O



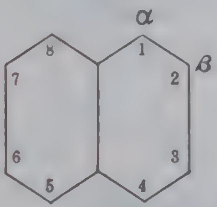
Anthranil
Benzpseudooxazole


O
N
N
1
2
3
4
5
6
7

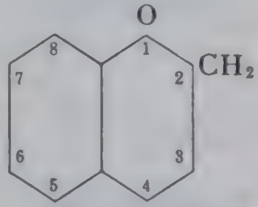
Benzoxadiazole


N
O
N
1
2
3
4
5
6
7

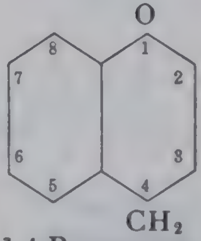
Benzofurazan
Benzisoxadiazole


α
β
1
2
3
4
5
6
7
8

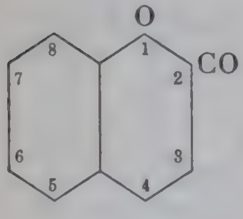
Naphthalene


O
CH₂
1
2
3
4
5
6
7
8

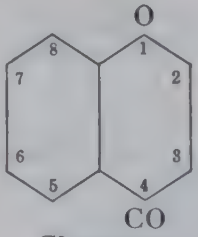
1,2-Benzopyran
1,2-Chromene


O
CH₂
1
2
3
4
5
6
7
8

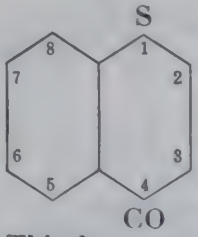
1,4-Benzopyran
1,4-Chromene


O
CO
1
2
3
4
5
6
7
8

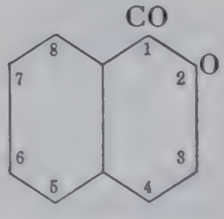
Coumarin
1,2-Benzopyrone


O
CO
1
2
3
4
5
6
7
8

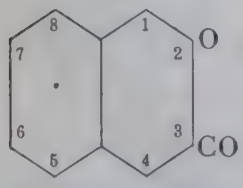
Chromone
1,4-Benzopyrone


S
CO
1
2
3
4
5
6
7
8

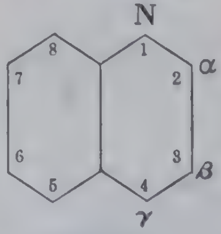
Thiochromone
1,4-Benzothiopyrone


CO
O
1
2
3
4
5
6
7
8

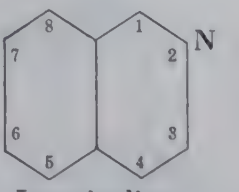
Isocoumarin
2,1-Benzopyrone


O
CO
1
2
3
4
5
6
7
8

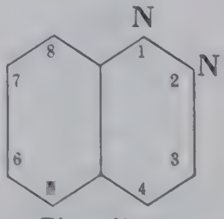
2,3-Benzopyrone


N
α
β
γ
1
2
3
4
5
6
7
8

Quinoline
1-Benzazine

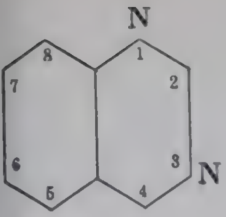


Isoquinoline
2-Benzazine
Leucoline

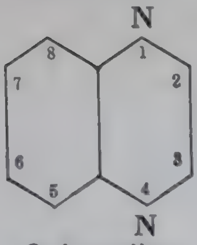


Cinnoline
1,2-Bezodiazine
α-Phenodiazine

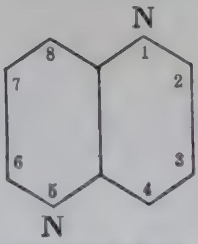
ORGANIC RING SYSTEMS



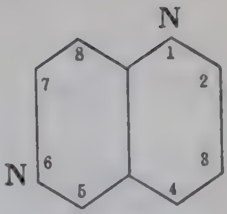
Quinazoline
1,3-Benzodiazine
Phenmiazine



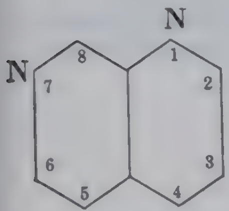
Quinoxaline
1,4-Benzodiazine
Phenpiazine



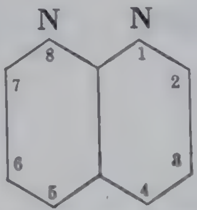
Pyrido[3,2-*b*]-
pyridine



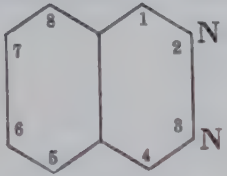
Pyrido[4,3-*b*]-
pyridine



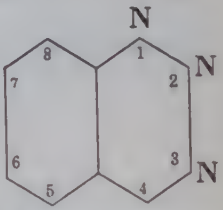
Pyrido[3,4-*b*]-
pyridine



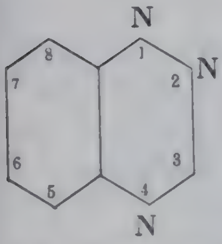
Naphthyridine



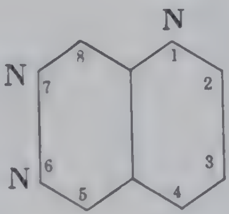
Phthalazine
2,3-Benzodiazine
β-Phenodiazine



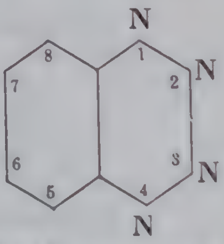
1,2,3-Benzotriazine
Phenotriazine



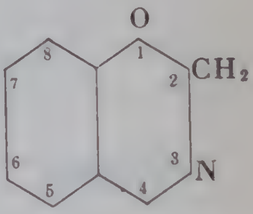
1,2,4-Benzotriazine



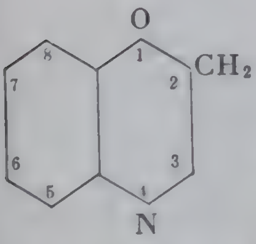
Pyrido[2,3-*d*]-
pyridazine



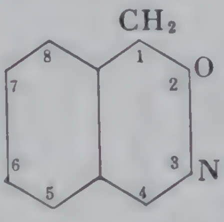
1,2,3,4-Benzotetrazine



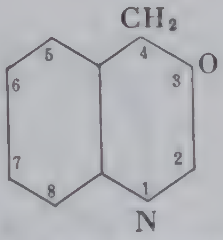
1,3,2-Benzoxazine



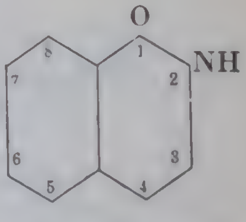
1,4,2-Benzoxazine



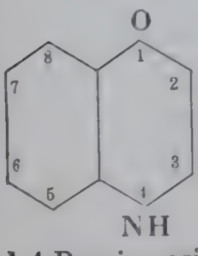
2,3,1-Benzoxazine



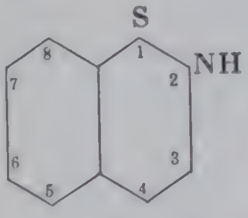
3,1,4-Benzoxazine



1,2-Benzisoxazine

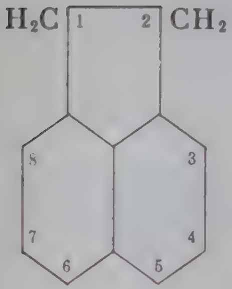


1,4-Benzisoxazine

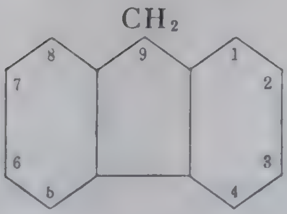


1,2-Benzisothiazine
Also a 1,4-Form

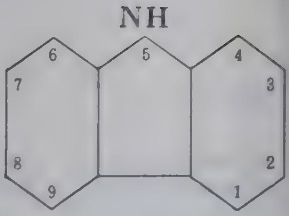
In a similar manner are derived:- benzoxadiazine; benzoxatriazine; etc.; benzodioxazine; etc.; benzotrioxazine; etc.



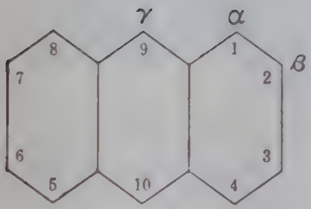
Acenaphthene



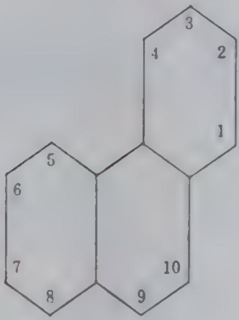
Fluorene
Diphenylenemethane



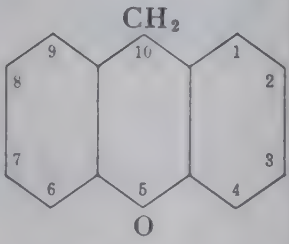
Carbazole
Dibenzopyrrole
Diphenyleneimide



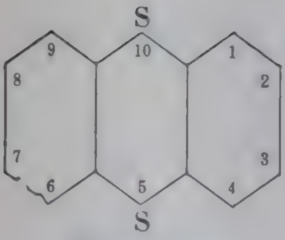
Anthracene



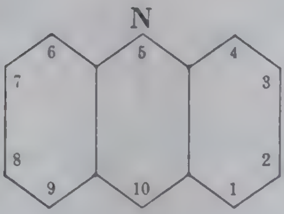
Phenanthrene



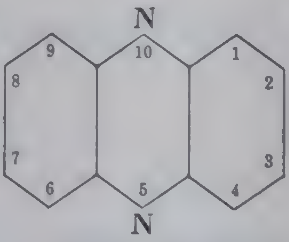
Xanthene



Thianthrene

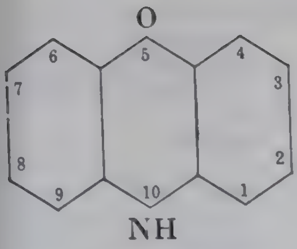


Acridine

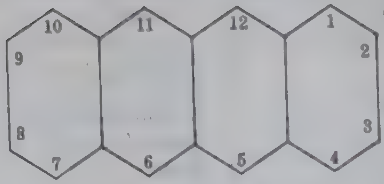


Phenazine

ORGANIC RING SYSTEMS


O
NH
1
2
3
4
5
6
7
8
9
10

Phenoxazine
S replacing O = Phenothiazine


1
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7
8
9
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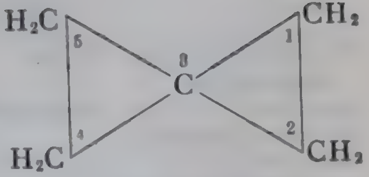
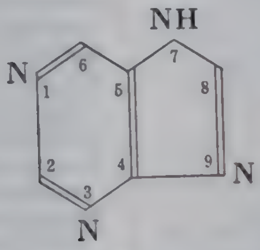
11
12

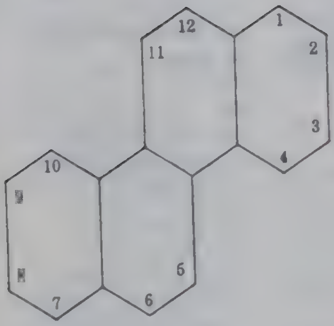
Naphthacene


H₂C
CH₂
C
H₂C
CH₂
1
2
3
4
5

Spiropentane
Rings with but one atom in common are known as "spiro compounds".


NH
N
N
N
1
2
3
4
5
6
7
8
9

Purine


1
2
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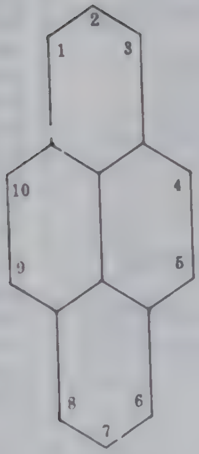
9
10
11
12

Chrysene


1
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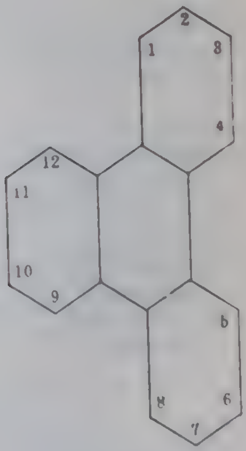
Pyrene


1
2
3
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5
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8
9
10
11
12

Triphenylene

NAMES AND FORMULAS OF ORGANIC RADICALS

Reprinted from *Chemical Abstracts*, Decennial Index, Subjects, 1917-1926, by permission.

Name	Formula
Acenaphthenyl (from acenaphthene)	$C_{12}H_9$–
Acetamido	CH_3CONH–
Acetenyl cf. ethinyl	....
Acetimido	$CH_3C(:NH)$–
Acetonyl	CH_3COCH_2–
Acetonylidene	CH_3COCH:
Acetoxy	$CH_3CO\cdot O$–
Acetyl	CH_3CO–
Acetylene	:CHCH:
Acridyl (from acridine)	$C_{13}H_8N$–
Acrylyl	$CH_2:CHCO$–
Adipyl	–$OC(CH_2)_4CO$–
Alanyl	CH_3CHNH_2CO–
Alkoxy (any alkyl radical attached by oxygen)	$C_nH_{2n+1}O$–
Allyl	$CH_2:CHCH_2$–
β–allyl cf. isopropenyl	....
Amidoxalyl cf. oxamyl	....
Amino (amido)	H_2N–
Amoxy	$CH_3(CH_2)_4O$–
Amyl	$CH_3(CH_2)_4$–
tert-Amyl	$(C_2H_5)(CH_3)_2C$–
Amylidene	$CH_3(CH_2)_3CH$:
Anilino	C_6H_5NH–
Anisal	p–$CH_3OC_6H_4CH$:
Anisoyl	p–$CH_3OC_6H_4CO$–
Anisyl	(o, m or p) $CH_3OC_6H_4$–
Anisylidene cf. anisal	....
Anthranilo	$o\text{–}\underbrace{C_6H_4CO\cdot N}\text{–}$
Anthranoyl	o–$H_2NC_6H_4CO$–
Anthraquinonyl (from anthraquinone)	two isomers
Anthryl (from anthracene)	five isomers
Anthrylene (from anthracene)	$C_{14}H_8$:(11 isomers)
Antipyryl (from antipyrene)	$\underbrace{CO\cdot N(C_6H_5)\cdot N(CH_3)\cdot C(CH_3):C}\text{–}$
Arseno	–As:As–
Arsino (from arsinic acid)	(HO)OAs:
Arsinoso	O:As–
Arsono (from arsonic acid)	$(HO)_2OAs$–
Arsyl	H_2As–
Arsylene	HAs:
Asaryl	(2,4,5) $(CH_3O)_3C_6H_2$–
Asparagyl	$H_2NCOCH_2CHNH_2\cdot CO$–

Name	Formula
Aspartyl	–$COCH_2CHNH_2CO$–
Auro	Au–
Azimino (azimido)	–N:NNH–
Azido cf. triazo	....
Azino	:N·N:
Azo	–N:N–
Azoxy	–NO:N–
Benzal	C_6H_5CH:
Benzamido	C_6H_5CONH–
Benzenyl	C_6H_5C:
Benzidino (from benzidine)	$H_2NC_6H_4C_6H_4NH$–
Benzilyl	$(C_6H_5)_2C(OH)CO$–
Benzimidazolyl (from benzimidazole)	$C_7H_5N_2$–
Benzimido	$C_6H_5C(:NH)$–
Benzofuryl (from benzofuran)	C_8H_5O
Benzohydryl	$(C_6H_5)_2CH$–
Benzohydrylidene cf. diphenylmethylene	....
Benzopyranyl (from benzopyran)	C_9H_7O (2–α–, etc.)
Benzoxazolyl (from benzoxazole)	C_7H_4NO–
Benzoxy	$C_6H_5CO\cdot O$–
Benzoyl	C_6H_5CO–
Benzoylene	–C_6H_4CO–
Benzyl	$C_6H_5CH_2$–
Benzylidene cf. benzal	....
Biphenylene	–$C_6H_4\cdot C_6H_4$–
Biphenylenedisazo	–$N:NC_6H_4C_6H_4N:N$–
Bornyl (from borneol)	$C_{10}H_{17}$–
Boryl	O:B–
Bromo	Br–
Δ^1-Butenyl	$CH_3CH_2CH:CH$–
Δ^2-Butenyl	$CH_3CH:CHCH_2$–
Δ^3-Butenyl	$CH_2:CH(CH_2)_2$–
Butoxy	$CH_3(CH_2)_2O$–
Butyl	$CH_3(CH_2)_3$–
sec-Butyl	$(C_2H_5)(CH_3)CH$–
tert-Butyl	$(CH_3)_3C$–
Butylene	–$CH_2CH_2CH_2CH_2$– (1, 4–form)
Butylidene	$CH_3(CH_2)_2CH$:
Butyryl	$CH_3(CH_2)_2CO$–
Camphanyl (from camphane)	$C_{10}H_{17}$–(3 isomers)
Camphoroyl (from camphoric acid)	$C_{10}H_{14}O_2$:
Camphoryl (from camphor)	$C_{10}H_{15}O$–
Camphorylidene (from camphor)	$C_{10}H_{14}O$:

NAMES AND FORMULAS OF ORGANIC RADICALS

Name	Formula
Carbamido	$H_2NCONH-$
Carbamyl	H_2NCO-
Carbanilino cf. phenylcarbamyl	....
Carbazyl (from carbazole)	$C_{12}H_8N-$(5 isomers)
Carbethoxy	$C_2H_5O{\cdot}CO-$
Carbomethoxy	$CH_3O{\cdot}CO-$
Carbonyl	$OC:$
Carbonyldioxy	$-O{\cdot}CO{\cdot}O-$
Carboxy	$-CO{\cdot}OH$
Carvacryl	$(CH_3)[(CH_3)_2CH]:C_6H_3-(1,4;2)$
Cetyl	$CH_3(CH_2)_{14}CH_2-$
Chloro	$Cl-$
Chloromercuri	$ClHg-$
Cinnamal	$C_6H_5CH:CHCH:$
Cinnamenyl cf. styryl	....
Cinnamyl	$C_6H_5CH:CHCO-$
Cinnamylidene cf. cinnamal	....
Cresotyl (from cresotinic acid)	$(HO)(CH_3)C_6H_3CO-(2,3)$
Cresoxy cf. toloxy	....
Cresyl (10 isomers)	$(o,m,p)(HO)(CH_3):C_6H_3-$
Cresylene cf. tolylene	....
Crotonyl	$CH_3CH:CHCO-$
Cumal	$p-(CH_3)_2CHC_6H_4CH:$
Cumenyl	$(CH_3)_2CHC_6H_4-$
Cumidino	$(CH_3)_2CHC_6H_4NH-$
Cuminal cf. cumal	....
Cyano	$NC-$
Cyclobutyl	$CH_2CH_2CH_2CH-$
Cyclohexenyl (from cyclohexene)	C_6H_9- (3 isomers)
Cyclohexyl (from cyclohexane)	$C_6H_{11}-$
Cyclohexylidene	$CH_2CH_2CH_2CH_2{\cdot}CH_2C:$
Cyclopentenyl (from cyclopentene)	C_5H_7-
Cyclopentyl (from cyclopentane)	C_5H_9-
Cyclopropyl	CH_2CH_2CH-
Cymyl (from cymene)	$C_{10}H_{13}-$
2-*p*-cymyl cf. carvacryl	....
3-*p*-cymyl cf. thymyl	....
Desyl	$(C_6H_5)(C_6H_5CO)CH-$
Diazo	$-N:N-$
Diazoamino cf. azimino	....
Diazoxy	$-N(:O):N-$

Name	Formula
Duryl	$(CH_3)_4C_6H-(2,3,5,6)$
Durylene	$(CH_3)_4C_6:(2,3,5,6)$
Epoxy	$-O-$(to different radicals already united in some other way)
Ethene cf. ethylene	....
Ethenyl	$CH_3C\vdots$
Ethinyl	$HC\vdots C-$
Ethoxalyl	$C_2H_5O{\cdot}OC{\cdot}CO-$
Ethoxy	C_2H_5O-
Ethyl	$CH_3{\cdot}CH_2-$
Ethylene	$-CH_2CH_2-$
Ethylenedioxy	$-O(CH_2)_2O-$
Ethylidene	$CH_3CH:$
Fenchyl (from fenchyl alcohol)	$C_{10}H_{17}-$(:2-fenchanyl)
Fluoro	$F-$
Fluoryl (from fluorene)	$C_{13}H_9-$(5 isomers)
Fluorylidene	$C_{13}H_8:$
Formamido	$HCONH-$
Formazyl	$(C_6H_5N:N{\cdot})(C_6H_5{\cdot}NHN:)C-$
Formyl	$H{\cdot}CO-$
Fural (2 isomers)	$OCH:CH{\cdot}CH:C{\cdot}CH:$
Furfural cf. fural	....
Furfuryl cf. furyl	....
Furfurylidene cf. fural	....
2-Furoyl cf. pyromucyl	....
3-Furoyl	$CH:CH{\cdot}O{\cdot}CH:C{\cdot}CO-$
Furyl (2 isomers)	$O{\cdot}CH:CH{\cdot}CH:C-$
Furylidene 3(2)–form	$CH:CH{\cdot}O{\cdot}CH_2{\cdot}C:$ (also a 2(3)–form)
Geranyl (from geraniol)	$C_{10}H_{17}-$
Glutamyl	$-OCCHNH_2(CH_2)_2{\cdot}CO-$
Glutaryl	$-OC(CH_2)_3CO-$
Glyceryl	$-CH_2(CH-)CH_2-$
Glycolyl	$HOCH_2CO-$
Glycyl	H_2NCH_2CO-
Glyoxyl	$OCH{\cdot}CO-$
Guaiacyl cf. *o*-anisyl	....
Guanido	$H_2NC(:NH)NH-$
Guanyl	$H_2NC(:NH)-$
Hendecyl	$CH_3(CH_2)_{10}-$
Heptyl	$CH_3(CH_2)_6-$
Hexadecyl cf. cetyl	....
Hexyl	$CH_3(CH_2)_5-$
Hippuryl	$C_6H_5CONHCH_2CO-$
Homopiperonyl	$(3,4)(CH_2O_2)C_6H_3{\cdot}CH_2CH_2-$
Hydrazi	$-NH{\cdot}NH-$(both valences to same atom)
Hydrazino	H_2NNH-

NAMES AND FORMULAS OF ORGANIC RADICALS

Name	Formula
Hydrazo	$-NH\cdot NH-$ (to different atoms)
Hydrazono	$H_2N\cdot N:$
Hydroxamino	$HONH-$
Hydroximino cf. isonitroso	....
Hydroxy (hydroxyl)	$HO-$
–idene (added to any radical usually means a double bond at point of attachment)	....
Imidazolyl (from imidazol)	$C_3H_3N_2-$ (4 isomers)
Imino (imido)	$HN:$
Indanyl (from indan)	C_9H_9- (4 isomers)
Indenyl (from indene)	C_9H_7- (7 isomers)
Indyl (from indole)	C_8H_6N- (7 isomers)
Indylidene	$C_6H_4\cdot NH\cdot CH_2\cdot C:$ 3(2)–, etc.
Iodo	$I-$
Iodoso	$OI-$
Iodoxy	O_2I-
Isoallyl cf. propenyl	....
Isoamoxy	$(CH_3)_2CHCH_2CH_2O-$
Isoamyl	$(CH_3)_2CHCH_2CH_2-$
Isoamylidine	$(CH_3)_2CHCH_2CH:$
Isobutenyl	$(CH_3)_2C:CH-$
Isobutoxy	$(CH_3)_2CHCH_2O-$
Isobutyl	$(CH_3)_2CHCH_2-$
Isobutyryl	$(CH_3)_2CHCO-$
Isocyano	$C:N-$
Isodiazo	$-NH\cdot N:$ (to the same atom)
Isohexyl	$(CH_3)_2CH(CH_2)_3-$
Isoindyl (from isoindole)	C_8H_6N- (4 isomers)
Isoleucyl	$CH_3CH_2CH(CH_3)\cdot CHNH_2CO-$
Isonitro	$HOON:$
Isonitroso	$HON:$
Δ^1-Isopentenyl	$(CH_3)_2CHCH:CH-$
Isophthalal	$:HC\cdot C_6H_4\cdot CH:$ (*m*)
Isophthalylidene cf. isophthalal	....
Isopropenyl	$CH_2:C(CH_3)-$
Isopropoxy	$(CH_3)_2CH\cdot O-$
Isopropyl	$(CH_3)_2CH-$
Isopropylidene	$(CH_3)_2C:$
Isoquinolyl (from isoquinoline)	C_9H_6N- (9 isomers)
Isothiocyano	$S:C:N-$
Isovaleryl	$(CH_3)_2CHCH_2CO-$
Isoxazolyl (from isoxazole)	C_3H_2ON- (5 isomers)
Keto	O: (to same atom)
Leucyl	$(CH_3)_2CHCH_2CHNH_2CO-$
Malonyl	$-OC\cdot CH_2\cdot CO-$
Menthyl (from menthane): as, 2-*p*-menthyl	$CH_3\cdot CH(CH_2)_2CH\cdot$ $(i\text{-}C_3H_7)CH_2CH-$
Mercapto	$HS-$
Mercuri	$-Hg-$
1-Mesityl	$(CH_3)_2C_6H_3CH_2-$ (1, 3, 5)
2-Mesityl	$(CH_3)_3C_6H_2-$ (2,4,6)
Methene cf. methylene	....
Methenyl	$HC:$
Methionyl	$CH_2(SO_2)_2:$
Methoxy	CH_3O-
Methyl	CH_3-
Methylene	$H_2C:$
Methylenedioxy	$-O\cdot CH_2\cdot O-$
Methylol cf. hydroxymethyl	....
Naphthal	$C_{10}H_7CH:$
Naphthalimido (from naphthalic acid)	$C_{10}H_6(CO)_2N-$
Naphthenyl	$C_{10}H_7C:$
Naphthobenzyl	$C_{10}H_7CH_2-$
Naphthoxy	$C_{10}H_7O-$
Naphthoyl	$C_{10}H_7CO-$
Naphthyl (1 or 2)	$C_{10}H_7-$
Naphthylene	$C_{10}H_6:$
Naphthylidene	$C_6H_4CH_2CH:CH\cdot C:$ (1(4)–), etc.
Nitramino	$O_2N\cdot NH-$
Nitrilo	$N:$
Nitro	O_2N-
aci-Nitro cf. isonitro	....
Nitroso	$ON-$
Norcamphanyl (from norcamphane)	$C_7H_{11}-$
Octyl	$CH_3(CH_2)_7-$
Oxalyl	$-OC\cdot CO-$
Oxamido	$H_2NCO\cdot CONH-$
Oxamyl	$H_2NCO\cdot CO-$
Oximido cf. isonitroso	....
Oxy cf. epoxy and keto	$-O-$ (used as a connective)
Pentamethylene	$-CH_2(CH_2)_3CH_2-$
Pentazyl	$N:N\cdot N:N\cdot N-$
Pentenyl (like butenyl)	C_5H_9-
Pentyl cf. amyl	....
Perimidyl (from perimidine)	$C_{11}H_7N_2-$ (8 isomers)
Perthio	$S:S:$
Phenacyl	$C_6H_5COCH_2-$
Phenacylidene	$C_6H_5COCH:$
Phenanthryl (from phenanthrene)	$C_{14}H_9-$ (5 isomers)

NAMES AND FORMULAS OF ORGANIC RADICALS

Name	Formula
Phenanthrylene	$C_{14}H_8$:(several isomers)
Phenenyl	C_6H_3: (*s*–, *as*–, *v*–)
Phenethyl	$C_6H_5CH_2CH_2$–
Phenetidino	$C_2H_5OC_6H_4NH$–
Phenetyl	$C_2H_5OC_6H_4$–(*o*, *m*, or *p*)
Phenoxy	C_6H_5O–
Phenyl	C_6H_5–
Phenylazo	$C_6H_5N:N$–
Phenylcarbamido	$C_6H_5NHCONH$–
Phenylene	C_6H_4:(*o*, *m*, or *p*)
Phenylenedisazo	$-N:NC_6H_4N:N$–(*o*,*m*,*p*)
Phenylidene (*p*)	$CH:CH\cdot CH_2\cdot CH:CH\cdot C$ (also *o*-isomer)
Phenylureido cf. phenylcarbamido	. . . .
Phosphazo	$-N:P$–
Phosphono	H_2O_3P–
Phthalal	$:HC\cdot C_6H_4\cdot CH:$
Phthalamido (*o*)	$HO_2C\cdot C_6H_4\cdot CONH$–
Phthalidene (from phthalide)	$C_6H_4\cdot CO\cdot O\cdot C:$
Phthalidyl	$C_6H_4\cdot CO\cdot O\cdot CH$–
Phthalimido (*o*)	$C_6H_4(CO)_2N$–
Phthalyl (*o*)	$-OC\cdot C_6H_4\cdot CO$–
Picryl	$(NO_2)_3C_6H_2$–(2,4,6)
Piperidyl (from piperidine)	$C_5H_{10}N$– (4 isomers)
Piperonyl	$(CH_2O_2)C_6H_3CH_2$–(3, 4)
Piperonylidine	$(CH_2O_2)C_6H_3CH$:(3,4)
Pivalyl (from pivalic acid)	$(CH_3)_3C\cdot CO$–
Prolyl (from proline)	$NH\cdot CH_2CH_2CH_2CH\cdot$ CO–
Propargyl	$HC:C\cdot CH_2$–
Propenyl	$CH_3CH:CH$–
Propenylidene	$CH_3CH:C:$
Propiolyl	$HC:C\cdot CO$–
Propionyl	CH_3CH_2CO–
Propoxy	$CH_3CH_2CH_2O$–
Propyl (*n*)	$CH_3CH_2CH_2$–
Propylene	$-CH(CH_3)CH_2$–
Propylidene	$CH_3CH_2CH:$
Pseudoallyl cf. isopropenyl	. . . .
as-Pseudocumyl	$(CH_3)_3C_6H_2$–(2,3,5)
s-Pseudocumyl	$(CH_3)_3C_6H_2$–(2,4,5)
v-Pseudocumyl	$(CH_3)_3C_6H_2$–(2,3,6)
Pseudoindyl (from pseudoindole)	C_8H_6N– (7 isomers)
Pyranyl (2-α, 2-γ, 3-α, etc.)	C_5H_5O–
Pyrazolyl (from pyrazole)	$C_3H_3N_2$–(4 isomers)

Name	Formula
Pyridyl (from pyridine)	C_5H_4N–(3 isomers)
Pyridylidene 4(1)–	$CH:CH\cdot NH\cdot CH:CH\cdot C:$
Pyrimidyl (from pyrimidine)	$C_4H_3N_2$–
Pyromucyl	$O\cdot CH:CH\cdot CH:C\cdot CO$–
Pyrrolidyl (from pyrrolidine)	C_4H_8N– (3 isomers)
Pyrroyl	$CH:CH\cdot CH:CH\cdot N\cdot CO$–
Pyrryl (from pyrrole)	C_4H_4N– (3 isomers)
Quinolyl (from quinoline)	C_9H_6N– (7 isomers)
Quinonyl (from quinone)	$C_6H_3O_2$–
Quinoxalyl (from quinoxaline)	$C_8H_5N_2$–
Salicyl (*o*)	$HO\cdot C_6H_4$–
Salicylal (*o*)	$HO\cdot C_6H_4\cdot CH:$
Salicylyl (*o*)	$HO\cdot C_6H_4\cdot CO$–
Selenino	$(HO)OSe$–
Seleno	$Se:$
Selenocyano	$NCSe$–
Selenono	HO_3Se–
Selenonyl	$-SeO_2$–
Selenyl	HSe–
Semicarbazido	$H_2NCONHNH$–
Silicono	$(HO)OSi$–
Silicyl	H_3Si–
Silicylene	$H_2Si:$
Stannyl	H_3Sn–
Stearyl	$CH_3(CH_2)_{16}CO$–
Stibono	$(HO)_2OSb$–
Styrene	$-CH(C_6H_5)CH_2$–
Styrolene cf. styrene	. . . .
Styryl	$C_6H_5CH:CH$–
Succinamyl	$H_2NCOCH_2CH_2CO$–
Succinyl	$-OCCH_2CH_2CO$–
Sulfamino	HO_3SNH–
Sulfamyl	H_2NO_2S–
Sulfhydryl cf. mercapto	. . . .
Sulfino	HO_2S–
Sulfinyl	$OS:$
Sulfo	HO_3S–
Sulfonamido	$-SO_2NH$–
Sulfonyl	$-SO_2$–
Sulfuryl cf. sulfonyl	. . . .
Tauryl	$H_2NCH_2CH_2SO_2$–
Telluro	$Te:$
Terephthalal (*p*)	$:HC\cdot C_6H_4\cdot CH:$
Tetramethylene cf. 1, 4-butylene	. . . .
Tetrazyl (from tetrazole)	CHN_4– (2 isomers)
Thiazyl (from thiazole)	C_3H_2NS– (3 isomers)
Thienyl (from thiophene)	C_4H_3S– (2 isomers)

NAMES AND FORMULAS OF ORGANIC RADICALS

Name	Formula
Thio	$-S-$
Thiocarbonyl	$SC:$
Thiocyano	$NCS-$
Thiohydroxy cf. mercapto	. . . .
Thiol (S replacing *O* in *OH*)	Used in place of "Thio" only when required for distinction
Thiono (S replacing *O* in *CO*)	
Thionyl cf. sulfinyl	. . . .
Thujyl (from sabinane)	$C_{10}H_{17}-$ (attached at 2 positions)
Thymyl (from thymol)	$HC:C(CH_3)\cdot CH:CH\cdot C(i-C_3H_7):C-$
Toloxy (*o*, *m*, or *p*)	$CH_3C_6H_4O-$
Toluino (*o*, *m*, or *p*)	$CH_3C_6H_4NH-$
Toluyl (*o*, *m*, or *p*)	$CH_3C_6H_4CO-$
α-Toluyl	$C_6H_5CH_2CO-$
Tolyl (*o*, *m*, or *p*)	$CH_3C_6H_4-$
α-Tolyl cf. benzyl	. . . .
Tolylene	$CH_3C_6H_3:$ (6 isomers)
α-Tolylene cf. benzal	. . . .
Triazeno	$H_2NH:N-$
Triazinyl (from triazine)	$C_3H_2N_3-$
Triazo	$N:N\cdot N-$
Triazolyl (from triazole)	$C_2H_2N_3-$
Trimethylene	$-CH_2CH_2CH_2-$
Tryptophyl (from tryptophan)	$C_{11}H_{11}ON_2-$
Tyrosyl (from tyrosine)	p-$HOC_6H_4CH_2CHNH_2\cdot CO-$
Undecyl cf. hendecyl (in sense $C_{11}H_{23}-$)	. . . .
Uramino cf. carbamido	. . . .
Ureido (by some used synonymously with carbamido)	$-NHCONH-$
Valeryl	$CH_3(CH_2)_3CO-$
Valyl (from valine)	$(CH_3)_2CHCHNH_2CO-$
Vanillal	$(CH_3O)(HO)C_6H_3CH:$ (3, 4)
Vanilloyl	$(CH_3O)(HO)C_6H_3CO-$ (3, 4)
Vanillyl	$(CH_3O)(HO)C_6H_3CH_2-$ (3, 4)
Veratral	$(CH_3O)_2C_6H_3CH:$ (3, 4)
Veratroyl	$(CH_3O)_2C_6H_3CO-$ (3,4)
Veratryl	$(CH_3O)_2C_6H_3CH_2-$ (3, 4)
Veratrylidene cf. veratral	. . . .
Vinyl	$H_2C:CH-$
Vinylene	$-CH:CH-$
Vinylidene	$H_2C:C:$
Xanthyl (from xanthene)	$C_{13}H_9O-$ (6 isomers)
Xyloyl (from xylic acid)	$(CH_3)_2C_6H_3CO-$ (7 isomers)
Xylyl (dimethylphenyl)	$(CH_3)_2C_6H_3-$
Xylylene	$-H_2C\cdot C_6H_4\cdot CH_2-$

NUMERICAL PREFIXES

See also *Greek Alphabet*

½ — Hemi
1 — Mono
1½ — Sesqui
2 — Di or Bi
3 — Tri
4 — Tetra
5 — Penta
6 — Hexa
7 — Hepta
8 — Octa
9 — Nona or Ennea
10 — Deca
11 — Undeca or Henadeca
12 — Dodeca
13 — Trideca
14 — Tetradeca
15 — Pentadeca
16 — Hexadeca
17 — Heptadeca
18 — Octadeca
19 — Nonadeca
20 — Eicosa
21 — Henicosa
22 — Docosa
23 — Tricosa
24 — Tetracosa
25 — Pentacosa
26 — Hexacosa
27 — Heptacosa
28 — Octacosa
29 — Nonacosa
30 — Triaconta
31 — Hentriaconta
32 — Dotriaconta
33 — Tritriaconta
34 — Tetratriaconta
35 — Pentatriaconta
36 — Hexatriaconta
37 — Heptatriaconta
38 — Octatriaconta
39 — Nonatriaconta
40 — Tetraconta
41 — Hentetraconta
42 — Dotetraconta
43 — Tritetraconta
44 — Tetratetraconta
45 — Pentatetraconta
46 — Hexatetraconta
47 — Heptatetraconta
48 — Octatetraconta
49 — Nonatetraconta
50 — Pentaconta
51 — Henpentaconta
52 — Dopentaconta
53 — Tripentaconta
54 — Tetrapentaconta
55 — Pentapentaconta
56 — Hexapentaconta
57 — Heptapentaconta
58 — Octapentaconta
59 — Nonapentaconta
60 — Hexaconta

FORMULA INDEX

For finding compounds listed in the table: PHYSICAL CONSTANTS OF ORGANIC COMPOUNDS.

The system used in this formula index is essentially the same as that employed in *Richter's Lexikon der Kohlenstoff Verbindungen*. The succession of the elements combined with carbon is as follows: H, O, N, S, F, Cl, Br, I. All the other elements are placed in alphabetical order according to their symbols. The arrangement depends (1) on the number of carbon atoms, (2) on the number of the other elements, which in addition to carbon, are contained in the compounds, (3) on the kind of elements, which in addition to carbon are contained in the molecule, in accordance with the order as stated above, and (4) on the number of atoms of each element which, in addition to carbon, is contained in the compound. Thus 2 III means two carbon atoms combined with three other elements; *e.g.*, $C_2H_2O_2F_2$ 2239, is a compound with 2 carbon atoms and *3* other elements, and it is the 2239th compound in the table to which this formula index is a part.

1 I

CH_4 4061
CO 1239
CO_2 1237
CN 1589
CS_2 1238
CF_4 1244
CCl_4 1243
CBr_4 1242
CI_4 1245

1 II

CHN 3714
CHF_3 3287
$CHCl_3$ 1477
$CHBr_3$ 1016
CHI_3 3887
CH_2O 3288; 3290
CH_2O_2 3301
CH_2N_2 1577; 1772
CH_2N_4 5870
CH_2S_3 6349
CH_2F_2 4433
CH_2Cl_2 4429
CH_2Br_2 4428
CH_2I_2 4434
CH_3N_3 4134
CH_3F 4240
CH_3Cl 4183
CH_3Br 4147
CH_3I 4287
CH_4O 4100
CH_4N_2 3297
CH_4S 4298
CH_5N 4105
CH_5N_3 3488
CH_5As 4132
CH_5P 4341
CH_6N_2 4269
CH_6N_4 322
COS 1248
$COCl_2$ 1247
$COBr_2$ 1246
CO_8N_4 5853
$CNCl$ 1591
$CNBr$ 1590
CNI 1592
$CSCl_2$ 5916
$CSCl_4$ 5089
$CFCl_3$ 3286
CF_2Cl_2 2246
$CClBr_3$ 1472
CCl_2Br_2 1983
CCl_2I_2 1986
CCl_3Br 6143
CCl_3I 6157
$CBrI_3$ 1004

1 III

$CHON$ 1576; 1579
CHO_2Na 3302
CHO_2Tl 3303
CHO_6N_3 6300
$CHNS$ 5897
$CHFCl_2$ 3271
$CHClBr_2$ 1361
$CHClI_2$ 1363
$CHCl_2Br$ 1970
$CHCl_2I$ 2006
$CHBrI_2$ 928
$CHBr_2I$ 1849
$CH_2O_3N_2$ 4323
$CH_2O_4N_2$ 2636
CH_2FCl 3267
CH_2ClBr 1344
CH_2ClI 1393
CH_2BrI 950
CH_3ON 3294; 3296
CH_3OCl 4281
CH_3OAs 4131
CH_3O_2N 1228; 4316; 4765
CH_3O_3N 4315
$CH_3O_3N_3$ 4863
CH_3NS 5901
CH_3NS_2 2819
CH_3Cl_2As 4214
CH_4ON_2 3298; 3307; 6386
$CH_4O_2N_2$ 3842; 4314
$CH_4O_2N_4$ 4743
CH_4O_2Si 5615
CH_4O_3S 4382
CH_4O_4S 4384
$CH_4O_6S_2$ 4432
CH_4N_2S 5920
CH_4N_2Se 5608
CH_5ON 4279
CH_5ON_3 5609
CH_5O_3As 4130
$CH_5O_4N_3$ 6389
CH_5N_3S 5919
CH_6ON_4 1236
$CH_6O_3N_4$ 3492
CH_6NCl 4106
CH_6N_3Cl 3491
CO_2NCl_3 4697
CO_2NBr_3 4688
CO_6N_3Br 1005
CO_6N_3I 3908

1 IV

CHO_2NBr_2 1854
$CHFClBr$ 3266
CH_2ONCl 1229
CH_2O_2NBr 966
$CH_2O_5S_2Na_2$ 3293
CH_3O_2SCl 4383
CH_3O_3SNa 3295
CH_3O_4SNa 3292
CH_5ON_2Cl 6388
CH_6ONCl 4280
CH_6ON_3Cl 5610
$CH_8O_4N_2S$ 4270
$CH_8O_4N_4S$ 324

2 I

C_2H_2 130
C_2H_4 3192
C_2H_6 2904
C_2N_2 1588
C_2Cl_4 5741
C_2Cl_6 3564
C_2Br_2 1796

FORMULA INDEX ORGANIC COMPOUNDS

C_2Br_4 5721
C_2Br_6 3562
C_2I_2 2382
C_2I_4 5812

2 II

C_2HCl 1305
C_2HCl_3 6155
C_2HCl_5 5054
C_2HBr 891
C_2HBr_3 6105
C_2HBr_5 5050
C_2HI_5 5072
C_2H_2O 3933
$C_2H_2O_2$ 3478
$C_2H_2O_3$ 3480
$C_2H_2O_4$ 5006-7
$C_2H_2N_2$ 3715
$C_2H_2N_4$ 5869
$C_2H_2F_2$ 2250
$C_2H_2Cl_2$ 135-6; 1998
$C_2H_2Cl_4$ 5739-40
$C_2H_2Br_2$ 131-3
$C_2H_2Br_4$ 5719-20
$C_2H_2I_2$ 137-8
C_2H_3N 49; 4195
$C_2H_3N_3$ 6080
C_2H_3F 6439
C_2H_3Cl 6435
$C_2H_3Cl_3$ 6151-2
C_2H_3Br 6434
$C_2H_3Br_3$ 6103
C_2H_3I 6442
$C_2H_3I_3$ 6237
C_2H_4O 5; 3210; 6429
$C_2H_4O_2$ 36; 3470; 4242
$C_2H_4O_3$ 3468
$C_2H_4N_4$ 2080
$C_2H_4N_6$ 1761
$C_2H_4S_2$ 2818
$C_2H_4F_2$ 2249
$C_2H_4Cl_2$ 1993-4
$C_2H_4Br_2$ 1836-7
$C_2H_4I_2$ 2390-1
C_2H_5N 6430
C_2H_5F 3046
C_2H_5Cl 3015
C_2H_5Br 2989
C_2H_5I 3077
C_2H_5Na 5622
C_2H_6O 2478; 2946
$C_2H_6O_2$ 3444
$C_2H_6N_2$ 15
C_2H_6S 2560; 3083
$C_2H_6S_2$ 3209; 4222
C_2H_6Cd 1186
C_2H_6Hg 4044
C_2H_6Se 2553; 3071
C_2H_6Te 2566
C_2H_6Zn 6504
C_2H_7N 2429; 2950
$C_2H_7N_3$ 4258
C_2H_7As 2456; 2970
C_2H_7P 2529; 3135
$C_2H_8N_2$ 2494-5; 3064; 3196-9
C_2OCl_4 6129
$C_2O_2Cl_2$ 5011
$C_2O_2Cl_4$ 6159
$C_2O_4Na_2$ 5008
$C_2O_6N_4$ 6288
C_2N_2S 1593
C_2FCl_3 3285
C_2FCl_5 3276
C_2FBr_5 3275
$C_2F_2Cl_2$ 2245
$C_2F_2Cl_4$ 2253-4
$C_2F_2Br_4$ 2252
C_2F_3Cl 6203
$C_2F_3Cl_3$ 6206
$C_2F_3Br_3$ 6205
C_2ClBr_5 1423
$C_2Cl_2Br_4$ 2073
$C_2Cl_3Br_3$ 6170
$C_2Cl_4Br_2$ 5736-7

2 III

C_2HOCl_3 1281; 1931
C_2HOBr_3 876
C_2HO_2N 5012
$C_2HO_2Cl_3$ 6128
$C_2HO_2Br_3$ 6088
$C_2HO_2I_3$ 6232
C_2HFCl_4 3278
C_2HFBr_4 3277
$C_2HF_2Br_3$ 2255
$C_2HF_3Br_2$ 6204
C_2HClBr_4 1465
$C_2HCl_2Br_3$ 2075-6
$C_2HCl_3Br_2$ 6150
$C_2H_2OCl_2$ 1304; 1926
$C_2H_2OBr_2$ 890
$C_2H_2O_2F_2$ 2239
$C_2H_2O_2Cl_2$ 1928
$C_2H_2O_2Br_2$ 1795
$C_2H_2O_2I_2$ 2381
C_2H_2NCl 1399
C_2H_2NBr 954
C_2H_2NI 3890
$C_2H_2N_2S_3$ 5898
$C_2H_2FCl_3$ 3284
$C_2H_2FBr_3$ 3282-3
$C_2H_2F_2Cl_2$ 2244
$C_2H_2F_2Br_2$ 2242-3
$C_2H_2F_3Cl$ 6202
$C_2H_2ClBr_3$ 1471
$C_2H_2Cl_2Br_2$ 1980-2
$C_2H_2Cl_3Br$ 6142
$C_2H_2Cl_3As$ 1473
C_2H_3ON 3474; 4194
C_2H_3OF 89
C_2H_3OCl 81; 1293
$C_2H_3OCl_3$ 6154
C_2H_3OBr 75
$C_2H_3OBr_3$ 6104
C_2H_3OI 92
$C_2H_3O_2N_3$ 6078
$C_2H_3O_2F$ 3255
$C_2H_3O_2Cl$ 1299; 4187
$C_2H_3O_2Cl_3$ 1286
$C_2H_3O_2Br$ 883
$C_2H_3O_2Br_3$ 877
$C_2H_3O_2I$ 3874
$C_2H_3O_3N$ 5016
$C_2H_3O_4N$ 105; 4592
$C_2H_3O_6N_3$ 6299
C_2H_3NS 4387-8
$C_2H_3FBr_2$ 3268-9
$C_2H_3F_2Cl$ 2241
$C_2H_3F_2Br$ 2240
$C_2H_3F_2I$ 2251
$C_2H_3ClBr_2$ 1359-60
$C_2H_3Cl_2Br$ 1968-9
$C_2H_3Cl_2I$ 2005
C_2H_4OS 5885
$C_2H_4OCl_2$ 1997; 2008
$C_2H_4O_2N_2$ 2256; 3479; 5009
$C_2H_4O_2N_4$ 603; 2851
$C_2H_4O_2S$ 5905
$C_2H_4O_3N_2$ 3105
$C_2H_4O_4N_2$ 2630; 3463
$C_2H_4N_2S_2$ 2821
$C_2H_4O_5S$ 5675
$C_2H_4O_6N_2$ 3462
$C_2H_4N_6Cl_2$ 1949
C_2H_4ClBr 1342-3
C_2H_4ClI 1390-1
C_2H_4BrI 948-9
C_2H_5ON 10; 14
C_2H_5OCl 1400; 3076; 3194
C_2H_5OBr 3193
C_2H_5OI 3208
$C_2H_5O_2N$ 3097; 3437; 3472; 4175; 4733
$C_2H_5O_2N_3$ 859; 5017
$C_2H_5O_3N$ 3096; 4735
C_2H_5NS 5882
C_2H_5SNa 5624
$C_2H_5Cl_2As$ 3040
$C_2H_6ON_2$ 2513; 3438; 4414
$C_2H_6ON_4$ 2081
C_2H_6OS 2563; 5904
$C_2H_6O_2N_4$ 3689
$C_2H_6O_2S$ 2562; 2905
$C_2H_6O_3S$ 2561; 2906
$C_2H_6O_4S$ 2559; 3069
$C_2H_6O_6S_2$ 3206
$C_2H_6N_2S$ 4390-1

FORMULA INDEX ORGANIC COMPOUNDS

$C_2H_6N_4S$ 3494
C_2H_6ClAs 1179
$C_2H_6Cl_3As$ 1181
C_2H_7ON 8; 2907; 3074-5
$C_2H_7O_2As$ 1182
$C_2H_7O_3As$ 2971
$C_2H_7O_4N_3$ 4415
$C_2H_7N_2Cl$ 16
$C_2H_8O_3N_4$ 323; 4259
C_2H_8NCl 2430; 2952
C_2H_8NBr 2951
$C_2H_9N_2Cl$ 2496
$C_2H_{10}ON_2$ 3199
$C_2H_{10}N_2Cl_2$ 3198
$C_2H_{10}N_2Br_2$ 3197
$C_2O_2N_2Ag_2$ 5620
$C_2O_2N_2Hg$ 4040

2 IV

$C_2HFCl_2Br_2$ 3270
$C_2H_2ONCl_3$ 6126
$C_2H_2ONBr_3$ 6086
$C_2H_3ONCl_2$ 1927; 2032
$C_2H_3ONBr_2$ 1793-4
$C_2H_3O_2NCl_2$ 2027
C_2H_4ONCl 1294-5; 1422
$C_2H_4ONCl_3$ 1283
C_2H_4ONBr 879
$C_2H_4O_2NCl$ 1416-7
$C_2H_4O_2NBr$ 965
$C_2H_5O_2SCl$ 3155
$C_2H_5O_3SCl$ 3022
$C_2H_5O_4SNa$ 13
$C_2H_7O_3NS$ 5696
$C_2H_{12}O_4N_6S$ 3493
$C_2H_{14}O_4N_8S$ 325

3 I

C_3H_4 183; 225
C_3H_6 1621; 5459
C_3H_8 5338
C_3O_2 1240
C_3S_2 1241
C_3Cl_8 4936

3 II

C_3HCl_7 3506
C_3H_2O 5349
$C_3H_2O_2$ 5348
$C_3H_2N_2$ 4006
$C_3H_2Br_2$ 1871
C_3H_3N 151
C_3H_3Cl 5343
C_3H_3Br 5342
C_3H_3I 3903; 5344
C_3H_4O 146; 226; 5341
$C_3H_4O_2$ 149
$C_3H_4O_3$ 5525
$C_3H_4O_4$ 4002; 4329
$C_3H_4O_5$ 5695
$C_3H_4O_6$ 4055
$C_3H_4N_2$ 3851; 5478
$C_3H_4Cl_2$ 2058-61
$C_3H_4Br_2$ 1869-70
C_3H_5N 3029; 5363
C_3H_5Cl 202; 5345-6
$C_3H_5Cl_3$ 6166-7
C_3H_5Br 199; 988-90
$C_3H_5Br_3$ 6112
C_3H_5I 208
C_3H_6O 56; 193; 5352; 5468-9
$C_3H_6O_2$ 55; 3048; 3436; 3454; 3942; 4087; 5351
$C_3H_6O_3$ 2292; 2468; 3289; 3380; 3456; 3682; 3939-40; 4063; 4255
$C_3H_6O_4$ 3379
$C_3H_6N_2$ 5479
$C_3H_6N_6$ 4019
C_3H_6S 210
$C_3H_6S_3$ 3309
$C_3H_6Cl_2$ 2050-3
$C_3H_6Br_2$ 1863-6
$C_3H_6I_2$ 2397-9
C_3H_7N 194
C_3H_7F 5406-7
C_3H_7Cl 5400-1
C_3H_7Br 5388-9
C_3H_7I 5417-8
C_3H_8O 4230; 5368-9
$C_3H_8O_2$ 3460; 4424; 5465; 6286
$C_3H_8O_3$ 3381
C_3H_8S 4238; 5424-5
$C_3H_8S_2$ 6284
C_3H_8Se 5448
C_3H_9N 4226; 5371-2; 6248
$C_3H_9N_3$ 2491
C_3H_9Al 231
C_3H_9As 6252
C_3H_9B 872
C_3H_9Bi 856
C_3H_9P 6269
C_3H_9Sb 6274
$C_3H_{10}N_2$ 5464; 6282
$C_3N_3Cl_3$ 6172

3 III

C_3HOBr_5 5048.1
$C_3H_2OCl_4$ 5728-9
$C_3H_2O_3N_2$ 5036
$C_3H_2O_3Br_2$ 1875
$C_3H_2O_4Br_2$ 1851
$C_3H_2O_4Ca$ 4003
C_3H_3ON 5527
$C_3H_3O_2N$ 1583
$C_3H_3O_2Cl$ 1306-7
$C_3H_3O_2Cl_3$ 4403
$C_3H_3O_3N_3$ 1594; 3313
$C_3H_3O_3Cl_3$ 6158
$C_3H_3O_4N$ 4762
$C_3H_3O_4Cl$ 1397
$C_3H_3O_4Br$ 952
C_3H_3NS 5878
$C_3H_3NCl_2$ 2056
$C_3H_3N_3S_3$ 5899
$C_3H_4ON_2$ 1581; 5480
$C_3H_4OCl_2$ 1444; 1929-30
$C_3H_4OBr_2$ 982
$C_3H_4O_2N_2$ 3679
$C_3H_4O_2Cl_2$ 1382; 2054-5
$C_3H_4O_2Br_2$ 1867-8
$C_3H_4O_3N_2$ 182
$C_3H_4O_4N_2$ 5013
$C_3H_4N_2S$ 377
C_3H_5ON 148; 3027-8; 3195; 3944
$C_3H_5ON_5$ 396
C_3H_5OF 5361
C_3H_5OCl 1301; 2879; 5360
$C_3H_5OCl_3$ 6168
C_3H_5OBr 886; 892; 5359
C_3H_5OI 2881; 5362
$C_3H_5O_2N$ 3927; 4829; 4873; 5526
$C_3H_5O_2Cl$ 1398; 1442-3; 3019; 4184
$C_3H_5O_2Br$ 955; 980-1; 4148
$C_3H_5O_2I$ 3901-2
$C_3H_5O_3N_3$ 5014
$C_3H_5O_4N$ 328
$C_3H_5O_6N_3$ 3429
$C_3H_5O_9N_3$ 3428
C_3H_5NS 3158-9
$C_3H_6ON_2$ 3212; 3216
$C_3H_6OS_2$ 6448
$C_3H_6OCl_2$ 3393-4
$C_3H_6OBr_2$ 3388-9
$C_3H_6OI_2$ 3401
$C_3H_6O_2N_2$ 123; 4004
$C_3H_6O_2S$ 5908; 5910
$C_3H_6O_3N_2$ 3678
$C_3H_6O_4N_2$ 2658-9; 4864
$C_3H_6O_7N_2$ 3405-6
C_3H_6ClBr 6279
C_3H_7ON 61; 235; 3047; 4085; 5353; 5356
$C_3H_7ON_3$ 12
C_3H_7OCl 4186; 5461-2; 6280
C_3H_7OBr 5460; 6278
C_3H_7OI 6287
$C_3H_7O_2N$ 158-60; 3291; 3943; 4107; 4827-8; 5428; 5600; 6392
$C_3H_7O_2N_3$ 3442
$C_3H_7O_2Cl$ 3395-6
$C_3H_7O_2I$ 3402
$C_3H_7O_3N$ 5427; 5611-4

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$C_3H_7O_3As$ 197
$C_3H_7O_3Na$ 5623
$C_3H_7O_5N$ 3407-8
C_3H_7NS 5917
$C_3H_7NS_2$ 3157
$C_3H_7N_6Cl$ 4020
$C_3H_8ON_2$ 2572-3; 3183
$C_3H_8O_2N_2$ 5429
$C_3H_8O_2S$ 4239; 5903
$C_3H_8N_2S$ 2568; 3162
C_3H_9ON 4111; 5339; **5416**
$C_3H_9O_2N$ 3385
$C_3H_9O_2N_3$ 3489
$C_3H_9O_3As$ 5376
$C_3H_9O_3B$ 6262
$C_3H_9O_4P$ 6268
$C_3H_9O_6P$ 3411
$C_3H_{10}ON_2$ 3384
$C_3H_{10}NCl$ 4227; **6249**
$C_3H_{12}O_3N_6$ 3490

3 IV

$C_3H_2ONCl_3$ 1284
$C_3H_3ONS_2$ 5560
$C_3H_3O_2NS$ 2369
$C_3H_4ON_2S$ 5907
$C_3H_4O_2NCl_3$ 1285
$C_3H_5O_2NCl_2$ 2031
$C_3H_5O_3NCl_2$ 2028
$C_3H_6ON_2S$ 122
$C_3H_6O_2NCl$ 1420-1
$C_3H_6NS_2Na$ 2477
C_3H_7ONS 5921; 6450
$C_3H_7O_2NS$ 1625
$C_3H_7O_4SNa$ 64
$C_3H_7O_6PNa_2$ 3412
$C_3H_8O_2NCl$ 5601

3 V

$C_3H_8O_2NSCl$ 1626

4 I

C_4H_2 1679
C_4H_6 1018-9; 1156-7
C_4H_8 1147-9; 1595; 4210
C_4H_{10} 1021-2

4 II

$C_4H_2O_3$ 3996
$C_4H_2O_4$ 134
C_4H_4O 3327
$C_4H_4O_2$ 5871
$C_4H_4O_3$ 5657
$C_4H_4O_4$ 3314; 3475; 3995
$C_4H_4N_2$ 5477; 5482; 5513; 5661
C_4H_4S 5923
C_4H_5N 204-5; 1563; 5521
$C_4H_5N_3$ 3853
C_4H_5Cl 1345
C_4H_6O 1559; 2499; 4058; 4348; 6436
$C_4H_6O_2$ 207; 1557-8; 1667; 3304; 4095-6; 5655; 6426-7
$C_4H_6O_3$ 37-8; 3934; 4366; 6440
$C_4H_6O_4$ 106; 2521; 3066; 3455; 5652-3
$C_4H_6O_5$ 2261; 3473; 3997-8; 4000
$C_4H_6O_6$ 5688; 5690-1
$C_4H_6O_8$ 2367
$C_4H_6N_2$ 4257
C_4H_6S 2852
C_4H_7N 1175-6; 5404-5; 5524
C_4H_7Cl 1566-7; 4060
$C_4H_7Br_3$ 6100-1
C_4H_7I 1568
C_4H_8O 1155; 1160; 1163; 1565; 4059; 4104; 4232; 4422; 5773; 6437-8
$C_4H_8O_2$ 43; 169; 1166-7; 2237; 2935; 3207; 4349; 5408-9; 6285
$C_4H_8O_3$ 2912; 3060; 3397; 3446; 3753-7; 4076; 4229; 4294
$C_4H_8O_4$ 4253
$C_4H_8N_2$ 9; 4256
C_4H_8S 3190
$C_4H_8S_2$ 2228
$C_4H_8Cl_2$ 1971-6
$C_4H_8Br_2$ 1821-5
$C_4H_8I_2$ 2389
C_4H_9N 4102; 5523
C_4H_9F 1085
C_4H_9Cl 1072-5
C_4H_9Br 1057-60
C_4H_9I 1095-8
$C_4H_{10}O$ 1034-7; 2911; 4353-4
$C_4H_{10}O_2$ 1154; 1265; 2196; 2329-32; 2415; 3061; 3459
$C_4H_{10}O_3$ 3404; 3453; 4077
$C_4H_{10}O_4$ 2894
$C_4H_{10}N_2$ 2225-6
$C_4H_{10}S$ 1103-5; 2214
$C_4H_{10}S_2$ 2166
$C_4H_{10}Be$ 845
$C_4H_{10}Cd$ 1185
$C_4H_{10}Hg$ 4043
$C_4H_{10}Se$ 2207
$C_4H_{10}Se_2$ 2208
$C_4H_{10}Sn$ 5949
$C_4H_{10}Te$ 2219
$C_4H_{10}Zn$ 6503
$C_4H_{11}N$ 1039-42; 2109; 2482; 4350
$C_4H_{11}P$ 2197
$C_4H_{12}N_2$ 2178; **5474**
$C_4H_{12}As_2$ 1178
$C_4H_{12}Pb$ 3958
$C_4H_{12}Si$ 5617
$C_4H_{12}Sn$ 5951
$C_4H_{13}N_3$ 2238
C_4OCl_{10} 5088

4 III

C_4HNI_4 5817
$C_4H_2O_2Cl_2$ 3316
$C_4H_2O_3Cl_2$ 4442
$C_4H_2O_3Br_2$ 4441
$C_4H_2O_4N_2$ 184-6
$C_4H_2O_4Cl_2$ 2007
$C_4H_2O_4Br_2$ 1840; **1850**
$C_4H_2SI_2$ 2400
C_4H_3OBr 942
$C_4H_3O_3N$ 4740
$C_4H_3O_4N_3$ 4862; **6445**
$C_4H_3O_4Cl$ 1384; **1396**
$C_4H_3O_4Br$ 941; **951**
$C_4H_3O_5N_3$ 4632
$C_4H_4O_2N_2$ 6383
$C_4H_4O_2Cl_2$ 5658
$C_4H_4O_3N_2$ 621
$C_4H_4O_3N_4$ 1774
$C_4H_4O_3Cl_2$ 1300
$C_4H_4O_4N_2$ 1686
$C_4H_4O_4Br_2$ 1877-8
$C_4H_4O_4Na_2$ 5654
$C_4H_4O_5N_2$ 186-7
$C_4H_4O_6Ca$ 5689
$C_4H_4O_8Na_2$ 2368
$C_4H_4O_{10}N_2$ 4842
$C_4H_4N_2S_2$ 3211
C_4H_5ON 2880
C_4H_5OCl 1562
$C_4H_5OCl_3$ 1158
$C_4H_5O_2N$ 1587; 3032; **4196**; 5660
$C_4H_5O_2N_3$ 386
$C_4H_5O_2Cl$ 1358
$C_4H_5O_2Cl_3$ 3179; 6153
$C_4H_5O_2Br$ 925
$C_4H_5O_2Br_3$ 3178
$C_4H_5O_3N_3$ 6384
$C_4H_5O_4Cl$ 1464
$C_4H_5O_4Br$ 997
C_4H_5NS 219-20; 378
$C_4H_6ON_2$ 4360
$C_4H_6O_2N_2$ 3035; **3315**; **3439**; 4267-8
$C_4H_6O_2N_4$ 139
$C_4H_6O_2S_2$ 85
$C_4H_6O_2Cl_2$ 1448; 1978-9; **1988**; 3039
$C_4H_6O_2Br_2$ 1826-7; 3036

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$C_4H_6O_3N_4$ 181
$C_4H_6O_4S$ 5911
$C_4H_6O_6Ca$ 3469
C_4H_6NCl 1351
$C_4H_6N_2S$ 329
$C_4H_6O_{12}N_4$ 2895
C_4H_7ON 57; 1560; 3758; 3936
$C_4H_7ON_3$ 1540
C_4H_7OCl 1173-4; 1401; 4223
$C_4H_7OCl_3$ 6145
$C_4H_7OBr_3$ 6102
$C_4H_7O_2N$ 1662; 4888
$C_4H_7O_2N_3$ 3177
$C_4H_7O_2Cl$ 1347-50; 1377; 3016; 5402-3
$C_4H_7O_2Cl_3$ 1159; 1282
$C_4H_7O_2Br$ 917-8; 936; 2990
$C_4H_7O_2I$ 3078; 3886
$C_4H_7O_3N$ 90; 4880; 5015; 5651
$C_4H_7O_3N_3$ 74
$C_4H_7O_3Cl$ 4075
$C_4H_7O_4N$ 589-90; 3098; 3852
$C_4H_7O_5N$ 5693
C_4H_7NS 5450-1
$C_4H_8ON_2$ 223
C_4H_8OS 3156
$C_4H_8OS_2$ 3087
$C_4H_8OCl_2$ 1977; 1995-6
$C_4H_8O_2N_2$ 2490; 2522-3; 4091; 5656
$C_4H_8O_2S$ 3160-1
$C_4H_8O_3N_2$ 588; 2947; 3476; 4001; 4891
$C_4H_8O_4N_2$ 5692
$C_4H_8O_4N_6$ 5005
$C_4H_8O_7N_2$ 2230
$C_4H_8N_2S$ 221
$C_4H_8SCl_2$ 1985
C_4H_9ON 1161; 1168-9; 2235; 2416; 2933; 4233
$C_4H_9ON_3$ 63; 5354-5
C_4H_9OCl 1151-3; 1362
C_4H_9OBr 939
$C_4H_9O_2N$ 86; 277-80; 1108-9; 3057; 3059; 4118; 4416; 4690-3; 5398
$C_4H_9O_2N_3$ 1539
$C_4H_9O_2Cl$ 2260; 4254
$C_4H_9O_3N$ 1107; 4694-5; 5932-4
$C_4H_9O_4N$ 4689
$C_4H_9O_5N$ 4859
C_4H_9NS 5884
$C_4H_{10}ON_2$ 2191; 5453; 6276
$C_4H_{10}OS$ 2217
$C_4H_{10}O_2S$ 2216; 5900
$C_4H_{10}O_3S$ 2215; 2567
$C_4H_{10}O_4S$ 2213
$C_4H_{10}O_6N_4$ 6390-1
$C_4H_{10}S_2Hg$ 4051
$C_4H_{11}ON$ 1023-4; 2443; 2957
$C_4H_{11}O_2N$ 1020; 2090
$C_4H_{11}O_3N$ 6230
$C_4H_{11}O_3As$ 1048
$C_4H_{11}O_4P$ 2198
$C_4H_{12}ON_2$ 3771
$C_4H_{12}OAs_2$ 1183
$C_4H_{12}NCl$ 2110; 5822
$C_4H_{12}NBr$ 5821
$C_4H_{12}NI$ 5826
$C_4H_{12}SAs_2$ 1180
$C_4H_{13}ON$ 5823-5
$C_4H_{14}N_2Cl_2$ 5475

4 IV

$C_4H_2O_4N_3Na$ 6446
$C_4H_2O_3N_2Cl_2$ 1951
$C_4H_2O_3N_2Br_2$ 1810
$C_4H_3O_2NS$ 4843
$C_4H_4O_2NCl$ 5659
$C_4H_4O_2N_2S$ 5887
C_4H_6ONCl 3764
$C_4H_7O_2NCl_2$ 171
$C_4H_7O_3N_2I$ 179
$C_4H_{10}O_2NCl$ 3058
$C_4H_{14}O_4N_4S_3$ 4391
$C_4H_{14}O_6N_8S$ 2082
$C_4H_{16}O_4N_6S$ 4260

4 V

$C_4H_3O_4SAuNa_2$ 4447
$C_4H_{16}O_4N_8Cl_2Ca$ 6387

5 I

C_5H_6 1618; 6415
C_5H_8 4154-5; 4168; 5064-5; 5086-7
C_5H_{10} 498-502; 1619; 4198
C_5H_{12} 5083-5

5 II

$C_5H_2O_5$ 1556
$C_5H_4O_2$ 3317-8; 5518
$C_5H_4O_3$ 1511; 3339-40
$C_5H_4O_4$ 140
$C_5H_4N_4$ 5473
C_5H_5N 5483
C_5H_6O 4245
$C_5H_6O_2$ 3137; 3332; 5340; 6428
$C_5H_6O_4$ 1510; 3370; 3928; 4243; 6425
$C_5H_6O_5$ 59
$C_5H_6O_8$ 1659
$C_5H_6N_2$ 360-2; 3377; 5463
C_5H_6S 4389
C_5H_7N 192; 4362-4
C_5H_8O 1620; 2427; 3136; 3213
$C_5H_8O_2$ 68; 189-90; 2424-6; 2942-3; 3846; 3968; 4193
$C_5H_8O_3$ 67; 1672; 3150; 3967; 4088
$C_5H_8O_4$ 2502-3; 3082; 3376; 4236; 4430; 5520
$C_5H_8O_5$ 1514; 3398; 3773-4; 3815; 3929
$C_5H_8O_7$ 6228-9
$C_5H_8N_2$ 2534
C_5H_9N 1083; 4365; 6246; 6405; 6413
$C_5H_9N_3$ 3667
$C_5H_{10}O$ 2180; 2949; 3189; 4103; 4224; 4355; 4357; 6243; 6400; 6407
$C_5H_{10}O_2$ 1086; 1088-9; 3138; 4169-71; 5081; 5365-6; 5775; 6245; 6277; 6399; 6406
$C_5H_{10}O_3$ 2138; 3063; 3079; 3843-5; 4182; 5413; 5467
$C_5H_{10}O_4$ 3056; 3382
$C_5H_{10}O_5$ 570; 3991-2; 5564; 6480
$C_5H_{10}O_6$ 573
$C_5H_{10}N_2$ 2143
$C_5H_{10}Cl_2$ 2033-41
$C_5H_{10}Br_2$ 1856-8
$C_5H_{10}I_2$ 2396
$C_5H_{11}N$ 5322
$C_5H_{11}Cl$ 442-8
$C_5H_{11}Br$ 427-31
$C_5H_{11}I$ 459-63
$C_5H_{12}O$ 404-11; 3142-3; 4161-2
$C_5H_{12}O_2$ 503-4; 2172
$C_5H_{12}O_3$ 3403; 4177; 5069
$C_5H_{12}O_4$ 5066
$C_5H_{12}O_5$ 156; 572; 6478
$C_5H_{12}S$ 467-9; 4167
$C_5H_{13}N$ 412-8; 4156-7; 4215
$C_5H_{14}N_2$ 1184

5 III

C_5H_3ON 3345
$C_5H_3O_2Cl$ 3344
$C_5H_3O_3Cl$ 1385
$C_5H_3O_3Br$ 943
$C_5H_3O_5N$ 4741
$C_5H_3NBr_2$ 1872-4
C_5H_4OS 5925
$C_5H_4O_2N_4$ 6449
$C_5H_4O_2S$ 5926-7
$C_5H_4O_3N_4$ 6393
C_5H_4NCl 1450-2
C_5H_4NBr 991-2
C_5H_5ON 3812-4
C_5H_5OCl 3335
$C_5H_5O_2N$ 2362-3; 3322-3; 3341-2; 5522

$C_5H_5O_3N$ 6231
C_5H_6OS 3337; 5924
$C_5H_6O_2N_2$ 4410-3
C_5H_6NCl 5484
C_5H_7ON 3333
$C_5H_7O_2N$ 3030
$C_5H_7NCl_2$ 5485
$C_5H_8O_2N_2$ 66
$C_5H_8O_2Cl_2$ 45
$C_5H_8O_3N_2$ 1678
$C_5H_8O_3Cl_2$ 1984
C_5H_9OCl 6404; 6412
$C_5H_9O_2N$ 1674; 4890; 5335
$C_5H_9O_2Cl$ 1077-8; 1445-7; 3020-1
$C_5H_9O_2Br$ 983-4; 1006-7; 2995-6
$C_5H_9O_3N$ 3808-9
$C_5H_9O_3Cl$ 2923
$C_5H_9O_4N$ 3371-2
$C_5H_9O_5N$ 3772
C_5H_9NS 1131-6
$C_5H_{10}ON_2$ 4898
$C_5H_{10}OS_2$ 2163-4
$C_5H_{10}O_3N_2$ 3374-5; 4886
$C_5H_{10}N_2S_2$ 1249
$C_5H_{11}ON$ 2173; 4356; 4358; 6244; 6401-2; 6408-9
$C_5H_{11}ON_3$ 1164; 4234
$C_5H_{11}O_2N$ 387-9; 391-5; 473; 846; 1067-8; 3184; 4790-3
$C_5H_{11}O_3N$ 472; 2922
$C_5H_{11}O_4N$ 4789
$C_5H_{11}NS$ 6275
$C_5H_{11}NS_2$ 2162
$C_5H_{11}N_3Cl_2$ 3668
$C_5H_{12}ON_2$ 1138-9; 2222-3; 5845
$C_5H_{12}O_2N_2$ 5000
$C_5H_{12}N_2S$ 2220
$C_5H_{13}ON$ 4584
$C_5H_{13}O_2N$ 243; 2444
$C_5H_{14}N_2S_2$ 2449
$C_5H_{15}O_2N$ 1488

5 IV

$C_5H_5O_3NS$ 5505
$C_5H_6O_2N_2S$ 121
$C_5H_8O_3NCl_3$ 1288
$C_5H_{10}O_4NCl$ 3373
$C_5H_{11}O_2NS$ 4062
$C_5H_{12}O_2NCl$ 390; 847; 2945
$C_5H_{14}ONCl$ 1489

6 I

C_6H_6 656; 2768
C_6H_8 1599; 1600
C_6H_{10} 1609; 2769; 3573-4
C_6H_{12} 1601; 3655-61; 4209
C_6H_{14} 3603-7
C_6O_6 1604
C_6Cl_6 3563
C_6Br_6 3561
C_6I_6 3589

6 II

C_6HCl_5 5053
C_6HBr_5 5049
C_6HI_5 5071
$C_6H_2Cl_4$ 5733-5
$C_6H_2Br_4$ 5715-6
$C_6H_2I_4$ 5809-11
$C_6H_3Cl_3$ 6134-6
$C_6H_3Br_3$ 6095-7
$C_6H_3I_3$ 6233-5
$C_6H_4O_2$ 5541-2
$C_6H_4O_4$ 2364
$C_6H_4O_6$ 5808
$C_6H_4Cl_2$ 1952-4
$C_6H_4Br_2$ 1811-3
$C_6H_4I_2$ 2386-8
$C_6H_5N_3$ 252; 6079
C_6H_5F 3258
C_6H_5Cl 1324
C_6H_5Br 902
C_6H_5I 3879
C_6H_6O 5118
$C_6H_6O_2$ 2312-4; 4244
$C_6H_6O_3$ 150; 848; 4246; 6216-9
$C_6H_6O_4$ 4443; 5802-3
$C_6H_6O_6$ 141; 3588
C_6H_6S 5915
$C_6H_6S_2$ 2820; 2822
$C_6H_6Cl_6$ 668-9
$C_6H_6Br_6$ 666
C_6H_6Se 5607
C_6H_7N 513; 5300-2
C_6H_7P 5219
C_6H_8O 2488
$C_6H_8O_2$ 2285; 5625; 5798
$C_6H_8O_4$ 209; 2487; 2501; 3945
$C_6H_8O_6$ 96; 586-7; 6123
$C_6H_8O_7$ 1515-6; 5578
$C_6H_8N_2$ 155; 2533; 5196; 5256; 5258; 5260
$C_6H_8N_4$ 4425
C_6H_8S 5928-31
C_6H_9N 2535-8; 3149
$C_6H_9N_3$ 6059-60; 6062
$C_6H_9N_{11}$ 4018
$C_6H_{10}O$ 191; 206; 1606; 4053; 4225
$C_6H_{10}O_2$ 65; 216; 1564; 3024-6; 3086
$C_6H_{10}O_3$ 2937; 3417; 3765-6; 4296; 5357
$C_6H_{10}O_4$ 153; 2193; 2554-8; 2940; 3154; 3214; 3445; 3926; 4235; 4251-2; 5422-3
$C_6H_{10}O_5$ 622; 1267; 1661; 2500; 3443; 3872; 3948; 3966; 3969; 5630
$C_6H_{10}O_6$ 2564-5; 3070; 3361; 3368
$C_6H_{10}O_8$ 4438-40; 5577
$C_6H_{10}N_4$ 5079
$C_6H_{10}S$ 1684
$C_6H_{10}S_3$ 222
$C_6H_{11}N$ 453; 1217-8; 1680; 2104
$C_6H_{11}N_5$ 5048
$C_6H_{11}Cl$ 1613
$C_6H_{11}Br$ 1612
$C_6H_{11}I$ 1614
$C_6H_{12}O$ 1212; 1605; 2099; 3144-5; 3614-5; 4163-6
$C_6H_{12}O_2$ 454-5; 1029-32; 1208-11; 1663; 2101; 2481; 3006-7; 4404; 4420-1; 5350; 5441-2
$C_6H_{12}O_3$ 7; 1266; 3073; 3759-60; 5419-20
$C_6H_{12}O_4$ 2924; 3413
$C_6H_{12}O_5$ 1608; 3312; 4423; 5558; 5561
$C_6H_{12}O_6$ 1602-3; 3616-20
$C_6H_{12}O_7$ 3359; 3946
$C_6H_{12}N_2$ 3681; 3932
$C_6H_{12}N_4$ 3599
$C_6H_{12}S_3$ 5879-81
$C_6H_{12}Cl_2$ 2001-2
$C_6H_{12}Br_2$ 1842-7
$C_6H_{12}I_2$ 2393
$C_6H_{13}N$ 326; 4344-7
$C_6H_{13}Cl$ 3644-7
$C_6H_{13}Br$ 3641-3
$C_6H_{13}I$ 3650-1
$C_6H_{14}O$ 2783-5; 3000-2; 3624-38; 4120-1
$C_6H_{14}O_2$ 4; 1071; 2139; 2346; 3598; 3662; 4332; 5312
$C_6H_{14}O_3$ 1232; 2808; 3471
$C_6H_{14}O_4$ 6199
$C_6H_{14}O_5$ 2259; 5557
$C_6H_{14}O_6$ 3608-9; 3611
$C_6H_{14}S$ 2799-800; 3005; 3652
$C_6H_{14}S_2$ 2782
$C_6H_{14}Hg$ 4046
$C_6H_{14}Zn$ 6505-6
$C_6H_{15}N$ 2772-3; 3639-40; 6180
$C_6H_{15}Al$ 230
$C_6H_{15}As$ 6183
$C_6H_{15}B$ 871

$C_6H_{15}Bi$ 855
$C_6H_{15}P$ 6189
$C_6H_{15}Sb$ 6198
$C_6H_{16}N_2$ 3596
$C_6H_{16}Si$ 6196
$C_6H_{18}N_4$ 6201
$C_6H_{26}O_8$ 5313
C_6OCl_6 3565-6
$C_6O_2Cl_4$ 5746
$C_6O_2Br_4$ 5726

6 III

C_6HOCl_5 5057
C_6HOBr_5 5051
$C_6HO_2Cl_3$ 6169
$C_6H_2OCl_4$ 5743
$C_6H_2O_2Cl_2$ 2070-1
$C_6H_2O_2Cl_4$ 5742
$C_6H_2O_8N_2$ 4586
$C_6H_2O_9N_4$ 5857
$C_6H_2NCl_5$ 5052
$C_6H_3OCl_3$ 6162-4
$C_6H_3OBr_3$ 6108
$C_6H_3OI_3$ 6238
$C_6H_3O_2Cl_3$ 6156
$C_6H_3O_2Br_3$ 6114
$C_6H_3O_6N_3$ 6292-4
$C_6H_3O_7N_3$ 6307-10
$C_6H_3O_8N_3$ 6312
$C_6H_3NCl_4$ 5730-2
$C_6H_3NBr_4$ 5714
$C_6H_4OCl_2$ 2042
$C_6H_4OBr_2$ 1859-62
$C_6H_4O_2Cl_2$ 2003-4
$C_6H_4O_3N_2$ 4896
$C_6H_4O_4N_2$ 2602-4
$C_6H_4O_5N_2$ 2646-7; 2649-52
$C_6H_4O_6N_2$ 2660-1
$C_6H_4O_6N_4$ 6289
$C_6H_4NCl_3$ 6130-3
$C_6H_4NBr_3$ 6089-93
$C_6H_4N_2Cl_2$ 5544
C_6H_4FCl 3263-5
C_6H_4FBr 3262
C_6H_4FI 3272
C_6H_4ClBr 1340-1
C_6H_4ClI 1387-9
C_6H_4BrI 945-7
C_6H_5ON 4876
C_6H_5OCl 1427-9
C_6H_5OBr 972-4
C_6H_5OI 3898-900; 3910
C_6H_5ONa 5119
$C_6H_5O_2N$ 4646; 5486; 5488; 5496; 5546
$C_6H_5O_2Cl$ 1386; 1460
$C_6H_5O_2Br$ 944
$C_6H_5O_2I$ 3912
$C_6H_5O_3N$ 3791-2; 4799; 4802-3; 4900
$C_6H_5O_3N_3$ 1767
$C_6H_5O_4N$ 4836
$C_6H_5O_4N_3$ 2587-92
$C_6H_5O_5N_3$ 5303
$C_6H_5O_6N_5$ 6311
$C_6H_5NCl_2$ 1932-7
$C_6H_5NBr_2$ 1798-802
$C_6H_5NI_2$ 2385
$C_6H_5N_2Cl$ 1765
$C_6H_5N_2Br_3$ 1768
C_6H_5ClHg 4037
$C_6H_5Cl_2P$ 5270
$C_6H_5Cl_3Si$ 5618
$C_6H_6ON_2$ 4875; 5493
C_6H_6OS 5909
$C_6H_6O_2N_2$ 4618-20; 5212; 5545
$C_6H_6O_2S$ 672
$C_6H_6O_2Si$ 5616
$C_6H_6O_3N_2$ 4610-6
$C_6H_6O_3N_4$ 4417-9
$C_6H_6O_3S$ 675
$C_6H_6O_4N_4$ 2657
$C_6H_6O_4S$ 5123-5
$C_6H_6O_5N_2$ 5490
$C_6H_6O_6S_2$ 664
$C_6H_6O_9S_3$ 686
C_6H_6NF 3256
C_6H_6NCl 1309-11
C_6H_6NBr 893-5
C_6H_6NI 3875-7
$C_6H_6N_2Cl_2$ 2044; 2048
$C_6H_6N_3Cl_9$ 1287
C_6H_7ON 113; 345; 347; 349; 4082; 5200-1
$C_6H_7ON_3$ 4897
$C_6H_7O_2N$ 372
$C_6H_7O_2N_3$ 4813; 4815
$C_6H_7O_3As$ 5158
$C_6H_7O_4As$ 3797
$C_6H_7N_2Cl$ 1433
$C_6H_7N_2Cl_3$ 2049
$C_6H_7N_2Br$ 975
$C_6H_8ON_2$ 1723; 1725-7
$C_6H_8O_2Cl_2$ 154
$C_6H_8O_3N_2$ 521
$C_6H_8O_5Na_2$ 2268
$C_6H_8O_{18}N_6$ 4011
C_6H_8NCl 520
C_6H_8NBr 519
$C_6H_9ON_3$ 6068
$C_6H_9O_2N_3$ 1574; 3669
$C_6H_9O_2Cl_3$ 6144
$C_6H_9O_3N$ 6055
$C_6H_9O_3N_3$ 4197; 5267
$C_6H_9O_3Cl$ 3017-8
$C_6H_9O_3Br$ 2991
$C_6H_9O_4N$ 88
$C_6H_9N_2Cl$ 5197
$C_6H_9N_2Cl_3$ 1434
$C_6H_{10}O_2Br_2$ 3037
$C_6H_{10}O_2S_2$ 2165
$C_6H_{10}O_6Ca$ 3941
$C_6H_{10}N_2Cl_2$ 5257; 5259; 5261
$C_6H_{11}ON$ 1607
$C_6H_{11}OCl$ 1216
$C_6H_{11}O_2N$ 2956
$C_6H_{11}O_2Cl$ 449-50; 1076
$C_6H_{11}O_2Cl_3$ 6124-5
$C_6H_{11}O_2Br$ 920; 2992-3
$C_6H_{11}O_3N$ 1111
$C_6H_{11}O_4N_3$ 1517; 2262
$C_6H_{11}NS$ 490-3
$C_6H_{11}N_3Cl_2$ 6061
$C_6H_{11}N_3Cl_4$ 6067
$C_6H_{12}OCl_2$ 1991-2
$C_6H_{12}O_2N_2$ 152; 2194
$C_6H_{12}O_2Cl_2$ 1925; 6207
$C_6H_{12}O_3N_2$ 3477
$C_6H_{12}O_4N_2$ 2631
$C_6H_{12}N_2S_4$ 5843
$C_6H_{12}N_3Cl_3$ 6063
$C_6H_{13}ON$ 1213; 1664; 2100
$C_6H_{13}ON_3$ 2181; 4359
$C_6H_{13}O_2N$ 282-7; 439-41; 2236; 3496; 3653; 4749-51; 5454
$C_6H_{13}O_2Cl$ 1292
$C_6H_{13}O_3N_3$ 1521
$C_6H_{13}O_5N$ 3311
$C_6H_{13}O_6N$ 3369
$C_6H_{13}NS_2$ 5875
$C_6H_{14}ON_2$ 494-5; 2790-1
$C_6H_{14}O_2N_2$ 3986; 3988
$C_6H_{14}O_2N_4$ 575
$C_6H_{14}O_2S$ 2802-3
$C_6H_{14}O_3S$ 2801
$C_6H_{14}O_4S$ 2798
$C_6H_{15}ON$ 2112
$C_6H_{15}OP$ 6190
$C_6H_{15}O_2N$ 2767
$C_6H_{15}O_3N$ 6178
$C_6H_{15}O_3Al$ 229
$C_6H_{15}O_3B$ 6186
$C_6H_{15}O_3P$ 6192
$C_6H_{15}O_4P$ 6188
$C_6H_{15}SP$ 6191
$C_6H_{16}OSi$ 6194
$C_6H_{16}NCl$ 6182
$C_6H_{16}NBr$ 6181

6 IV

$C_6H_2ONCl_3$ 2072
$C_6H_2O_6N_3Cl$ 5308
$C_6H_3O_2NCl_2$ 2022-6
$C_6H_3O_2SCl_3$ 1956
$C_6H_3O_3NCl_2$ 2029-30

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$C_6H_3O_3NBr_2$ 1855
$C_6H_3O_4N_2Cl$ 1364-9
$C_6H_3O_4N_2Br$ 930-1
$C_6H_3O_5N_2Cl$ 1372
$C_6H_3O_5N_2Na$ 2648
C_6H_4ONCl 5543
$C_6H_4O_2NF$ 3274
$C_6H_4O_2NCl$ 1412-4
$C_6H_4O_2NBr$ 960-2
$C_6H_4O_2NI$ 3893-5
$C_6H_4O_2NNa$ 5547
$C_6H_4O_2N_2Cl_2$ 2021
$C_6H_4O_3NCl$ 4698-706
$C_6H_4O_3NK$ 4801
$C_6H_4O_3NNa$ 4800; 4804-5
$C_6H_4O_3N_2S$ 1769-71
$C_6H_4O_3SCl_2$ 1955
$C_6H_4O_4SI_2$ 5626
$C_6H_4O_4S_2Cl_2$ 663
$C_6H_4O_5N_3Na$ 5304
$C_6H_4O_6S_2Na_2$ 665
$C_6H_4O_7N_2S$ 2605
$C_6H_5ONBr_2$ 1797
C_6H_5OClHg 4034-5
$C_6H_5O_2N_2Cl$ 1407-10
$C_6H_5O_2SCl$ 678
$C_6H_5O_2SNa$ 673
$C_6H_5O_3NHg$ 4038
$C_6H_5O_3SCl$ 1326
$C_6H_5O_3SBr$ 903-4
$C_6H_5O_3SNa$ 676
$C_6H_5O_4SCl$ 1430
$C_6H_5O_4SNa$ 5126
$C_6H_5O_5NS$ 4654-5
$C_6H_5O_6NS$ 4806-7
$C_6H_5O_6S_2Cl$ 1325
$C_6H_6O_2NCl$ 5487; 5489
$C_6H_6O_2N_2Cl_2$ 1408; 1411
$C_6H_6O_4AsNa$ 3798
$C_6H_6O_5NAs$ 4810
$C_6H_6O_5N_2S$ 4621-2
$C_6H_7O_2NS$ 677
$C_6H_7O_3NS$ 523-5; 674
$C_6H_7O_4NS$ 353-5
$C_6H_7O_6NS_2$ 517-8
$C_6H_7NSCl_2$ 1308
C_6H_7NClBr 896
C_6H_8ONCl 346; 348; 350
$C_6H_8O_2NCl$ 373
$C_6H_8O_2N_2S$ 527
$C_6H_8O_2N_3Cl$ 4814; 4816
$C_6H_8O_3NAs$ 515
$C_6H_8O_3N_2S$ 5198; 5262
$C_6H_8N_2ClBr$ 976
$C_6H_{10}ON_2Cl_2$ 1724
$C_6H_{10}O_2N_3Cl$ 3671
$C_6H_{10}O_4N_2Cl_2$ 5804
$C_6H_{11}O_2N_2Br$ 1009
$C_6H_{11}O_2N_3Cl_2$ 3670
$C_6H_{12}ONBr$ 2131
$C_6H_{12}O_4N_2S_2$ 1627
$C_6H_{15}O_2N_2Cl$ 2865
$C_6H_{15}O_2N_4Cl$ 576
$C_6H_{16}O_2N_2Cl_2$ 3987; 3989-90
$C_6H_{16}O_3NCl$ 6179
$C_6H_{20}O_4N_6S$ 2491

6 V

$C_6H_2ONClBr_2$ 1876
$C_6H_2O_4SI_2Hg$ 5628
$C_6H_3O_4SI_2Na$ 5627
$C_6H_3O_7N_2SNa$ 2606
$C_6H_4O_2SClBr$ 905
$C_6H_4O_4NSCl$ 4657
$C_6H_4O_4SClNa$ 1431
$C_6H_4O_5NSCl$ 1415
$C_6H_4O_5NSBr$ 963
$C_6H_4O_5NSNa$ 4656
$C_6H_5O_3NSCl_2$ 1938
$C_6H_6O_3NSNa$ 526
$C_6H_6O_3N_2SCl_2$ 2045
$C_6H_7O_2NClAs$ 4013
$C_6H_{10}O_3N_2SCl_2$ 5263

7 I

C_7H_8 5960
C_7H_{10} 2286-8
C_7H_{12} 1598; 3510; 3558; 4207-8
C_7H_{14} 1596; 3554-6; 4199
C_7H_{16} 3512-9

7 II

$C_7H_4O_7$ 4016
C_7H_5N 716; 5178
$C_7H_5N_3$ 1766
$C_7H_5Cl_3$ 735
C_7H_6O 642
$C_7H_6O_2$ 711; 3347; 3733-5; 6001
$C_7H_6O_3$ 761; 2310-1; 3350-1; 3742; 3745-6
$C_7H_6O_4$ 2315-20
$C_7H_6O_5$ 6220-3
$C_7H_6N_2$ 267-9; 708; 1578
C_7H_6S 5888-9
$C_7H_6Cl_2$ 635; 1339
$C_7H_6Br_2$ 634; 912; 1880
$C_7H_7N_3$ 263; 788
C_7H_7F 3279-81
C_7H_7Cl 796; 1466-8
C_7H_7Br 793; 999-1001
C_7H_7I 813; 3905-7
C_7H_8O 537; 782; 1545-7
$C_7H_8O_2$ 2370-4; 3750-2; 4079-81; 4998
$C_7H_8O_3$ 3050-1; 3331; 4361; 6396
$C_7H_8N_2$ 649
C_7H_8S 816; 5894-6
C_7H_9N 783; 3146-8; 3981-4; 4125; 5995; 5997; 5999
$C_7H_{10}O_2$ 5772
$C_7H_{10}O_3$ 1668
$C_7H_{10}O_4$ 2469; 2498; 2504; 2939; 5700-1
$C_7H_{10}O_5$ 58; 2195; 3084
$C_7H_{10}N_2$ 808; 1682; 4336; 4338; 4340; 5311; 6003; 6005; 6007; 6022; 6024; 6026
$C_7H_{11}N_3$ 6069
$C_7H_{12}O$ 1597; 4204-6
$C_7H_{12}O_2$ 200; 3042; 3577
$C_7H_{12}O_3$ 3081; 3085; 3587; 5367; 5774
$C_7H_{12}O_4$ 1102; 2184-5; 2489; 3054-5; 4097-9; 4237; 5309-10; 5449; 5466; 6281
$C_7H_{12}O_5$ 3383
$C_7H_{12}O_6$ 2160; 5536
$C_7H_{13}N$ 3648
$C_7H_{14}O$ 2786-7; 3003-4; 3521; 3557; 4122-3; 4200-3
$C_7H_{14}O_2$ 397-403; 1123-5; 3185-6; 3520; 3649; 4173; 5392-5
$C_7H_{14}O_3$ 1099-1100; 2780; 3793
$C_7H_{14}O_4$ 2926; 3392; 4178
$C_7H_{14}O_5$ 2411
$C_7H_{14}O_6$ 4250; 4286; 4297
$C_7H_{14}O_7$ 3358; 4012
$C_7H_{15}Cl$ 3546-7
$C_7H_{15}Br$ 3545
$C_7H_{15}I$ 3549
$C_7H_{16}O$ 2961-2; 3527-43
$C_7H_{16}O_2$ 3511; 5458
$C_7H_{16}O_3$ 3049; 3391
$C_7H_{16}O_7$ 5090
$C_7H_{16}S$ 3525
$C_7H_{17}N$ 3544

7 III

$C_7H_3O_2Cl_3$ 6137-41
$C_7H_3O_2Br_3$ 6098-9
$C_7H_3O_2I_3$ 6236
$C_7H_3O_7N_3$ 6291
$C_7H_3O_8N_3$ 6295
$C_7H_4OCl_2$ 1334-6
$C_7H_4OBr_2$ 910
$C_7H_4OBr_4$ 5717
$C_7H_4O_2N_2$ 4667-9
$C_7H_4O_2Cl_2$ 1959-64
$C_7H_4O_2Br_2$ 1814-9
$C_7H_4O_3N_2$ 1773; 4811
$C_7H_4O_3I_2$ 2394-5
$C_7H_4O_4S$ 5679

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$C_7H_4O_5N_2$ 2600-1
$C_7H_4O_5Br_2$ 1841
$C_7H_4O_6N_2$ 2607-11
$C_7H_4O_7N_2$ 2662
C_7H_4NCl 1330
C_7H_4NBr 909
C_7H_5ON 544; 3748; 5177
$C_7H_5ON_3$ 653
C_7H_5OF 757
C_7H_5OCl 755; 1318-20
$C_7H_5OCl_3$ 6146-9
C_7H_5OBr 753
$C_7H_5OBr_3$ 6094
C_7H_5OI 762
$C_7H_5O_2N_3$ 4662
$C_7H_5O_2F$ 3259-61
$C_7H_5O_2Cl$ 1327-9; 1461
$C_7H_5O_2Br$ 906-8
$C_7H_5O_2I$ 3880-2
$C_7H_5O_2Na$ 712
$C_7H_5O_3N$ 4637; 4639-40; 4877-9
$C_7H_5O_3Br$ 993
$C_7H_5O_3I$ 3904; 3911
$C_7H_5O_3Na$ 3744
$C_7H_5O_4N$ 4663-4; 4666; 5497-502
$C_7H_5O_5N$ 4753-60
$C_7H_5O_6N_3$ 2594; 6313-7
$C_7H_5O_7N_3$ 6290; 6298
$C_7H_5O_8N_3$ 6306
$C_7H_5O_8N_5$ 5873
C_7H_5NS 5241
$C_7H_5NS_2$ 4033
$C_7H_5NCl_2$ 5168
$C_7H_6ON_2$ 709
$C_7H_6OBr_2$ 1831
C_7H_6OS 5891
$C_7H_6OS_2$ 2823
$C_7H_6O_2S$ 5918
$C_7H_6O_3N_2$ 4642-4
$C_7H_6O_4N_2$ 2666-71; 4604-9
$C_7H_6O_5N_2$ 2593; 2616-7
$C_7H_6O_5S$ 5676-8
$C_7H_6O_6S$ 5681
$C_7H_6N_2S$ 273
C_7H_6ClBr 913-4; 1337-8
C_7H_7ON 254-6; 643-4; 713; 3299; 4903-5
C_7H_7OF 3257
C_7H_7OCl 1314; 1354-7
C_7H_7OBr 897-8
C_7H_7OI 3878
$C_7H_7O_2N$ 264-6; 710; 3348-9; 3736; 3738-40; 4844-6; 4881; 5167; 5213
$C_7H_7O_2N_3$ 4739
$C_7H_7O_3N$ 374-6; 4623-5; 4678-80; 4710
$C_7H_7O_3N_3$ 4658-60
$C_7H_7O_4N$ 3352; 4742
$C_7H_7O_5As$ 651
$C_7H_7O_5P$ 730
C_7H_7NS 5902
$C_7H_7N_3S$ 734
C_7H_7ClHg 4039
$C_7H_8ON_2$ 257-61; 688; 760; 3308; 4887; 5253
$C_7H_8O_2N_2$ 1700-5; 3684; 4767-9; 4849-58
$C_7H_8O_2S$ 5964
$C_7H_8O_3N$ 352
$C_7H_8O_3N_2$ 4601-3
$C_7H_8O_3N_4$ 1250
$C_7H_8O_3S$ 5966-8
$C_7H_8O_6S_2$ 5962
C_7H_8NCl 1469-70
C_7H_8NBr 1002-3
$C_7H_8N_2S$ 5244
C_7H_9ON 292-3; 295-9; 534-6; 810-1; 4115; 6028-30
$C_7H_9ON_3$ 5236-7
$C_7H_9O_2N_3$ 6064-6
$C_7H_9O_3N$ 1584
$C_7H_9O_3As$ 787
$C_7H_9N_3S$ 5243
$C_7H_{10}ON_2$ 1687
$C_7H_{10}O_4Br_2$ 2155
$C_7H_{10}NCl$ 5996; 5998; 6000
$C_7H_{11}O_4$ 2133
$C_7H_{11}O_6I$ 4763
$C_7H_{11}N_2Cl$ 6023; 6025; 6027
$C_7H_{12}O_3Cl_2$ 2057
$C_7H_{12}N_2Cl_2$ 4337; 6004; 6006; 6008
$C_7H_{13}ON$ 112
$C_7H_{13}O_2Br$ 2997-8
$C_7H_{14}N_3Cl_3$ 6070
$C_7H_{15}ON$ 2931; 3522-3; 4124
$C_7H_{15}ON_3$ 5314
$C_7H_{15}O_2N$ 1140-1; 3551; 4744-8
$C_7H_{16}ON_2$ 2806-7
$C_7H_{16}O_4S_2$ 5683
$C_7H_{17}ON$ 2117-8
$C_7H_{17}O_2N$ 2113

7 IV

$C_7H_3O_5N_2Cl$ 2613
$C_7H_3O_6N_2Cl$ 1370-1
$C_7H_3O_6N_2Br$ 932
C_7H_4ONCl 1333
C_7H_4OClBr 911
C_7H_4OClI 3883
$C_7H_4O_3NCl$ 4673-5
$C_7H_4O_4NBr$ 964
$C_7H_4O_4NNa$ 4665
C_7H_4NSCl 1332
$C_7H_5O_2NCl_2$ 4635-6
$C_7H_5O_2NBr_2$ 1804; 4634
$C_7H_5O_2NI_2$ 2383
$C_7H_5O_3NS$ 5579
$C_7H_5O_3NHg$ 4057
$C_7H_5O_4N_2Cl$ 2615
$C_7H_5O_6SNa$ 5682
C_7H_6ONCl 1321-3
C_7H_6ONNa 3300
$C_7H_6O_2NCl$ 1315; 4682-4
$C_7H_6O_2NBr$ 4681
$C_7H_6O_6S_2Na_2$ 5963
$C_7H_7O_2SCl$ 5974-5
$C_7H_7O_2SNa$ 5965
$C_7H_7O_3SNa$ 5969
$C_7H_7O_4NS$ 5671-3
$C_7H_7O_5NS$ 4847
C_7H_8ONCl 1312
$C_7H_9ONCl_2$ 1313
$C_7H_9O_2NS$ 5970-1
$C_7H_9O_3NS$ 379-83
$C_7H_9O_4N_2As$ 1230
$C_7H_{10}O_2N_2Cl_2$ 1705
$C_7H_{10}O_2N_4S$ 5666
$C_7H_{12}ON_2Cl_2$ 1688-9
$C_7H_{12}O_2N_3Cl_3$ 6066
$C_7H_{12}O_4N_2S$ 6009
$C_7H_{14}ONBr$ 4580
$C_7H_{14}O_4N_2S_2$ 2854
$C_7H_{16}ONBr$ 6264
$C_7H_{16}O_2NCl$ 83
$C_7H_{16}O_2NBr$ 82

7 V

$C_7H_4O_3NSNa$ 5580
$C_7H_6O_4NSCl$ 4848
$C_7H_7O_2NSCl_2$ 2074

7 VI

$C_7H_7O_2NSClNa$ 1290

8 I

C_8H_6 5146
C_8H_8 5646
C_8H_{10} 2973; 6454; 6457; 6462
C_8H_{12} 2289-91
C_8H_{14} 1530; 2493; 4991
C_8H_{16} 1617; 1923; 2471-3; 4984-90
C_8H_{18} 4944-58

8 II

$C_8H_4O_3$ 5282
$C_8H_4N_2$ 5288-9
$C_8H_5Cl_5$ 5055
C_8H_6O 1538
$C_8H_6O_2$ 5278-80; 5290
$C_8H_6O_3$ 162-4; 758; 5323
$C_8H_6O_4$ 165-8; 5274; 5276-7; 5327

FORMULA INDEX ORGANIC COMPOUNDS

$C_9H_8O_5N_2$ 4752
$C_9H_8O_6N_2$ 3043
C_9H_9ON 1502; 3703
C_9H_9OCl 3708
C_9H_9OBr 4333
$C_9H_9O_2N$ 289-91; 4899; 5586
$C_9H_9O_2Cl$ 797
$C_9H_9O_3N$ 125-7; 3664
$C_9H_9O_4N$ 2539; 3099-101; 4677; 5195
$C_9H_9O_6N_3$ 6318-20
$C_9H_9O_7N_3$ 2672
$C_9H_{10}O_3N_2$ 4597; 4766
$C_9H_{10}O_4N_2$ 2635; 4591
$C_9H_{10}O_5N_2$ 4860
$C_9H_{11}ON$ 26-8; 780; 2435-6; 2457; 2972; 3305; 3707; 4086; 5358
$C_9H_{11}OBr$ 987
$C_9H_{11}O_2N$ 18-20; 97-8; 2440-1; 2953-5; 4302; 4711-3; 4764; 5148-50; 5254
$C_9H_{11}O_3N$ 6367
$C_9H_{11}O_4N$ 2361
$C_9H_{12}ON_2$ 330; 3134
$C_9H_{12}O_2N_2$ 5112
$C_9H_{12}O_3S$ 3169
$C_9H_{13}O_2N$ 2882
$C_9H_{13}O_3N$ 157; 5512
$C_9H_{14}O_3N_4$ 1251
$C_9H_{14}NI$ 6267
$C_9H_{16}O_2N_2$ 217; 4906
$C_9H_{17}ON$ 2107; 6056
$C_9H_{17}OCl$ 5046
$C_9H_{17}O_5N$ 5033-4
$C_9H_{17}N_4I$ 3600
$C_9H_{19}ON$ 5044-5; 6414
$C_9H_{19}O_2N$ 4784-5
$C_9H_{20}ON_2$ 1922; 5767
$C_9H_{20}O_4S_2$ 5872
$C_9H_{20}N_2S$ 1921
$C_9H_{21}O_3N$ 6347
$C_9H_{22}N_2S_2$ 2120

9 IV

$C_9H_5ONBr_2$ 1848
$C_9H_7O_4NS$ 3828
$C_9H_8O_3NNa$ 3666
$C_9H_9O_2N_3S_2$ 5670
$C_9H_9O_3NCl_2$ 2077
$C_9H_9O_3NBr_2$ 1881
$C_9H_9O_3NI_2$ 2401-2
$C_9H_{10}ONBr$ 889
$C_9H_{10}O_2N_2S$ 5242
$C_9H_{11}O_3SCl$ 1383
$C_9H_{13}O_2NS$ 5977-8
$C_9H_{14}O_2NCl$ 4582
$C_9H_{14}O_3NCl$ 1523
$C_9H_{15}O_2N_3S$ 2890
$C_9H_{15}O_3N_2Br$ 84
$C_9H_{24}ON_2I_2$ 3591

9 V

C_9H_5ONClI 1392
$C_9H_6O_4NSI$ 3888
$C_9H_9O_2SHgNa$ 4052

10 I

$C_{10}H_8$ 4458
$C_{10}H_{10}$ 2278; 3120
$C_{10}H_{12}$ 2089; 5786
$C_{10}H_{14}$ 1049-52; 1622-4; 2126-8; 2483-6; 3582; 4351-2; 5827-9
$C_{10}H_{16}$ 870; 1189; 3232; 3972-3; 5092-3; 5318; 5576; 5684; 5704-5; 5709
$C_{10}H_{18}$ 1188; 1258, 1630-2; 2514-5; 4023; 5317
$C_{10}H_{20}$ 1650-3; 3579
$C_{10}H_{22}$ 1635-8

10 II

$C_{10}H_5Cl_3$ 6160-1
$C_{10}H_6O_2$ 4520-1; 4523
$C_{10}H_6O_3$ 3786-9
$C_{10}H_6O_4$ 1536; 3328; 4477-8
$C_{10}H_6O_5$ 3343
$C_{10}H_6O_8$ 680-2
$C_{10}H_6Cl_2$ 2009-18
$C_{10}H_6Br_2$ 1852
$C_{10}H_7F$ 3273
$C_{10}H_7Cl$ 1402-3
$C_{10}H_7Br$ 956-7
$C_{10}H_7I$ 3891-2
$C_{10}H_8O$ 4489-90
$C_{10}H_8O_2$ 2348-57; 4192
$C_{10}H_8O_3$ 743; 4406
$C_{10}H_8O_4$ 510; 638; 1504; 3336; 3346; 5604
$C_{10}H_8N_2$ 2810-3; 6051-3
$C_{10}H_8S$ 5913-4
$C_{10}H_8Cl_4$ 4473
$C_{10}H_9N$ 4367; 4369-70; 4372; 4374-5; 4529-30; 5229
$C_{10}H_{10}O$ 626
$C_{10}H_{10}O_2$ 198; 741; 4191; 5175-6; 5581-2
$C_{10}H_{10}O_3$ 637; 771; 2980; 4139; 5094
$C_{10}H_{10}O_4$ 763; 815; 2530-2; 3067; 3236-7; 3716; 4017; 4090; 5239; 5552
$C_{10}H_{10}O_5$ 837; 4993
$C_{10}H_{10}O_6$ 3502
$C_{10}H_{10}N_2$ 2809; 4563; 4565; 4571-9
$C_{10}H_{11}Cl$ 4188
$C_{10}H_{11}Br$ 4152
$C_{10}H_{12}O$ 511; 2901; 2987; 5377, 5439-40; 5787-90
$C_{10}H_{12}O_2$ 829; 1280; 3118-9; 3163-5; 3218; 3223; 4126; 5185; 5380-5; 5831; 5943; 6256-61; 6481
$C_{10}H_{12}O_3$ 814; 1529; 2968; 5412; 5415; 5446-7; 6419
$C_{10}H_{12}O_4$ 3187; 6226-7
$C_{10}H_{12}O_5$ 3414; 6240-2
$C_{10}H_{12}N_2$ 6363
$C_{10}H_{13}N$ 3930; 5792-5
$C_{10}H_{13}Cl$ 1572
$C_{10}H_{13}Br$ 915; 926
$C_{10}H_{14}O$ 1116; 1119-20; 1255; 1261; 1571; 2466; 5436-7; 5938
$C_{10}H_{14}O_2$ 1070; 2091-3; 5937
$C_{10}H_{14}O_3$ 457; 1200
$C_{10}H_{14}O_4$ 2188; 3400
$C_{10}H_{15}N$ 1046-7; 1256; 2121; 5818-20; 5946
$C_{10}H_{16}O$ 1191; 1257; 1512; 2275; 3233; 5320; 5472; 5935-6
$C_{10}H_{16}O_2$ 585
$C_{10}H_{16}O_4$ 1197-9; 2108; 2788
$C_{10}H_{16}O_5$ 2105
$C_{10}H_{16}O_8$ 1673
$C_{10}H_{16}N_2$ 303; 5606; 5839
$C_{10}H_{16}Cl_2$ 1192-4
$C_{10}H_{17}Cl$ 864; 5319
$C_{10}H_{18}O$ 860; 1260; 1518; 2274; 2516-8; 3217; 3234-5; 3974; 4026; 5471; 5706-8
$C_{10}H_{18}O_2$ 1190
$C_{10}H_{18}O_3$ 2102; 6403; 6410
$C_{10}H_{18}O_4$ 1905-6; 2106; 2187; 2203-4; 2796-7; 3450; 3550; 5605
$C_{10}H_{18}O_6$ 2804-5; 6200
$C_{10}H_{19}N$ 862; 1203-4; 1207
$C_{10}H_{20}O$ 1206; 1259; 1519; 4024-5; 4326; 5414
$C_{10}H_{20}O_2$ 496-7; 1065; 1205; 1219; 3010; 3553; 4331; 4959-60; 5703
$C_{10}H_{20}O_4$ 1069
$C_{10}H_{21}N$ 2145; 4029
$C_{10}H_{21}Cl$ 1646
$C_{10}H_{21}I$ 1647
$C_{10}H_{22}O$ 1640-4; 1740-1; 2519-20; 3106
$C_{10}H_{22}O_2$ 1634; 1654

FORMULA INDEX ORGANIC COMPOUNDS

$C_{10}H_{22}O_3$ 5410; 5703
$C_{10}H_{22}O_5$ 5769
$C_{10}H_{22}S$ 1751-2
$C_{10}H_{22}S_2$ 1753-4
$C_{10}H_{23}N$ 1645; 1734-6

10 III

$C_{10}H_4O_2Cl_2$ 2020
$C_{10}H_4O_8N_4$ 5854-6
$C_{10}H_5OCl_5$ 5056
$C_{10}H_5OBr_3$ 6107
$C_{10}H_5O_6N_3$ 6301-4
$C_{10}H_5O_7N_3$ 6305
$C_{10}H_5O_{10}N$ 5503-4
$C_{10}H_6OCl_2$ 2019
$C_{10}H_6OBr_2$ 1853
$C_{10}H_6O_2N_2$ 5514
$C_{10}H_6O_3S$ 4524
$C_{10}H_6O_4N_2$ 2637-40
$C_{10}H_6O_4Cl_4$ 3068
$C_{10}H_6O_5N_2$ 2641-3
$C_{10}H_6NBr_3$ 6113
$C_{10}H_7OCl$ 1404-6
$C_{10}H_7OBr$ 958-9
$C_{10}H_7O_2N$ 4772-3; 4892-4; 5533
$C_{10}H_7O_3N$ 95; 3937; 4775-9
$C_{10}H_8ON_2$ 4895
$C_{10}H_8O_2N_2$ 4780-3; 4830
$C_{10}H_8O_2S$ 4465-6
$C_{10}H_8O_3S$ 4470-1
$C_{10}H_8O_4N_2$ 3329-30
$C_{10}H_8O_4S$ 4498; 4502-5; 4507; 4510
$C_{10}H_8O_5N_4$ 5305
$C_{10}H_8O_6S_2$ 4461-4
$C_{10}H_8O_7S_2$ 4491
$C_{10}H_8O_8N_2$ 2633
$C_{10}H_8O_8S_2$ 2359
$C_{10}H_8NCl$ 1395
$C_{10}H_8NI$ 3889
$C_{10}H_9ON$ 91; 332-4; 336; 3816-9; 4083; 4179-80; 4567
$C_{10}H_9O_2N$ 3865
$C_{10}H_9O_4N$ 4320-2
$C_{10}H_9O_6N$ 2512
$C_{10}H_{10}ON_2$ 5202
$C_{10}H_{10}O_2N_2$ 2414; 2464; 2981-2
$C_{10}H_{10}O_2Br_2$ 4213
$C_{10}H_{10}O_5N_2$ 4598
$C_{10}H_{10}O_8N_6$ 1541
$C_{10}H_{10}NCl$ 4531-2
$C_{10}H_{11}ON$ 3111; 5134
$C_{10}H_{11}OCl$ 2524
$C_{10}H_{11}O_2N$ 40; 1670
$C_{10}H_{11}O_2N_3$ 4581
$C_{10}H_{11}O_2Br$ 3121
$C_{10}H_{11}O_3N$ 110; 129; 744-5; 1669; 3110
$C_{10}H_{11}N_2Cl$ 4564; 4566
$C_{10}H_{12}ON_2$ 215
$C_{10}H_{12}O_2N_2$ 1676-7
$C_{10}H_{12}O_3N_2$ 129; 1681; 4734; 4871
$C_{10}H_{12}O_4N_2$ 4596
$C_{10}H_{12}O_5N_2$ 2665
$C_{10}H_{13}ON$ 102-4; 1172; 2417-22; 2913; 2934; 5203; 5386; 5874
$C_{10}H_{13}OCl$ 1346; 5939
$C_{10}H_{13}OBr$ 916
$C_{10}H_{13}OI$ 5940
$C_{10}H_{13}O_2N$ 23-5; 2448; 3125; 4714; 4902; 5373
$C_{10}H_{13}O_2Cl$ 5135
$C_{10}H_{13}O_3N$ 4405
$C_{10}H_{13}O_4N_3$ 2619
$C_{10}H_{13}N_2Cl$ 6364
$C_{10}H_{14}ON_2$ 318; 4882
$C_{10}H_{14}OBr_2$ 1828
$C_{10}H_{14}O_2N_2$ 4717-9; 5115
$C_{10}H_{14}O_3N_2$ 5370
$C_{10}H_{14}O_3S$ 5452
$C_{10}H_{14}O_4S$ 5942
$C_{10}H_{14}NBr$ 927
$C_{10}H_{15}ON$ 1262; 2115-6; 2877-8; 3124; 3675
$C_{10}H_{15}OCl$ 1352
$C_{10}H_{15}OBr$ 919
$C_{10}H_{15}O_2N$ 5181; 6476
$C_{10}H_{15}O_3N$ 2345; 4696
$C_{10}H_{16}O_3N_2$ 2776; 2999
$C_{10}H_{16}O_4S$ 1196
$C_{10}H_{16}O_4Br_2$ 2781
$C_{10}H_{17}ON$ 281; 1195
$C_{10}H_{17}N_2Cl$ 304
$C_{10}H_{18}O_5N_4$ 6209
$C_{10}H_{18}N_2Cl_2$ 5840
$C_{10}H_{21}O_2N$ 1649; 4715-6
$C_{10}H_{21}O_3N$ 1648
$C_{10}H_{22}O_2S$ 1756
$C_{10}H_{22}O_3S$ 1755
$C_{10}H_{23}ON$ 1887

10 IV

$C_{10}H_5O_5N_2Na$ 2642
$C_{10}H_5O_5SNa$ 4522
$C_{10}H_6O_2NCl$ 1418-9
$C_{10}H_6O_4SNa$ 4512
$C_{10}H_6O_7S_2Ca$ 4492
$C_{10}H_6O_7S_2K_2$ 4493; 4495
$C_{10}H_6O_7S_2Na_2$ 4494; 4496
$C_{10}H_6O_8N_2S$ 3240
$C_{10}H_7O_2NS$ 4475
$C_{10}H_7O_2SCl$ 4468-9
$C_{10}H_7O_3SNa$ 4472
$C_{10}H_7O_4SK$ 4500; 4509
$C_{10}H_7O_4SNa$ 4501; 4511
$C_{10}H_8ON_2S$ 641
$C_{10}H_8O_2NBr$ 940
$C_{10}H_8O_2N_2S$ 773; 5589
$C_{10}H_9O_2NS$ 4467
$C_{10}H_9O_2NCl_2$ 42
$C_{10}H_9O_3NS$ 4541; 4543-53
$C_{10}H_9O_4NS$ 337-40
$C_{10}H_9O_6NS_2$ 4533-5; 4537
$C_{10}H_9O_7NS_2$ 342; 344
$C_{10}H_9O_9NS_3$ 4554
$C_{10}H_{10}ONCl$ 335
$C_{10}H_{10}O_2NCl$ 41
$C_{10}H_{10}O_2NBr$ 884
$C_{10}H_{10}O_2N_4S$ 5665; 5667
$C_{10}H_{10}O_4N_2S$ 5680
$C_{10}H_{13}O_3N_2Br$ 5390
$C_{10}H_{13}O_3SCl$ 1449
$C_{10}H_{15}O_2N_2Cl$ 5116
$C_{10}H_{15}O_3NS$ 2122
$C_{10}H_{16}O_3N_2S$ 853
$C_{10}H_{17}O_6N_3S$ 3378

10 V

$C_{10}H_4O_8NS_3Na_3$ 4476
$C_{10}H_4O_8N_2SNa_2$ 3241
$C_{10}H_5O_8NS_2Na_2$ 4901
$C_{10}H_6O_9NS_3Na$ 4555
$C_{10}H_7O_6NS_2Na_2$ 4540
$C_{10}H_7O_7NS_2Na_2$ 343
$C_{10}H_8O_3NSNa$ 4542
$C_{10}H_8O_4NSNa$ 341
$C_{10}H_8O_6NS_2K$ 4536; 4538
$C_{10}H_8O_6NS_2Na$ 4539

11 I

$C_{11}H_{10}$ 4304-5
$C_{11}H_{16}$ 421-4; 2221; 4158-60; 5074
$C_{11}H_{20}$ 6382
$C_{11}H_{22}$ 6373-4
$C_{11}H_{24}$ 6370

11 II

$C_{11}H_6O_{10}$ 671
$C_{11}H_7N$ 4487-8
$C_{11}H_8O$ 4482-3
$C_{11}H_8O_2$ 4306; 4480-1
$C_{11}H_8O_3$ 3778-85; 4275
$C_{11}H_9N$ 5226-8
$C_{11}H_{10}O$ 4311-2
$C_{11}H_{10}O_2$ 3131
$C_{11}H_{10}O_4$ 3696-7; 3971
$C_{11}H_{11}N$ 832; 2540-1; 2544; 2546-8; 4309-10; 6035-7
$C_{11}H_{12}O_2$ 52; 528; 3023; 5151-2
$C_{11}H_{12}O_3$ 739; 6416
$C_{11}H_{12}O_4$ 636; 834; 2941; 3228
$C_{11}H_{14}O$ 1117-8; 6247

FORMULA INDEX ORGANIC COMPOUNDS

$C_{11}H_{14}O_2$ 794; 1053-4; 3065; 3222; 3224; 5347
$C_{11}H_{14}O_3$ 1091-3; 5944; 6507
$C_{11}H_{16}O$ 476; 478-9; 1056; 1079-80; 1115; 5078
$C_{11}H_{16}O_3$ 2231
$C_{11}H_{17}N$ 419-20; 4216-8; 5073
$C_{11}H_{18}O_2$ 3356
$C_{11}H_{18}N_2$ 480
$C_{11}H_{20}O_2$ 6376
$C_{11}H_{20}O_3$ 5778
$C_{11}H_{20}O_4$ 1904; 2134-6; 2158; 2202; 6283
$C_{11}H_{21}N$ 6381
$C_{11}H_{22}O$ 1743-4; 3107; 4324; 6375; 6378
$C_{11}H_{22}O_2$ 436-7; 3113; 4172; 5397; 6377
$C_{11}H_{22}O_3$ 1737-8
$C_{11}H_{22}O_6$ 4386
$C_{11}H_{24}O$ 6371-2
$C_{11}H_{24}O_3$ 3390

11 III

$C_{11}H_7ON$ 4558-9
$C_{11}H_7OCl$ 4486
$C_{11}H_7O_4N$ 4774
$C_{11}H_7NS$ 4570
$C_{11}H_9ON$ 4484-5
$C_{11}H_9O_2N$ 4308; 5528-32
$C_{11}H_9O_3N$ 4278; 5537
$C_{11}H_{10}ON_2$ 3324
$C_{11}H_{11}ON$ 3013
$C_{11}H_{11}O_2N$ 3867
$C_{11}H_{11}O_4N$ 3102-4
$C_{11}H_{12}ON_2$ 565; 2497
$C_{11}H_{12}O_2N_2$ 3126; 6365
$C_{11}H_{12}NI$ 5539
$C_{11}H_{13}O_4N$ 29; 2205
$C_{11}H_{13}O_6N_3$ 6296
$C_{11}H_{15}ON$ 2111; 5364; 6411
$C_{11}H_{15}O_2N$ 1043; 1045
$C_{11}H_{15}O_3N$ 3949; 4064
$C_{11}H_{16}O_3N_2$ 1038
$C_{11}H_{16}O_3S$ 1137
$C_{11}H_{16}O_4N_2$ 571; 5565
$C_{11}H_{18}O_3N_2$ 505
$C_{11}H_{19}ON_3$ 1513
$C_{11}H_{19}N_2Cl$ 302
$C_{11}H_{23}ON$ 6379-80
$C_{11}H_{23}O_2N$ 3038; 4861
$C_{11}H_{25}ON$ 1888-9

11 IV

$C_{11}H_{11}ON_2Br$ 901
$C_{11}H_{11}O_2N_3S$ 5668
$C_{11}H_{15}O_3N_2Br$ 1061
$C_{11}H_{17}O_2NS$ 5973
$C_{11}H_{17}O_3N_2Na$ 506; 4583
$C_{11}H_{18}O_3N_2S$ 854

11 V

$C_{11}H_{10}O_2N_3SNa$ 5669

12 I

$C_{12}H_8$ 3
$C_{12}H_{10}$ 2; 2695
$C_{12}H_{12}$ 2507-9; 3089-90
$C_{12}H_{16}$ 5179
$C_{12}H_{18}$ 2777-8; 3590; 4119; 6184-5
$C_{12}H_{22}$ 2083; 2864
$C_{12}H_{24}$ 2863; 6122
$C_{12}H_{26}$ 2856-7
$C_{12}Cl_{10}$ 1629

12 II

$C_{12}H_6O_3$ 4474
$C_{12}H_6O_{12}$ 667
$C_{12}H_6Cl_4$ 5738
$C_{12}H_8O$ 2763
$C_{12}H_8O_4$ 4459-60; 5037
$C_{12}H_8N_2$ 5101-4
$C_{12}H_8S_2$ 5877
$C_{12}H_8F_2$ 2247-8
$C_{12}H_8Cl_2$ 1989-90
$C_{12}H_8Br_2$ 1833
$C_{12}H_9N$ 1231
$C_{12}H_9Cl$ 1291; 1373-5
$C_{12}H_9Br$ 878; 933-4
$C_{12}H_9I$ 3884-5
$C_{12}H_{10}O$ 2719; 4313; 5216-8
$C_{12}H_{10}O_2$ 48; 2338-43; 3770; 4526-8
$C_{12}H_{10}O_4$ 2817; 5321; 5535
$C_{12}H_{10}N_2$ 599; 2279
$C_{12}H_{10}S$ 2749
$C_{12}H_{10}S_2$ 2715
$C_{12}H_{10}I_2$ 2729
$C_{12}H_{10}Hg$ 4047
$C_{12}H_{10}P_2$ 5271
$C_{12}H_{10}Se$ 2742
$C_{12}H_{11}N$ 830-1; 2698; 5153-5
$C_{12}H_{11}N_3$ 247-9; 1762
$C_{12}H_{12}O$ 3093-4
$C_{12}H_{12}O_2$ 203
$C_{12}H_{12}O_6$ 3775; 5516
$C_{12}H_{12}O_{12}$ 3580
$C_{12}H_{12}N_2$ 313-4; 1710-4; 2725; 2727; 3685
$C_{12}H_{12}N_4$ 1696-9
$C_{12}H_{13}N$ 2505-6; 3091-2; 6270-3
$C_{12}H_{13}N_3$ 262; 1717-8
$C_{12}H_{13}N_5$ 6058
$C_{12}H_{14}O_3$ 3219; 5776
$C_{12}H_{14}O_4$ 569; 1122; 2199-201; 5784
$C_{12}H_{14}N_4$ 1722; 2269-70
$C_{12}H_{16}O$ 481-2; 1615-6; 4181
$C_{12}H_{16}O_2$ 425; 1113-4; 5075; 5945
$C_{12}H_{16}O_3$ 458; 486-7; 584; 1106; 3117; 3487
$C_{12}H_{16}O_8$ 1270
$C_{12}H_{18}O$ 426; 452; 477; 4066
$C_{12}H_{18}O_2$ 1112; 3654
$C_{12}H_{18}O_3$ 5265
$C_{12}H_{18}O_6$ 2146-51
$C_{12}H_{18}O_8$ 2152
$C_{12}H_{19}N$ 2775
$C_{12}H_{20}O_2$ 861; 3354; 3975; 5710
$C_{12}H_{20}O_4$ 1903
$C_{12}H_{20}O_6$ 1666; 2095; 3432
$C_{12}H_{20}O_7$ 6187
$C_{12}H_{22}O_2$ 1520; 4027-8; 4407
$C_{12}H_{22}O_3$ 1214
$C_{12}H_{22}O_4$ 1745; 1910-2; 2171; 2210; 2552; 2771
$C_{12}H_{22}O_5$ 1902
$C_{12}H_{22}O_6$ 1919-20; 2410
$C_{12}H_{22}O_{11}$ 3947; 4007; 5663; 6054
$C_{12}H_{23}N$ 2085; 3956
$C_{12}H_{24}O$ 3952
$C_{12}H_{24}O_2$ 1066; 1639; 3008; 3950
$C_{12}H_{24}O_3$ 1162; 1165
$C_{12}H_{25}Cl$ 2861
$C_{12}H_{25}Br$ 2860
$C_{12}H_{26}O$ 2859
$C_{12}H_{27}N$ 6115-6
$C_{12}H_{30}Sn_2$ 5953

12 III

$C_{12}H_5O_{12}N_7$ 2764
$C_{12}H_6O_8N_4$ 5847-9
$C_{12}H_6O_9N_4$ 5851
$C_{12}H_6O_{10}N_4$ 5846
$C_{12}H_7O_3N$ 4732; 5554
$C_{12}H_7O_4N$ 5551
$C_{12}H_8OS$ 5129
$C_{12}H_8OBr_2$ 1834
$C_{12}H_8O_4N_2$ 2620-3
$C_{12}H_8O_5N_2$ 2627-8
$C_{12}H_8O_5N_4$ 2598
$C_{12}H_8O_9N_4$ 5492
$C_{12}H_9OCl$ 1436-8
$C_{12}H_9OBr$ 885; 935; 977
$C_{12}H_9O_2N$ 3869; 4587; 4723-5
$C_{12}H_9O_3N$ 4729-31
$C_{12}H_9O_4N_3$ 2624-6; 4650-1
$C_{12}H_9O_4N_5$ 2618
$C_{12}H_9O_5N_3$ 2634
$C_{12}H_9O_8N_5$ 5495
$C_{12}H_9NS$ 5138

FORMULA INDEX ORGANIC COMPOUNDS

$C_{12}H_9N_3S$ 5922
$C_{12}H_{10}ON_2$ 615; 2733; 3727-9; 4884
$C_{12}H_{10}OS$ 2752
$C_{12}H_{10}O_2N_2$ 609-11; 662; 4726-7
$C_{12}H_{10}O_2S$ 2750
$C_{12}H_{10}O_2S_2$ 2716
$C_{12}H_{10}O_3N_2$ 4593
$C_{12}H_{10}N_2Cl_2$ 1957
$C_{12}H_{10}ClAs$ 2712
$C_{12}H_{10}Cl_2Se$ 2743
$C_{12}H_{11}ON$ 46-7; 3767-9
$C_{12}H_{11}OI$ 2728
$C_{12}H_{11}O_2N$ 31-2; 3031
$C_{12}H_{11}O_2N_3$ 4661
$C_{12}H_{11}O_4P$ 2735-6
$C_{12}H_{12}ON_2$ 1720
$C_{12}H_{12}O_3N_2$ 5113
$C_{12}H_{12}NCl$ 2699
$C_{12}H_{12}N_2S$ 5886
$C_{12}H_{12}N_2Cl_4$ 1958
$C_{12}H_{12}N_3Cl$ 250
$C_{12}H_{13}O_2N$ 3866
$C_{12}H_{13}O_3N$ 5476
$C_{12}H_{13}O_6N$ 2190
$C_{12}H_{13}N_2Cl$ 315; 2726
$C_{12}H_{13}N_4Cl$ 1699
$C_{12}H_{14}O_2N_2$ 2098; 2129
$C_{12}H_{14}O_8N_4$ 232
$C_{12}H_{14}NI$ 4368; 4371; 4373
$C_{12}H_{14}N_2Cl_2$ 1715
$C_{12}H_{15}ON$ 770
$C_{12}H_{15}O_2N$ 39
$C_{12}H_{15}O_6N_3$ 6297
$C_{12}H_{16}OCl_2$ 1381
$C_{12}H_{16}O_3N_2$ 3231; 5091
$C_{12}H_{16}O_8N_2$ 2528
$C_{12}H_{17}ON$ 77; 1215
$C_{12}H_{17}O_4N$ 2474
$C_{12}H_{17}O_5N$ 2116
$C_{12}H_{17}O_7N$ 5110
$C_{12}H_{18}O_4N_2$ 5559
$C_{12}H_{18}O_5N_2$ 3366-7
$C_{12}H_{19}ON$ 2114
$C_{12}H_{20}O_4Br_2$ 1896
$C_{12}H_{22}O_{14}Ca$ 3360
$C_{12}H_{23}OCl$ 3955
$C_{12}H_{25}ON$ 3953
$C_{12}H_{27}O_2N$ 3951
$C_{12}H_{27}O_3B$ 6117
$C_{12}H_{27}O_4P$ 6121
$C_{12}H_{28}O_4N_2$ 3200
$C_{12}H_{28}NI$ 5866
$C_{12}H_{30}OSi_2$ 6197
$C_{12}H_{30}N_6Cl_2$ 5685

12 IV

$C_{12}H_4O_{12}N_6S$ 2765
$C_{12}H_6O_3SCl_4$ 2043
$C_{12}H_6O_8N_4S_2$ 5850
$C_{12}H_8ON_2Cl_2$ 1950
$C_{12}H_8O_2SBr_2$ 1835
$C_{12}H_8O_3SCl_2$ 5180
$C_{12}H_8O_4N_2S_2$ 2655-6
$C_{12}H_9O_3SCl$ 5170
$C_{12}H_9O_3SNa$ 2751
$C_{12}H_{10}O_4N_2S$ 3730
$C_{12}H_{10}O_5N_2S$ 2307; 4728
$C_{12}H_{11}ONS$ 5906
$C_{12}H_{11}O_3NS$ 2701
$C_{12}H_{11}O_3N_2Na$ 5114
$C_{12}H_{12}ON_2S_2$ 2437
$C_{12}H_{12}O_3N_2S$ 696
$C_{12}H_{12}O_6N_2S_2$ 695
$C_{12}H_{13}O_4NS$ 2700
$C_{12}H_{14}ON_4S$ 5893
$C_{12}H_{14}O_4N_2S$ 1716
$C_{12}H_{16}O_2NCl$ 2413
$C_{12}H_{16}O_4N_2S$ 522
$C_{12}H_{19}O_2N_2Br$ 5470
$C_{12}H_{24}O_6N_6Cu$ 1522

12 V

$C_{12}H_6O_4N_2S_2Cl_2$ 1987
$C_{12}H_6O_8S_2I_4Zn$ 5629
$C_{12}H_9O_4N_2SNa$ 3731
$C_{12}H_9O_5N_2SNa$ 2308
$C_{12}H_{14}O_2N_2Cl_2As_2$ 5592
$C_{12}H_{14}O_2N_5SCl$ 5337
$C_{12}H_{18}ON_4SCl_2$ 5876
$C_{12}H_{19}O_3N_2Na$ 5002

13 I

$C_{13}H_{10}$ 3246
$C_{13}H_{12}$ 2731; 5245-7
$C_{13}H_{26}$ 6175
$C_{13}H_{28}$ 6173

13 II

$C_{13}H_8O$ 3248
$C_{13}H_8O_2$ 6451
$C_{13}H_8O_4$ 3227
$C_{13}H_8O_5$ 2891
$C_{13}H_9N$ 142; 4517-9
$C_{13}H_{10}O$ 724; 3247; 6447
$C_{13}H_{10}O_2$ 3320; 3749; 5159-62; 6453
$C_{13}H_{10}O_3$ 2321-8; 2711; 5133; 5235
$C_{13}H_{10}O_4$ 4276; 6224-5
$C_{13}H_{10}O_6$ 5070
$C_{13}H_{10}N_2$ 690; 1234-5; 4334
$C_{13}H_{10}Cl_2$ 726
$C_{13}H_{11}N$ 632; 2271
$C_{13}H_{12}O$ 691; 823-4; 4073-4
$C_{13}H_{12}O_2$ 2344; 3718
$C_{13}H_{12}N_2$ 646; 2721
$C_{13}H_{13}N$ 693; 786; 4219-20
$C_{13}H_{13}N_3$ 2723; 4211
$C_{13}H_{14}O_3$ 625
$C_{13}H_{14}O_4$ 740
$C_{13}H_{14}O_6$ 5584
$C_{13}H_{14}N_2$ 826; 1721; 4271-3; 4431
$C_{13}H_{15}N$ 5426
$C_{13}H_{16}O_3$ 2983
$C_{13}H_{18}O$ 1611
$C_{13}H_{18}O_3$ 3483
$C_{13}H_{18}O_4$ 1028
$C_{13}H_{20}O$ 3663; 3913-5
$C_{13}H_{20}O_8$ 5067
$C_{13}H_{24}O_4$ 2123; 2168
$C_{13}H_{25}N$ 2862
$C_{13}H_{26}O$ 2267; 4408
$C_{13}H_{26}O_2$ 438; 3181; 4295; 6176
$C_{13}H_{28}O$ 6118; 6174
$C_{13}H_{28}O_3$ 1087; 3386
$C_{13}H_{28}O_4$ 5399

13 III

$C_{13}H_7O_3Br_3$ 6110
$C_{13}H_8OCl_2$ 1965-6
$C_{13}H_8O_5N_2$ 2612
$C_{13}H_8O_8N_4$ 5852
$C_{13}H_9ON$ 145; 2714; 3249; 4525
$C_{13}H_9OCl$ 1331
$C_{13}H_9O_2N$ 4738
$C_{13}H_9O_3N$ 4670-2
$C_{13}H_9O_5N$ 4837
$C_{13}H_9O_5N_3$ 4652
$C_{13}H_9NS$ 687; 2755
$C_{13}H_{10}O_3N_2$ 4645
$C_{13}H_{10}O_4N_2$ 2629
$C_{13}H_{10}NCl$ 4519
$C_{13}H_{11}ON$ 270-2; 631; 715; 728; 3306
$C_{13}H_{11}O_2N$ 3741; 5157
$C_{13}H_{11}O_2N_3$ 4638
$C_{13}H_{11}O_4N_3$ 4649
$C_{13}H_{11}NS$ 5890
$C_{13}H_{12}ON_2$ 657-8; 767-8; 828; 1706-8; 2759-60; 3737
$C_{13}H_{12}ON_4$ 2709
$C_{13}H_{12}O_2N_2$ 4771
$C_{13}H_{12}O_2S$ 5252
$C_{13}H_{12}O_3S$ 5248
$C_{13}H_{12}O_5N_6$ 2654
$C_{13}H_{12}N_2S$ 5892
$C_{13}H_{12}N_4S$ 2753
$C_{13}H_{13}ON$ 22; 784; 5791
$C_{13}H_{13}ON_3$ 246; 2744-7
$C_{13}H_{14}ON_4$ 2710
$C_{13}H_{14}O_3N_2$ 5336

$C_{11}H_{14}O_2$ 794; 1053-4; 3065; 3222; 3224; 5347
$C_{11}H_{14}O_3$ 1091-3; 5944; 6507
$C_{11}H_{16}O$ 476; 478-9; 1056; 1079-80; 1115; 5078
$C_{11}H_{16}O_3$ 2231
$C_{11}H_{17}N$ 419-20; 4216-8; 5073
$C_{11}H_{18}O_2$ 3356
$C_{11}H_{18}N_2$ 480
$C_{11}H_{20}O_2$ 6376
$C_{11}H_{20}O_3$ 5778
$C_{11}H_{20}O_4$ 1904; 2134-6; 2158; 2202; 6283
$C_{11}H_{21}N$ 6381
$C_{11}H_{22}O$ 1743-4; 3107; 4324; 6375; 6378
$C_{11}H_{22}O_2$ 436-7; 3113; 4172; 5397; 6377
$C_{11}H_{22}O_3$ 1737-8
$C_{11}H_{22}O_6$ 4386
$C_{11}H_{24}O$ 6371-2
$C_{11}H_{24}O_3$ 3390

11 III

$C_{11}H_7ON$ 4558-9
$C_{11}H_7OCl$ 4486
$C_{11}H_7O_4N$ 4774
$C_{11}H_7NS$ 4570
$C_{11}H_9ON$ 4484-5
$C_{11}H_9O_2N$ 4308; 5528-32
$C_{11}H_9O_3N$ 4278; 5537
$C_{11}H_{10}ON_2$ 3324
$C_{11}H_{11}ON$ 3013
$C_{11}H_{11}O_2N$ 3867
$C_{11}H_{11}O_4N$ 3102-4
$C_{11}H_{12}ON_2$ 565; 2497
$C_{11}H_{12}O_2N_2$ 3126; 6365
$C_{11}H_{12}NI$ 5539
$C_{11}H_{13}O_4N$ 29; 2205
$C_{11}H_{13}O_6N_3$ 6296
$C_{11}H_{15}ON$ 2111; 5364; 6411
$C_{11}H_{15}O_2N$ 1043; 1045
$C_{11}H_{15}O_3N$ 3949; 4064
$C_{11}H_{16}O_3N_2$ 1038
$C_{11}H_{16}O_3S$ 1137
$C_{11}H_{16}O_4N_2$ 571; 5565
$C_{11}H_{18}O_3N_2$ 505
$C_{11}H_{19}ON_3$ 1513
$C_{11}H_{19}N_2Cl$ 302
$C_{11}H_{23}ON$ 6379-80
$C_{11}H_{23}O_2N$ 3038; 4861
$C_{11}H_{25}ON$ 1888-9

11 IV

$C_{11}H_{11}ON_2Br$ 901
$C_{11}H_{11}O_2N_3S$ 5668
$C_{11}H_{15}O_3N_2Br$ 1061
$C_{11}H_{17}O_2NS$ 5973
$C_{11}H_{17}O_3N_2Na$ 506; 4583
$C_{11}H_{18}O_3N_2S$ 854

11 V

$C_{11}H_{10}O_2N_3SNa$ 5669

12 I

$C_{12}H_8$ 3
$C_{12}H_{10}$ 2; 2695
$C_{12}H_{12}$ 2507-9; 3089-90
$C_{12}H_{16}$ 5179
$C_{12}H_{18}$ 2777-8; 3590; 4119; 6184-5
$C_{12}H_{22}$ 2083; 2864
$C_{12}H_{24}$ 2863; 6122
$C_{12}H_{26}$ 2856-7
$C_{12}Cl_{10}$ 1629

12 II

$C_{12}H_6O_3$ 4474
$C_{12}H_6O_{12}$ 667
$C_{12}H_6Cl_4$ 5738
$C_{12}H_8O$ 2763
$C_{12}H_8O_4$ 4459-60; 5037
$C_{12}H_8N_2$ 5101-4
$C_{12}H_8S_2$ 5877
$C_{12}H_8F_2$ 2247-8
$C_{12}H_8Cl_2$ 1989-90
$C_{12}H_8Br_2$ 1833
$C_{12}H_9N$ 1231
$C_{12}H_9Cl$ 1291; 1373-5
$C_{12}H_9Br$ 878; 933-4
$C_{12}H_9I$ 3884-5
$C_{12}H_{10}O$ 2719; 4313; 5216-8
$C_{12}H_{10}O_2$ 48; 2338-43; 3770; 4526-8
$C_{12}H_{10}O_4$ 2817; 5321; 5535
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$C_{12}H_{10}S$ 2749
$C_{12}H_{10}S_2$ 2715
$C_{12}H_{10}I_2$ 2729
$C_{12}H_{10}Hg$ 4047
$C_{12}H_{10}P_2$ 5271
$C_{12}H_{10}Se$ 2742
$C_{12}H_{11}N$ 830-1; 2698; 5153-5
$C_{12}H_{11}N_3$ 247-9; 1762
$C_{12}H_{12}O$ 3093-4
$C_{12}H_{12}O_2$ 203
$C_{12}H_{12}O_6$ 3775; 5516
$C_{12}H_{12}O_{12}$ 3580
$C_{12}H_{12}N_2$ 313-4; 1710-4; 2725; 2727; 3685
$C_{12}H_{12}N_4$ 1696-9
$C_{12}H_{13}N$ 2505-6; 3091-2; 6270-3
$C_{12}H_{13}N_3$ 262; 1717-8
$C_{12}H_{13}N_5$ 6058
$C_{12}H_{14}O_3$ 3219; 5776
$C_{12}H_{14}O_4$ 569; 1122; 2199-201; 5784
$C_{12}H_{14}N_4$ 1722; 2269-70
$C_{12}H_{16}O$ 481-2; 1615-6; 4181
$C_{12}H_{16}O_2$ 425; 1113-4; 5075; 5945
$C_{12}H_{16}O_3$ 458; 486-7; 584; 1106; 3117; 3487
$C_{12}H_{16}O_8$ 1270
$C_{12}H_{18}O$ 426; 452; 477; 4066
$C_{12}H_{18}O_2$ 1112; 3654
$C_{12}H_{18}O_3$ 5265
$C_{12}H_{18}O_6$ 2146-51
$C_{12}H_{18}O_8$ 2152
$C_{12}H_{19}N$ 2775
$C_{12}H_{20}O_2$ 861; 3354; 3975; 5710
$C_{12}H_{20}O_4$ 1903
$C_{12}H_{20}O_6$ 1666; 2095; 3432
$C_{12}H_{20}O_7$ 6187
$C_{12}H_{22}O_2$ 1520; 4027-8; 4407
$C_{12}H_{22}O_3$ 1214
$C_{12}H_{22}O_4$ 1745; 1910-2; 2171; 2210; 2552; 2771
$C_{12}H_{22}O_5$ 1902
$C_{12}H_{22}O_6$ 1919-20; 2410
$C_{12}H_{22}O_{11}$ 3947; 4007; 5663; 6054
$C_{12}H_{23}N$ 2085; 3956
$C_{12}H_{24}O$ 3952
$C_{12}H_{24}O_2$ 1066; 1639; 3008; 3950
$C_{12}H_{24}O_3$ 1162; 1165
$C_{12}H_{25}Cl$ 2861
$C_{12}H_{25}Br$ 2860
$C_{12}H_{26}O$ 2859
$C_{12}H_{27}N$ 6115-6
$C_{12}H_{30}Sn_2$ 5953

12 III

$C_{12}H_5O_{12}N_7$ 2764
$C_{12}H_6O_8N_4$ 5847-9
$C_{12}H_6O_9N_4$ 5851
$C_{12}H_6O_{10}N_4$ 5846
$C_{12}H_7O_3N$ 4732; 5554
$C_{12}H_7O_4N$ 5551
$C_{12}H_8OS$ 5129
$C_{12}H_8OBr_2$ 1834
$C_{12}H_8O_4N_2$ 2620-3
$C_{12}H_8O_5N_2$ 2627-8
$C_{12}H_8O_5N_4$ 2598
$C_{12}H_8O_9N_4$ 5492
$C_{12}H_9OCl$ 1436-8
$C_{12}H_9OBr$ 885; 935; 977
$C_{12}H_9O_2N$ 3869; 4587; 4723-5
$C_{12}H_9O_3N$ 4729-31
$C_{12}H_9O_4N_3$ 2624-6; 4650-1
$C_{12}H_9O_4N_5$ 2618
$C_{12}H_9O_5N_3$ 2634
$C_{12}H_9O_8N_5$ 5495
$C_{12}H_9NS$ 5138

$C_{12}H_9N_3S$ 5922
$C_{12}H_{10}ON_2$ 615; 2733; 3727-9; 4884
$C_{12}H_{10}OS$ 2752
$C_{12}H_{10}O_2N_2$ 609-11; 662; 4726-7
$C_{12}H_{10}O_2S$ 2750
$C_{12}H_{10}O_2S_2$ 2716
$C_{12}H_{10}O_3N_2$ 4593
$C_{12}H_{10}N_2Cl_2$ 1957
$C_{12}H_{10}ClAs$ 2712
$C_{12}H_{10}Cl_2Se$ 2743
$C_{12}H_{11}ON$ 46-7; 3767-9
$C_{12}H_{11}OI$ 2728
$C_{12}H_{11}O_2N$ 31-2; 3031
$C_{12}H_{11}O_2N_3$ 4661
$C_{12}H_{11}O_4P$ 2735-6
$C_{12}H_{12}ON_2$ 1720
$C_{12}H_{12}O_3N_2$ 5113
$C_{12}H_{12}NCl$ 2699
$C_{12}H_{12}N_2S$ 5886
$C_{12}H_{12}N_2Cl_4$ 1958
$C_{12}H_{12}N_3Cl$ 250
$C_{12}H_{13}O_2N$ 3866
$C_{12}H_{13}O_3N$ 5476
$C_{12}H_{13}O_6N$ 2190
$C_{12}H_{13}N_2Cl$ 315; 2726
$C_{12}H_{13}N_4Cl$ 1699
$C_{12}H_{14}O_2N_2$ 2098; 2129
$C_{12}H_{14}O_8N_4$ 232
$C_{12}H_{14}NI$ 4368; 4371; 4373
$C_{12}H_{14}N_2Cl_2$ 1715
$C_{12}H_{15}ON$ 770
$C_{12}H_{15}O_2N$ 39
$C_{12}H_{15}O_6N_3$ 6297
$C_{12}H_{16}OCl_2$ 1381
$C_{12}H_{16}O_3N_2$ 3231; 5091
$C_{12}H_{16}O_8N_2$ 2528
$C_{12}H_{17}ON$ 77; 1215
$C_{12}H_{17}O_4N$ 2474
$C_{12}H_{17}O_5N$ 2116
$C_{12}H_{17}O_7N$ 5110
$C_{12}H_{18}O_4N_2$ 5559
$C_{12}H_{18}O_5N_2$ 3366-7
$C_{12}H_{19}ON$ 2114
$C_{12}H_{20}O_4Br_2$ 1896
$C_{12}H_{22}O_{14}Ca$ 3360
$C_{12}H_{23}OCl$ 3955
$C_{12}H_{25}ON$ 3953
$C_{12}H_{27}O_2N$ 3951
$C_{12}H_{27}O_3B$ 6117
$C_{12}H_{27}O_4P$ 6121
$C_{12}H_{28}O_4N_2$ 3200
$C_{12}H_{28}NI$ 5866
$C_{12}H_{30}OSi_2$ 6197
$C_{12}H_{30}N_6Cl_2$ 5685

12 IV

$C_{12}H_4O_{12}N_6S$ 2765
$C_{12}H_6O_3SCl_4$ 2043
$C_{12}H_6O_8N_4S_2$ 5850
$C_{12}H_8ON_2Cl_2$ 1950
$C_{12}H_8O_2SBr_2$ 1835
$C_{12}H_8O_3SCl_2$ 5180
$C_{12}H_8O_4N_2S_2$ 2655-6
$C_{12}H_9O_3SCl$ 5170
$C_{12}H_9O_3SNa$ 2751
$C_{12}H_{10}O_4N_2S$ 3730
$C_{12}H_{10}O_5N_2S$ 2307; 4728
$C_{12}H_{11}ONS$ 5906
$C_{12}H_{11}O_3NS$ 2701
$C_{12}H_{11}O_3N_2Na$ 5114
$C_{12}H_{12}ON_2S_2$ 2437
$C_{12}H_{12}O_3N_2S$ 696
$C_{12}H_{12}O_6N_2S_2$ 695
$C_{12}H_{13}O_4NS$ 2700
$C_{12}H_{14}ON_4S$ 5893
$C_{12}H_{14}O_4N_2S$ 1716
$C_{12}H_{16}O_2NCl$ 2413
$C_{12}H_{16}O_4N_2S$ 522
$C_{12}H_{19}O_2N_2Br$ 5470
$C_{12}H_{24}O_6N_6Cu$ 1522

12 V

$C_{12}H_6O_4N_2S_2Cl_2$ 1987
$C_{12}H_6O_8S_2I_4Zn$ 5629
$C_{12}H_9O_4N_2SNa$ 3731
$C_{12}H_9O_5N_2SNa$ 2308
$C_{12}H_{14}O_2N_2Cl_2As_2$ 5592
$C_{12}H_{14}O_2N_5SCl$ 5337
$C_{12}H_{18}ON_4SCl_2$ 5876
$C_{12}H_{19}O_3N_2Na$ 5002

13 I

$C_{13}H_{10}$ 3246
$C_{13}H_{12}$ 2731; 5245-7
$C_{13}H_{26}$ 6175
$C_{13}H_{28}$ 6173

13 II

$C_{13}H_8O$ 3248
$C_{13}H_8O_2$ 6451
$C_{13}H_8O_4$ 3227
$C_{13}H_8O_5$ 2891
$C_{13}H_9N$ 142; 4517-9
$C_{13}H_{10}O$ 724; 3247; 6447
$C_{13}H_{10}O_2$ 3320; 3749; 5159-62; 6453
$C_{13}H_{10}O_3$ 2321-8; 2711; 5133; 5235
$C_{13}H_{10}O_4$ 4276; 6224-5
$C_{13}H_{10}O_6$ 5070
$C_{13}H_{10}N_2$ 690; 1234-5; 4334
$C_{13}H_{10}Cl_2$ 726
$C_{13}H_{11}N$ 632; 2271
$C_{13}H_{12}O$ 691; 823-4; 4073-4
$C_{13}H_{12}O_2$ 2344; 3718
$C_{13}H_{12}N_2$ 646; 2721
$C_{13}H_{13}N$ 693; 786; 4219-20
$C_{13}H_{13}N_3$ 2723; 4211
$C_{13}H_{14}O_3$ 625
$C_{13}H_{14}O_4$ 740
$C_{13}H_{14}O_6$ 5584
$C_{13}H_{14}N_2$ 826; 1721; 4271-3; 4431
$C_{13}H_{15}N$ 5426
$C_{13}H_{16}O_3$ 2983
$C_{13}H_{18}O$ 1611
$C_{13}H_{18}O_3$ 3483
$C_{13}H_{18}O_4$ 1028
$C_{13}H_{20}O$ 3663; 3913-5
$C_{13}H_{20}O_8$ 5067
$C_{13}H_{24}O_4$ 2123; 2168
$C_{13}H_{25}N$ 2862
$C_{13}H_{26}O$ 2267; 4408
$C_{13}H_{26}O_2$ 438; 3181; 4295; 6176
$C_{13}H_{28}O$ 6118; 6174
$C_{13}H_{28}O_3$ 1087; 3386
$C_{13}H_{28}O_4$ 5399

13 III

$C_{13}H_7O_3Br_3$ 6110
$C_{13}H_8OCl_2$ 1965-6
$C_{13}H_8O_5N_2$ 2612
$C_{13}H_8O_8N_4$ 5852
$C_{13}H_9ON$ 145; 2714; 3249; 4525
$C_{13}H_9OCl$ 1331
$C_{13}H_9O_2N$ 4738
$C_{13}H_9O_3N$ 4670-2
$C_{13}H_9O_5N$ 4837
$C_{13}H_9O_5N_3$ 4652
$C_{13}H_9NS$ 687; 2755
$C_{13}H_{10}O_3N_2$ 4645
$C_{13}H_{10}O_4N_2$ 2629
$C_{13}H_{10}NCl$ 4519
$C_{13}H_{11}ON$ 270-2; 631; 715; 728; 3306
$C_{13}H_{11}O_2N$ 3741; 5157
$C_{13}H_{11}O_2N_3$ 4638
$C_{13}H_{11}O_4N_3$ 4649
$C_{13}H_{11}NS$ 5890
$C_{13}H_{12}ON_2$ 657-8; 767-8; 828; 1706-8; 2759-60; 3737
$C_{13}H_{12}ON_4$ 2709
$C_{13}H_{12}O_2N_2$ 4771
$C_{13}H_{12}O_2S$ 5252
$C_{13}H_{12}O_3S$ 5248
$C_{13}H_{12}O_5N_6$ 2654
$C_{13}H_{12}N_2S$ 5892
$C_{13}H_{12}N_4S$ 2753
$C_{13}H_{13}ON$ 22; 784; 5791
$C_{13}H_{13}ON_3$ 246; 2744-7
$C_{13}H_{14}ON_4$ 2710
$C_{13}H_{14}O_3N_2$ 5336

$C_{13}H_{14}N_4S$ 2754
$C_{13}H_{15}ON$ 2479
$C_{13}H_{15}N_2Cl$ 827
$C_{13}H_{16}NI$ 2543; 2545
$C_{13}H_{17}ON_3$ 363
$C_{13}H_{18}O_3N_4$ 3602
$C_{13}H_{19}ON$ 2774
$C_{13}H_{20}O_2N_2$ 4934-5
$C_{13}H_{25}O_2Br$ 4153
$C_{13}H_{27}ON$ 6177

13 IV

$C_{13}H_8O_5N_3Na$ 4653
$C_{13}H_9O_3SBr_3$ 6111
$C_{13}H_{10}ONCl$ 2708
$C_{13}H_{10}O_3SCl_2$ 2047
$C_{13}H_{11}O_3SCl$ 1439-40
$C_{13}H_{13}O_2NS$ 5972
$C_{13}H_{13}O_4N_3S$ 5328
$C_{13}H_{14}ONCl$ 785
$C_{13}H_{15}O_3N_2Cl_3$ 567
$C_{13}H_{18}O_2NBr$ 1008
$C_{13}H_{21}O_2N_2Cl$ 4934

13 V

$C_{13}H_{16}O_6NHgNa$ 5591

13 VI

$C_{13}H_{13}O_4N_2SAs_2Na$ 5593

14 I

$C_{14}H_{10}$ 538; 5095; 5954
$C_{14}H_{12}$ 2272; 5642-3
$C_{14}H_{14}$ 842-3; 2717-8; 2825-9
$C_{14}H_{16}$ 3576
$C_{14}H_{22}$ 5758-9
$C_{14}H_{26}$ 5752
$C_{14}H_{28}$ 5751
$C_{14}H_{30}$ 5748

14 II

$C_{14}H_6O_8$ 2872
$C_{14}H_8O_2$ 548-50; 5097
$C_{14}H_8O_3$ 3724-6
$C_{14}H_8O_4$ 2297-304; 3747
$C_{14}H_8O_5$ 6212-5
$C_{14}H_8O_6$ 5799-801
$C_{14}H_8O_8$ 5575
$C_{14}H_8Cl_2$ 1939-40
$C_{14}H_8Br_2$ 1803
$C_{14}H_9Br$ 968
$C_{14}H_{10}O$ 545; 561-2; 2730; 5098-100
$C_{14}H_{10}O_2$ 697; 2293-4; 2360; 5019; 5096
$C_{14}H_{10}O_3$ 714; 750-2; 2295-6
$C_{14}H_{10}O_4$ 766; 2688-91
$C_{14}H_{10}O_5$ 5585
$C_{14}H_{10}O_9$ 5687
$C_{14}H_{11}N$ 542-3; 4092-4; 4514-6
$C_{14}H_{12}O$ 1660; 2273; 5144; 5249-51
$C_{14}H_{12}O_2$ 717; 789-92; 2697; 4070; 6013-5
$C_{14}H_{12}O_3$ 694; 699; 809; 833; 3482; 6038-40
$C_{14}H_{12}O_4$ 2347; 2358; 3486
$C_{14}H_{12}N_2$ 633; 5182
$C_{14}H_{13}N$ 3011
$C_{14}H_{14}O$ 806; 2918; 4221; 5164
$C_{14}H_{14}O_2$ 2079; 2693; 3202; 3701-2
$C_{14}H_{14}O_3$ 3931
$C_{14}H_{14}O_8$ 5841
$C_{14}H_{14}N_2$ 54; 612-4; 1729-31; 2696
$C_{14}H_{14}S$ 1791; 2842
$C_{14}H_{14}S_2$ 805; 2836; 3204
$C_{14}H_{14}Hg$ 4048-50
$C_{14}H_{15}N$ 1783; 2830-2; 3044; 4144
$C_{14}H_{15}N_3$ 309-12; 1764; 2431-2
$C_{14}H_{15}P$ 3045
$C_{14}H_{16}N_2$ 1719; 2720; 3692-4; 5955; 5959
$C_{14}H_{17}N$ 2189
$C_{14}H_{18}O$ 451
$C_{14}H_{18}O_4$ 2130; 2794-5; 4231
$C_{14}H_{18}O_6$ 2412
$C_{14}H_{18}O_9$ 1269
$C_{14}H_{20}O_6$ 5781
$C_{14}H_{22}O$ 3918
$C_{14}H_{22}O_4$ 2087
$C_{14}H_{22}O_6$ 5785
$C_{14}H_{22}O_8$ 5764
$C_{14}H_{23}N$ 1891
$C_{14}H_{24}O_2$ 3355
$C_{14}H_{24}N_2$ 300
$C_{14}H_{26}O_3$ 3524
$C_{14}H_{26}O_4$ 1748-50; 1883; 2167; 2177; 2206; 3451
$C_{14}H_{26}O_6$ 1757; 2920
$C_{14}H_{27}N$ 4456
$C_{14}H_{28}O$ 3182; 4451
$C_{14}H_{28}O_2$ 2858: 3080; 3552; 4450
$C_{14}H_{29}Br$ 4457
$C_{14}H_{30}O$ 2264; 5750
$C_{14}H_{30}S$ 2266

14 III

$C_{14}H_4O_{12}N_4$ 1491
$C_{14}H_6O_2Cl_2$ 1941-8
$C_{14}H_6O_2Br_2$ 1805-9
$C_{14}H_6O_6N_2$ 2595-7; 2644
$C_{14}H_7O_2Cl$ 1316-7
$C_{14}H_7O_2Br$ 899-900
$C_{14}H_7O_4N$ 4627-8; 4794
$C_{14}H_7O_6N$ 4599-600
$C_{14}H_8O_5S$ 559
$C_{14}H_8O_7S$ 177
$C_{14}H_8O_8S_2$ 556
$C_{14}H_9O_2N$ 244-5; 4626; 5273
$C_{14}H_9O_3N$ 172-3; 327
$C_{14}H_9O_4N$ 241-2
$C_{14}H_{10}O_2N_2$ 1690-5; 5163
$C_{14}H_{10}O_2S_2$ 1779
$C_{14}H_{10}O_4N_2$ 600-2; 2663-4
$C_{14}H_{10}O_5N_2$ 616-8
$C_{14}H_{10}O_6Ca$ 3743
$C_{14}H_{11}ON$ 80
$C_{14}H_{11}OCl$ 5215
$C_{14}H_{11}OBr$ 5214
$C_{14}H_{11}O_2N$ 703-5; 1776; 5587
$C_{14}H_{11}O_3N$ 746-8
$C_{14}H_{12}O_2N_2$ 700-2; 5010
$C_{14}H_{12}O_3N_2$ 546
$C_{14}H_{12}O_4N_2$ 3686-8
$C_{14}H_{13}ON$ 84.1; 630; 775-7; 5143
$C_{14}H_{13}OCl$ 1376
$C_{14}H_{13}O_2N$ 720-1; 825
$C_{14}H_{14}ON_2$ 533; 4176
$C_{14}H_{14}OS$ 836; 2919
$C_{14}H_{14}O_2N_2$ 598
$C_{14}H_{14}O_2S$ 835; 2843
$C_{14}H_{14}O_3S$ 1554
$C_{14}H_{14}O_4S_2$ 3203
$C_{14}H_{15}ON$ 1786; 5137
$C_{14}H_{16}O_2N_2$ 1759
$C_{14}H_{16}O_6N_2$ 352; 5201
$C_{14}H_{16}N_3Cl$ 2432
$C_{14}H_{17}O_6N$ 3856
$C_{14}H_{18}ON_6$ 1709
$C_{14}H_{18}N_2Cl_2$ 5956
$C_{14}H_{19}O_8N$ 5108
$C_{14}H_{19}O_9Cl$ 44
$C_{14}H_{21}O_4N$ 2159
$C_{14}H_{23}ON_3$ 3916-7
$C_{14}H_{26}N_2Cl_2$ 301
$C_{14}H_{27}OCl$ 4455
$C_{14}H_{29}ON$ 4452
$C_{14}H_{29}ON_3$ 4409

14 IV

$C_{14}H_6O_8S_2Na_2$ 553-5; 557
$C_{14}H_7O_5SNa$ 558; 560
$C_{14}H_7O_7NS$ 4630-1
$C_{14}H_7O_7SNa$ 178
$C_{14}H_{10}OClBr$ 1435
$C_{14}H_{13}O_3SCl$ 4189
$C_{14}H_{14}O_6N_2S_2$ 1732
$C_{14}H_{15}O_2NS$ 5980-1
$C_{14}H_{16}O_2N_3As$ 2433
$C_{14}H_{16}O_3N_3As$ 2434
$C_{14}H_{16}O_6N_2S_2$ 5958
$C_{14}H_{17}O_4N_3S_2$ 6368

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$C_{14}H_{18}O_4N_2S$ 5957
$C_{14}H_{20}O_6N_2S$ 294; 4116-7
$C_{14}H_{22}O_2NCl$ 5644
$C_{14}H_{22}O_4N_4S$ 4339
$C_{14}H_{23}O_2N_2Cl$ 6366

14 V

$C_{14}H_{14}O_3N_3SNa$ 4328

14 VI

$C_{14}H_{14}O_8N_2S_2As_2Na_2$ 5674

15 I

$C_{15}H_{12}$ 4127-8
$C_{15}H_{16}$ 2985
$C_{15}H_{18}$ 470
$C_{15}H_{24}$ 1263
$C_{15}H_{32}$ 5060

15 II

$C_{15}H_8O_4$ 551-2
$C_{15}H_8O_6$ 176; 2305-6
$C_{15}H_{10}O_2$ 539-41; 640; 3243; 4129
$C_{15}H_{10}O_3$ 2758
$C_{15}H_{10}O_4$ 1494-5; 4101
$C_{15}H_{10}O_5$ 727; 769; 772; 2874
$C_{15}H_{10}O_6$ 5805
$C_{15}H_{10}O_7$ 5806-7
$C_{15}H_{11}N$ 5230-3
$C_{15}H_{12}O$ 627
$C_{15}H_{12}O_2$ 1781; 3763; 5172-4
$C_{15}H_{12}O_3$ 1492; 2258; 4140; 6002
$C_{15}H_{12}O_4$ 120; 4143
$C_{15}H_{13}N$ 2510-1
$C_{15}H_{13}N_3$ 5199
$C_{15}H_{14}O$ 1787; 2838
$C_{15}H_{14}O_2$ 2739; 5190
$C_{15}H_{14}O_3$ 2409; 2833-5
$C_{15}H_{14}O_4$ 180; 4307
$C_{15}H_{14}O_5$ 3484; 5264 5594
$C_{15}H_{16}O$ 1573
$C_{15}H_{16}O_2$ 2694
$C_{15}H_{16}O_3$ 3409
$C_{15}H_{16}O_9$ 2899
$C_{15}H_{17}N$ 2984
$C_{15}H_{17}N_3$ 2837
$C_{15}H_{18}O$ 471
$C_{15}H_{18}O_3$ 5598
$C_{15}H_{20}O_2$ 3497
$C_{15}H_{20}O_4$ 2170; 5597; 5599
$C_{15}H_{20}N_4$ 5713
$C_{15}H_{22}O_{10}$ 4385
$C_{15}H_{24}O$ 5595
$C_{15}H_{24}O_8$ 5765
$C_{15}H_{26}O_2$ 867; 869
$C_{15}H_{26}O_6$ 3421
$C_{15}H_{28}O_2$ 4032
$C_{15}H_{28}O_4$ 2157
$C_{15}H_{30}O$ 2265
$C_{15}H_{30}O_2$ 4303
$C_{15}H_{31}Br$ 5063
$C_{15}H_{32}O$ 5062
$C_{15}H_{33}N$ 6074-6

15 III

$C_{15}H_9O_4N$ 4770
$C_{15}H_{11}O_3N$ 4633
$C_{15}H_{11}O_4N$ 4641
$C_{15}H_{12}ON_2$ 2722
$C_{15}H_{12}OBr_2$ 628-9
$C_{15}H_{12}O_2N_2$ 2724
$C_{15}H_{12}O_3N_2$ 3326
$C_{15}H_{12}O_5N_2$ 3353
$C_{15}H_{12}N_2S$ 317
$C_{15}H_{13}ON$ 30
$C_{15}H_{14}O_2N_2$ 4005
$C_{15}H_{15}ON$ 812; 2442
$C_{15}H_{15}O_2N$ 2761; 5588
$C_{15}H_{15}O_2N_3$ 4376
$C_{15}H_{16}ON_2$ 2467; 2847-9
$C_{15}H_{16}N_2S$ 2844-6
$C_{15}H_{17}N_4Cl$ 4585
$C_{15}H_{25}O_2Br$ 863
$C_{15}H_{31}ON$ 5059
$C_{15}H_{33}O_3B$ 6077

15 IV

$C_{15}H_6O_5NCl$ 4629
$C_{15}H_{11}O_4NI_4$ 5947
$C_{15}H_{11}O_4N_3S$ 679
$C_{15}H_{14}ON_2Cl$ 144
$C_{15}H_{14}O_2N_3Na$ 4377-8
$C_{15}H_{20}ONI$ 2480
$C_{15}H_{25}O_2NS$ 5976
$C_{15}H_{25}O_2N_2Cl$ 5032

16 I

$C_{16}H_{10}$ 3245; 5481
$C_{16}H_{12}$ 5204-5
$C_{16}H_{14}$ 2453-5; 2525; 2969
$C_{16}H_{16}$ 2277
$C_{16}H_{26}$ 1739; 5068
$C_{16}H_{30}$ 3571-2
$C_{16}H_{32}$ 3570
$C_{16}H_{34}$ 3569

16 II

$C_{16}H_{10}N_2$ 4513
$C_{16}H_{12}O_3$ 5324
$C_{16}H_{12}O_5$ 874
$C_{16}H_{12}O_6$ 3498
$C_{16}H_{12}O_7$ 5556
$C_{16}H_{13}N$ 5206-7
$C_{16}H_{13}N_3$ 660-1
$C_{16}H_{14}O_2$ 798
$C_{16}H_{14}O_3$ 718; 2257; 2979; 3485; 5991
$C_{16}H_{14}O_4$ 2748; 3447
$C_{16}H_{14}O_5$ 875
$C_{16}H_{14}O_6$ 3500; 3559; 3672; 5326
$C_{16}H_{14}N_2$ 3242
$C_{16}H_{16}O_2$ 719; 1782
$C_{16}H_{16}O_6$ 1264
$C_{16}H_{18}O$ 1121
$C_{16}H_{18}O_2$ 3448
$C_{16}H_{18}O_3$ 2692
$C_{16}H_{18}O_4$ 3457
$C_{16}H_{18}O_6$ 3710
$C_{16}H_{18}O_{10}$ 3310
$C_{16}H_{18}N_2$ 2738
$C_{16}H_{19}N$ 2988
$C_{16}H_{20}O_{10}$ 1268
$C_{16}H_{20}N_2$ 5830
$C_{16}H_{21}N_3$ 5833
$C_{16}H_{22}O_4$ 1908
$C_{16}H_{22}O_6$ 2096
$C_{16}H_{22}O_8$ 1528
$C_{16}H_{22}O_{11}$ 3362-3
$C_{16}H_{24}O_4$ 2086
$C_{16}H_{26}O_2$ 1742
$C_{16}H_{28}O_2$ 3680; 5029
$C_{16}H_{30}O$ 4446
$C_{16}H_{30}O_2$ 3849
$C_{16}H_{30}O_3$ 1224
$C_{16}H_{31}N$ 5028
$C_{16}H_{32}O$ 5023
$C_{16}H_{32}O_2$ 2263; 3088; 5022; 5749
$C_{16}H_{32}O_4$ 2234
$C_{16}H_{33}Br$ 1276
$C_{16}H_{33}I$ 1277
$C_{16}H_{34}O$ 1275; 2684
$C_{16}H_{34}O_3$ 456

16 III

$C_{16}H_{10}O_2N_2$ 3857; 3862
$C_{16}H_{10}O_4N_2$ 850
$C_{16}H_{11}O_2N$ 5234
$C_{16}H_{11}O_3N_3$ 4648
$C_{16}H_{12}O_2N_2$ 3863
$C_{16}H_{13}O_{15}N_9$ 1542
$C_{16}H_{14}O_3N_2$ 1509
$C_{16}H_{15}O_3N$ 3848
$C_{16}H_{16}O_2N_2$ 1671; 1780
$C_{16}H_{17}ON_3$ 124
$C_{16}H_{17}O_2N$ 5165
$C_{16}H_{18}O_2N_2$ 606-8
$C_{16}H_{18}O_3N_2$ 851
$C_{16}H_{20}N_3Cl$ 253
$C_{16}H_{27}O_5N_3$ 737
$C_{16}H_{31}OCl$ 5027
$C_{16}H_{33}ON$ 5024-5
$C_{16}H_{36}NI$ 5727

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16 IV

$C_{16}H_9O_2NI_2$ 2384
$C_{16}H_{10}O_5N_2S$ 3861
$C_{16}H_{10}O_8N_2S_2$ 3860
$C_{16}H_{11}O_{10}N_3S$ 5491
$C_{16}H_{12}O_9N_4S$ 5494
$C_{16}H_{13}O_3NS$ 5208
$C_{16}H_{13}O_3N_3S$ 331
$C_{16}H_{18}O_6S_2Ca$ 6460
$C_{16}H_{18}N_3SCl$ 4427
$C_{16}H_{19}ON_3S$ 4426
$C_{16}H_{24}O_2NCl$ 764; 2119
$C_{16}H_{24}O_6N_2S$ 2447
$C_{16}H_{27}O_2N_2Cl$ 276; 736

16 V

$C_{16}H_8O_8N_2S_2Na_2$ 3858
$C_{16}H_9O_9N_4S_2Na_3$ 5694
$C_{16}H_9O_{10}N_3S_2Na_2$ 4647
$C_{16}H_{11}O_4N_2SNa$ 4994-5
$C_{16}H_{14}O_4N_2As_2Na_2$ 581

17 I

$C_{17}H_{14}$ 817-8
$C_{17}H_{28}$ 3180
$C_{17}H_{36}$ 3508

17 II

$C_{17}H_{11}N$ 547
$C_{17}H_{12}O$ 5210-1
$C_{17}H_{12}O_2$ 4556-7
$C_{17}H_{12}O_3$ 4568-9
$C_{17}H_{14}O$ 819-20; 1506; 1775; 5209
$C_{17}H_{14}N_2$ 689
$C_{17}H_{15}N$ 6031-4
$C_{17}H_{15}N_3$ 5961
$C_{17}H_{16}O_2$ 5192
$C_{17}H_{16}O_3$ 3220; 5387
$C_{17}H_{16}O_6$ 4277
$C_{17}H_{16}O_7$ 3229
$C_{17}H_{19}N_3$ 143
$C_{17}H_{21}N_3$ 592
$C_{17}H_{22}O_3$ 866
$C_{17}H_{22}N_2$ 5834
$C_{17}H_{24}O_2$ 4030; 4977
$C_{17}H_{24}O_3$ 4031
$C_{17}H_{28}O_4$ 868
$C_{17}H_{32}O_3$ 5780
$C_{17}H_{34}O$ 2685; 4015
$C_{17}H_{34}O_2$ 4014; 4330; 5061
$C_{17}H_{36}O$ 3509

17 III

$C_{17}H_9O_4N$ 174
$C_{17}H_{11}O_5N$ 3801
$C_{17}H_{12}O_5N_2$ 2599
$C_{17}H_{13}ON$ 765
$C_{17}H_{20}ON_2$ 2137; 4436
$C_{17}H_{20}O_3N_2$ 2687
$C_{17}H_{20}O_5N_2$ 5117
$C_{17}H_{20}O_6N_4$ 5563
$C_{17}H_{22}ON_2$ 4435

17 IV

$C_{17}H_{19}ON_2Cl$ 5519
$C_{17}H_{24}O_3N_3Cl_3$ 364

17 V

$C_{17}H_{11}O_{10}NS_2Na_2$ 175

18 I

$C_{18}H_{12}$ 650; 1493
$C_{18}H_{14}$ 2703-5
$C_{18}H_{18}$ 5555
$C_{18}H_{20}$ 2476
$C_{18}H_{30}$ 3575; 5867
$C_{18}H_{34}$ 4942
$C_{18}H_{36}$ 4941
$C_{18}H_{38}$ 4938

18 II

$C_{18}H_{10}O_2$ 1496
$C_{18}H_{12}O_4$ 1658
$C_{18}H_{12}N_2$ 2814-6
$C_{18}H_{14}O$ 821
$C_{18}H_{14}O_3$ 1503
$C_{18}H_{14}O_4$ 3790; 5020
$C_{18}H_{15}N$ 6328
$C_{18}H_{15}N_3$ 659
$C_{18}H_{15}As$ 580
$C_{18}H_{15}Bi$ 857
$C_{18}H_{15}P$ 6342
$C_{18}H_{15}Sb$ 563
$C_{18}H_{16}O_2$ 1508
$C_{18}H_{16}O_4$ 1785; 1788; 3924-5
$C_{18}H_{16}O_7$ 6394-5
$C_{18}H_{16}N_2$ 6336
$C_{18}H_{17}N_3$ 2438-9
$C_{18}H_{18}O_2$ 2883-4; 2886-8
$C_{18}H_{18}O_3$ 1055
$C_{18}H_{18}O_4$ 1790; 2921
$C_{18}H_{18}O_6$ 1792
$C_{18}H_{20}O_2$ 2209
$C_{18}H_{22}O_2$ 2903
$C_{18}H_{23}N_3$ 4133
$C_{18}H_{24}O_2$ 2900
$C_{18}H_{24}O_3$ 2902
$C_{18}H_{26}O_4$ 1746-7
$C_{18}H_{26}O_{12}$ 3610; 3612
$C_{18}H_{28}O_4$ 2873
$C_{18}H_{30}O_2$ 3977
$C_{18}H_{30}O_4$ 2084
$C_{18}H_{32}O_2$ 1279; 2871; 3976; 5639
$C_{18}H_{32}O_3$ 5569
$C_{18}H_{32}O_4$ 5641
$C_{18}H_{32}O_6$ 3434-5
$C_{18}H_{32}O_7$ 6119
$C_{18}H_{32}O_{16}$ 5549
$C_{18}H_{34}O_2$ 2870; 3495; 4992
$C_{18}H_{34}O_3$ 5566; 5568
$C_{18}H_{34}O_4$ 1909; 3452
$C_{18}H_{34}O_6$ 2097
$C_{18}H_{35}N$ 5638
$C_{18}H_{36}O$ 5633
$C_{18}H_{36}O_2$ 1274; 2683; 3112 5631
$C_{18}H_{36}O_3$ 3829-31
$C_{18}H_{36}O_4$ 2365-6
$C_{18}H_{37}I$ 4940
$C_{18}H_{38}O$ 4939
$C_{18}H_{39}N$ 6210

18 III

$C_{18}H_{10}O_6N_2$ 3659
$C_{18}H_{12}ON_2$ 670
$C_{18}H_{12}O_4N_2$ 3205
$C_{18}H_{14}O_2N_4$ 1778
$C_{18}H_{14}O_8Ca$ 116
$C_{18}H_{14}O_8Mg$ 118
$C_{18}H_{15}O_3P$ 6343
$C_{18}H_{15}O_4P$ 6341
$C_{18}H_{15}ClSn$ 5948
$C_{18}H_{15}Cl_2Bi$ 858
$C_{18}H_{15}Cl_2Sb$ 564
$C_{18}H_{16}O_2N_2$ 508; 5171
$C_{18}H_{17}O_3Na$ 5120
$C_{18}H_{18}O_4N_2$ 5590
$C_{18}H_{22}O_4N_4$ 5193
$C_{18}H_{27}O_3N$ 1227
$C_{18}H_{33}O_3Na$ 5567
$C_{18}H_{35}OCl$ 5637
$C_{18}H_{37}ON$ 5634
$C_{18}H_{39}O_2N$ 5632

18 IV

$C_{18}H_{12}O_4Cl_3P$ 6165
$C_{18}H_{13}O_4Cl_2P$ 2046
$C_{18}H_{14}O_4ClP$ 2713
$C_{18}H_{15}OS_3P$ 6350
$C_{18}H_{15}O_3SP$ 6346
$C_{18}H_{16}O_6N_2S$ 3627
$C_{18}H_{16}O_6N_2Ca$ 3665
$C_{18}H_{23}O_2N_2Cl$ 2910
$C_{18}H_{28}O_4N_2S$ 655
$C_{18}H_{32}O_5N_2S$ 5031
$C_{18}H_{32}O_{10}N_2Ca$ 5035

18 V

$C_{18}H_{14}O_3N_3SNa$ 4056; 4996

19 I

$C_{19}H_{15}$ 6339
$C_{19}H_{16}$ 802-3; 6337
$C_{19}H_{40}$ 4908

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19 II

$C_{19}H_{12}O_2$ 4479
$C_{19}H_{13}N$ 5147
$C_{19}H_{14}O$ 2741
$C_{19}H_{14}O_2$ 652; 5255
$C_{19}H_{14}O_3$ 593
$C_{19}H_{14}O_5$ 2766
$C_{19}H_{15}N$ 725
$C_{19}H_{15}Cl$ 6333
$C_{19}H_{15}Br$ 6330
$C_{19}H_{16}O$ 6331
$C_{19}H_{16}O_3$ 3963
$C_{19}H_{16}N_2$ 729
$C_{19}H_{17}N$ 384-5; 804
$C_{19}H_{17}N_3$ 6334-5
$C_{19}H_{18}O$ 2824
$C_{19}H_{18}O_3$ 1758; 3221
$C_{19}H_{18}N_2$ 1733
$C_{19}H_{19}N_3$ 6071-3
$C_{19}H_{22}O_3$ 5004
$C_{19}H_{28}O_2$ 1657; 5711-2
$C_{19}H_{30}O_2$ 509
$C_{19}H_{36}O_2$ 4327
$C_{19}H_{38}O$ 2682; 4261
$C_{19}H_{38}O_2$ 4381; 4909

19 III

$C_{19}H_{13}O_6N_3$ 6322
$C_{19}H_{13}O_7N_3$ 6321
$C_{19}H_{14}O_5S$ 5127
$C_{19}H_{15}O_2N$ 212
$C_{19}H_{17}O_2N$ 3130
$C_{19}H_{18}N_3Cl$ 5039
$C_{19}H_{19}ON_3$ 5038
$C_{19}H_{20}O_4N_2$ 568
$C_{19}H_{21}O_5N$ 6420
$C_{19}H_{24}O_2Br_2$ 865

19 IV

$C_{19}H_{10}O_5SBr_4$ 5724
$C_{19}H_{10}O_5SI_4$ 5815
$C_{19}H_{10}O_{13}N_4S$ 5858
$C_{19}H_{14}ONCl$ 3980
$C_{19}H_{16}O_2NCl$ 213

20 I

$C_{20}H_{14}$ 2574-5; 5156
$C_{20}H_{18}$ 2756-7
$C_{20}H_{38}$ 5293
$C_{20}H_{40}$ 5297
$C_{20}H_{42}$ 1017; 2868; 5294

20 II

$C_{20}H_{12}O_3$ 3244
$C_{20}H_{12}O_5$ 3250; 3720
$C_{20}H_{14}O$ 4560-2
$C_{20}H_{14}O_2$ 2336-7; 5292
$C_{20}H_{14}O_4$ 2737; 5121; 5553
$C_{20}H_{14}O_5$ 3254
$C_{20}H_{14}N_2$ 604-5
$C_{20}H_{14}S$ 2583-4
$C_{20}H_{14}Hg$ 4045
$C_{20}H_{15}N$ 2576
$C_{20}H_{15}N_3$ 251; 1763
$C_{20}H_{16}O_2$ 6327; 6338
$C_{20}H_{16}O_3$ 5573
$C_{20}H_{16}O_4$ 5122
$C_{20}H_{16}N_2$ 3690-1
$C_{20}H_{16}N_4$ 4872
$C_{20}H_{18}O$ 6332
$C_{20}H_{18}O_2$ 529; 3717
$C_{20}H_{19}N$ 1784
$C_{20}H_{20}N_2$ 2839-40
$C_{20}H_{21}N_3$ 3962
$C_{20}H_{24}O_4$ 1555
$C_{20}H_{26}O_3$ 2209
$C_{20}H_{26}O_4$ 2088
$C_{20}H_{30}O_2$ 1
$C_{20}H_{30}O_6$ 1027
$C_{20}H_{32}N_2$ 3961
$C_{20}H_{36}O_2$ 3014
$C_{20}H_{38}O_2$ 3109
$C_{20}H_{40}O$ 5298
$C_{20}H_{40}O_2$ 574; 3153
$C_{20}H_{42}O$ 2869; 5295

20 III

$C_{20}H_8O_5Br_4$ 2875-6
$C_{20}H_8O_5I_4$ 2896-7
$C_{20}H_{10}O_3Cl_2$ 3252
$C_{20}H_{10}O_4Cl_4$ 5744
$C_{20}H_{10}O_4Br_4$ 5722
$C_{20}H_{10}O_4I_4$ 5813
$C_{20}H_{10}O_5Cl_2$ 1999; 2000
$C_{20}H_{10}O_5Br_2$ 1838-9
$C_{20}H_{10}O_5I_2$ 2392
$C_{20}H_{10}O_5Na_2$ 3251
$C_{20}H_{14}ON_2$ 619-20
$C_{20}H_{18}ON_2$ 722-3
$C_{20}H_{20}O_5N_2$ 566
$C_{20}H_{20}N_3Cl$ 5571
$C_{20}H_{21}ON_3$ 5570
$C_{20}H_{22}O_4N_2$ 5307
$C_{20}H_{33}ON$ 4454
$C_{20}H_{41}ONa$ 5296

20 IV

$C_{20}H_6O_5Br_4Na_2$ 2876
$C_{20}H_6O_5I_4Na_2$ 2897
$C_{20}H_8O_4Br_4Na_2$ 5723
$C_{20}H_8O_4I_4Na_2$ 5814
$C_{20}H_{14}O_8S_2Ca$ 4499; 4506; 4508
$C_{20}H_{30}O_2N_3Cl$ 1025
$C_{20}H_{32}O_6N_2S$ 3676-7

20 V

$C_{20}H_8O_6Br_2HgNa_2$ 4041
$C_{20}H_8O_{10}S_2Br_4Na_2$ 998
$C_{20}H_{11}O_{10}N_2S_3Na_3$ 3732

21 I

$C_{21}H_{16}$ 822; 2580-2; 4190
$C_{21}H_{20}$ 5183
$C_{21}H_{42}$ 3504
$C_{21}H_{44}$ 3503

21 II

$C_{21}H_{14}O$ 2577-9
$C_{21}H_{16}N_2$ 3978
$C_{21}H_{18}O$ 2078; 2740
$C_{21}H_{18}N_2$ 233; 3700
$C_{21}H_{20}O_6$ 1575
$C_{21}H_{20}O_9$ 227
$C_{21}H_{21}N$ 6084
$C_{21}H_{21}N_3$ 512
$C_{21}H_{24}O_4$ 2153
$C_{21}H_{30}O_2$ 5333-4
$C_{21}H_{30}N_2$ 5761
$C_{21}H_{32}O_2$ 4084
$C_{21}H_{32}O_{11}$ 3365
$C_{21}H_{36}O_2$ 5329-32
$C_{21}H_{38}O_6$ 3423
$C_{21}H_{40}O_3$ 5782
$C_{21}H_{42}O_4$ 3415-6

21 III

$C_{21}H_{15}ON$ 698
$C_{21}H_{15}O_3N$ 6081
$C_{21}H_{16}ON_2$ 2585
$C_{21}H_{18}O_5S$ 1550-1
$C_{21}H_{20}O_4N_2$ 228
$C_{21}H_{21}O_3P$ 6354-5
$C_{21}H_{21}O_4P$ 6351-3
$C_{21}H_{24}O_5N_2$ 2779
$C_{21}H_{28}ON_2$ 5760

21 IV

$C_{21}H_{14}O_5SBr_4$ 5718
$C_{21}H_{16}O_5SBr_2$ 1832
$C_{21}H_{21}O_3SP$ 6356-8

22 I

$C_{22}H_{14}$ 1777; 5299
$C_{22}H_{46}$ 2855

22 II

$C_{22}H_{15}N_3$ 5572
$C_{22}H_{16}O_3$ 6082-3
$C_{22}H_{16}O_5$ 4999
$C_{22}H_{18}O_4$ 1548; 1789; 2841
$C_{22}H_{20}O_4$ 1549
$C_{22}H_{22}O_8$ 5306
$C_{22}H_{28}O_3$ 5596
$C_{22}H_{32}O_3$ 507
$C_{22}H_{34}O_2$ 2932
$C_{22}H_{40}O_2$ 624
$C_{22}H_{42}O_2$ 873; 1110; 2892
$C_{22}H_{42}O_3$ 1127-8
$C_{22}H_{42}O_4$ 1924; 3201
$C_{22}H_{44}O$ 2893

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$C_{22}H_{44}O_2$ 623; 1129-30
$C_{22}H_{44}O_4$ 2309

22 III

$C_{22}H_{16}ON_4$ 5664
$C_{22}H_{21}O_2N$ 5603
$C_{22}H_{23}O_4P$ 2707
$C_{22}H_{40}O_4N_8$ 3601

22 IV

$C_{22}H_{24}O_4N_2S$ 2542

23 I

$C_{23}H_{48}$6171

23 II

$C_{23}H_{17}N$ 50
$C_{23}H_{18}O$ 2732
$C_{23}H_{22}O_6$ 1655; 5574
$C_{23}H_{22}O_7$ 5699
$C_{23}H_{26}N_2$ 3964
$C_{23}H_{27}N_3$ 5844
$C_{23}H_{32}O_6$ 5645
$C_{23}H_{44}O_2$ 475
$C_{23}H_{46}O$ 2850
$C_{23}H_{46}O_2$ 488-9

23 III

$C_{23}H_{23}N_2I$ 2144
$C_{23}H_{25}O_2N_3$ 5838
$C_{23}H_{25}N_2Cl$ $(ZnCl_2)$ 3993
$C_{23}H_{26}ON_2$ 5835

23 IV

$C_{23}H_{26}O_3N_3Cl$ 1760

24 I

$C_{24}H_{18}$ 6329
$C_{24}H_{50}$ 5747

24 II

$C_{24}H_{16}O_7$ 3253
$C_{24}H_{20}O_6$ 3420
$C_{24}H_{20}N_2$ 2706; 5863
$C_{24}H_{20}Pb$ 3959
$C_{24}H_{20}Sn$ 5952
$C_{24}H_{28}O_4$ 4931-2
$C_{24}H_{28}N_2$ 5837
$C_{24}H_{40}O_2$ 5238
$C_{24}H_{40}O_4$ 1479
$C_{24}H_{40}O_5$ 1487
$C_{24}H_{44}O_6$ 3425
$C_{24}H_{46}O_3$ 3954
$C_{24}H_{48}O_2$ 3970

24 III

$C_{24}H_{19}O_4P$ 2762
$C_{24}H_{19}O_5N$ 1675
$C_{24}H_{20}BrAs$ 5859
$C_{24}H_{21}O_3N_3$ 801
$C_{24}H_{25}ON_3$ 749
$C_{24}H_{28}ON_2$ 5836
$C_{24}H_{28}N_3Cl$ 5077
$C_{24}H_{29}ON_3$ 5076
$C_{24}H_{41}ON$ 5636

24 IV

$C_{24}H_{14}O_2N_2S_2$ 3868
$C_{24}H_{26}O_4N_4S$ 316

24 V

$C_{24}H_{20}O_6N_2S_2Ba$ 2702

25 I

$C_{25}H_{20}$ 5864
$C_{25}H_{52}$ 5058

25 II

$C_{25}H_{21}N_3$ 5862
$C_{25}H_{22}O_3$ 2885
$C_{25}H_{26}O_9$ 3226
$C_{25}H_{30}O_4$ 4933
$C_{25}H_{31}N_3$ 3595
$C_{25}H_{50}O_2$ 3847

25 III

$C_{25}H_{20}ON_2$ 5865
$C_{25}H_{25}N_2I$ 5316
$C_{25}H_{27}N_2I$ 5003
$C_{25}H_{30}N_3Cl$ 3593
$C_{25}H_{31}ON_3$ 3592

25 IV

$C_{25}H_{29}ON_2I$ 2144

26 I

$C_{26}H_{18}$ 2734
$C_{26}H_{20}$ 5861
$C_{26}H_{22}$ 5860
$C_{26}H_{52}$ 1271
$C_{26}H_{54}$ 3567-8

26 II

$C_{26}H_{20}O$ 731
$C_{26}H_{22}O$ 692
$C_{26}H_{22}O_2$ 732; 2853
$C_{26}H_{22}N_4$ 706-7
$C_{26}H_{42}O_{11}$ 3364
$C_{26}H_{50}O_4$ 3458
$C_{26}H_{52}O_2$ 1272; 4983
$C_{26}H_{54}O$ 1273

26 III

$C_{26}H_{31}O_4P$ 1907
$C_{26}H_{33}N_3Cl_2$ 3594
$C_{26}H_{43}O_6N$ 3440

26 IV

$C_{26}H_{42}O_6NNa$ 3441
$C_{26}H_{45}O_7NS$ 5697

26 V

$C_{26}H_{44}O_7NSNa$ 5698

27 I

$C_{27}H_{18}$ 6362
$C_{27}H_{56}$ 3507

27 II

$C_{27}H_{26}O_7$ 6085
$C_{27}H_{36}O_4$ 595
$C_{27}H_{38}O_4$ 594
$C_{27}H_{44}O_3$ 5602
$C_{27}H_{44}O_4$ 1478
$C_{27}H_{46}O$ 1480-2
$C_{27}H_{48}O$ 2276
$C_{27}H_{50}O_6$ 3424

27 III

$C_{27}H_{34}ON_2$ 5762

27 IV

$C_{27}H_{28}O_5SBr_2$ 1879
$C_{27}H_{34}O_4N_2S$ 5763

28 I

$C_{28}H_{58}$ 4937

28 II

$C_{28}H_{18}O_4$ 4497
$C_{28}H_{20}N_2$ 234
$C_{28}H_{30}O_4$ 5941
$C_{28}H_{34}O_{15}$ 3560
$C_{28}H_{44}O$ 1187; 2889; 3979
$C_{28}H_{54}O_3$ 4453
$C_{28}H_{54}O_4$ 2227

28 III

$C_{28}H_{24}O_7N_2$ 4997
$C_{28}H_{33}O_{11}N_5$ 1044

28 IV

$C_{28}H_{31}O_3N_2Cl$ 5766

29 I

$C_{29}H_{60}$ 4907

29 II

$C_{29}H_{48}O_2$ 1483

29 III

$C_{29}H_{35}N_2I$ 1580

30 I

$C_{30}H_{60}$ 4021
$C_{30}H_{62}$ 6057; 4021

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30 II

$C_{30}H_{48}O_2$ 4444
$C_{30}H_{50}O_2$ 1486
$C_{30}H_{58}O_4$ 3461
$C_{30}H_{62}O$ 4449

30 III

$C_{30}H_{23}O_4P$ 5184
$C_{30}H_{39}O_4P$ 6120

31 I

$C_{31}H_{64}$ 3505

31 II

$C_{31}H_{46}O_2$ 4342
$C_{31}H_{62}O$ 5030
$C_{31}H_{62}O_2$ 4022
$C_{31}H_{64}O$ 4449

31 III

$C_{31}H_{43}ON_3$ 3191

32 I

$C_{32}H_{66}$ 2866

32 II

$C_{32}H_{52}O_2$ 2867
$C_{32}H_{62}O_3$ 5026
$C_{32}H_{64}O_2$ 1278

32 III

$C_{32}H_{36}O_6N_4$ 851
$C_{32}H_{36}O_8N_4$ 852

32 V

$C_{32}H_{22}O_6N_6S_2Na_2$ 1527

33 I

$C_{33}H_{68}$ 6359

33 II

$C_{33}H_{62}O_6$ 3422
$C_{33}H_{66}O_2$ 4448

34 I

$C_{34}H_{70}$ 5868

34 II

$C_{34}H_{50}O_2$ 1484-5
$C_{34}H_{66}O_4$ 3464

34 IV

$C_{34}H_{33}O_5N_4Fe$ 3499

34 V

$C_{34}H_{26}O_6N_6S_2Na_2$ 733
$C_{34}H_{26}O_{14}N_6S_4Na_4$ 3228
$C_{34}H_{32}O_4N_4ClFe$ 3501

35 I

$C_{35}H_{72}$ 5080

35 II

$C_{35}H_{28}O_2$ 647-8
$C_{35}H_{40}O_{12}$ 3239
$C_{35}H_{52}O_4$ 4343
$C_{35}H_{70}O$ 5640

36 I

$C_{36}H_{74}$ 3613

36 II

$C_{36}H_{54}O_6$ 849
$C_{36}H_{70}O_3$ 5635

36 III

$C_{36}H_{27}O_4P$ 6360
$C_{36}H_{43}O_4P$ 1146

36 IV

$C_{36}H_{62}O_8N_4S$ 1890

37 V

$C_{37}H_{27}O_9N_3S_3Na_2$ 6345

38 II

$C_{38}H_{30}O_2$ 6340
$C_{38}H_{74}O_4$ 3467

38 III

$C_{38}H_{32}N_3Cl$ 516

39 II

$C_{39}H_{74}O_6$ 3426

40 I

$C_{40}H_{56}$ 1252-4; 3985

40 II

$C_{40}H_{50}O_2$ 5562
$C_{40}H_{56}O$ 1570
$C_{40}H_{56}O_2$ 6452

42 IV

$C_{42}H_{84}O_9NP$ 3960

45 II

$C_{45}H_{86}O_6$ 3427

51 II

$C_{51}H_{98}O_6$ 3431

52 III

$C_{52}H_{54}O_{12}N_4$ 3994

57 II

$C_{57}H_{104}O_6$ 3430
$C_{57}H_{110}O_6$ 3433

63 II

$C_{63}H_{122}O_6$ 3419

69 IV

$C_{69}H_{75}N_6Cl_7Zn_2$ 3993

76 IV

$C_{76}H_{64}O_4N_6S$ 6344

MELTING POINTS OF ORGANIC COMPOUNDS

The compounds below are arranged in the order of the ascending values of th melting points, an arrangement intended to serve as an aid in the identification o organic compounds. The values given may be uncertain by one or more units in th last figure and consequently are not to be used as fixed points for calibration. Se special table for *Calibration of Thermometers and Thermocouples.* The numbers liste under a temperature-interval heading refer to the compounds with corresponding numerical listings in the table *Physical Constants of Organic Compounds.* Thus, under the temperature interval 186° to 190° C. is listed *No. 31* which is *acetamino-α-naphtho* m. p. 187°C.

Below −140° C.

498; 499; 872; 1022; 1147; 1149; 1239; 1772; 2246; 2904; 3192; 3574; 3604; 3656; 3933; 4061; 4154; 4209; 5084; 5338; 5459; 6203; 6435; 6439

−130° to −139° C.

183; 202; 500; 501; 502; 1018; 1021; 1072; 1074; 1248; 2478; 3015; 3517; 3655; 3659; 3660; 3661; 3957; 5083; 5346; 5425; 6434

−120° to −129° C.

5; 193; 990; 1148; 1156; 1621; 2783; 2911; 3083; 3271; 3515; 3606; 4155; 4199; 4298; 4957; 4958; 5083; 5368; 5400; 6248

−110° to −119° C.

81; 199; 406; 988; 1035; 1057; 1058; 1059; 1103; 1175; 2245; 2415; 2911; 2946; 2989; 3210; 3280; 3513; 3514; 3516; 3518; 3554; 3556; 3607; 3657; 4154; 4161; 4917; 4946; 4950; 5388; 5401; 5424; 5950; 6180; 6404

−100° to −109° C.

225; 415; 1019; 1036; 1040; 1095; 1096; 1148.1; 1238; 1240; 1247; 1400; 1609; 1885; 1916; 1923; 2778; 2782; 3062; 3077; 3096; 3631; 4238; 4424; 4827; 4914; 4916; 4947; 4948; 4949; 4956; 4984; 5086; 5087; 5372

−90° to −99° C.

56; 75; 208; 427; 442; 455; 871; 1031; 1089; 1097; 1142; 1160; 1174; 1599; 1600; 1619; 1898; 1993; 2208; 2214; 2429; 2499; 2973; 3006; 3167; 3185; 3186; 3288; 3357; 3512; 3578; 3603; 3605; 3973; 4087; 4100; 4105; 4147; 4169; 4183; 4242; 4357; 4420; 4429; 4733; 4828; 4953; 4960; 4986; 5345; 5360; 5363; 5365; 5378; 5379; 5392; 5408; 5417; 5418; 5458; 5960; 6348; 6400; 6405

−80° to −89° C.

130; 135; 146; 151; 204; 220; 459; 1041; 1049; 1064; 1104; 1123; 1173; 1216; 1246; 1378; 1579; 1618; 1684; 2127; 2473; 2484; 2493; 2560; 2935; 2950; 3007; 3019; 3142; 3158; 3166; 3279; 3285; 3558; 4088; 4164; 4170; 4171; 4232; 4269; 4349; 4422; 4735; 4911; 5352; 5369; 5371; 5389; 5418; 6121

−70° to −79° C.

37; 397; 404; 421; 432; 447; 454; 483; 989; 1029; 1034; 1050; 1104; 1125; 1217; 1265; 1379; 1622; 1636; 1825; 1886; 1914; 2051; 2240; 2472; 2769; 3048; 3049; 3138; 3279; 3418; 3421; 3449; 3474; 3557; 3658; 4156; 4182; 4355; 4965; 4991; 5300; 5366; 5441; 5455; 6155

−60° to −69° C.

89; 1042; 1083; 1141; 1163; 1380; 1477; 1559; 1623; 1624; 1740; 1821; 1980; 2172; 2483; 2485; 2502; 2569; 2773; 2784; 2965; 3009; 3029; 3108; 3168; 3194; 3266; 3628; 3648; 3708; 4262; 4287; 4352; 4697; 4910; 4985; 5046; 5773; 6426

−50° to −59° C.

132; 136; 412; 724; 781; 886; 1039; 1051; 1052; 1132; 1171; 1183; 1237; 1281; 1344; 1563; 1595; 1620 1631; 1864; 1870; 1970; 2133; 2184; 2242; 2407; 2471; 2486; 2792; 3269; 3459; 3624; 4053; 4125; 4163; 4166; 4214; 4289; 4387; 4392; 4428; 4944; 5318; 5380; 5710; 6159; 6255; 6399; 6403; 6407; 6448

−40° to −49° C.

49; 319; 994; 1167; 1179; 1180; 1214; 1218; 1301; 1324; 1467; 1606; 1613; 1638; 1663; 1735; 2128; 2138; 2180; 2184; 2193; 2749; 2772; 2937; 3010; 3113; 3114; 3257; 3258; 3263; 3521; 3637; 3944; 4174; 4195; 4694; 4980; 5146; 5317; 5357; 5483; 6254; 6255; 6285; 6457; 6504

−30° to −39° C.

537; 796; 843; 902; 1000; 1098; 1157; 1209; 1466; 1565; 1588; 1632; 1635; 1679; 1824; 1857; 1865; 1883; 1973; 1994; 2053; 2109; 2121; 2126; 2195; 2772; 2786; 2863; 2975; 3003; 3026; 3047; 3084; 3318; 3406; 3445; 3527; 3529; 3530; 3543; 3637; 4122; 4184 4384; 4711; 4737; 4919; 4959; 4962; 5111; 5466; 5646; 5739; 5786; 5923; 5997; 6122; 6152; 6198; 6206; 6262; 6349; 6382; 6399; 6406; 6427

−20° to −29° C.

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−10° to −19° C.

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71; 160; 228; 276; 357; 388; 520; 562; 603; 638; 734; 1182; 1196; 1370; 1582; 1702; 1830; 1948; 2299; 2316; 2317; 2319; 2327; 2335; 2528; 2621; 2634; 2657; 2917; 2982; 3126; 3226; 3371; 3490; 3588; 3677; 3696; 3747; 3820; 3861; 3904; 3919; 3960; 4249; 4278; 4644; 4651; 4708; 4933; 5069; 5070; 5243; 5307; 5572; 5608; 5614; 5687; 5699; 5736; 5842; 5851; 5899; 5907; 6395

201° to 205° C.

33; 71; 279; 280; 284; 336; 388; 546; 577; 603; 605; 610; 706; 900; 1197; 1492; 1509; 1521; 1944; 1963; 2299; 2315; 2335; 2402; 2453; 2609; 2611; 2865; 3253; 3373; 3499; 3676; 3686; 3730; 3745; 3747; 3789; 3803; 3821; 3911; 3919; 3923; 3947; 4243; 4484; 4604; 4612; 4644; 4662; 4708; 5039; 5193; 5243; 5273; 5307; 5571; 5604; 5608; 5670; 5686; 5690; 5713; 5736; 5757; 5855; 5858; 5907; 6127; 6141; 6394

206° to 210° C.

90; 157; 317; 327; 388; 508; 541; 549; 630; 651; 701; 706; 860; 1308; 1317; 1492; 1517; 1521; 1531; 1533; 1703; 1805; 1940; 1941; 1948; 2080; 2295; 2328; 2334; 2335; 2447; 2556; 2663; 2887; 3780; 3826; 3838; 3840; 3925; 4128; 4438; 4608; 4649; 4660; 4877; 5013; 5075; 5097; 5307; 5487; 5511; 5690; 5717; 5860; 6054; 6081; 6082; 6219; 6220; 6295; 6319; 6417

211° to 215° C.

157; 388; 549; 594; 611; 630; 666; 681; 706; 778; 1315; 1394; 1517; 1521; 1548; 1686; 1948; 1987; 2279; 2282; 2335; 2401; 2522; 2626; 2661; 2663; 2705; 2981; 3238; 3373; 3476; 3492; 3584; 3746; 3784; 3819; 3935; 4438; 4590; 4649; 4774; 4816; 4825; 5016; 5075; 5307; 5487; 5600; 5802; 5860; 6082; 6219; 6260; 6295; 6322; 6366

216° to 220° C.

119; 123; 275; 351; 375; 393; 538; 549; 647; 681; 684; 1521; 1541; 1549; 1585; 1819; 1951; 2337; 2356; 2497; 2522; 2625; 2638; 2663; 2690; 2848; 2981; 3309; 3476; 3584; 3592; 3679; 3684; 3746; 3783; 4360; 4578; 4590; 4825; 5162; 5195; 5234; 5281; 5307; 5321; 5335; 5473; 5487; 5504; 5562; 5712; 5802; 5813; 5846; 5849; 5893; 5996; 6082; 6219; 6221; 6231; 6260; 6295; 6303

221° to 225° C.

232; 263; 358; 576; 681; 707; 1200; 1521; 1778; 1803; 2294; 2542; 2545; 2618; 2625; 2687; 2885; 2887; 2900; 3237; 3372; 3672; 3679; 3684; 3697; 3822; 3852; 3988; 4005; 4035; 4112; 4179; 4812; 4819; 5017; 5051; 5289; 5335; 5487; 5492; 5579; 5712; 5813; 5846; 5861; 5889; 5893; 5933; 6061; 6106; 6208; 6231; 6236; 6369; 6445

MELTING POINTS OF ORGANIC COMPOUNDS

226° to 230° C.

152; 348; 576; 588; 671; 681; 707; 847; 853; 1250; 1521; 1704; 1731; 1840; 2110; 2305; 2394; 2542; 2543; 2545; 2618; 2687; 2688; 2765; 3237; 3489; 3559; 3563; 3720; 3817; 3852; 3959; 4005; 4106; 4627; 4629; 4754; 4755; 4758; 4812; 4878; 5051; 5306; 5327; 5492; 5500; 5508; 5579; 5612; 5889; 5893; 5932; 5933; 5952; 5998; 6083; 6106; 6231; 6267; 6369

231° to 235° C.

32; 167; 181; 374; 515; 576; 588; 681; 700; 707; 853; 1250; 1496; 1506; 1608; 1704; 1804; 1810; 1818; 2305; 2383; 2394; 2622; 3205; 3437; 3563; 3720; 3726; 3779; 3817; 3818; 3824; 3852; 3990; 4035; 4039; 4368; 4411; 4648; 4754; 4999; 5052; 5109; 5122; 5150; 5274; 5330; 5488; 5528; 5645; 5742; 5821; 5826; 5887; 5947; 6083; 6087; 6099; 6223; 6318

236° to 240° C.

32; 98; 181; 543; 575; 600; 618; 671; 680; 681; 700; 1250; 1496; 1704; 1708; 1804; 2320; 2333; 2437; 2441; 2490; 2599; 2759; 3227; 3437; 3443; 3668; 3779; 3800; 3824; 3852; 3922; 3924; 3990; 4050; 4260; 4609; 4666; 4860; 5122; 5197; 5287; 5329; 5499; 5528; 5545; 5672; 5742; 6239

241° to 245° C.

98; 129; 168; 234; 539; 618; 621; 680; 1231; 1329; 1675; 1697; 1809; 1832; 1881; 2333; 2437; 2455; 2490; 2706; 2764; 3668; 3670; 3800; 3804; 3965; 4045; 4142; 4391; 4459; 4599; 4666; 4707; 5036; 5197; 5507; 5529; 5545; 5623; 5656; 5696; 6000

246° to 250° C.

6; 126; 165; 173; 234; 616; 621; 670; 680; 747; 875; 1489; 1780; 1881; 2077; 2262; 2333; 2437; 2490; 2734; 2764; 3309; 3325; 3498; 3560; 3668; 3671; 3980; 4019; 4101; 4117; 4743; 4761; 4879; 5010; 5337; 5491; 5498; 5506; 5529; 5611; 5613; 5934; 6181

251° to 260° C.

127; 244; 335; 356; 539; 589; 641; 848; 908; 1251; 1493; 1522; 1540; 1602; 1603; 1627; 1628; 1705; 1780; 1878; 1943; 2077; 2333; 2351; 2362; 2437; 2454; 2691; 2847; 2874; 2884; 2886; 2888; 2903; 3252; 3254; 3325; 3374; 3560; 3671; 3689; 3781; 3791; 3888; 4019; 4037; 4101; 4117; 4405; 4497; 4498; 4652; 4794; 4821; 4932; 5264; 5337; 5501; 5531; 5589; 5665; 5667; 5678; 5745; 5811; 5856; 5876; 5934; 5941; 6182; 6213; 6364

261° to 270° C.

174; 288; 355; 376; 589; 682; 1478; 1690; 1692; 1777; 1808; 1939; 1946; 2122; 2293; 2298; 2343; 2362; 2437; 2451; 2452; 2594; 2597; 2654; 2849; 2851; 2891; 2898; 2903; 3315; 3442; 3785; 3808; 3809; 3816; 3882; 3888; 4141; 4412; 4544; 4605; 4606; 4770; 4822; 5066; 5121; 5494; 5509; 5514; 5531; 5724; 6209; 6327

271° to 280° C.

109; 174; 286; 287; 355; 359; 376; 525; 540; 582; 589; 590; 748; 1494; 2300; 2343; 2361; 2395; 2614; 2883; 2888; 2898; 2902; 3439; 3442; 3591; 3690; 3828; 3978; 4412; 4474; 4478; 4606; 5148; 5149; 5316; 5489; 5537; 5673; 5722; 5724; 5725; 5801; 5866; 6249; 6398

281° to 290° C.

109; 164; 277; 352; 355; 359; 519; 525; 540; 550; 552; 589; 667; 1555; 1807; 1839; 1947; 2297; 2302; 2491; 2664; 2883; 2890; 2902; 2932; 3314; 3669; 3801; 3806; 3937; 4062; 4600; 4709; 5149; 5163; 5198; 5530; 5563; 5722; 5746; 5806; 5859; 5864; 5866; 6365; 6397; 6398

291° to 300° C.

139; 158; 159; 282; 285; 354; 359; 387; 391; 525; 551; 690; 772; 846; 979; 1539; 1838; 1967; 2336; 2384; 2585; 2664; 2724; 2854; 2890; 2966; 3250; 3586; 4443; 5049; 5475; 5726; 6367; 6397;

301° to 310° C.

139; 176; 241; 245; 283; 350; 354; 394; 593; 669; 709; 730; 1677; 1694; 1820; 1838; 2644; 2817; 2854; 3586; 3725; 3792; 3805; 4118; 4931; 5556; 5573; 5744; 6212

311° to 320° C.

392; 395; 617; 669; 709; 1691; 1693; 1694; 2596; 2854; 3561; 4118; 5496; 5669; 5680; 5807; 5816; 6367

321° to 330° C.

602; 1671; 1693; 1695; 2306; 2722; 2854; 4413; 5502; 5816; 6205

331° to 340° C.

601; 602; 1629; 1671; 1695; 2303; 2304; 2595; 2854; 3589; 3807; 6383

341° to 360° C.

145; 601; 779; 2689; 2854; 3589; 4335; 5276; 5956

361° to 380° C.

685; 1594; 4417; 4418; 4562; 5299; 5800; 5805; 6214; 6215; 6362

Above 380° C.

676 3857; 5009; 5277; 5822; 6384

PHYSICAL CONSTANTS OF

See also special tables on FOODS, FATS AND OILS, ALKALOIDS, GLUCOSIDES, RESINS, NOMENCLATURE, ORGANIC RADICALS, COMMON OR TRADE NAMES OF CHEMICALS, and DYESTUFF INTERMEDIATES.

Names of the compounds in the table below are arranged alphabetically. The names were selected in such a manner as to bring isomers and closely related compounds in close sequence to enable a convenient means of comparison. In general, names with prefixes such as *iso* or *tertiary* are placed with the normal compounds; thus, *isopropyl* will be found listed under *propyl.* Indented words are suffixes of the word in bold face type immediately preceding; thus, compound No. 8 is acetaldehyde ammonia. No compound is listed more than once in the table and each compound is given a number.

Synonyms are listed in two ways. In the column headed "Synonym" will be found a different name for the same compound. At the bottom of each page is an alphabetical listing for compounds which are to be found in the main body of the table but under a different name; the number following the name refers to the numerical place of this compound in the table; thus, *acetaldazine* 9 indicates that this compound is the 9th compound in the table where it will be found listed under the name *acetaldehyde azine.* Alkaloids which are listed in another table are indicated by *alkd.*; thus, *quinine, cf. alkd.*, means that this compound does not appear in the table below but will be found in a special table of alkaloids. Similarly, glucosides are indicated by *glcde.*; thus, *absinthin*, cf. *glcde.* indicates that the compound is listed in the table of glucosides.

Formulas are presented in a semi-structural form. To indicate the position of substituents on aromatic rings, position numbers are given in the same sequence as they appear in the formula; thus, in the formula "$HO{\cdot}C_6H_3(CHO){\cdot}CO_2H$ (2;5,1)", the CO_2H group is at position 1, the CHO at 5 and the OH at 2.

Beil. Ref. In the column so headed will be found the reference to the volume and page numbers of the 4th edition of Beilstein: *Handbuch der Organischen Chemie* (published by Springer, Berlin). Where the Roman numeral, which indicates the volume number, is preceded by an asterisk, reference is made to the first supplementary volumes. Thus, "*I-23", indicates that the compound will be found listed in the supplement to volume 1 and on page 23.

Formula Weights are based upon the International Atomic Weights of 1941 and are computed to the nearest hundredth.

Crystalline Form and Color. In addition to the crystalline form and color, the solvent used in purification is often given; thus, "rhb./al." indicates that rhombic

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Abbreviations used in the table

a., acid
abs., absolute
ac., acetic acid
Ac, acetyl (i. e. CH_3CO)
act., acetone
al., ethyl alcohol
alk., alkali (i. e. aqueous NaOH or KOH)
alkd., an alkaloid; see alkaloids
Am, amyl (i. e. C_5H_{11})
amor., amorphous
anh., anhydrous
anhyd., anhydride
art., artificial
atm., atmosphere
aq., aqueous; water
Beil. Ref., reference to 4th ed. Beilstein
b., blue
bl., black
b. p., boiling point
brn., brown
bz., benzene, C_6H_6
c., cold
carb., carbonate
chl., chloroform, $CHCl_3$
col., colorless or white
conc., concentrated
cr., crystals or crystalline
d, dextro-rotatory
d., decomposes or decomposed
delq., deliquescent
dil., dilute
diss., dissociates
dl, inactive (i. e. 50% ***d*** and 50% *l*)
eff., effloresces
et., ether ($C_2H_5OC_2H_5$)
Et, ethyl (C_2H_5)
expl., explodes
fl., flakes
gly., glycerol
gn., green
gr., gray
h., hot
hex., hexagonal
hyg., hygroscopic
i., insoluble

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1	**Abietic acid**	sylvic acid	$C_{20}H_{30}O_2$	. . . .	302.44
2	**Acenaphthene**	naphthylene ethylene	$C_{10}H_6(CH_2)_2$	V-586	154.20
3	**Acenaphthylene**	. . . .	$C_{12}H_8$	V-625	152.18

Abalyn 4084
Abasin 84
Abietin, cf. glcde.
Abrastol 4506

ORGANIC COMPOUNDS

crystals were obtained when the compound was crystallized from alcohol. Where no color is stated it may generally be inferred that the material is colorless.

Specific Gravity values are given at room temperatures (15 to 20°C.) unless otherwise indicated by the small figures which follow the value; thus, "$1.069^{95°}_{95}$" indicates a specific gravity of 1.069 for the substance at 95°C. referred to water at 95°C. Specific gravity of gases with the notation "(A)" or "(D)" indicate the density of the gas referred to (A) air = 1 or (D) hydrogen = 1 respectively. See also special tables.

Melting Point is recorded in a certain case as "82 d." and in some other case as "d. 82", the distinction being made in this manner to indicate that the former is a melting point with decomposition at 82°C., while in the latter decomposition only occurs at 82°C. Where a value such as "$-2H_2O$, 82" is given it indicates loss of two moles of water per formula weight of the compound at a temperature of 82°C.

Boiling Point is given at atmospheric pressure (760 mm of mercury) unless otherwise indicated; thus, "82^{15mm}" indicates the boiling point is 82°C. when the pressure is 15 mm.

Solubility is given in parts by weight (of the formula shown at the extreme left) per 100 parts by weight of the solvent; the small exponent indicates the temperature in degrees C. In the case of gases the solubility is often expressed in some manner as "$5^{10°}$ cc." which indicates that at 10°C., 5 cc. of the gas are soluble in 100 grams of the solvent.

References. The information given in the table has been collected mainly from the following sources:—

Beilstein: *Handbuch der Organischen Chemie*, 4th edition, Published by Springer, Berlin.

The Merck Index, 5th edition. Published by Merck and Co., Inc., Rahway, N. J.

Heilbron: *Dictionary of Organic Compounds*. Published by Oxford Press, New York.

Tables Annuelles Internationales de Constants et Donnes Numeriques. Published by McGraw-Hill Book Co., New York.

International Critical Tables, Vol. 1. Published by McGraw-Hill Book Co., New York.

Seidell: *Solubilities of Inorganic and Organic Compounds*. Published by Van Nostrand and Co., New York.

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ign., ignites
K_2CO_3, aqueous potassium carbonate
l, levo-rotatory
lf., leaves or leaflets
lg., ligroin
lq., liquid
lt., light
m, meta position
Me, methyl (CH_3)
Me al., methyl alcohol
met., metallic
mn., monoclinic
m. p., melting point
n, normal
NaOAc, aqueous sodium acetate
nd., needles
o, ortho position
or., orange
p, para position
pa., pale
pd., powder
pet., petroleum ether
Ph, phenyl (C_6H_5)
pl., plates
pr., prisms
pyr., pyridine
r., red
rhb., rhombic
s., soluble
sc., scales
sec, secondary
silv., silvery
sl., slight or slightly
soln., solution
subl., sublimes
sym, symmetrical
syr., syrup
tert, tertiary
tet., tetragonal
tri., triclinic
trig., trigonal
uns, unsymmetrical
v., very
vl., violet
v. s., very soluble
v. sl. s., very slightly soluble
vac., vacuo or vacuum
wh., white
yel., yellow
∞, soluble in all proportions; i. e., miscible
>, greater than
<, less than
42±, about or near to 42
$-3H_2O$, 100, loses 3 molecules of water at 100° C.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1	lf.	. . . .	182	. . . .	i.	v. s.	v. s.
2	rhb./al.	$1.069^{95°}_{95}$	95	278-9	i.; $26^{18°}$bz.	s. h. $3^{18°}$ac.	s. chl.
3	rhb.	$0.899^{16°}_{4}$	92-3	265-75(sl.d.)	i.	v. s.	v. s.

Absinthin, cf. glcde.
Accelerine 4883

Acecoline 83

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4	**Acetal**	acetaldehyde-diethylacetal	$CH_3 \cdot CH(OC_2H_5)_2$	I-603	118.17
5	**Acetaldehyde**	ethanal	$CH_3 \cdot CHO$	I-594	44.05
6	**Acetaldehyde,** meta-	metaldehyde	$(C_2H_4O)_4$	I-602	176.21
7	**Acetaldehyde,** par-	paraldehyde	$(C_2H_4O)_3$	XIX-385	132.16
8	ammonia	....	$(CH_3 \cdot CHOH \cdot NH_2)_3$	XXVI-7	183.25
9	azine	acetaldazine	$CH_3CH:N \cdot N:CHCH_3$	I-609	84.12
10	oxime	acetaldoxime	$CH_3CH:NOH$	I-608	59.07
11	phenylhydrazone	....	$C_6H_5NHN:CHCH_3$	XV-127	134.18
12	semicarbazone	....	$CH_3CH:NNHCONH_2$	III-101	101.11
13	sodium bisulfite	....	$CH_3CHO \cdot NaHSO_3 \cdot \frac{1}{2}H_2O$	I-605	157.13
14	**Acetamide**	ethanamide	$CH_3 \cdot CO \cdot NH_2$	II-175	59.07
15	**Acetamidine**	....	$CH_3 \cdot C(NH)NH_2$	II-185	58.08
16	hydrochloride	....	$CH_3 \cdot C(NH)NH_2 \cdot HCl$	II-185	94.55
17	**Acet**-anilide	antifebrin	$C_6H_5NH \cdot COCH_3$	XII-237	135.16
18	anisidide (*o*)	acetyl-*o*-anisidine	$CH_3O \cdot C_6H_4NH \cdot COCH_3$	XIII-371	165.19
19	anisidide (*m*)	acetyl-*m*-anisidine	$CH_3O \cdot C_6H_4NH \cdot COCH_3$	XIII-416	165.19
20	anisidide (*p*)	methacetin; *p*-methoxy-acetanilide	$CH_3O \cdot C_6H_4NH \cdot COCH_3$	XIII-461	165.19
21	metanilic acid (Na)	....	$CH_3CO \cdot NH \cdot C_6H_4 \cdot SO_3Na \cdot 2H_2O$ (1,3)	XIV-691	273.24
22	methyl-*α*-naphthylamide	....	$CH_3CO \cdot (CH_3)N \cdot C_{10}H_7$	XII-1231	199.24
23	*o*-phenetidide	*o*-ethoxyacetanilide	$CH_3CONH \cdot C_6H_4 \cdot OC_2H_5$	XIII-371	179.21
24	*m*-phenetidide	acetyl-*m*-phenetidine	$CH_3CONH \cdot C_6H_4 \cdot OC_2H_5$	XIII-416	179.21
25	*p*-phenetidide	phenacetin	$CH_3CONH \cdot C_6H_4 \cdot OC_2H_5$	XIII-461	179.21
26	toluidide (*o*)	*N*-tolylacetamide	$CH_3C_6H_4NH \cdot COCH_3$	XII-792	149.19
27	toluidide (*m*)	*N*-tolylacetamide	$CH_3C_6H_4NH \cdot COCH_3$	XII-860	149.19
28	toluidide (*p*)	*N*-tolylacetamide	$CH_3C_6H_4NH \cdot COCH_3$	XII-920	149.19
29	**Acetamino**-ethyl-salicylic acid (5;2,1)	benzacetin	$CH_3CONH \cdot C_6H_3 \cdot (OC_2H_5)CO_2H$	XIV-583	223.22
30	fluorene(2)	....	$C_{13}H_9NH \cdot COCH_3$	XII-1331	223.26
31	*α*-naphthol (4,1)	naphthacetol	$CH_3CO \cdot NH \cdot C_{10}H_6OH$	XIII-669	201.22
32	*β*-naphthol (1,2)	....	$CH_3CO \cdot NH \cdot C_{10}H_6OH$	XIII-679	201.22
33	phenol (*o*)	*o*-hydroxyacetanilide	$CH_3CONHC_6H_4OH$	XIII-370	151.16
34	phenol (*m*)	acetyl-aminophenol	$CH_3CONHC_6H_4OH$	XIII-415	151.16
35	phenol (*p*)	....	$CH_3CONHC_6H_4OH$	XIII-460	151.16
36	**Acetic** acid	ethanoic acid	$CH_3 \cdot COOH$	II-96	60.05
37	anhydride	....	$(CH_3CO)_2O$	II-166	102.09
38	**Acetoacetic** acid	acetyl acetic acid	$CH_3CO \cdot CH_2CO_2H$	III-630	102.09
39	*β*-anil	Et *β*-anilinocrotonate	$CH_3C(:NC_6H_5) \cdot CH_2 \cdot CO_2C_2H_5$	XII-518	205.25

Acetaldazine 9
Acetaldehyde-cyanohydrin 3944
Acetaldehyde-ethylene-acetal 3207
Acetaldol 169
Acetaldoxime 10

Acetarsone 128
Acet-bromamide 879
Acet-dibromamide 1794
Acet-dimethylamide 2416

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4	lq.	$0.821\tfrac{22^\circ}{4}$	....	102.2	6^{25°	∞	∞
5	col. lq.	$0.783\tfrac{18^\circ}{4}$	−123.5	20.2	∞	∞	∞
6	nd.	....	246.2*	....	i.; s. chl.	2 h.; s. bz.	0.5^{35°; v. sl. s. h.
7	col. cr.	$0.994\tfrac{20^\circ}{4}$	10.5-12	124.4^{752mm}	12^{13° 6^{100°	∞; ∞ chl.	∞
8	col. cr.	....	97	100-10(sl.d.)	v. s.	v. s.	sl. s.
9	lq.	0.832^{17°	....	95-6	....	....	....
10	nd. or lq.	$0.965\tfrac{20^\circ}{4}$	47(13)	114-5	s.	∞	∞
11	col. nd.	....	(α)98-101 (β)57	$236\text{-}7^{20mm}$ $133\text{-}6^{20mm}$	....	....	s. pet.
12	nd. / aq. or al.	....	162-3	....	3^{17°	s.	....
13	col. nd.	....	....	....	s.; d. a.	i.	i.
14	col. cr.	1.159	81(69.4)	222	s.	s.	v. sl. s.
15	in aq. soln.	....	....	....	d. h.	....	....
16	nd./al.	....	177	....	s.	v. s.	i.
17	rhb./al.	1.21^{4°	113-4	305	0.53^{6°; 3.5^{80°	21^{20°; 46^{60°	7^{25°
18	cr./aq.	....	87-8	303-5	v. s. h.	55.3^{21°	v. s. ac.
19	cr./aq.	....	80-1	....	....	80^{21°	....
20	pl./aq.	....	127	....	0.2^{15°; 8^{100°	12.7^{21°; s. act.	s. chl.; s. dil. alk.
21	nd./aq.	....	184-5	....	v. s. h.	v. sl. s.	i.
22	pr./aq.	....	94-5	....	v. sl. s.	s.	s.
23	lf./aq. al.	....	79	>250	i.	s.	....
24	lf./aq.	....	96-7	....	sl. s.	s.	....
25	col. mn.	....	134-5	d.	0.7^{20°	7.4 c.; 40 h.	1.6^{25°; s. gly.
26	rhb.	1.168^{15°	110	296	0.86^{19°	s.; s. bz.	s.; s. chl.
27	mn./aq.	1.141^{15°	65.5	303	0.44^{13°	v. s.	v. s.
28	rhb. or mn.	1.212^{15°	153	306-7	0.09^{22°	10.2^{25° abs.	s.; i. lg.
29	col. nd./aq.	....	189-90	....	sl. s.	s.	....
30	cr./50% ac.	....	191	....	....	....	....
31	nd./al.	....	187	....	s. h.	s; s. NH_4OH	s. Na_2CO_3
32	lf./aq. al.	....	235.5	subl. sl. d.	v. s. aq. NaOH	s; s. bz.	s.; s. h. ac.
33	lf./aq. al.	....	203	....	s. h.	s.	s. KOH
34	nd./aq.	....	148-9	....	s.	s.; sl. s. chl.	sl. s.; sl. s. bz.
35	mn./al.	1.293^{21°	168-9	....	v. s. h.	v. s.	sl. s.
36	col. lq.	$1.049\tfrac{20^\circ}{4}$	16.7	118.1	∞	∞	∞
37	col. lq.	$1.082\tfrac{20^\circ}{4}$	−73	139.6	12 c.; d. h.	∞; d. h.	∞
38	col. oil	....	....	d. <100	∞	∞	s.
39	oil	....	....	d. 240	i.	s.	s.

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* In sealed tube; subl. 112-6; partly depolymerized.

Acet-methylamide 4085
Acet-oxime 61
Acet-phenetidide 23-5
Acetamino-, cf. also acetylamino.
Acetic ester 2935
Acetic ether 2935
Acetin 3382
Aceto-acetic ester 2937

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Acetoacetic				
40	anilide	acetoacetanilide	$CH_3COCH_2CONH\cdot C_6H_5$	XII-518	177.20
41	2-chloroanilide	*o*-chloroaceto-acetanilide	$CH_3CO\cdot CH_2CO\cdot NH\cdot C_6H_4Cl$	*XII-300	211.65
42	2,5-dichloroanilide	....	$CH_3CO\cdot CH_2CO\cdot NH\cdot C_6H_3Cl_2$	....	246.09
43	**Acetoin**	methylacetyl carbinol	$CH_3CHOH\cdot CO\cdot CH_3$	I-827	88.10
44	**Aceto**-chloroglucose	tetraacetyl-α-glucosyl chloride	$Cl\cdot CH(CHO_2CCH_3)_3\cdot$ $CH\cdot(CH_2O_2CCH_3)\cdot O$	....	366.75
45	dichlorohydrin	dichloropropyl acetate (β,γ)	$CH_3CO_2CH_2CHCl\cdot CH_2Cl$	II-129	171.03
46	naphthalide (α)	acetyl naphthylamine	$C_{10}H_7NH\cdot COCH_3$	XII-1230	185.22
47	naphthalide (β)	....	$C_{10}H_7NH\cdot COCH_3$	XII-1284	185.22
48	naphthol (1,2)	hydroxy-acetonaphthone	$HO\cdot C_{10}H_6\cdot COCH_3$	VIII-149	186.20
49	nitrile	methyl cyanide	$CH_3\cdot CN$	II-183	41.05
50	phenine	....	$C_{23}H_{17}N$	....	307.37
51	phenone	methyl-phenyl ketone	$CH_3\cdot CO\cdot C_6H_5$	VII-271	120.14
52	phenone acetone	phenacyl acetone	$C_6H_5\cdot CO\cdot C_2H_4\cdot COCH_3$	VII-687	176.21
53	phenone oxime	....	$C_6H_5(CH_3)C{:}NOH$	VII-278	135.16
54	phenone phenylhydrazone	....	$C_6H_5NH\cdot N{:}C(CH_3)\cdot C_6H_5$	XV-139	210.27
55	**Acetol**	acetyl carbinol	$CH_3CO\cdot CH_2OH$	I-821	74.08
56	**Acetone**	propanone	$CH_3\cdot CO\cdot CH_3$	I-635	58.08
57	cyanohydrin	....	$(CH_3)_2C(OH)\cdot CN$	III-316	85.10
58	diacetic acid	....	$CO{:}(C_2H_4\cdot CO_2H)_2$	III-804	174.15
59	dicarboxylic acid	β-ketoglutaric acid	$CO{:}(CH_2CO_2H)_2$	III-789	146.10
60	glucose, mono	glucose diMe-ketal	$(CH_3)_2C{:}(HCO)_2\cdot$ $(CHOH)_2\cdot CH\cdot$ $(CH_2OH)\cdot O$	....	220.22
61	oxime	acetoxime	$(CH_3)_2C{:}NOH$	I-649	73.09
62	phenylhydrazone	....	$C_6H_5NH\cdot N{:}C(CH_3)_2$	XV-129	148.20
63	semicarbazone	....	$(CH_3)_2C{:}N\cdot NH\cdot CONH_2$	III-101	115.14
64	sodium bisulfite	....	$(CH_3)_2CO\cdot NaHSO_3$	I-649	162.14
65	**Acetonyl** acetone	....	$(CH_3\cdot CO\cdot CH_2)_2$	I-788	114.14
66	urea	dimethyl hydantoin	$(CH_3)_2{:}$ $CNHCONHCO$	XXIV-289	128.13
67	**Acetoxy acetone**	acetol acetate	$CH_3CO_2CH_2COCH_3$	II-155	116.11
68	**Acetyl**-acetone	diacetylmethane	$(CH_3CO)_2CH_2$	I-777	100.11
69	benzoic acid (*o*)	acetophenone carboxylic acid	$CH_3CO\cdot C_6H_4\cdot CO_2H$	X-690	164.15
70	benzoic acid (*m*)	....	$CH_3CO\cdot C_6H_4\cdot CO_2H$	X-694	164.15
71	benzoic acid (*p*)	....	$CH_3CO\cdot C_6H_4\cdot CO_2H$	X-694	164.15
72	benzoyl	Me-Ph-diketone	$CH_3CO\cdot CO\cdot C_6H_5$	VII-677	148.15

Aceto-acetanilide 40
Aceto-aniside 18-20
Aceto-anisole 5132
Aceto-chloramide 1295
Aceto-cymene 4181
Aceto-mesitylene 6247
Aceto-naphthone 4313
Aceto-phen 115
Aceto-phenone alcohol 754
Aceto-phenone carboxylic acid 69-71
Aceto-propionic acid 3967
Aceto-pyrine 566
Aceto-sal(in) 115
Aceto-thioamide 5882
Aceto-vanillone 3776

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
40	lf.	....	85	....	sl. s.; s. alk.	s.	s.; s. h. bz.
41	col. nd.	....	105	....	i.	s.	i.; i. lg.
42	col. nd.	....	94-5	....	i.	sl. s.	i.
43	lq.	$1.011^{15^\circ}_{15}$	15	148	∞	v. s.	sl. s.; i. lg.
44	col. mn. nd./et.-lg.	....	70-1 (d.)	....	d. h.; i. pet.	s.; s. act.	s.; s. CCl_4
45	col. lq.	1.168^{15°	....	$191\text{-}2^{755\text{mm}}$	....	....	....
46	cr./al.	....	159-60	....	s. h.	4^{25°	....
47	lf./al.	....	134	....	s. h.	s. h.	....
48	yel. nd./lg.	....	103(98)	325(sl. d.)	i.; v. s. bz.	v. sl. s. c.	s. ac.; s. CS_2
49	col. lq.	$0.783^{20^\circ}_{4}$	–41	81.6-2.0	∞	∞	∞
50	nd./al.	....	135	....	....	s.	....
51	cr. lf.	$1.033^{15^\circ}_{15}$	20.5	$202.3^{749\text{mm}}$	i.	s.	s.
52	yel. oil	>1	....	162^{12}(sl. d.)	sl. s.	....	i. alk.
53	nd./aq.	....	59	d.	....	v. s.	v. s.
54	col. nd.	....	105-6	....	sl. s.	sl. s. c.	s.
55	col. lq.	$1.082^{20^\circ}_{20}$	–17	145-6	∞	∞	∞
56	col. lq.	$0.792^{20^\circ}_{4}$	–94.6	56.5	∞	∞	∞
57	col. lq.	0.932^{19°	–19	$82^{25\text{mm}}$	v. s.	v. s.	v. s.; v. sl. s. pet.
58	rhb./aq.	....	142-3	....	s. h.	s.	sl. s.; i. bz.
59	nd./et.	....	138	....	v. s.	v. s.	sl. s.; i. bz.
60	col. mn. nd./aq.	....	162	....	s.	s.; s. h. EtOAc	i.
61	pr.	$0.97^{20^\circ}_{20}$	60-1	136.3	v. s.	v. s.	v. s.; s. lg.
62	oil	....	26.6	$163^{50\text{mm}}$	s. c. dil. a.	....	....
63	nd./aq.	....	190-1(d.)	....	s. c.	sl. s. c.	i.
64	col. lf.	....	....	....	s.; d. a.	sl. s.	i.
65	col. lq.	$0.974^{20^\circ}_{4}$	–9	$194^{754\text{mm}}$	∞; i. KOH	∞	∞
66	tri. pr./al.	....	175	subl.	s.	s.	s.
67	col. oil	$1.075^{20^\circ}_{4}$	....	174-5	v. s.	v. s.	v. s.
68	lq.	$0.976^{20^\circ}_{4}$	–23.2(–9)	$139^{746\text{mm}}$	12.5	∞	∞; ∞ chl.
69	cr./aq.	....	114-5	....	s. h.	....	....
70	nd./aq.	....	172	....	s. h.	s.; sl. s. chl.	s.; sl. s. bz.
71	nd./h. aq.	....	200-5(d.)	....	s. h.	sl. s.	sl. s.; i. lg.
72	yel. oil	$1.101^{20^\circ}_{4}$	....	216-8	0.3^{20°	....	....

Aceto-xylidide 2417-22
Acetozone 73
Acetol acetate 67
Acetol phenyl ether 5132
Acetone azine 3932
Acetone bromoform 6102
Acetone chloride 2053
Acetone chloroform 6145
Acetone chloroform acetate 6144
Acetone diethylsulfone 5683
Acetone oxalic ester 2939
Acetonic acid 3757
Acetonyl-acetophenone 52
Acetonyl-amine 235
Acetonyl anisole 4126

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Acetyl				
73	benzoyl peroxide	acetozone	$C_6H_5CO{\cdot}O_2{\cdot}COCH_3$	IX-179	180.15
74	biuret	....	$CH_3CO(NHCO)_2NH_2$	III-72	145.12
75	bromide	ethanoyl bromide	$CH_3CO{\cdot}Br$	II-174	122.96
76	5-bromosalicylic acid (2;5,1)	5-bromoaspirin	$CH_3CO_2{\cdot}C_6H_3(Br){\cdot}CO_2H$	X-108	259.06
77	*n*-butylaniline	....	$CH_3CO{\cdot}N(C_4H_9){\cdot}C_6H_5$	XII-247	191.26
78	caproyl	octandione-2,3	$CH_3(CH_2)_4CO{\cdot}COCH_3$	I-795	142.19
79	caproyl oxime	isonitroso-*n*-amyl-ketone	$C_8H_{15}O_2N$	I-795	157.21
80	carbazole (*N*)	....	$CH_3CO{\cdot}NC_{12}H_8$	XX-436	209.24
81	chloride	ethanoyl chloride	$CH_3CO{\cdot}Cl$	II-173	78.50
82	choline bromide	pragmoline	$(CH_3)_3N(Br)(CH_2)_2{\cdot}O_2C{\cdot}CH_3$	*IV-428	226.12
83	choline chloride	acecoline	$(CH_3)_3N(Cl)C_2H_4{\cdot}O_2C{\cdot}CH_3$	IV-281	181.66
84	diethylbromo-acetyl-urea (*N,N′*)	abasin; acetylcarbromal	$(C_2H_5)_2CBr{\cdot}CO{\cdot}NH{\cdot}CO{\cdot}NH{\cdot}COCH_3$	*III-30	279.14
84.1	diphenylamine	*N*-diPh acetamide	$(C_6H_5)_2N{\cdot}COCH_3$	XII-247	211.25
85	disulfide	diacetyl disulfide	$(CH_3CO)_2S_2$	II-232	150.21
86	ethanolamine (*N*)	....	$HO(CH_2)_2NH{\cdot}COCH_3$	....	103.12
87	ethylmalonate	....	$CH_3CO{\cdot}CH{\cdot}(CO_2C_2H_5)_2$	III-796	202.20
88	ethyloxamate	....	$(CH_3CO)NHC_2O_2{\cdot}OC_2H_5$	II-545	159.14
89	fluoride	ethanoyl fluoride	$CH_3CO{\cdot}F$	II-172	62.04
90	glycine	aceturic acid	$CH_3CO{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$	IV-354	117.10
91	indole (1)(*N*)	....	$CH_3CO{\cdot}NC_8H_6$	XX-309	159.18
92	iodide	ethanoyl iodide	$CH_3CO{\cdot}I$	II-174	169.96
93	iodosalicylic acid	4-iodoaspirin (2;4,1)	$CH_3CO_2C_6H_3(I)CO_2H$	*X-49	306.07
94	iodosalicylic acid	5-iodoaspirin (2;5,1)	$CH_3CO_2C_6H_3(I)CO_2H$	*X-49	306.07
95	isatin (*N*)	....	$CH_3CO{\cdot}N(CO)_2C_6H_4$	XXI-447	189.16
96	malic acid	....	$C_2H_3O_2{\cdot}C_2H_3(CO_2H)_2$	III-429	176.12
97	*o*-methylamino-phenol	....	$CH_3CO{\cdot}N(CH_3)C_6H_4{\cdot}OH$	XIII-372	165.19
98	*p*-methylamino-phenol	....	$CH_3CO{\cdot}N(CH_3)C_6H_4{\cdot}OH$	XIII-466	165.19
99	*β*-methylcholine bromide	mecholyl bromide	$(CH_3)_3N(Br)CH_2{\cdot}CH(CH_3)O_2C{\cdot}CH_3$	....	240.15
100	*β*-methylcholine chloride	mecholyl; mecholin	$(CH_3)_3N(Cl)CH_2{\cdot}CH(CH_3)O_2C{\cdot}CH_3$	....	195.69
101	*β*-methylcholine iodide	mecholyl iodide	$(CH_3)_3N(I)CH_2{\cdot}CH(CH_3)O_2C{\cdot}CH_3$	....	287.15
102	methyl-*o*-toluidine	*N*-Me-acet-*o*-toluidide	$CH_3CO{\cdot}N(CH_3)C_6H_4{\cdot}CH_3$	XII-793	163.21
103	methyl-*m*-toluidine	*N*-Me-acet-*m*-toluidide	$CH_3CO{\cdot}N(CH_3)C_6H_4{\cdot}CH_3$	XII-861	163.21
104	methyl-*p*-toluidine	*N*-Me-acet-*p*-toluidide	$CH_3CO{\cdot}N(CH_3)C_6H_4{\cdot}CH_3$	XII-922	163.21
105	nitrate	....	$CH_3CO_2NO_2$	II-171	105.05
106	peroxide	diacetyl peroxide	$(CH_3CO)_2O_2$	II-170	118.09
107	*p*-phenylenediamine	amino-acetanilide (*p*)	$C_2H_3O{\cdot}NHC_6H_4NH_2$	XIII-94	150.18

Acetoxy-acetophenone 5094
Aceturic acid 90
Acetyl, cf. also aceto or acet.
Acetyl-acetic acid 38
Acetyl-anisidine 18-20
Acetyl-anisole 4065
Acetyl-anthranilic acid (*N*) 125
Acetyl-arsanilic acid 577
Acetyl-benzoin 718
Acetyl-benzoylaconine, cf. alkd.
Acetyl-benzylamine 780
Acetyl-carbinol 55

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
73	col. nd./lg.	....	37-9	130^{19mm}	$0.06^{25°}$ d.	s. oils	s.; s. chl.
74	nd.	....	107	....	s. bz.	v. s.	s.
75	col. lq.	$1.663\frac{16°}{4}$	−96.5	76^{750mm}	d.	d.; ∞ bz.	∞; ∞ chl.
76	cr./al.	....	168	....	i.; i. bz.	$16^{25°}$; i. CCl_4	$10^{25°}$
77	lq.	....	....	$273\text{-}5^{718mm}$	....	....	....
78	lq.	....	....	$172\text{-}3^{733mm}$	....	....	....
79	cr.	....	39	139^{16mm}	....	....	....
80	nd./aq.	....	69	>360 d.	v. sl. s. h.	v. s.	v. s.; s. bz.
81	col. lq.	$1.105\frac{20°}{4}$	−112.0	51-2	d.	d.; ∞ bz.	∞; ∞ chl.
82	hyg. pr./abs. al.	....	143	....	v. s.; d. h.	s.	i.
83	hyg. col. pr.	....	....	....	v. s.; d. h.	s.	i.
84	col. cr./aq.	....	108-9	....	sl. s.	s.	s. EtOAc
84.1	rhb./aq.	....	103	subl.	sl. s.	s.	sl. s.
85	cr.	....	20	d.	i.; s. CS_2	v. s.	v. s.
86	col. syr.	....	....	....	sl. s.	s.	s.
87	lq.	$1.083\frac{26°}{5}$	....	120^{17mm}	s. dil. alk.	....	....
88	nd.	....	54	....	d. h.	s.	s.
89	lg or gas	$0.993^{20°}$	<−60	20.8^{770mm}	5; d.	∞; ∞ bz.	∞
90	cr./aq.	....	206	....	$2.7^{15°}$	s. abs.	i.
91	lq.	$1.071^{0°}$	<−20	239	v. sl. s.	v. s.	v. s.; v. s. bz.
92	col. lq.	$1.98^{17°}$	....	108	d.	d.	s.
93	col. cr.	....	156	....	i.	s.	s.
94	col. cr.	....	166	....	i.	s.	s.
95	yel. nd./bz.	....	141	....	sl. s. c.; d. h.	s.	d. h. HCl
96	col. cr. pd.	....	132-9 d.	....	s.; d. h.	....	i. bz.
97	nd./MeOH	....	150	....	sl. s.	s.	s.
98	sc./aq.	....	240-1	....	v. sl. s	v. s.	s.
99	col. delq. cr.	....	148-9	....	v. s.	70	i.; d. alk.
100	col. delq. cr./al.	....	172-3	....	v. s.	v. s.	i.; d. alk.
101	col. cr.	....	138-9	....	v. s.	75	i.
102	col. cr.	....	55-6	260	....	s.	....
103	col. cr.	....	66	....	....	s.	....
104	lf./al.-et.	....	80	283	....	s.	s. h. lg.
105	col. lq.	$1.24^{15°}$	expl.	22^{70mm}	....	....	....
106	col. cr.	....	30	$63^{21°}$; expl.	sl. s. c.; d.	....	....
107	nd./aq.	....	162	....	s. h.	v. s.	v. s.

Acetyl-carbromal 84
Acetyl-cyanide 5527
Acetyl-diethylamine 2100
Acetyl-ethylanilide 2934
Acetyl-formic acid 5525
Acetyl-guaiacol 3481
Acetyl-methylurea 4091
Acetyl-naphthalene 4313
Acetyl-naphthylamine 46-7
Acetyl-phenetidine 23-5
Acetyl-phenol 5141

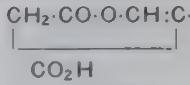
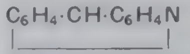
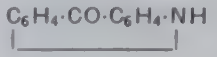
No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Acetyl				
108	*m*-phenylenediamine	aminoacetanilide (*m*)	$C_2H_3O{\cdot}NHC_6H_4NH_2$	XIII-45	150.18
109	*m*-phenylene diamine HCl	....	$C_2H_3ONHC_6H_4NH_2{\cdot}HCl$	XIII-45	186.64
110	phenylglycine	*N*-Ph-aceturic acid	$C_6H_5N(COCH_3)CH_2{\cdot}CO_2H$	XII-476	193.20
111	phenylhydrazine (β)	hydracetin	$CH_3CO{\cdot}NH{\cdot}NHC_6H_5$	XV-241	150.18
112	piperidine	....	$CH_3CO{\cdot}NC_5H_{10}$	XX-45	127.18
113	pyrrol (*N*)	....	$CH_3CO{\cdot}NC_4H_4$	XX-165	109.12
114	resorcinol (1,3)	euresol; eurisol	$CH_3CO_2{\cdot}C_6H_4{\cdot}OH$	VI-816	152.14
115	*o*-salicylic acid	aspirin	$CH_3CO_2{\cdot}C_6H_4{\cdot}CO_2H$	X-67	180.15
116	*o*-salicylic acid (Ca)	aspirin soluble	$(C_9H_7O_4)_2Ca{\cdot}2H_2O$	*X-29	434.40
117	*o*-salicylic acid (Li)	litmopyrin	$C_9H_7O_4Li$	X-68	186.09
118	*o*-salicylic acid (Mg)	magnespirin	$(C_9H_7O_4)_2Mg$†	*X-29	382.61
119	*o*-salicylic acid (Na)	hydropyrin	$C_9H_7O_4Na$	X-68	202.14
120	salol	spiroform; vesipyrin	$CH_3CO_2{\cdot}C_6H_4{\cdot}CO_2C_6H_5$	X-79	256.25
121	2-thiohydantoin	....	$CH_3CO{\cdot}N{\cdot}CH_2{\cdot}$ $CONH{\cdot}CS$	*XXIV-293	158.17
122	thiourea	....	$CH_3CO{\cdot}NHCSNH_2$	III-191	118.15
123	urea	....	$CH_3CO{\cdot}NHCONH_2$	III-61	102.09
124	**Acetylamino-** azotoluene	azodermin (4-NH₂, 3,2-diMe)	$CH_3{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_3(CH_3){\cdot}NH{\cdot}COCH_3)$	....	267.32
125	benzoic acid (*o*)	*N*-acetyl-anthranilic acid	$CH_3CO{\cdot}NH{\cdot}C_6H_4{\cdot}CO_2H$	XIV-337	179.17
126	benzoic acid (*m*)	....	$CH_3CO{\cdot}NH{\cdot}C_6H_4{\cdot}CO_2H$	XIV-396	179.17
127	benzoic acid (*p*)	acetaminobenzoic acid	$CH_3CO{\cdot}NH{\cdot}C_6H_4{\cdot}CO_2H$	XIV-432	179.17
128	hydroxyphenylarsonic acid (3;4,1)	stovarsol; spirocid	$CH_3CONH{\cdot}C_6H_3(OH){\cdot}AsO_3H_2$	....	275.08
129	phenylglycine (*p*)	....	$CH_3CONH{\cdot}C_6H_4{\cdot}CH_2CO_2H$	....	193.20
130	**Acetylene**	ethyne; ethine	$CH \vdots CH$	I-228	26.04
131	dibromide (1,1)	α,α-dibromoethylene	$CH_2{:}CBr_2$	I-190	185.87
132	dibromide (*cis*)	1,2-dibromoethene	$CHBr{:}CHBr$	I-190	185.87
133	dibromide (*trans*)	1,2-dibromoethene	$CHBr{:}CHBr$	I-190	185.87
134	dicarboxylic acid	butynedioic acid	$(C{\cdot}CO_2H)_2$	II-801	114.06
135	dichloride (*cis*)	1,2-dichloroethene	$CHCl{:}CHCl$	I-187	96.95
136	dichloride (*trans*)	dioform	$CHCl{:}CHCl$	I-187	96.95
137	diiodide (*cis*)	1,2-diiodoethene	$CHI{:}CHI$	I-194	279.88
138	diiodide (*trans*)	1,2-diiodoethene	$CHI{:}CHI$	I-194	279.88
139	urea	glycoluril	$C_2H_2(CON_2H_2)_2$	XXVI-441	142.12

† Also cr. + $3H_2O$, and + $4H_2O$.

Acetyl-propiophenone 62
Acetyl-propylaniline 5364
Acetyl-resorcinol 5550
Acetyl-thymol 5945

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Water	Alcohol	Ether
108	pl./bz.	....	softens >70	d. >87	s.; s. act.	s.; sl. s. bz.	s.; i. lg.
109	pl./al.	....	280 ±	....	s.; i. bz.	sl. s.	i.; i. lg.
110	lf./aq.	....	190-2	....	v. sl. s.	s.; s. ac.	v. sl. s.
111	pr.	....	129	....	s. h.	s.	sl. s.
112	lq.	$1.011^{9°}$	....	226-7	∞	s.	....
113	lq.	....	....	181-2	i.	....	d. HCl
114	yel. oil	....	....	283 d.	i.; s. alk.	∞; ∞ bz.	∞ chl.
115	col. nd./aq.	....	135-6	....	$1^{37°}$	v. sl. s. bz.	$5^{20°}$
116	cr., aq. al.	....	....	....	16	1.4	i.
117	wh. hyg. pd.	....	....	....	100	25	i.
118	wh. pd.	....	....	....	s.	sl. s.	i.
119	cr./act.-et.	....	218 sl. d.	....	v. s.	v. s.	sl. s. act.
120	col. cr./ abs. al.	....	97-8	198^{11mm}	i.	s.	s.
121	cr./al.	....	175-6	....	i.	sl. s.	i.
122	pr./aq.	....	166-7	....	s. h.	s.	sl. s.
123	nd./al.	....	218	....	$2^{15°}$; v. s. h.	10 h.	....
124	r. nd./al.	....	185-6	....	i.	s. chl.	s.; s. oils
125	rhb./ac.	....	184-6	....	s. h.	s.	s.; s. bz.
126	nd./al.	....	248-50	subl.	v. sl. s. h.	s. h.	v. sl. s.
127	nd.	....	256.5 d.	....	sl. s.	s.	....
128	wh. pd.	....	....	....	sl. s.	s. alk.	....
129	col. fl.	....	241-2	....	i.	sl. s.	sl. s.
130	col. gas	lq. $0.613^{-80°}$ s. $0.730^{-85°}$ (A) 0.906	-81.5^{891mm}	-84^{760mm}	$100\ cc^{18°}$ cf. special table	$600\ cc^{18°}$	$2500\ cc^{15°}$ act.; 30,000 cc act. 12 atm.
131	col. lq.	$2.178^{21°}_{4}$	....	$91\text{-}2^{754mm}$	i.	v. s.	v. s.
132	col. lq.	$2.285^{17.5°}_{4}$	-53	110^{754mm}	i.	v. s.	v. s.
133	col. lq.	$2.267^{17.5°}_{4}$	-6.5	108	i.	v. s.	v. s.
134	pl. et.	....	179-80	....	v. s.	v. s.	v. s.
135	col. lq.	$1.291^{15°}_{4}$	-80.5	60.3	$0.35^{20°}$	∞	∞
136	col. lq.	$1.265^{15°}_{4}$	-50	48.4	$0.63^{20°}$	∞	∞
137	col. lq.	$3.063^{20°}$	-13.8	188 d.	i.	s.	s.
138	mn. pr.	$3.303^{21°}$	73	192	i.	s.	s.
139	nd./aq.	....	d. 300 ±	....	$0.1^{17°}$; $1.5^{100°}$	i.; s. conc. HCl	>1, h. NH_4OH

Acetyl-toluidine 26-8
Acetylamino-phenol 33-5
Acetylene-tetrabromide 5719
Acetylene-tetrachloride 5739
Acetylidene-*o*-aminophenol 2908

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
140	**Aconic acid**	....	 $CH_2{\cdot}CO{\cdot}O{\cdot}CH{:}C{\cdot}CO_2H$	XVIII-395	128.08
141	**Aconitic acid**	equisetic acid; citridic acid	$C_3H_3(CO_2H)_3$	II-849	174.11
142	**Acridine**	....	 $C_6H_4{\cdot}CH{\cdot}C_6H_4N$	XX-459	179.21
143	orange (3,6)	....	$NC_{13}H_7[N(CH_3)_2]_2$	XXII-487	265.35
144	red (2,7)	....	$CH_3NH{\cdot}C_{13}H_7O{:}N(Cl)CH_3$	....	273.74
145	**Acridone**	dihydroketo-acridine	 $C_6H_4{\cdot}CO{\cdot}C_6H_4{\cdot}NH$	XXI-335	195.21
146	**Acrolein**	acrylic aldehyde	$CH_2{:}CH{\cdot}CHO$	I-725	56.06
147	**Acrolein** (*meta*)	metacrolein	$(C_3H_4O)_3$	I-727	168.19
148	**Acrylamide**	acrylic amide	$CH_2{:}CH{\cdot}CONH_2$	II-400	71.08
149	**Acrylic** acid	propenoic acid	$CH_2{:}CH{\cdot}CO_2H$	II-397	72.06
150	anhydride	....	$(CH_2{:}CH{\cdot}CO)_2O$	II-400	126.11
151	nitrile	vinyl cyanide	$CH_2{:}CH{\cdot}CN$	II-400	53.06
152	**Adipamide**	adipic diamide	$({\cdot}CH_2CH_2CONH_2)_2$	II-653	144.17
153	**Adipic** acid	hexandioic acid	$({\cdot}CH_2CH_2CO_2H)_2$	II-649	146.14
154	**Adipyl** chloride	....	$({\cdot}CH_2CH_2CO{\cdot}Cl)_2$	II-653	183.04
155	dinitrile	tetramethylene dicyanide	$({\cdot}CH_2CH_2CN)_2$	II-653	108.14
156	**Adonitol**	adonite	$HOCH_2(CHOH)_3{\cdot}CH_2OH$	I-530	152.15
157	**Adrenaline** (*l*)(3,4,1)	*l*-suprarenine	$C_6H_3(OH)_2(CHOH{\cdot}CH_2NHCH_3)$	XIII-830	183.20
158	**Alanine** (α) (*l* +)	α-aminopropionic acid	$H_2N{\cdot}CH(CH_3){\cdot}CO_2H$	IV-387	89.09
159	**Alanine** (α) (*dl*)	....	$H_2N{\cdot}CH(CH_3){\cdot}CO_2H$	IV-387	89.09
160	**Alanine** (β)	β-aminopropionic acid	$H_2N{\cdot}CH_2{\cdot}CH_2{\cdot}CO_2H$	IV-401	89.09
161	**Aldehydin** (2,5)	2-Me-5-Et-pyridine	$(CH_3)C_5H_3N(C_2H_5)$	XX-248	121.18
162	**Aldehydo**-benzoic acid (*o*)	phthalic aldehyde	$HO_2C{\cdot}C_6H_4{\cdot}CHO$	X-666	150.13
163	benzoic acid (*m*)	isophthalic aldehyde	$HO_2C{\cdot}C_6H_4{\cdot}CHO$	X-671	150.13
164	benzoic acid (*p*)	terephthalic aldehyde	$HO_2C{\cdot}C_6H_4{\cdot}CHO$	X-671	150.13
165	*o*-hydroxybenzoic acid	(2;5,1)	$HO{\cdot}C_6H_3(CHO){\cdot}CO_2H$	X-953	166.13
166	*o*-hydroxybenzoic acid	(2;3,1)	$HO{\cdot}C_6H_3(CHO){\cdot}CO_2H{\cdot}1H_2O$	X-952	184.14
167	*m*-hydroxybenzoic acid	(3;4,1)	$HO{\cdot}C_6H_3(CHO){\cdot}CO_2H$	X-954	166.13
168	*p*-hydroxybenzoic acid	(4;3,1) formyl salicylic acid (5)	$HO{\cdot}C_6H_3(CHO){\cdot}CO_2H$	X-953	166.13
169	**Aldol**	2-hydroxybutyraldehyde	$CH_3{\cdot}CHOH{\cdot}CH_2{\cdot}CHO$	I-824	88.10
170	**Aldol** par-	paraldol	$(C_4H_8O_2)_2$	I-825	176.21
171	**Aleudrin**	α,α′-diCl-*iso*Pr-carbamate	$H_2N{\cdot}CO_2{\cdot}CH(CH_2{\cdot}Cl)_2$	III-29	172.02

Achilleic acid 141
Acid Cβ 4534
Acid F 4510
Acid G 4495-6
Acid H 342
Acid I 337
Acid J 337
Acid L 4503
Acid NW 4502
Acid R 4491
Acid S 339 or 344
Acid Sα 4533
Acid α S 4533
Acid β 559
Acid βC 4534
Acid βγ 4537
Acid γ 338
Acid δ 4533 or 4553
Acid λ 4544
Acid ρ 553
Acid χ 554
Acid 1:2:4 340
Acid of sugar 5006-7
Acid amido G 4537
Acid amino H 4555
Acid yellow D 4996
Acid yellow S 3241
Acidogen nitrate 6389
Acidol 847; also cf. alkd.
Acidulin 3373
Acocantherin, cf. glcde.
Acoin 1760

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
140	rhb./aq.	....	164	....	18^{15°	....	s.
141	lf. or nd./ aq.	....	192 d.	....	33^{15°	50^{12°, 88% al.	v. sl. s.
142	rhb./aq. al.	....	110-1	346	sl. s. h.	s.	s.; s. CS_2
143	yel. nd./aq. al.	....	181	....	s.; s. dil. a.	s.; s. act.	v. sl. s. pet.
144	bronze pd.	....	....	....	sl. s.	s.	i.
145	yel. nd./al.	....	354	....	i. aq. KOH; s. h. HCl	s. h.; s. h. ac.	i.; i. bz.; i. chl.
146	col. lq.	$0.841_{4}^{20^\circ}$	-87.7	52.5	40	s.	s.
147	nd.	....	45-50	sl. diss.	v. sl. s. h.	s.	s.
148	lf./bz.	....	84-5	....	v. s.	v. s.	v. s.
149	col. lq.	$1.062_{4}^{16^\circ}$	12.3-13	141-2	∞	∞	....
150	col. lq.	1.094^{0°	....	97^{35mm}	....	....	....
151	col. lq.	$0.806_{4}^{20^\circ}$	-82	77.3	s.	....	....
152	cr. pd.	....	226-7	....	0.4^{12°	....	....
153	mn. pr.	$1.360_{4}^{25^\circ}$	151-3	265^{10mm}	1.4^{15°	v. s.	0.6^{15°
154	col. lq.	....	....	$125\text{-}8^{11mm}$	d. h.	d. h.	....
155	col. oil	$0.951_{19}^{19^\circ}$	1	295	v. sl. s.	s.	v. sl. s.
156	pr./aq.	....	102	....	v. s.	s. h.	i.; i. lg.
157	col. cr. pd.	....	d. 207-11	....	0.027^{20°; s. alk.	v. sl. s.; s. a.	i.; i. chl.
158	col. rhb./ aq.	....	297 d.	....	20.5^{45°	v. sl. s. abs.	i.
159	col. nd./aq.	....	295 d.	subl. >200	21.7^{17°; 32^{75°	0.2, 80% c. al.	i.; i. act.
160	col. rhb.	....	196 d.	....	v. s.	v. sl. s. abs.	i.
161	lq.	0.918^{23°	....	173-4	i.; s. aq. a.	s.	s.; s. H_2SO_4
162	mn.	1.404	97-8	....	v. s.	v. s.	v. s.
163	nd.	....	164-6	....	....	....	....
164	nd./aq.	....	285	....	sl. s. h.	s. chl.	s.
165	nd.	....	248-9	....	0.04^{25°; 0.7^{100°	s. h.; s. alk.	s.; i. chl.
166	nd./aq.	....	-H_2O, 100; m. anh. 179	....	0.06^{25°; 6^{100°	s.	s. alk.
167	nd.	....	234	....	sl. s. h.	s.	s.
168	pr./aq.	....	243-4	subl.	sl. s.	s.	s.
169	col. lq.	$1.103_{4}^{20^\circ}$	....	83^{20mm}; d. 85	∞	∞	s.
170	tri.	....	82	in vac. 90-100 (diss.)	v. s.	25^{25°, 99% al.	5^{23°
171	col. cr. pd.	....	80-2	....	sl. s.; s. bz.	s.; s. chl.	s.; s. oil

Aconine, cf. alkd.
Aconitine, cf. alkd.
Acopyrin 566
Acorn sugar 1608
Acraconitine, cf. alkd.
Acrol 1724
Acrylic aldehyde 146
Acrylic amide 148
Adamon 865
Adenine, cf. alkd.
Adormin 5510
Adipic diamide 152
Adonite 156
Adurol-Hauff 1386
Adurol-Schering 944
Aesculin, cf. glcde.
Aethon 3049
Afenil 6387
Agmatine, cf. alkd.
Agotan 5234
Alanine ethyl ester 2945
Alant starch 3872
Alantin 3872
Alantolactone 3497
Alanyl histidine 1251
Alcohol 2946
Aldehyde ammonia 8

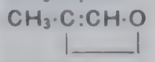
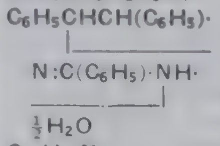
No.	Name	Synonym	Formula	Beil. Ref.	Formul Weight
172	**Alizarin** amide (β) (1,2)	....	$C_6H_4(CO)_2C_6H_2\cdot(OH)NH_2$	XIV-267	239.22
173	amide (α) (2,1)	....	$C_6H_4(CO)_2C_6H_2\cdot(OH)NH_2$	XIV-275	239.22
174	blue	diOH-anthraquinone-quinoline	$C_6H_4(CO)_2C_9H_3N:(OH)_2$	XXI-632	291.25
175	blue S	....	$C_{17}H_9O_4N\cdot 2NaHSO_3$	XXI-633	499.38
176	carboxylic acid (β)	....	$(HO)_2C_6H_2(CO)_2:C_6H_3\cdot CO_2H$	X-1035	284.21
177	3-sulfonic acid (1,2;3)	....	$(HO)_2C_{14}H_5O_2\cdot SO_3H$	XI-355	320.26
178	3-sulfonic acid (Na)	alizarin S; alizarin carmine	$(HO)_2C_{14}H_5O_2\cdot SO_3Na\cdot H_2O$	XI-355	360.27
179	**Aljodan**	iodoethyl allophanate	$IC_2H_4\cdot CO_2NHCONH_2$	**III-56	258.03
180	**Alkannin**	....	$C_{15}H_{14}O_4$	....	258.26
181	**Allantoin** †	glyoxyldiureide	$C_4H_6O_3N_4$	XXV-474	158.12
182	**Allanturic acid**	lantanuric acid	$NH_2\cdot CO\cdot N:CH\cdot CO_2H$	XXV-475	116.08
183	**Allene**	propadiene	$CH_2:C:CH_2$	I-248	40.06
184	**Alloxan**	mesoxalylurea	$\underline{HN\cdot(CO)_3\cdot NH\cdot CO}\cdot 4H_2O$	XXIV-500	214.14
185	**Alloxan**	....	$\underline{HN\cdot(CO)_3\cdot NH\cdot CO}$	XXIV-500	142.07
186	**Alloxan** (monohydrate)	....	$\underline{CO\cdot NHCONHCO\cdot C}:(OH)_2$	XXIV-500	160.09
187	**Alloxanic acid**	....	$C_4H_4O_5N_2$	III-772	160.09
188	**Alloxantin**	uroxin	$C_8H_6O_8N_4\cdot 2H_2O$	XXVI-556	286.16
189	**Allyl** acetate	....	$CH_3CO_2\cdot C_3H_5$	II-136	100.11
190	acetic acid	pentenoic acid	$CH_2:CH\cdot C_2H_4\cdot CO_2H$	II-425	100.11
191	acetone	....	$C_3H_5\cdot CH_2\cdot CO\cdot CH_3$	I-734	98.14
192	acetonitrile	....	$C_3H_5\cdot CH_2CN$	II-426	81.11
193	alcohol	propen-1-ol-3	$CH_2:CH\cdot CH_2OH$	I-436	58.08
194	amine	....	$CH_2:CH\cdot CH_2\cdot NH_2$	IV-205	57.09
195	*iso*-amyl ether	....	$C_3H_5\cdot O\cdot C_5H_{11}$	I-438	128.21
196	aniline	....	$C_3H_5\cdot NH\cdot C_6H_5$	XII-170	133.19
197	arsonic acid	....	$CH_2:CH\cdot CH_2\cdot AsO(OH)_2$	**IV-998	166.00
198	benzoate	....	$C_6H_5\cdot CO_2\cdot C_3H_5$	IX-114	162.18
199	bromide	3-bromo-propene-1	$CH_2:CH\cdot CH_2Br$	I-201	120.99
200	butyrate	....	$CH_3(CH_2)_2CO_2\cdot C_3H_5$	II-272	128.17
201	caproate (*n*)	....	$CH_3(CH_2)_4CO_2\cdot C_3H_5$	**II-285	156.22
202	chloride	3-chloro-propene-1	$CH_2:CH\cdot CH_2Cl$	I-198	76.53
203	cinnamate	....	$C_6H_5\cdot(CH)_2CO_2\cdot C_3H_5$	....	188.22
204	cyanide	vinyl-acetonitrile	$CH_2:CH\cdot CH_2\cdot CN$	II-408	67.09
205	*iso*-cyanide	allyl carbylamine	$CH_2:CH\cdot CH_2\cdot NC$	IV-208	67.09
206	ether	diallyl ether	$(CH_2:CH\cdot CH_2)_2O$	I-438	98.14
207	formate	....	$HCO_2\cdot CH_2\cdot CH:CH_2$	II-23	86.09
208	iodide	3-iodo-propene-1	$CH_2:CH\cdot CH_2I$	I-202	167.99
209	malonic acid	....	$C_3H_5\cdot CH(CO_2H)_2$	II-776	144.12
210	mercaptan	....	$CH_2:CH\cdot CH_2\cdot SH$	I-440	74.14
211	phenol (*p*)	chavicol	$CH_2:CH\cdot CH_2\cdot C_6H_4\cdot OH$	VI-571	134.17

† Cf. also Alkaloids table.

Alival 3402
Alizarin 2297
Alizarin (leuco) 2295
Alizarin S 177
Alizarin bordeaux 5801
Alizarin carmine 177
Alizarin orange 4599
Alizarin β-quinoline 174
Alizarin red R 178
Alizarin yellow A 6224
Alizarin yellow C 6211
Alizarin yellow R 4653

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
172	br. nd./al.	....	....	....	i.	s.	s.; sl. s. NH_4OH
173	br. nd./al.	....	250	....	s. alk.	s.	s.; s. alk. carb.
174	b. met. nd./bz.	....	270 ±	subl.	i.; s. h. bz.	sl. s.; s. ac.	sl. s.
175	r. br. cr.	....	....	....	v. s.; d. h.	sl. s.	i.
176	or. nd./ $PhNO_2$	....	305	subl.	s. aq. NaOAc	sl. s.	v. sl. s.
177	or. yel. cr.	....	....	....	s.	s.	i.
178	or. yel. pd.	....	....	....	s.	s.	....
179	col. pd.	....	192 ± d.	....	sl. s.	s.; s. act.	v. sl. s. bz.
180	br. met.	....	<100	....	s. alk.	v. sl. s.	v. sl. s.
181	nd./h. aq.	....	235-6	....	$0.76^{22°}$; 3.3 h.	sl. s.; s. NaOH	i.
182	hyg. pd.	....	....	....	delq.	i.	d. h. alk.
183	gas	....	−146	−32	....	....	....
184	rhb. pr. /aq.; eff. $-3H_2O$	....	$-4H_2O$, 150	d. 170	s.	s.	....
185	rhb. yel. hyg.	....	d. 170	....	v. s.; s. ac.	v. s.; sl. s. pet.	i.; sl. s. chl.
186	tri./aq.	....	d. 170	....	v. s.	v. s.	i.
187	tri.	....	d.	....	v. s.	16	s.
188	rhb.	....	$-2H_2O$, 120	d. 253-5	$0.3^{25°}$; 6h.	v. sl. s.	v. sl. s.
189	col. lq.	$0.928^{20°}_{4}$	....	104^{762mm}	i.	∞	∞
190	col. lq.	$0.984^{18°}_{4}$	<−18	187-9	sl. s.	s.	s.
191	col. lq.	$0.847^{16°}_{4}$	....	129^{748mm}	i.	....	....
192	lq.	$1.180^{13°}$	....	140	i.	....	....
193	lq.	$0.854^{20°}_{4}$	−129	96.6	∞	∞	∞
194	col. lq.	$0.761^{22°}_{4}$	....	56.5^{756mm}	∞	∞	∞
195	col. lq.	....	....	120	i.	∞	∞
196	yel. oil	$0.982^{25°}$	....	$217\text{-}9^{736mm}$	i.	s.	s.
197	col. cr./aq.	....	129-30	....	v.s.h.; d.h.a.	s.	....
198	yel. lq.	$1.058^{15°}_{15}$	....	230	i.	s.	s.
199	lq.	$1.398^{20°}_{4}$	−119.4	$70\text{-}1^{753mm}$	i.	∞	∞
200	col. lq.	....	....	143^{772mm}	i.	s.	s.
201	pa. yel. lq.	....	....	186-8	i.	s.	s.
202	col. lq.	$0.938^{20°}_{4}$	−136.4	44.6	<0.1	∞	∞
203	col. cr.	$1.052^{25°}_{25}$	....	286 d.	i.	s.	v. s.
204	col. lq.	$0.837^{16°}$	−86.8	118-9	....	s.	....
205	lq.	$0.797^{17°}$	....	106	sl. s.	s.	∞
206	lq.	$0.826^{20°}_{4}$	....	94.3	0.3	∞	∞
207	lq.	$0.948^{18°}$	....	83.6^{768mm}	i.	s.	....
208	yel. lq.	$1.848^{12°}_{12}$	−99.3	102^{744mm}	i.	∞	∞
209	cr./et.	....	102-5	d.−CO_2,180	s.	s.	s.; s. h. bz.
210	lq.	$0.925^{23°}_{4}$	....	67-8	....	∞	∞
211	lq.	$1.023^{19.4°}_{4}$	<−25	237	∞ pet.	∞; ∞ chl.	∞

"Alkazene 6" 3575
"Alkazene 12" 2778
"Alkazene 20" 1379
"Alkazene 32" 5055
Allantoin, cf. alkd.
Allocinnamic acid 1497
Allophanamide 859
Allothreonine 5934
Alloxan-oxime 6445
Allyl-benzene 5223-5
Allyl-carbinol 6437
Allyl-carbylamine 205
Allyl ethyl ether 2949
Allyl guaiacol 3218
Allyl iodourotropine 3600

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Allyl				
212	phenylcinchonate	atoquinol (2,4)	$C_9H_5N(C_6H_5)CO_2 \cdot C_3H_5$	....	289.32
213	phenylcinchonate HCl	....	$C_{19}H_{15}O_2N \cdot HCl$	....	325.78
214	phenyl ether	....	$C_3H_5 \cdot O \cdot C_6H_5$	VI-144	134.17
215	phenyl urea (*N,N'*)	....	$C_3H_5NH \cdot CO \cdot NHC_6H_5$	XII-350	176.21
216	propionate	....	$C_2H_5 \cdot CO_2 \cdot C_3H_5$	II-241	114.14
217	*iso*-propylacetyl-carbamide	sedormid	$(C_3H_7)(C_3H_5):CH \cdot CO \cdot NHCONH_2$	**III-53	184.23
218	pyridine (2)	....	$C_3H_5 \cdot C_5H_4N$	....	119.16
219	thiocyanate	....	$C_3H_5 \cdot SCN$	III-177	99.15
220	*iso*-thiocyanate	mustard oil	$C_3H_5 \cdot N:C:S$	IV-214	99.15
221	thiourea	thiosinamine	$C_3H_5 \cdot NH \cdot CS \cdot NH_2$	IV-211	116.18
222	trisulfide	....	$(C_3H_5)_2S_3$	I-441	178.32
223	urea	....	$C_3H_5 \cdot NH \cdot CO \cdot NH_2$	IV-209	100.12
224	*iso*-valerate	....	$(CH_3)_2CH \cdot CH_2 \cdot CO_2C_3H_5$	II-313	142.19
225	**Allylene**	propyne; propine	$CH_3 \cdot C \vdots CH$	I-246	40.06
226	oxide	....	 $CH_3 \cdot C:CH \cdot O$	XVII-20	56.06
227	**Aloin**	....	$C_{21}H_{20}O_9$	....	416.37
228	**Alstonine**	....	$C_{21}H_{20}O_4N_2 \cdot 3\frac{1}{2}H_2O$	....	427.44
229	**Aluminum** ethoxide	....	$Al(OC_2H_5)_3$	I-313	164.15
230	triethyl	....	$Al(C_2H_5)_3$	IV-643	114.15
231	trimethyl	....	$Al(CH_3)_3$	IV-643	72.07
232	**Amalinic acid**	tetraMe-alloxantin	$(CH_3)_4C_8H_2O_8N_4$	XXVI-559	342.26
233	**Amarine**	triphenyl-iminazoline	 $C_6H_5CHCH(C_6H_5) \cdot N:C(C_6H_5) \cdot NH \cdot \frac{1}{2}H_2O$	XXIII-304	307.38
234	**Amaron**	tetraphenylpyrazine	$C_{28}H_{20}N_2$	XXIII-343	384.46
235	**Amino**-acetone	acetonyl-amine	$NH_2 \cdot CH_2 \cdot CO \cdot CH_3$	IV-314	73.09
236	acetophenone (*o*)	....	$NH_2 \cdot C_6H_4 \cdot CO \cdot CH_3$	XIV-41	135.16
237	acetophenone (*m*)	....	$NH_2 \cdot C_6H_4 \cdot CO \cdot CH_3$	XIV-45	135.16
238	acetophenone (*p*)	....	$NH_2 \cdot C_6H_4 \cdot CO \cdot CH_3$	XIV-46	135.16
239	acetophenone (ω)	phenacylamine	$C_6H_5 \cdot CO \cdot CH_2 \cdot NH_2$	XIV-49	135.16
240	acetophenone HCl (ω)	....	$C_8H_7O \cdot NH_2 \cdot HCl$	XIV-49	171.63
241	alizarin (3)	β-aminoalizarin	$C_6H_4(CO)_2C_6H \cdot (OH)_2NH_2$	XIV-285	255.22
242	alizarin (4)	α-aminoalizarin	$C_{14}H_5O_2(OH)_2NH_2$	XIV-286	255.22
243	amylene glycol	2-NH₂-2-Et-1,3-propandiol	$C_2H_5 \cdot C(NH_2):(CH_2OH)_2$	....	119.16
244	anthraquinone (1)	....	$C_6H_4(CO)_2C_6H_3NH_2$	XIV-177	223.22
245	anthraquinone (2)	....	$C_6H_4(CO)_2C_6H_3NH_2$	XIV-191	223.22
246	2-azo-5-anisole	benzene-azo-*o*-anisidine (5;2,1)	$C_6H_5 \cdot N:N \cdot C_6H_3(NH_2) \cdot OCH_3$	XVI-396	227.26
247	azobenzene (*o*)	....	$NH_2 \cdot C_6H_4 \cdot N_2 \cdot C_6H_5$	XVI-303	197.23
248	azobenzene (*m*)	....	$NH_2 \cdot C_6H_4 \cdot N_2 \cdot C_6H_5$	XVI-304	197.23

Allyl sulfide 1684
Allylen dichloride 2059
Almond oil 642
Alpha S acid 4533
Alphogen 5662
Alphol 4568
Alphozone 5662
Alurate 5370
Alypin 736-7
Amatol, a mixt. of 6316 and ammonium nitrate.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
212	yel. nd./al.	....	36	260^{15mm}	i.; s. oil	8; s. bz.	v. s.
213	yel. nd./al.	....	145-7	....	d.	s. h.	i.
214	col. oil	$0.986\frac{15°}{15}$	....	191.7	i.	....	....
215	nd./bz.	....	114.5-5.5	....	s. bz.	....	....
216	col. lq.	....	....	124.5^{774mm}	....	....	....
217	nd./al.	....	194	....	0.03c., 0.5 h.	10	1.3
218	lq.	$0.959^{0°}$	....	189-90	....	....	....
219	oil	$1.056^{15°}$	....	161	v. sl. s.	v. s.	v. s.
220	col. oil	$1.013\frac{20°}{4}$	-80	152	0.2	∞	∞
221	col. pr.	$1.219\frac{20°}{20}$	77-8	....	30^{0}; s. h.	s.; i. bz.	v. sl. s.
222	lq.	$1.085^{15°}$	....	$112\text{-}22^{16mm}$	....	....	....
223	nd./al.	....	85	....	v. s.	v. s.	v. sl. s.
224	lq.	....	....	155	....	∞	∞
225	gas	$0.660\frac{-13°}{4}$	-102.7	-23.2	v. sl. s.	v. s.	$3000cc.^{16°}$
226	lq.	....	....	62-3	sl. s.	....	i. aq. K_2CO_3
227	yel. pr./al.	....	147.9	....	sl. s. h.	sl. s. h.	v. s. alk.
228	br. amor.	....	<100; 195 ± (anh.)	....	sl. s.	s.	v. sl. s.
229	pd.	$1.142\frac{20°}{0}$	150-60	$200\text{-}5^{10mm}$	d.	i.; sl. s. bz.	v. sl. s.
230	col. lq.	....	<-18	194	....	....	....
231	col. lq.	....	0	129-30	....	....	....
232	cr./aq.	....	221 d.	....	sl. s. h.	v. sl. s.	s. alk.
233	cr./al.	....	106; 131-3 (anh.)	d. 198 (anh.)	i.	s.	s.
234	red nd./ac.	....	245-6	subl.	i.; v. s. h. bz.	sl. s. h.; s. chl.	sl. s. h.
235	only salts are known	....	....	....	....	....	....
236	yel. oil	....	....	250 (sl. d.)	i.	s.	s.
237	lf./aq.	....	99.5	289-90	....	....	....
238	cr./aq.	....	106	293-5	s. h.	s.	s.
239	unstable	....	....	....	....	....	....
240	cr.	....	184-8	....	s.	....	i.
241	red pr./ac.	....	>300	subl. d.	s. KOH	sl. s.	sl. s. HCl
242	bl. nd./al.	....	....	....	s. alk.	s.	....
243	col. cr.	$1.099\frac{20°}{20}$	37.5-8.5	$152\text{-}3^{10mm}$	∞	∞	v. sl. s.
244	red nd.	....	256	subl.	i.; s. HCl	s.; s. bz.	s.; s. chl.
245	red nd./al.	....	302	subl.	i.	s.	i.; s. bz.
246	red br. pl./PhMe	....	110.5-1.5	....	s. ac.	s.; s. bz.	s.
247	red pr./al.	....	59	....	i.	v. s.	v. s.
248	or. nd./lg.	....	56-7	....	s. bz.	s.	s.; s. chl.

Amber salt 5653
Amidol 1724
Amidopyrine 363
Amino-acetic acid 3437
Amino-acetanilide 107-8
Amino-acetylphenetidine 5115
Amino-anilinoacetic acid 358
Amino-anisole 534-6
Amino-anthracene 542-3

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Amino				
249	azobenzene (*p*)	aniline yellow	$NH_2\cdot C_6H_4\cdot N_2\cdot C_6H_5$	XVI-307	197.23
250	azobenzene HCl (*p*)	....	$C_{12}H_9N_2(NH_2)\cdot HCl$	XVI-310	233.70
251	*α*-azonaphthalene	azodinaphthylamine	$NH_2\cdot C_{10}H_6\cdot N_2\cdot C_{10}H_7$	XVI-365	297.34
252	azophenylene	benzotriazole	$C_6H_4NH\cdot N{:}N$	XXVI-38	119.12
253	azoxylene HCl	....	$(CH_3)_4C_{12}H_5(NH_2)N_2\cdot HCl$	....	289.80
254	benzaldehyde (*o*)	....	$NH_2\cdot C_6H_4\cdot CHO$	XIV-21	121.13
255	benzaldehyde (*m*)	....	$NH_2\cdot C_6H_4\cdot CHO$	XIV-28	121.13
256	benzaldehyde (*p*)	....	$NH_2\cdot C_6H_4\cdot CHO$	XIV-29	121.13
257	benzaldoxime (*o*)	....	$NH_2\cdot C_6H_4\cdot CH{:}NOH$	XIV-24	136.15
258	benzaldoxime (*m*)	....	$NH_2\cdot C_6H_4\cdot CH{:}NOH$	XIV-28	136.15
259	benzamide (*o*)	anthranilamide	$NH_2\cdot C_6H_4\cdot CO\cdot NH_2$	XIV-320	136 15
260	benzamide (*m*)	....	$NH_2\cdot C_6H_4\cdot CO\cdot NH_2\cdot H_2O$	XIV-390	154.17
261	benzamide (*p*)	....	$C_7H_8ON_2\cdot \frac{1}{4}H_2O$	XIV-425	140.66
262	benzidine (2,4;4′)	triamino-diphenyl	$(NH_2)_2C_6H_3C_6H_4\cdot NH_2$	XIII-306	199.25
263	benzimidazole (2)	*o*-phenylene-guanidine	$C_6H_4\cdot NH\cdot C(NH_2){:}N$	XXIV-116	133.15
264	benzoic acid (*o*)	anthranilic acid	$NH_2\cdot C_6H_4\cdot CO_2H$	XIV-310	137.13
265	benzoic acid (*m*)	....	$NH_2\cdot C_6H_4\cdot CO_2H$	XIV-383	137.13
266	benzoic acid (*p*)	aminodracylic acid	$NH_2\cdot C_6H_4\cdot CO_2H$	XIV-418	137.13
267	benzonitrile (*o*)	anthranilic nitrile	$NH_2\cdot C_6H_4\cdot CN$	XIV-322	118.13
268	benzonitrile (*m*)	....	$NH_2\cdot C_6H_4\cdot CN$	XIV-391	118.13
269	benzonitrile (*p*)	....	$NH_2\cdot C_6H_4\cdot CN$	XIV-425	118.13
270	benzophenone (*o*)	....	$C_6H_5\cdot CO\cdot C_6H_4\cdot NH_2$	XIV-76	197.23
271	benzophenone (*m*)	....	$C_6H_5\cdot CO\cdot C_6H_4\cdot NH_2$	XIV-81	197.23
272	benzophenone (*p*)	....	$C_6H_5\cdot CO\cdot C_6H_4\cdot NH_2$	XIV-81	197.23
273	benzothiazole (2)	....	$C_6H_4\cdot N{:}C(NH_2)\cdot S$	XXVII-182	150.19
274	benzyl-cyanide (*p*)	aminophenyl-aceto-nitrile	$H_2N\cdot C_6H_4\cdot CH_2\cdot CN$	XIV-457	132 16
275	benzyl-cyanide HCl (*p*)	....	$H_2N\cdot C_6H_4\cdot CH_2\cdot CN\cdot HCl$	XIV-457	168.62
276	benzoyl-2,2-dimethyl-3-diethylaminopropanol HCl (*p*)	larocaine	$H_2N\cdot C_6H_4\cdot CO_2\cdot CH_2\cdot C(CH_3)_2\cdot CH_2\cdot N(C_2H_5)_2\cdot HCl$	....	314.85
277	butyric acid (*α*) (*dl*)	....	$C_2H_5\cdot CHNH_2\cdot CO_2H$	IV-408	103.12
278	butyric acid (*β*) (*dl*)	....	$CH_3\cdot CHNH_2\cdot CH_2\cdot CO_2H$	IV-412	103.12
279	butyric acid (*γ*)	piperidinic acid	$NH_2\cdot (CH_2)_3\cdot CO_2H$	IV-413	103.12
280	*iso*-butyric acid (*α*)	....	$(CH_3)_2CNH_2\cdot CO_2H$	IV-414	103.12
281	camphor (3) (*α*)	....	$C_{10}H_{15}O\cdot NH_2$	XIV-10	167.24
282	*n*-caproic acid (*α*) (*dl*)	....	$CH_3(CH_2)_3CHNH_2\cdot CO_2H$	IV-433	131.17
283	*n*-caproic acid (*α*)	norleucine (*l* +)	$CH_3(CH_2)_3CHNH_2\cdot CO_2H$	IV-432	131.17
284	*n*-caproic acid (*ε*)	....	$H_2N(CH_2)_5CO_2H$	IV-434	131.17

Amino-azotoluene 309-12
Amino-barbituric acid 6384
Amino-benzene 513

Amino-benzene sulfonic acid 523-5
Amino-butyl-guanidine, cf. alkd.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
249	yel. mn.	....	126-7	225^{120mm}	sl. s. h.	s. h.	s.
250	steel b.*	....	....	....	s.	....	....
251	br. nd.	....	175	....	sl. s. bz.	sl. s.	sl. s.
252	col. nd./bz.	....	98.5	....	i.	s.	s. bz.
253	br. pd.	....	....	....	i.	s.	sl. s.
254	lf.	....	39-40	d.	v. sl. s.	v. s.	v. s.
255	unstable	....	....	....	....	....	....
256	lf./aq.	....	71.5	....	s.	....	....
257	nd./bz.	....	135-6	subl.	v. sl. s.	s.	s.
258	nd./bz.	....	88	....	v. sl. s. lg.	s.	s.
259	lf./chl.	....	108	300 ± (sl.d.)	v. s. h.	v. s.	sl. s.; i. bz.
260	mn./aq.	....	78-9	$-H_2O > 100$	s.	s.	s.
261	pa. yel. cr.	....	182.9 (anh.)	$-\frac{1}{2}H_2O$, 170	sl. s.	....	....
262	nd.	....	134	....	....	....	....
263	lf./aq.	....	222-4	....	s.; s. alk.; s. dil. a.	s.; s. act.; v. sl. s. bz.	v. sl. s.
264	col. rhb.	....	144-5	subl.	$0.35^{14°}$	$**10.7^{10°}$	$16^{7°}$
265	nd./aq.	$1.511^{4°}$	173-4	....	$**0.6^{15°}$	$**2.2^{10°}$	$1.8^{6°}$
266	mn./pr.	....	187-8	....	$0.3^{13°}$	$**11.3^{10°}$	$8.2^{6°}$
267	nd./CS_2	....	51	$267\text{-}8^{777mm}$	v. sl. s.	s.	s.
268	nd./aq. al.	....	53	288-90	s. h.	v. s.	v. s.
269	mn. pr.	....	86	d.	v. s. h.	v. s.	v. s.; i. HCl
270	yel. lf./al.	....	106-10	....	....	s.	s.
271	yel. lf./aq.	....	86-7	....	sl. s.	s.	s.
272	lf./aq. al.	....	124	....	v. sl. s. c.	v. s.	$2^{25°}$
273	lf./aq.	....	130-2	d.	v. sl. s.; s. conc. a.	s.; s. chl.	s.
274	lf./aq.	....	46	312	sl. s. h.	s.	s.
275	cr.	....	217-20	....	....	v. sl. s. c.	....
276	col. cr.	....	196-7	....	33.3	10	sl. s. c.
277	lf.	....	285 d.	subl. > 300	33 c.	0.2 h.	i.
278	cr.	....	193-4	....	100	i. abs. al.	i. abs. et.
279	lf. or nd.	....	203 d.	....	v. s.	i.	i.
280	pl. or pr./aq.	....	203 d.	subl. 280	v. s.	sl. s.	i.
281	waxy cr.	....	70-110	245-6	i.	s.	s.
282	col. lf./aq.	....	300 ± †	....	1.25	....	....
283	pl. or lf./aq.	....	301	subl. > 275	$1.74^{23°}$	v. sl. s.	....
284	lf./MeOH-et.	....	202-3	softens > 190	v. s.	i.	sl. s. MeOH

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* Also a red-black crystalline form.

** In 90% alcohol.

† Sealed tube.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
285	**Amino** *iso*-caproic (α)	leucine (*l* −)	$(CH_3)_2CHCH_2\cdot CH(NH_2)\cdot CO_2H$	IV-437	131.17
286	caproic acid (α)	isoleucine (*l* +)	$(C_2H_5)(CH_3)CH\cdot CHNH_2CO_2H$	IV-454	131.17
287	caproic acid (α)	allo-isoleucine (*d* −)	$(C_2H_5)(CH_3)CH\cdot CHNH_2CO_2H$	IV-457	131.17
288	caprylic acid (α) (*dl*)	....	$CH_3(CH_2)_5CHNH_2\cdot CO_2H$	IV-461	159.22
289	cinnamic acid (*o*)	....	$H_2N\cdot C_8H_6\cdot CO_2H$	XIV-517	163.17
290	cinnamic acid (*m*)	....	$H_2N\cdot C_8H_6\cdot CO_2H$	XIV-520	163.17
291	cinnamic acid (*p*)	....	$H_2N\cdot C_8H_6\cdot CO_2H$	XIV-521	163.17
292	*o*-cresol (4;1,2)	amino-hydroxy-toluene	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	XIII-574	123.15
293	*o*-cresol (5;1,2)	....	$NH_2\cdot C_6H_3CH_3\cdot(OH)$	XIII-576	123.15
294	*o*-cresol H_2SO_4	(5;1,2)	$(C_7H_9ON)_2\cdot H_2SO_4$	XIII-576	344.38
295	*m*-cresol (2;1,3)	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	XIII-589	123.15
296	*m*-cresol (4;1,3)	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	XIII-590	123.15
297	*m*-cresol (6;1,3)	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	XIII-593	123.15
298	*p*-cresol (2;1,4)	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	XIII-598	123.15
299	*p*-cresol (3;1,4)	....	$NH_2\cdot C_6H_3\cdot CH_3(OH)$	XIII-601	123.15
300	dibutylaniline (*p*)	....	$(C_4H_9)_2N\cdot C_6H_4\cdot NH_2$	*XIII-23	220.35
301	dibutylaniline (*p*)	HCl	$C_{14}H_{24}N_2\cdot 2HCl$	*XIII-23	293.28
302	diethylamino-toluene (mono) HCl	(5;1,2)	$(C_2H_5)_2N\cdot C_6H_3\cdot(CH_3)NH_2\cdot HCl$	....	214.74
303	diethylaniline (*p*)	diEt-phenylene-diNH$_2$	$(C_2H_5)_2N\cdot C_6H_4\cdot NH_2$	XIII-75	164.24
304	diethylaniline (*p*)	(mono-HCl)	$C_{10}H_{16}N_2\cdot HCl$	....	200.71
305	dimethylaniline (*o*)	diMe-*o*-phenylene-diamine (*N*,*N*)	$(CH_3)_2N\cdot C_6H_4\cdot NH_2$	XIII-15	136.19
306	dimethylaniline (*m*)	....	$(CH_3)_2N\cdot C_6H_4\cdot NH_2$	XIII-38	136.19
307	dimethylaniline (*p*)	....	$(CH_3)_2N\cdot C_6H_4\cdot NH_2$	XIII-72	136.19
308	dimethylaniline (*p*)	H_2SO_4	$C_8H_{12}N_2\cdot H_2SO_4$	XIII-73	234.27
309	2,3′-dimethyl-azobenzene (4)	amino-azo-toluene (3′;1,2,4)	$CH_3\cdot C_6H_4\cdot N_2\cdot C_6H_3\cdot(CH_3)NH_2$	XVI-348	225.28
310	2,3′-dimethyl-azobenzene (4′)	(2;1,3′,4′)	$CH_3\cdot C_6H_4\cdot N_2\cdot C_6H_3\cdot(CH_3)NH_2$	XVI-344	225.28
311	2,4′-dimethyl-azobenzene (4)	(4′;1,2,4)	$CH_3\cdot C_6H_4\cdot N_2\cdot C_6H_3\cdot(CH_3)NH_2$	XVI-348	225.28
312	3,4′-dimethyl-azobenzene (4)	(4′;1,3,4)	$CH_3\cdot C_6H_4\cdot N_2\cdot C_6H_3\cdot(CH_3)NH_2$	XVI-345	225.28
313	diphenylamine (*o*)	*N*-phenyl-*o*-phenylenediamine	$NH_2\cdot C_6H_4\cdot NH\cdot C_6H_5$	XIII-16	184.23
314	diphenylamine (*p*)	....	$NH_2\cdot C_6H_4\cdot NH\cdot C_6H_5$	XIII-76	184.23
315	diphenylamine (*p*)	HCl	$C_{12}H_{10}N\cdot NH_2\cdot HCl$	*XIII-23	220.70
316	diphenylamine (*p*)	H_2SO_4	$(C_{12}H_{10}N\cdot NH_2)_2\cdot H_2SO_4$	XIII-78	466.54
317	4-(*p*-diphenyl)-thiazole (2)	....	$C_6H_5\cdot C_6H_4\cdot C:CH\cdot$ $S\cdot C(NH_2):N$	....	252.32
318	ethylacetanilide (*p*)	....	$NH_2C_6H_4N(C_2H_5)\cdot COCH_3$	....	178.23

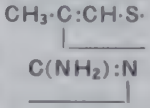
Amino-cyclohexane 326
Amino-cymene 1256
Amino-dihydro-phthalazinedione 359

Amino-diiodobenzoic acid 2383
Amino-dimethylbenzene 6471-5, 6477
Amino-diphenyl 5153-5

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
285	lf./aq. al.	$1.293\frac{18}{4}^{\circ}$	293-5 d.*	subl.	2^{17°; 6.6 h.	0.07^{17° abs.	i.; 10.9 ac.
286	rhb./80% al.	....	280 d.*	subl. >280	$3.9^{15.5^\circ}$; 6.1^{75°	sl. s. h.; s. h. ac.	i.; s. h. gly.
287	lf. or rods	....	280 d.*	....	2.6^{20°	i. c.	s. h. ac.
288	lf./aq.	....	263-4; subl.	....	sl. s. c.; 0.6 h.	v. sl. s.	v. sl. s.
289	yel. nd.	....	158-9 d.	....	s. h.	s.	s.
290	pa. yel. nd./al.	....	181-2	....	sl. s. h.	s.	s.
291	yel. nd.	....	175-6 d.	....	s. h.	s.	s.
292	col. lf./aq.	....	159-61	subl.	s. h.	v. s.	v. s.
293	lf./bz.	....	174-5	subl.	v. sl. s.	s.	s.; sl. s. bz.
294	....	....	178-9	....	s.	i.	i.
295	lf.	....	148-50	subl.	....	....	....
296	lf.	....	....	....	....	....	....
297	cr./bz.	....	174 d.	....	....	....	....
298	cr./aq.	....	144.5	subl.	sl. s. c.	....	....
299	rhb./bz.	....	135	subl.	i. c.	s.; sl. s. bz.	s.; s. chl.
300	lq.	....	....	....	....	....	....
301	nd./al.	....	....	....	s.	s.	i.
302	col. nd.	....	....	....	s.	sl. s.	i.
303	lq.	....	....	260-2	i.	s.	s.
304	col. nd.	....	....	....	s.	s.	i.
305	oil	....	....	$217.5^{751.5mm}$	sl. s.	s.	s.
306	oil	0.995^{25°	<-20	$268\text{-}70^{740mm}$	sl. s.	s.	s.
307	col. nd.	$1.041\frac{15}{15}^{\circ}$	41	262.3	s. c.	v. s.	s.; s. chl.
308	lf.	....	....	....	v. s.	....	....
309	yel. nd.	....	80	....	i.	s.	....
310	yel. mn./al.	....	100	....	i.	s.	s.; s. chl.
311	yel. lf./al.	....	127	....	i.	s.	sl. s. lg.
312	yel. nd./lg.	....	127-8	....	i.	s.	sl. s. lg.
313	nd./aq.	....	79-80	....	s. chl.	s. act.	s. bz.; sl. s. lg.
314	nd./aq. al.	....	66-7**	354 (in H_2)	sl. s.	s. abs. al.	s.
315	grn. pd.	....	....	....	s. h.	s. h.	i.
316	gr. pd.	....	....	....	v. sl. s.	sl. s.	i.
317	col. pd.	....	206-8	....	i.	s. h.	i.
318	col. fl.	....	98-9	....	i.	v. s.	i.

* Sealed tube.
** Cryst./pet. m.p. 75°.
Amino-dracylic acid 266

Amino-ethane 2950
Amino-ethyl alcohol 8, 2907

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
319	**Amino** ethylbenzene (*o*)	*o*-Et-aniline	$NH_2\cdot C_6H_4\cdot C_2H_5$	XII-1089	121.18
320	ethylbenzene (*m*)	....	$NH_2\cdot C_6H_4\cdot C_2H_5$	XII-1090	121.18
321	ethylbenzene (*p*)	....	$NH_2\cdot C_6H_4\cdot C_2H_5$	XII-1090	121.18
322	guanidine	guanyl hydrazine	$H_2N\cdot C(NH)\cdot NH\cdot NH_2$	III-117	74.09
323	guanidine H_2CO_3	(bicarbonate)	$CH_6N_4\cdot H_2CO_3$	III-118	136.12
324	guanidine H_2SO_4	(acid sulfate)	$CH_6N_4\cdot H_2SO_4$	III-118	172.17
325	guanidine H_2SO_4	....	$(CH_6N_4)_2\cdot H_2SO_4\cdot H_2O$	....	264.27
326	hexahydrobenzene	cyclohexylamine	$H_6C_6H_5\cdot NH_2$	XII-5	99.17
327	1-hydroxyanthraquinone (4)	quinizarinamide	$C_6H_4(CO)_2C_6H_2\cdot(OH)NH_2$	XIV-268	239.22
328	malonic acid	....	$NH_2\cdot CH(CO_2H)_2$	IV-469	119.08
329	4-methylthiazole (2)	....	 $CH_3\cdot C{:}CH\cdot S\cdot$ $C(NH_2){:}N$	XXVII-159	114.16
330	methylacetanilide (*p*)	....	$NH_2\cdot C_6H_4\cdot N(CH_3)\cdot COCH_3$	....	164.20
331	naphthalene-4-azobenzene-*p*-sulfonic acid (1)	(1,4;4′)	$NH_2\cdot C_{10}H_6\cdot N{:}N\cdot C_6H_4\cdot SO_3H$	....	327.36
332	α-naphthol (4,1)	4-amino-naphthol-1	$NH_2\cdot C_{10}H_6\cdot OH$	XIII-667	159.18
333	α-naphthol (8,1)	8-amino-naphthol-1	$NH_2\cdot C_{10}H_6\cdot OH$	XIII-672	159.18
334	β-naphthol (1,2)	1-amino-naphthol-2	$NH_2\cdot C_{10}H_6\cdot OH$	XIII-676	159.18
335	β-naphthol (1,2)	HCl	$NH_2\cdot C_{10}H_6\cdot OH\cdot HCl$	XIII-677	195.65
336	β-naphthol (7,2)	7-amino-naphthol-2	$NH_2\cdot C_{10}H_6\cdot OH$	XIII-684	159.18
337	1-naphthol-3-sulfonic acid (6) (6;1,3)	J acid	$NH_2\cdot C_{10}H_5(OH)\cdot SO_3H$	XIV-823	239.24
338	1-naphthol-3-sulfonic acid (7) (7;1,3)	gamma acid	$NH_2\cdot C_{10}H_5(OH)\cdot SO_3H$	XIV-828	239.24
339	1-naphthol-5-sulfonic acid (8) (8;1,5)	S acid	$NH_2\cdot C_{10}H_5(OH)\cdot SO_3H$	XIV-835	239.24
340	2-naphthol-4-sulfonic acid (1) (1;2,4)	1:2:4-acid	$NH_2\cdot C_{10}H_5(OH)\cdot SO_3H\cdot\frac{1}{2}H_2O$	XIV-846	248.25
341	2-naphthol-6-sulfonic acid (1) Na	eikonogen (1;2,6)	$NH_2\cdot C_{10}H_5(OH)\cdot SO_3Na\cdot 2\frac{1}{2}H_2O$	XIV-848	306.27
342	1-naphthol-3,6-disulfonic acid (8;1,3,6)	H acid	$NH_2\cdot C_{10}H_4(OH){:}(SO_3H)_2$	XIV-840	319.30
343	naphthol-disulfonic acid Na	H acid Na salt	$C_{10}H_7O_7NS_2Na_2\cdot 1\frac{1}{2}H_2O$	XIV-840	390.30
344	1-naphthol-5,7-disulfonic acid (8;1,5,7)	2S acid	$NH_2\cdot C_{10}H_4(OH){:}(SO_3H)_2$	XIV-845	319.30
345	phenol (*o*)	2-aminophenol	$NH_2\cdot C_6H_4\cdot OH$	XIII-354	109.12
346	phenol (*o*) HCl	....	$HO\cdot C_6H_4\cdot NH_2\cdot HCl$	XIII-358	145.59
347	phenol (*m*)	3-aminophenol	$NH_2\cdot C_6H_4\cdot OH$	XIII-401	109.12
348	phenol (*m*) HCl	....	$HO\cdot C_6H_4\cdot NH_2\cdot HCl$	XIII-403	145.59
349	phenol (*p*)	*p*-hydroxyaniline	$NH_2\cdot C_6H_4\cdot OH$	XIII-427	109.12
350	phenol (*p*) HCl	....	$HO\cdot C_6H_4\cdot NH_2\cdot HCl$	XIII-434	145.59

Amino-ethyl-indole 6363
Amino-ethyl propandiol 243
Amino-form 3599
Amino G acid 4537
Amino-glutaric acid 3371-2
Amino H acid 4555
Amino-hydrocinnamic acid 5149-50
Amino-hydroxybenzoic acid 374-6
Amino-hydroxybutyric acid 5932-4
Amino-hydroxypurine, cf. alkd.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
319	lq.	0.983^{22°	–45	214.3	i.	∞	∞
320	lq.	0.990^{0°	....	$214\text{-}5^{764\text{mm}}$	....	....	....
321	col. oil	0.976^{22°	–5	217.4	i.	∞	∞
322	cr.	....	d.	....	s.	s.	i.
323	cr.	....	172 d.	....	i. c.; d. h.	....	....
324	large pl.	....	161	....	s.	....	....
325	....	....	207 ±	....	s.	....	....
326	col. lq.	$0.865^{20^\circ}_{0}$	....	134	s.	s.	....
327	red-violet pd.	....	207-8	....	s. conc. HCl	s.	s. bz.
328	cr.	....	109 d.	....	s. c.	sl. s.	....
329	hyg. cr.	....	42*	231-2 (sl.d.)	v. s.	v. s.	v. s.
330	nd./pet.	....	63	....	....	....	....
331	vl. nd.	....	....	....	i.	v. sl. s.	....
332	nd.	....	....	....	sl. s.	s.	s.
333	cr./bz.-lg.	....	95-7 d.	....	s. h.	s. alk.	s. HCl
334	lf./et.	....	....	....	v. sl. s. h.	....	sl. s.
335	nd.	....	255 d.	....	....	6.6 h.	....
336	nd./al.	....	201 (163)	....	sl. s.	s.	s.
337	....	....	....	....	sl. s.	....	....
338	nd.	....	....	....	0.4 h.	....	....
339	nd.	....	....	....	sl. s.	i.	s. alk.
340	nd.	....	....	....	v. sl. s.	i.	i.; i. bz.
341	col. pd.	....	....	....	s.	i.	i.
342	col. cr.	....	....	....	sl. s.	sl. s.	s. alk.
343	col. cr.	....	....	....	0.2^{20°; 2.4^{60°	....	....
344	cr.	....	....	....	s.	....	s. alk.
345	col. nd.	....	173	subl.	1.7^{0°	4.3^{0°	v. s.
346	col. cr.	....	....	....	80^{0°	40^{0°	....
347	pr./toluene	....	122-3	....	2.6^{0°	s.	sl. s.
348	pr./aq.	....	229	....	....	....	....
349	lf.	....	184-6 d.	subl. sl. d.	1.1^{0°	4.6^{0°, abs.	i. bz.
350	col. pr.	....	306 d.	....	71^{0°	10^{0°, abs.	....

* Cryst. + 1 HCl, m. 100-2°.

Amino-hydroxytoluene 292-9
Amino-menthane 4029
Amino-methane 4105
Amino-methylaniline 4336
Amino-methylanisole 1544
Amino-naphthalene 4529-30
Amino-nitrophenol 4610-6
Amino-nonane 4926
Amino-octane 4970-2
Amino-oxamide 5017
Amino-pentane, cf. amylamine.
Amino-phenetole 5105

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
351	**Amino** phenol (*p*) $H_2C_2O_4$	acid oxalate	$HO{\cdot}C_6H_4{\cdot}NH_2{\cdot}H_2C_2O_4$	*XIII-144	199.16
352	phenol (*p*) $H_2C_2O_4$	oxalate	$(HOC_6H_4NH_2)_2{\cdot}H_2C_2O_4$	*XIII-144	308.28
353	phenol sulfonic acid	(1,2,4)	$C_6H_3(OH)(NH_2)SO_3H{\cdot}\frac{1}{2}H_2O$	XIV-814	198.19
354	phenol sulfonic acid	(1,4,2)	$C_6H_3(OH)(NH_2)SO_3H$	XIV-806	189.18
355	phenol sulfonic acid	(1,4,3)	$C_6H_3(OH)(NH_2)SO_3H$	XIV-812	189.18
356	phenylacetic acid (*α*) (*dl*)	....	$C_6H_5{\cdot}CH(NH_2){\cdot}CO_2H$	XIV-460	151.16
357	phenylacetic acid (*p*)	*p*-amino-toluic acid	$H_2N{\cdot}C_6H_4{\cdot}CH_2CO_2H$	XIV-456	151.16
358	phenylglycine (*p*)	*N*-(4-aminophenyl)-glycine	$H_2N{\cdot}C_6H_4{\cdot}NH{\cdot}CH_2{\cdot}CO_2H$	XIII-105	166.18
359	phthalhydrazide (3)	luminol	$H_2N{\cdot}C_6H_3{\cdot}CO{\cdot}NH{\cdot}NH{\cdot}CO$	*XXV-698	177.16
360	pyridine (2) (*α*)	....	$N{\cdot}CH(CH)_3{\cdot}C{\cdot}NH_2$	XXII-428	94.11
361	pyridine (3) (*β*)	....	$NH_2{\cdot}C_5H_4N$	XXII-431	94.11
362	pyridine (4) (*γ*)	....	$NH_2{\cdot}C_5H_4N$	XXII-433	94.11
363	pyrine	3-keto-1,5-diMe-4-dimethylamino-2-Ph-2,3-dihydropyrazole	$(CH_3)_2N{\cdot}C{:}C(CH_3){\cdot}N(CH_3){\cdot}N(C_6H_5){\cdot}CO$	....	231.29
364	pyrine-butyl-chloral-hydrate	trigemin	$C_{13}H_{17}ON_3{\cdot}C_4H_7O_2Cl_3$	....	424.76
365	quinoline (2) (*α*)	....	$NH_2{\cdot}C_9H_6N$	XXII-443	144.17
366	quinoline (3) (*β*)	....	$NH_2{\cdot}C_9H_6N$	*XXII-638	144.17
367	quinoline (4) (*γ*)	....	$NH_2{\cdot}C_9H_6N{\cdot}H_2O$	XXII-444	162.19
368	quinoline (5)	....	$NH_2{\cdot}C_6H_3{\cdot}CH{:}CH{\cdot}CH{:}N$	XXII-445	144.17
369	quinoline (6)	....	$NH_2{\cdot}C_9H_6N{\cdot}2H_2O$	XXII-447	180.20
370	quinoline (7)	....	$NH_2{\cdot}C_9H_6N+$aq.	XXII-450	144.17
371	quinoline (8)	....	$NH_2{\cdot}C_9H_6N$	XXII-450	144.17
372	resorcinol (2)	base unknown	....	....	......
373	resorcinol (2) HCl	(2;1,3)	$NH_2{\cdot}C_6H_3(OH)_2{\cdot}HCl$	XIII-782	161.59
374	salicylic acid (3)	3-NH₂-2-OH-benzoic acid	$C_6H_3(CO_2H)(OH){\cdot}NH_2$	XIV-577	153.13
375	salicylic acid (4)	....	$C_7H_4O_2(OH)NH_2$	XIV-579	153.13
376	salicylic acid (5)	....	$C_7H_4O_2(OH)NH_2$	XIV-579	153.13
377	thiazol (2)	....	$NH_2{\cdot}C{:}N{\cdot}CH{:}CH{\cdot}S$	XXVII-155	100.14
378	thiophene (*α*)	thiophenine	$NH_2C_4H_3S$	XVII-248	99.15
379	toluene sulfonic acid (1,2,3)	toluidine sulfonic acid	$C_6H_3(CH_3)(NH_2){\cdot}SO_3H$	XIV-723	187.21

Amino-phenyl-acetonitrile 274
Amino-phenyl-lepidine 3242
Amino-phenyl-propionic acid 5148
Amino-propandiol 3385

Amino-propane 5371-2
Amino-propionic acid 158-60
Amino-*iso*-propyl alcohol 5339
Amino-propylene-glycol 3385

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
351	vl. cr./aq.	....	220 d.	....	sl. s.	....	....
352	col. fl.	....	290 d.	....	i.	sl. s. alc.	i.
353	col. cr.	....	....	....	1^{14°	....	....
354	nd. +aq.	....	d. >300	....	0.07^{14°	i.	i.
355	nd. +aq.	....	d. >270-85	....	2^{14°	i.	i.; s. alk.
356	pr./aq. al.	....	256	subl.256-65	v. sl. s.	v. sl. s.	v. sl. s.; s. alk.
357	col. lf./aq.	....	199-200 d.	....	s. h.	s.	s. alk.
358	lf./aq.	....	222-3 d.	....	sl. s.	....	....
359	yel. nd.	....	280-300	....	i.; s. h. ac.	sl. s.	sl. s.
360	lf./lg.	....	56	204	s.	v. s.	s.; sl. s. lg.
361	lf./bz. lg.	....	64	250-2	v. s.	v. s.	v. s.; i. lg.
362	nd./bz.	....	158	....	s.; s. alk.	s.; sl. s. bz.	sl. s.
363	col. cr.	....	107-9	....	5.5	75	10; 10 bz.
364	col. pd.	....	82-4	....	1.5	50	10; s. bz.
365	lf./aq.	....	129	....	v. s. h.	s.; sl. s. bz.	s.; sl. s. lg.
366	cr.	....	94(84)	....	s.	s.	....
367	nd./aq.	....	69-70*	$-H_2O$, 100	s. h.	s.; s. chl.	v. sl. s. CS_2
368	nd./al.	....	109-10	310	sl. s.	s.	s.; i. lg.
369	cr./aq.	....	73.5**	subl.	sl. s.	s.	s.; s. NH_4OH
370	yel. nd./aq.	....	74-5	....	....	....	....
371	yel. nd./al.	....	70	....	s. h.	....	....
372	....	....	....	....	....	....	....
373	gr. pd.	....	....	....	v. s.	s.	i.
374	cr.	....	235 d.	....	....	v. sl. s.	....
375	cr. pd.	....	220 d.	....	v. s.	v. s.	sl. s.
376	nd.	....	d. 260-80	....	sl. s. h.	i.; s. HCl	s. CS_2
377	yel. pl./al.	....	90	d.	sl. s.	sl. s.; s. h.	sl. s.
378	oil	....	....	$77\text{-}9^{11mm}$	v. s.	v. s.	i.
379	nd.	....	....	....	0.97^{11°; v. s. h.	....	....

* Anh. m.p. 154°.
** Anh. m.p. 93-4°.
Amino-purine, cf. alkd.
Amino Schaeffer's acid 4552
Amino-succinic acid 589-90
Amino-thiophenylimine 5922
Amino-toluene (ω) 783

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
380	**Amino** toluene sulfonic acid	(1,2,4)	$C_6H_3(CH_3)(NH_2)\cdot SO_3H\cdot H_2O$	XIV-728	205.23
381	toluene sulfonic acid	(1,4,2)	$C_6H_3(CH_3)(NH_2)\cdot SO_3H\cdot H_2O$	XIV-720	205.23
382	toluene sulfonic acid	(1,4,3)	$C_6H_3(CH_3)(NH_2)\cdot SO_3H\cdot \frac{1}{2}H_2O$	XIV-723	196.22
383	toluene sulfonic acid	(1,2,5)	$C_6H_3(CH_3)(NH_2)\cdot SO_3H\cdot H_2O$	XIV-726	205.23
384	triphenylmethane (*m*)	benzhydryl aniline	$(C_6H_5)_2CH\cdot C_6H_4NH_2$	XII-1342	259.33
385	triphenylmethane	(*p*)	$(C_6H_5)_2CH\cdot C_6H_4NH_2$	XII-1342	259.33
386	uracil (5)	....	$H_2N\cdot C{:}CH\cdot NH\cdot CO\cdot$ $NH\cdot CO$	XXIV-463	127.10
387	valeric acid (α)	....	$C_2H_5\cdot CH_2\cdot CHNH_2\cdot CO_2H$	IV-416	117.15
388	valeric acid (γ) (*dl*)	....	$CH_3\cdot CHNH_2\cdot (CH_2)_2\cdot CO_2H$	IV-418	117.15
389	valeric acid (δ)	....	$NH_2\cdot (CH_2)_4\cdot CO_2H$	IV-418	117.15
390	valeric acid HCl (δ)	....	$NH_2(CH_2)_4CO_2H\cdot HCl$	IV-419	153.61
391	*iso*-valeric acid (α) (*dl*)	α-valine	$(CH_3)_2CH\cdot CHNH_2\cdot CO_2H$	IV-430	117.15
392	*iso*-valeric acid (α) (*l*+)	valine	$(CH_3)_2CH\cdot CHNH_2\cdot CO_2H$	IV-427	117.15
393	*iso*-valeric acid (β)	β-valine	$(CH_3)_2CNH_2\cdot CH_2\cdot CO_2H$	IV-426	117.15
394	valeric acid (α)	*dl-iso*-valine	$C_2H_5\cdot C(CH_3)(NH_2)\cdot CO_2H$	IV-425	117.15
395	valeric acid (α)	*iso*-valine (*l*+)	$C_2H_5\cdot C(CH_3)(NH_2)\cdot CO_2H\cdot H_2O$	*IV-513	117.15
396	**Ammelin**	triuretdiamidine	$(CN)_3(NH_2)_2OH$	XXVI-244	127.11
397	**Amyl** acetate (*n*)	....	$CH_3\cdot CO_2\cdot C_5H_{11}$	II-131	130.18
398	acetate (*iso*)	common amyl acetate	$CH_3CO_2\cdot CH_2CH_2CH{:}(CH_3)_2$	II-132	130.18
399	acetate	β-Me-Bu-acetate	$CH_3CO_2\cdot CH_2\cdot CH\cdot (CH_3)\cdot C_2H_5$	II-132	130.18
400	acetate (*sec*)	α-Me-Bu-acetate	$CH_3CO_2\cdot CH(CH_3)\cdot CH_2\cdot C_2H_5$	II-131	130.18
401	acetate (*sec*)	diEt-carbinol acetate	$CH_3CO_2\cdot CH(C_2H_5)_2$	II-131	130.18
402	acetate (*tert*)	....	$CH_3CO_2\cdot C(CH_3)_2\cdot C_2H_5$	II-132	130.18
403	acetic acid (*iso*)	....	$(CH_3)_2{:}C_4H_7\cdot CO_2H$	II-342	130.18
404	alcohol (*n*)	pentanol-1	$CH_3\cdot (CH_2)_3\cdot CH_2OH$	I-383	88.15
405	alcohol (*sec. n*)	pentanol-2	$C_2H_5\cdot CH_2\cdot CHOH\cdot CH_3$	I-384	88.15
406	alcohol (*prim. iso*)	2-methyl-butanol-4	$(CH_3)_2CH\cdot CH_2\cdot CH_2OH$	I-392	88.15
407	alcohol (*sec. iso*)	2-methyl-butanol-3	$(CH_3)_2CH\cdot CHOH\cdot CH_3$	I-391	88.15
408	alcohol	pentanol-3	$(C_2H_5)_2{:}CHOH$	I-385	88.15
409	alcohol (*tert*)	2-methyl-butanol-2	$(CH_3)_2COH\cdot C_2H_5$	I-388	88.15
410	alcohol	2,2-diMe-propanol-1	$(CH_3)_3C\cdot CH_2OH$	I-406	88.15
411	alcohol (*d*)	active amyl alcohol	$C_2H_5\cdot CH(CH_3)\cdot CH_2OH$	I-385	88.15

Amino-toluic acid 357
Amphotropin 3601

Amygdalin, cf. glcde.
Amyl, cf. also diamyl.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
380	nd.	....	....	....	0.9^{11°	i.	....
381	mn.	....	d.	....	0.5^{20°	i.	....
382	nd.	....	....	....	0.47	....	....
383	tri./aq.	....	$-H_2O$, 120	....	2.7^{11° (anh.)	i.	....
384	nd./et.	....	120	....	....	....	....
385	pr./et.	....	83-4	248^{12mm} ±	i.	s. bz.	....
386	nd./aq.	....	d.	subl. d.	0.05 c.; 1.6 h.	s. a.; s. alk.	s. NH_4OH
387	nd./aq.	....	291.5	subl.	10^{15°; v. s. h.	sl. s.	i.
388	cr.	....	193-214 d.	....	v. s.	v. sl. s.	i.; i. bz.
389	lf.	....	157-8 d.	....	v. s.	v. sl. s. abs.	i.
390	pl. or pr.	....	90-2	....	s.	s.	i.
391	lf./al.	....	298 d.	subl.	7^{25°	v. sl. s.	v. sl. s.
392	lf./aq. al.	....	315*	subl. d.	$9.1^{16.5^\circ}$	v. sl. s.	v. sl. s.
393	cr./al.+et.	....	217	subl. >180	v. s.	v. sl. s.	i.
394	rhb.+aq./ aq. al.	....	307.5**	subl. 300 ±	36^{20°	0.6^{15°	6 h.
395	nd./aq. al.	....	315	subl.	s.	sl. s.	....
396	nd./aq.	....	....	....	0.008^{23°	i.	i.; s. HCl
397	col. lq.	$0.879^{20^\circ}_{20}$	−70.8	148.4^{737mm}	v. sl. s.	∞	∞
398	col. lq.	$0.876^{15^\circ}_{4}$	....	142^{757mm}	0.25^{15°	∞	∞
399	col. lq.	$0.880^{12.5^\circ}$	....	141-2	v. sl. s.	∞	∞
400	col. lq.	0.922^{0°	....	133.5	sl. s.	∞	∞
401	col. lq.	$0.871^{20^\circ}_{4}$	....	133	sl. s.	∞	∞
402	col. lq.	0.874^{19°	....	124.5^{749mm}	v. sl. s.	∞	∞
403	col. oil	$0.912^{18^\circ}_{18}$	....	216^{762mm}	sl. s. h.	∞	∞
404	col. lq.	$0.817^{20^\circ}_{20}$	−78.5	137.8-7.9	2.7^{22°	∞	∞
405	col. lq.	$0.810^{20^\circ}_{20}$	....	118.5-9.5	4^{20°	∞	∞
406	col. lq.	$0.813^{15^\circ}_{4}$	−117.2	132.0	2^{14°	∞	∞
407	col. lq.	0.819^{19°	....	113-4	2.8^{30°	∞	∞
408	col. lq.	$0.815^{25^\circ}_{4}$	....	115.6	5.5^{30°	∞	∞
409	col. lq.	$0.809^{20^\circ}_{4}$	−11.9	102	sl. s.	s.	s.
410	cr.	....	52-3	113-4	sl. s.	∞	∞
411	col. lq.	$0.816^{20^\circ}_{4}$	....	128	3.6^{30°	∞	∞

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* Sealed tube.

** Sealed tube; loses aq. at 100°.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
412	**Amyl** amine (*n*)	....	$CH_3(CH_2)_4NH_2$	IV-175	87.16
413	amine (*sec. n*)	....	$(C_3H_7)(CH_3){:}CHNH_2$	IV-177	87.16
414	amine (*iso*)	....	$(CH_3)_2CH(CH_2)_2NH_2$	IV-180	87.16
415	amine (*tert*)	....	$(C_2H_5)(CH_3)_2C\cdot NH_2$	IV-179	87.16
416	amine	1-NH_2-2-Me-butane	$C_2H_5CH(CH_3)\cdot CH_2NH_2$	IV-178	87.16
417	amine	3-aminopentane	$(C_2H_5)_2{:}CH\cdot NH_2$	IV-178	87.16
418	amine	3-NH_2-2-Me-butane	$(CH_3)_2CH\cdot CH\cdot (CH_3)NH_2$	IV-179	87.16
419	aniline (*iso*)	....	$C_6H_5\cdot NH\cdot C_5H_{11}$	XII-169	163.25
420	aniline (*p*) (*tert*)	....	$(C_2H_5)(CH_3)_2C\cdot C_6H_4\cdot NH_2$	XII-1179	163.25
421	benzene (*n*)	1-phenylpentane	$C_5H_{11}\cdot C_6H_5$	V-434	148.24
422	benzene (*iso*)	....	$C_5H_{11}\cdot C_6H_5$	V-434	148.24
423	benzene (*tert*)	diMe-Et-Ph-methane	$C_5H_{11}\cdot C_6H_5$	V-436	148.24
424	benzene (*sec*)	diEt-Ph-methane	$(C_2H_5)_2CH\cdot C_6H_5$	V-436	148.24
425	benzoate (*iso*)	....	$C_6H_5\cdot CO_2\cdot C_5H_{11}$	IX-113	192.25
426	benzyl ether (*iso*)	....	$C_6H_5\cdot CH_2\cdot O\cdot C_5H_{11}$	....	178.26
427	bromide (*n*)	1-bromopentane	$CH_3\cdot (CH_2)_3\cdot CH_2Br$	I-131	151.05
428	bromide (*iso*)	4-Br-2-Me-butane	$(CH_3)_2CH(CH_2)_2Br$	I-136	151.05
429	bromide (*tert*)	2-Br-2-Me-butane	$(CH_3)_2C(Br)\cdot C_2H_5$	I-136	151.05
430	bromide	1-Br-2, 2-diMe-propane	$(CH_3)_3C\cdot CH_2Br$	I-141	151.05
431	bromide	1-Br-2-Me-butane	$C_2H_5\cdot CH(CH_3)\cdot CH_2Br$	I-136	151.05
432	*n*-butyrate (*n*)	....	$C_2H_5CH_2CO_2(CH_2)_4\cdot CH_3$	II-271	158.23
433	*n*-butyrate (*iso*)	....	$C_2H_5CH_2CO_2\cdot C_5H_{11}$	II-271	158.23
434	*n*-butyrate (*tert*)	....	$C_3H_7CO_2\cdot C(CH_3)_2\cdot C_2H_5$	II-271	158.23
435	*iso*-butyrate (*iso*)	....	$(CH_3)_2CHCO_2\cdot C_5H_{11}$	II-291	158.23
436	*n*-caproate (*n*)	....	$C_5H_{11}CO_2\cdot C_5H_{11}$	II-323	186.29
437	*n*-caproate (*iso*)	....	$C_5H_{11}CO_2\cdot (CH_2)_2\cdot CH{:}(CH_3)_2$	....	186.29
438	*n*-caprylate (*iso*)	....	$C_7H_{15}CO_2\cdot (CH_2)_2\cdot CH{:}(CH_3)_2$	....	214.34
439	carbamate (*n*)	....	$H_2N\cdot CO_2\cdot C_5H_{11}$	....	131.17
440	carbamate (*iso*)	....	$NH_2\cdot CO_2\cdot C_5H_{11}$	III-30	131.17
441	carbamate (*tert*)	aponal	$H_2N\cdot CO_2\cdot C(CH_3)_2\cdot C_2H_5$	*III-14	131.17
442	chloride (*n*)	1-chloropentane	$CH_3\cdot (CH_2)_3\cdot CH_2Cl$	I-130	106.60
443	chloride (*sec*)	2-chloropentane	$C_3H_7\cdot CHCl\cdot CH_3$	I-131	106.60
444	chloride (*sec*)	3-chloropentane	$(C_2H_5)_2CHCl$	I-131	106.60
445	chloride (*iso*)	4-Cl-2-Me-butane	$(CH_3)_2CH(CH_2)_2Cl$	I-135	106.60
446	chloride (*sec. iso*)	3-Cl-2-Me-butane	$(CH_3)_2CH\cdot CHCl\cdot CH_3$	I-135	106.60
447	chloride (*tert*)	2-Cl-2-Me-butane	$(CH_3)_2CCl\cdot C_2H_5$	I-134	106.60
448	chloride	1-Cl-2-Me-butane	$(CH_3)(C_2H_5)CH\cdot CH_2Cl$	I-134	106.60
449	chloroformate (*n*)	*n*-amyl chlorocarbonate	$C_2H_5(CH_2)_3O\cdot COCl$	....	150.61
450	chloroformate (*iso*)	*iso*-amyl chlorocarbonate	$(CH_3)_2CH(CH_2)_2\cdot O\cdot COCl$	III-12	150.61

Amyl borate 6077

Amyl carbinol (*iso*) 3634

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
412	col. lq.	0.766^{19°	–55	103-4	s.	s.	s.
413	col. lq.	$0.749_{4}^{20^\circ}$	....	91-2	∞	∞	∞
414	col. lq.	$0.751_{4}^{18^\circ}$	....	95	∞	∞	∞
415	col. lq.	$0.731_{4}^{25^\circ}$	–105	77-8	∞	∞ ; ∞ chl.	∞
416	col. lq.	0.755^{18°	....	95-6	∞	∞	∞
417	col. lq.	$0.749_{4}^{20^\circ}$	....	90-1	∞	∞	∞
418	col. lq.	$0.757^{18.5^\circ}$	....	83-4	∞	∞	∞
419	lq.	$0.928_{4}^{15^\circ}$	....	254.5	....	....	....
420	col. lq.	....	....	259-62	i.	s.	s.
421	lq.	$0.858_{4}^{20^\circ}$	–78.3	205.3	i.	∞	∞
422	lq.	$0.859_{4}^{20^\circ}$	....	198-9	i.	∞	∞
423	lq.	$0.867_{4}^{20^\circ}$	....	189-90	i.	∞	∞
424	col. lq.	$0.876_{4}^{15^\circ}$	....	187^{753mm}	i.	s.	s.
425	col. lq.	$0.992_{14}^{14^\circ}$	....	260.7^{746mm}	i.	∞	∞
426	col. lq.	....	....	237^{748mm}	i.	s.	s.
427	col. lq.	$1.218_{4}^{20^\circ}$	–95	129.7	i.	s.	....
428	col. lq.	$1.220_{15}^{17^\circ}$	....	120.4^{745mm}	i.	s.	s.
429	lq.	$1.216_{0}^{19^\circ}$	....	108^{765mm}	i.	s.	s.
430	col. lq.	$1.260_{4}^{20.4^\circ}$	....	$89\text{-}91^{749mm}$	i.	s.	s.
431	lq.	$1.221_{4}^{20^\circ}$	....	121^{755mm}	i.	s.	s.
432	col. lq.	$0.871_{4}^{15^\circ}$	–73.2	186.4	0.05^{50°	∞	∞
433	col. lq.	$0.866_{15}^{19^\circ}$	....	178.6	i.	∞	∞
434	col. lq.	$0.865_{0}^{14.5^\circ}$	....	164	sl. s.	∞	∞
435	lq.	$0.876_{4}^{0^\circ}$	....	168.8	i.	s.	s.
436	col. lq.	....	....	222-7	....	....	....
437	col. lq.	....	....	$94\text{-}6^{10mm}$	i.	s.	....
438	col. lq.	....	....	136^{10mm}	i.	s.	....
439	col. pl.	....	56-7.5	....	i.	s.	s.
440	nd./aq.	$0.944_{4}^{70.6^\circ}$	64	220	s. h.	s.	s.
441	nd./aq. al.	....	86	....	sl. s.	s.	s.; sl. s. pet.
442	col. lq.	$0.878_{4}^{20^\circ}$	–99	108.4	i.	s.	s.
443	lq.	$0.870_{4}^{20^\circ}$	....	96.7	i.	s.	s.
444	col. lq.	0.895^{21°	....	97.3	i.	∞	∞
445	col. lq.	$0.893_{4}^{20^\circ}$	....	99.7^{758mm}	i.	s.	∞
446	lq.	0.883^{0°	....	91^{753mm}	i.	s.	s.
447	lq.	$0.871_{4}^{20^\circ}$	–72.9	85.7	i.	s.	s.
448	lq.	$0.881^{17.5^\circ}$	....	98-9	i.	s.	s.
449	col. lq.	....	....	$43\text{-}5^{7mm}$	....	....	....
450	lq.	$1.028_{15}^{18.5^\circ}$	....	155-6	i.	∞	∞

Amyl carbonate 1737-8

Amyl chlorocarbonate 449-50

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
451	**Amyl** cinnamaldehyde (*n*) (*α*)	....	$C_6H_5\cdot CH{:}C(C_5H_{11})\cdot CHO$	....	202.28
452	*m*-cresol (*n*)	....	$C_5H_{11}\cdot C_6H_3(OH)CH_3$	....	178.26
453	*iso*-cyanide (*iso*)	*iso*-caproic *iso*-nitrile	$(CH_3)_2CH(CH_2)_2\cdot NC$	IV-184	97.16
454	formate (*n*)	....	$HCO_2\cdot C_5H_{11}$	II-22	116.16
455	formate (*iso*)	....	$HCO_2\cdot C_5H_{11}$	II-22	116.16
456	formate, ortho (*n*)	....	$HC(OC_5H_{11})_3$	II-22	274.43
457	furoate (*iso*)	*iso*-Am pyromucate	$C_4H_3O\cdot CO_2\cdot C_5H_{11}$	....	182.21
458	*β*-furylacrylate (*n*)	....	$C_4H_3O\cdot CH{:}CH\cdot CO_2C_5H_{11}$	....	208.25
459	iodide (*n*)	1-iodopentane	$CH_3\cdot(CH_2)_3\cdot CH_2I$	I-133	198.06
460	iodide (*iso*)	4-I-2-Me-butane	$(CH_3)_2CH\cdot CH_2\cdot CH_2I$	I-138	198.06
461	iodide (*sec n*)	2-iodopentane	$C_3H_7\cdot CHI\cdot CH_3$	I-133	198.06
462	iodide (*tert*)	2-I-2-Me-butane	$(CH_3)_2CI\cdot C_2H_5$	I-138	198.06
463	iodide	1-I-2-Me-butane	$C_2H_5\cdot CH(CH_3)\cdot CH_2I$	I-138	198.06
464	*d*-lactate (*dl*) (–)	....	$C_2H_5OCO_2\cdot CH_2\cdot CH(CH_3)C_2H_5$	III-265	160.21
465	malonic acid (*n*)	....	$C_5H_{11}CH(CO_2H)_2$	II-695	174.19
466	malonic acid (*iso*)	....	$C_5H_{11}CH(CO_2H)_2$	II-700	174.19
467	mercaptan (*n*)	pentanthiol-1	$CH_3\cdot(CH_2)_3\cdot CH_2\cdot SH$	I-384	104.21
468	mercaptan (*n*)	pentanthiol-3	$(C_2H_5)_2CH\cdot SH$	*I-194	104.21
469	mercaptan (*iso*)	2-Me-butanthiol-4	$(CH_3)_2CH(CH_2)_2SH$	I-405	104.21
470	naphthalene (*iso*) (*β*)	....	$C_5H_{11}\cdot C_{10}H_7$	V-574	198.29
471	*β*-naphthyl ether (*iso*)	....	$C_5H_{11}\cdot O\cdot C_{10}H_7$	VI-642	214.29
472	nitrate (*iso*)	....	$(CH_3)_2CH\cdot CH_2\cdot CH_2\cdot O\cdot NO_2$	I-403	133.15
473	nitrite (*n*)	....	$C_5H_{11}\cdot O\cdot NO$	I-384	117.15
474	nitrite (*iso*)	....	$(CH_3)_2CH\cdot CH_2\cdot CH_2\cdot O\cdot NO$	I-402	117.15
475	oleate (*iso*)	....	$C_8H_{17}CH{:}CHC_7H_{14}\cdot CO_2\cdot C_5H_{11}$	II-467	352.58
476	phenol (*tert*) (*p*)	pentaphen	$C_5H_{11}\cdot C_6H_4\cdot OH$	VI-548	164.24
477	phenol methyl ether (*tert*) (*p*)	....	$(C_2H_5)(CH_3)_2C\cdot C_6H_4\cdot O\cdot CH_3$	VI-549	178.26
478	phenyl ether (*n*)	....	$CH_3(CH_2)_4\cdot O\cdot C_6H_5$	*VI-82	164.24
479	phenyl ether (*iso*)	....	$C_5H_{11}\cdot O\cdot C_6H_5$	VI-143	164.24
480	*α*-phenylhydrazine	(*iso*) (*α*)	$C_6H_5\cdot N(NH_2)C_5H_{11}$	XV-121	178.27
481	phenyl ketone (*n*)	caprophenone	$C_5H_{11}\cdot CO\cdot C_6H_5$	VII-333	176.25
482	phenyl ketone (*iso*)	*iso*-caprophenone	$C_5H_{11}\cdot CO\cdot C_6H_5$	VII-334	176.25
483	propionate (*n*)	....	$C_2H_5\cdot CO_2\cdot C_5H_{11}$	....	144.21
484	propionate (*iso*)	....	$C_2H_5\cdot CO_2\cdot C_5H_{11}$	II-241	144.21
485	propionate (*act*)	....	$C_2H_5\cdot CO_2\cdot C_5H_{11}$	II-241	144.21
486	salicylate (*n*)	....	$HO\cdot C_6H_4\cdot CO_2\cdot C_5H_{11}$	....	208.25
487	salicylate (*iso*)	....	$HO\cdot C_6H_4\cdot CO_2\cdot C_5H_{11}$	X-76	208.25
488	stearate (*iso*)	....	$CH_3(CH_2)_{16}CO_2\cdot C_5H_{11}$	II-380	354.60
489	stearate	....	$C_{17}H_{35}CO_2\cdot CH_2\cdot CH{:}(CH_3)C_2H_5$	II-380	354.60
490	thiocyanate (*iso*)	....	$(CH_3)_2CH(CH_2)_2\cdot S\cdot CN$	III-177	129.22
491	*iso*-thiocyanate (*n*)	amyl mustard oil	$CH_3(CH_2)_4\cdot N{:}C{:}S$	IV-176	129.22

Amyl cyanide 1217-8, 2104
Amyl disulfide 1753-4
Amyl ether 1740-1
Amyl-ethyl-barbituric acid 505
Amyl mustard oil 491-3
Amyl oxalate 1745
Amyl phthalate 1746-7

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
451	yel. lq.	....	....	163-8$^{15\text{mm}}$	....	....	....
452	col.	....	24-5	137-9$^{15\text{mm}}$	i.	s.	s.
453	lq.	....	....	137-9	i.	s.	s.
454	lq.	$0.902^{0°}$	−73.5	132	v. sl. s.	∞	∞
455	lq.	$0.882^{20°}_{4}$	−93.5	123.5	$0.3^{22°}$	∞	∞
456	lq.	$0.864^{23°}$	....	265-7 dec.	....	....	....
457	col. lq.	....	....	135-7$^{25\text{mm}}$	i.	∞	....
458	col. lq.	$1.032^{20°}_{4}$	....	119$^{4\text{mm}}$	i.	....	....
459	lq.	$1.510^{20°}_{4}$	−86	157.0	i.	s.	∞
460	lq.	$1.515^{18°}_{4}$	....	147$^{765\text{mm}}$	i.	∞	∞
461	lq.	$1.507^{17°}_{4}$	....	144-5	i.	∞	∞
462	lq.	$1.471^{19°}_{15}$	....	127$^{765\text{mm}}$	i.	∞	∞
463	lq.	$1.524^{20°}_{4}$	....	148$^{760\text{mm}}$	i.	∞	∞
464	col. lq.	$0.971^{20°}_{4}$	....	114-5$^{36\text{mm}}$	v. sl. s.	s.	s.
465	col. pr.	....	82	d. 140	v. s.	v. s.	v. s.
466	nd./aq.	....	95d.	d.	v. s.	v. s.	v. s.
467	lq.	$0.857^{20°}$	....	126$^{767\text{mm}}$	i.	∞	∞
468	col. lq.	....	....	105	i.	∞	∞
469	lq.	$0.835^{20°}_{4}$	....	120	i.	∞	∞
470	col. lq.	$0.973^{0°}$	<−21	288-92	i.	s.	s.
471	col. lf.	$1.016^{12°}_{4}$	26.5	323-6	i.	s.	s.
472	lq.	$0.996^{21.7°}$	....	147-8	v. sl. s.	i.	i.
473	pa. yel. lq.	$0.853^{20°}$	....	104$^{761\text{mm}}$	sl. s.	∞	∞
474	lq.	$0.872^{20°}_{4}$	....	99	sl. s.	∞	∞
475	col. lq.	$0.897^{15°}$	....	223-4$^{10\text{mm}}$	i.	s.	v. s.
476	cr.	....	93	265-7	sl. s.	s.	s.
477	col. lq.	....	....	216-7	i.	s.	s.
478	col. lq.	....	....	111$^{17\text{mm}}$	i.	s.	s.
479	col. oil	$0.920^{22°}_{4}$	....	224-5	i.	s.	s.
480	lq.	$0.968^{15°}$	....	260-2	....	....	....
481	lf.	$0.958^{25°}_{4}$	24.7	265.2	....	....	....
482	lq.	$0.962^{15°}_{4}$	−2	240-2$^{720\text{mm}}$	i.	v. s.	v. s.
483	lq.	$0.876^{15°}_{4}$	−73.1	168.7	i.	∞	∞
484	col. lq.	$0.870^{20°}_{4}$	....	160.2	$0.1^{25°}$	∞	∞
485	col. lq.	$0.866^{20°}_{4}$	....	58$^{16\text{mm}}$	v. sl. s.	∞	∞
486	lq.	$1.065^{15°}$	....	265	i.	∞	∞
487	lq.	$1.045^{25°}_{25}$	....	276-7$^{743\text{mm}}$	$0.004^{22°}$	∞	∞; ∞ chl.
488	col. pl.	$0.855^{20°}_{4}$	23	185-90$^{1\text{mm}}$	i.	sl. s.	s.
489	col. lq.	$0.855^{20°}_{4}$	21-2	....	i.	s.	s.
490	pa. yel. oil	0.905	....	197	i.	s.	s.
491	lq.	....	....	193.4	v. sl. s.	v. s.	v. s.

Amyl pyromucate 457
Amyl succinate 1748-50
Amyl sulfide (*iso*) 1751-2
Amyl sulfite 1755
Amyl sulfone 1756
Amyl tartrate 1757

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
492	**Amyl** *iso*-thiocyanate (*iso*)	amyl mustard oil	$(CH_3)_2CH(CH_2)_2\cdot N:C:S$	IV-186	129.22
493	*iso*-thiocyanate (*tert*)	amyl mustard oil	$C_5H_{11}N:C:S$	IV-179	129.22
494	urea (*iso*)	....	$C_5H_{11}\cdot NH\cdot CO\cdot NH_2$	IV-185	130.19
495	urea (*tert*)	....	$C_5H_{11}\cdot NH\cdot CO\cdot NH_2$	IV-179	130.19
496	*iso*-valerate (*iso*)	....	$C_4H_9\cdot CO_2\cdot C_5H_{11}$	II-312	172.26
497	*iso*-valerate (*tert*)	valamin	$C_4H_9\cdot CO_2\cdot C_5H_{11}$	II-312	172.26
498	**Amylene** (*n*)	pentene-1	$C_2H_5\cdot CH_2\cdot CH:CH_2$	I-210	70.13
499	**Amylene** (*iso*)	2-methyl-butene-3	$(CH_3)_2CH\cdot CH:CH_2$	I-213	70.13
500	**Amylene** (α)	2-methyl-butene-1	$(C_2H_5)(CH_3)C:CH_2$	I-211	70.13
501	**Amylene** (β)(*cis*)	pentene-2	$C_2H_5\cdot CH:CH\cdot CH_3$	I-210	70.13
501.1	**Amylene** (β)(*trans*)	pentene-2	$C_2H_5\cdot CH:CH\cdot CH_3$	I-210	70.13
502	**Amylene** (β) (*iso*)	2-methyl-butene-2	$(CH_3)_2:C:CH\cdot CH_3$	I-211	70.13
503	glycol (1,4)	γ-pentylene glycol	$C_5H_{10}(OH)_2$	I-480	104.15
504	glycol (2,4)	*iso*-amylene alcohol	$C_5H_{10}(OH)_2$	I-483	104.15
505	**Amytal**	*iso*-Am-Et-barbituric acid	$(C_2H_5)(C_5H_{11}):C\cdot CO\cdot$ $NH\cdot CO\cdot NH\cdot CO$	....	226.27
506	sodium	....	$C_{11}H_{17}O_3N_2Na$	....	248.26
507	**Anacardic acid**	....	$HO\cdot C_{21}H_{30}\cdot CO_2H$	X-327	344.48
508	**Analgen**	8-EtO-5-benzoyl-amino-quinoline	$C_7H_5ONH\cdot C_6H_2\cdot (OC_2H_5):C_3H_3N$	XXII-503	292.32
509	**Androsterone**	3-*trans*-hydroxy-17-keto-androstane	$C_{19}H_{30}O_2$	....	290.43
510	**Anemonin**	pulsatilla camphor	$C_{10}H_8O_4$	....	192.16
511	**Anethole**	*p*-propenyl anisole	$CH_3\cdot CH:CH\cdot C_6H_4\cdot OCH_3$	VI-566	148.20
512	**Anhydroformald-aniline**	methylene aniline	$(CH_2NC_6H_5)_3$	XXVI-3	315.40
513	**Aniline**	aminobenzene	$C_6H_5\cdot NH_2$	XII-59	93.12
514	acetate	....	$C_6H_5NH_2\cdot C_2H_4O_2$	XII-118	153.18
515	arsonic acid (*p*)	arsanilic acid	$H_2N\cdot C_6H_4\cdot AsO_3H_2$	XVI-878	217.04
516	blue	spirit blue	$C_{38}H_{32}N_3\cdot Cl$	XIII-768	566.12
517	disulfonic acid	(2,5)	$NH_2\cdot C_6H_3:(SO_3H)_2\cdot 4H_2O$	XIV-780	325.31
518	disulfonic acid	(2,4)	$NH_2\cdot C_6H_3:(SO_3H)_2\cdot 2H_2O$	XIV-778	289.28
519	hydrobromide	....	$C_6H_5NH_2\cdot HBr$	XII-116	174.05
520	hydrochloride	....	$C_6H_5NH_2\cdot HCl$	XII-116	129.59
521	nitrate	....	$C_6H_5NH_2\cdot HNO_3$	XII-116	156.14
522	sulfate	....	$(C_6H_5NH_2)_2\cdot H_2SO_4$	XII-117	284.32
523	*o*-sulfonic acid	orthanilic acid	$NH_2\cdot C_6H_4\cdot SO_3H$†	XIV-681	173.18
524	*m*-sulfonic acid	metanilic acid	$NH_2\cdot C_6H_4\cdot SO_3H$‡	XIV-688	173.18
525	*p*-sulfonic acid	sulfanilic acid	$NH_2\cdot C_6H_4\cdot SO_3H$§	XIV-695	173.18
526	*p*-sulfonic Na	....	$NH_2\cdot C_6H_4\cdot SO_3Na\cdot 2H_2O$	XIV-698	231.21
527	*p*-sulfonic amide	sulfanilamide	$NH_2\cdot C_6H_4\cdot SO_2\cdot NH_2$	XIV-698	172.20

† Also crysts. + ½H_2O.

‡ Also crysts. + 1½H_2O.

§ Also crysts. + 1H_2O.

Amyl toluene 4119
Amylene alcohol 504, 4103
Amylene chloride 2034
Amylocaine 5644
Anabasine, cf. alkd.
Analgesine 565
Andirine 4405
Anemone camphor 510
Anesthesine 2955
Angelic acid 2425
Angeline 4405
Anhaline, cf. alkd.
Anhalonine, cf. alkd.
Aniline salt 520
Aniline violet 3593
Aniline yellow 249
Anilino-acetic acid 5194

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
492	yel. lq.	0.942^{17°	....	183-4	v. sl. s.	v. s.	v. s.
493	lq.	....	<-10	166^{770mm}	v. sl. s.	v. s.	v. s.
494	cr.	....	92-3	....	v. sl. s.	....	....
495	mn./aq.	....	152-8	....	1.3^{27°	....	....
496	col. lq.	$0.858^{20^\circ}_{15}$	....	194	v. sl. s.	∞	∞
497	col. lq.	$0.861^{14^\circ}_{0}$	....	173-4	sl. s.	s.	∞ oils
498	lq.	0.641^{20°	−165.2	30.0	i.	∞	∞
499	col. lq.	0.627^{20°	−168.5	20.1	*	∞	∞
500	col. lq.	0.650^{20°	−137.6	31.1	**	∞	∞
501	col. lq.	0.656^{20°	−151.4	37.1	v. sl. s.	∞	∞
501.1	col. lq.	0.648^{20°	−140.2	36.4	v. sl. s.	∞	∞
502	col. lq.	0.662^{20°	−133.8	38.5	**	s.	∞
503	oil	$0.996^{17^\circ}_{4}$	....	$219\text{-}20^{13mm}$	∞	∞	∞ chl.; i. lg.
504	syrup	0.989^{20°	....	202-3	....	....	....
505	col. cr.	....	154-6	....	sl. s.	s.	s.; s. alk.
506	hyg. pd.	....	150-5	....	v. s.	100	i.
507	cr.	....	26	....	i.	s.	s.
508	yel. nd./al.	....	210	....	i.	v. sl. s. c.	s. a.
509	col. nd./ 65% al.	....	184-5	....	i.; s. MeOH	s.; s. CCl_4	s.; s. bz.
510	yel.-wh. cr.	....	157-8	....	sl. s. h.	s. h.	i.
511	lf./al.	$0.991^{20^\circ}_{20}$	22.5	235.3	v. sl. s.	∞ abs. al.	∞
512	pr./al.	....	143	185	i.	sl. s.	s.; s. bz.
513	col. oil	$1.022^{20^\circ}_{4}$	−6.2	184.4	3.6^{18°	∞	∞
514	col. lq.	1.07	....	d., $-H_2O$	∞	∞	....
515	nd./aq.	....	232	d. $-H_2O$, 150	v. s. h.	v. s. h.	i.; i. bz.
516	bl.-brn. cr.	....	....	....	i.	sl. s.	i.
517	cr./aq.	....	....	....	v. s.	v. s.	....
518	nd./aq.	....	d. >120	....	v. s.	v. s.	i.; s. alk.
519	cr. pd.	....	286	....	s.	s.	....
520	lf. or nd.	1.222^{4°	198	245	18^{15°; 107^{25°	s.	i.
521	rhb.	1.356^{4°	d. 190	....	s.	s.	sl. s.
522	lf./al.	1.377^{4°	d.	....	5^{14°	sl. s.	i.
523	col. cr.	....	d.	....	1.5^{15°	v. sl. s.	v. sl. s.
524	col. nd.	....	d.	....	2^{15°	v. sl. s.	v. sl. s.
525	col. cr.	....	d. 280-300	....	0.8^{10°; 6.6^{100°	v. sl. s.	v. sl. s.
526	rhb.	....	....	....	v. s.	s. h.	i.
527	col. lf./ aq. al.	....	165-6	....	0.8 c.; v. s. h.	3 c.	s.; 20 act.

* Insoluble in a mixt. of $2H_2SO_4 + 1H_2O$.

** Very soluble in mixt. of $2H_2SO_4 + 1H_2O$.

Anilino-azobenzene 659
Anilino-benzoic acid 5157
Anilino-ethyl alcohol 2930
Anilino-glyoxylic acid 3921
Anilino-phenol 3767-9
Aniluvitonic acid 5529
Animal starch 3443
Anisal-benzylamine 812
Anise camphor 511
Anise oil 1261
Anisic acid 4069
Anisoyl-anisole 2409
Anisoyl chloride 4071

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
528	**Anis-**alacetone (*p*)	MeO-benzalacetone	$CH_3O \cdot C_6H_4 \cdot CH:CH \cdot CO \cdot CH_3$	VIII-131	176.22
529	alcinnamalacetone	(α,α′)	$C_6H_5 \cdot (CH:CH)_2 \cdot CO \cdot CH:CH \cdot C_6H_4 \cdot OCH_3$	VIII-208	290.34
530	alcohol	*p*-MeO-benzyl alcohol	$CH_3O \cdot C_6H_4 \cdot CH_2OH$	VI-897	138.16
531	aldehyde (*o*)	MeO-benzaldehyde	$CH_3O \cdot C_6H_4 \cdot CHO$	VIII-43	136.14
532	aldehyde (*p*)	....	$CH_3O \cdot C_6H_4 \cdot CHO$	VIII-67	136.14
533	aldehyde phenylhydrazone (*p*)	....	$C_6H_5NH \cdot N:CH \cdot C_6H_4 \cdot OCH_3$	XV-192	226.27
534	**Anisidine** (*o*)	2-amino-anisole	$NH_2 \cdot C_6H_4 \cdot OCH_3$	XIII-358	123.15
535	**Anisidine** (*m*)	MeO-aniline (*m*)	$NH_2 \cdot C_6H_4 \cdot OCH_3$	XIII-404	123.15
536	**Anisidine** (*p*)	4-amino-anisole	$NH_2 \cdot C_6H_4 \cdot OCH_3$	XIII-435	123.15
537	**Anisole**	methyl-phenyl ether	$CH_3 \cdot O \cdot C_6H_5$	VI-138	108.13
538	**Anthracene**	....	$(C_6H_4CH)_2$	V-657	178.22
539	carboxylic acid (1) (β)	....	$C_6H_4:C_2H(CO_2H):C_6H_4$	IX-704	222.23
540	carboxylic acid (2) (γ)	....	$C_6H_4:(CH)_2:C_6H_3 \cdot CO_2H$	IX-705	222.23
541	carboxylic acid (9) (α)	....	$C_6H_4:(CH)_2:C_6H_3 \cdot CO_2H$	IX-705	222.23
542	**Anthramine** (α)	α-amino-anthracene	$C_{14}H_9 \cdot NH_2$	XII-1335	193.24
543	**Anthramine** (β)	β-amino-anthracene	$C_{14}H_9 \cdot NH_2$	XII-1335	193.24
544	**Anthranil**	....	$O \cdot N:C_6H_4:CH$	XXVII-39	119.12
545	**Anthranol**	γ-hydroxy anthracene	$C_6H_4 \cdot CO \cdot C_6H_4 \cdot CH_2$	VII-473	194.22
546	**Anthranoyl anthranilic acid**	....	$NH_2 \cdot C_6H_4 \cdot CO \cdot NHC_6H_4 \cdot CO_2H$	XIV-358	256.25
547	**Anthraquinoline** (β)	....	$C_{17}H_{11}N$	XX-506	229.27
548	**Anthraquinone** (1,2)	....	$C_{10}H_6(CO)_2CH:CH$	VII-780	208.20
549	**Anthraquinone** (1,4)	....	$C_{10}H_6(COCH)_2$	VII-781	208.20
550	**Anthraquinone** (9,10)	anthraquinone	$(C_6H_4)_2(CO)_2$	VII-781	208.20
551	carboxylic acid (α)	....	$C_6H_4(CO)_2C_6H_3 \cdot CO_2H$	X-834	252.21
552	carboxylic acid (β)	....	$C_6H_4(CO)_2C_6H_3 \cdot CO_2H$	X-835	252.21
553	disulfonate Na_2 (1,5)	ρ-anthraquinone disulfonate	$C_{14}H_6O_2(SO_3Na)_2 \cdot 5H_2O$	XI-340	502.38
554	disulfonate Na_2 (1,8)	χ-anthraquinone disulfonate	$C_{14}H_6O_2(SO_3Na)_2 \cdot 4H_2O$	XI-341	484.37
555	disulfonate Na_2 (2,6)	....	$C_{14}H_6O_2(SO_3Na)_2 \cdot 7H_2O$	*XI-84	538.41
556	disulfonic acid (2,7)	....	$C_{14}H_6O_2(SO_3H)_2$	*XI-84	368.32
557	disulfonate Na_2 (2,7)	....	$C_{14}H_6O_2(SO_3Na)_2 \cdot 4H_2O$	*XI-84	484.37
558	sulfonate Na (1)	....	$C_{14}H_7O_2 \cdot SO_3Na$	XI-336	310.25
559	sulfonic acid (2)	β-sulfoanthraquinone	$C_{14}H_7O_2 \cdot SO_3H \cdot 3H_2O$	XI-337	342.31

Anisyl chloride 4071
Anisyl methyl ketone 4065
Anisylidene, cf. anisal.
Annidalin 5940
Anol 1605
Anon 1606
Anthracene-hexahydride 3576
Anthrachryson 5800
Anthraflavic acid 2303-4
Anthragallol 6212
Anthrahydroquinone 5019
Anthrahydroquinone diacetate 5020
Anthralin 2296
Anthranilamide 259
Anthranilic acid 264
Anthranilic nitrile 267
Anthrapurpurin 6215
Anthrarobin 2295

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
528	lf./et.	....	73-4	....	i.; s. bz.	v. s.	v. s.; s. ac.
529	yel. lf./al. or CS_2	....	138-9	....	i.; s. chl.	sl. s.; s. bz.	sl. s.; sl. s. CCl_4
530	nd.	$1.113^{15°}_{15}$	25	258.8	i.	s.	s.
531	col. pr.	$1.135^{15°}_{15}$	35-8 (3)	243-4	i.; sl. s. bz.	sl. s.	v. s.
532	col. oil	$1.123^{20°}_{4}$	2.5	247-8	v. sl. s.	∞	∞
533	col. nd.	....	120-1	....	s. h. bz.	s. h.	s.
534	col. lq.	$1.098^{15°}_{15}$	5.2	225	v. sl. s.	∞	∞
535	oil	$1.096^{20°}_{4}$	<-12	251	v. sl. s.	s.	s.; s. a.
536	pl./aq.	$1.089^{55°}_{55}$	57.2	243	s. h.	s.	s.
537	col. lq.	$0.990^{22°}_{4}$	-37.3	154-5	i.	s.	s.
538	col mn.	$1.25^{27°}_{4}$	217-8	340-2	i.	$1.9^{20°}$, abs. al.	$12.2^{100°}$, toluene
539	yel. pr./al.	....	245 (260)	subl.	i.	s.	s.; sl. s. bz.
540	yel. lf./al.	....	280±	subl.	i.	sl. s.	i. bz.; i. CS_2
541	lt. yel./al.	....	206 ($-CO_2$)	....	v. sl. s. h.	s.	....
542	yel. nd./al.	....	130±	....	i. HCl	s.	....
543	yel. lf./al.	....	238	subl. 93^{9mm}	i.	sl. s.	sl. s.
544	col. oil	$1.187^{15°}_{4}$	<-18	d. >215	sl. s. h.	s.	s.; s. c. HCl
545	col. rhb.	....	160-70 d.	....	i.	v. s. h. bz.	s. h. alk.
546	nd./aq. al.	....	202-4	d.	v. sl. s. c.	3, in 50% h. al.	0.3, h. bz.
547	col. lf.	....	170	446	i.	s.	s.
548	or. nd./al.	....	185-90 d.	....	v. sl. s.	3	s. h. chl.
549	yel. nd./al.	....	206-18 d.	....	....	....	....
550	yel. rhb.	$1.438^{20°}_{4}$	286	379-81	i.	$0.05^{18°}$; 2.25 h.	v. sl. s.
551	yel. nd./aq.	....	293.4	....	sl. s. h.	....	....
552	yel. nd./al.	....	290	....	s. act.	v. sl. s. abs. al.	i.
553	yel. lf.	....	....	....	v. s.	i.	i.
554	yel. pr.	....	....	....	sl. s.	....	....
555	col. cr. darken in light	....	....	....	$3.9^{20°}$; $18^{100°}$	....	....
556	yel. cr.	....	....	....	v. s.	s.	i.; i. bz.
557	cr.	....	....	....	$30.5^{20°}$; $13^{100°}$	v. sl. s.	i.; i. bz.
558	yel. lf.	....	....	....	0.5 c.; s. h.	i.; v. sl. s. act.	i.
559	col. lf.	....	....	....	v. s. c.	v. s.	i.

Anthrarufin 2300
Antiarin, cf. glcde.
Antifebrin 17
Antimony triethyl 6198
Antimony trimethyl 6274
Antipyrene salicylate 5590
Antisepsin 882
Antodin 3410
Antodyne 3410
Aphrodine, cf. alkd.
Apiin, cf. glcde.
Apocupreine, cf. alkd.
Apocynin 3776
Apomorphine, cf. alkd.
Aponal 1738
Apoquinine, cf. alkd.
Aposafranone 670
Apothesine 2119
Apple oil 496
Apyron 118

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
560	**Anthraquinone** sulfonate Na (2)	"silver salt"	$C_{14}H_7O_2\cdot SO_3Na$	XI-337	310.25
561	**Anthrol** (α)	1-hydroxy-anthracene	$C_6H_4(CH)_2C_6H_3OH$	VI-702	194.22
562	**Anthrol** (β)	2-anthrol	$C_6H_4(CH)_2C_6H_3OH$	VI-702	194.22
563	**Antimony triphenyl**	triphenyl stibine	$Sb(C_6H_5)_3$	XVI-891	353.06
564	dichloride	tri-Ph-stibine-di-Cl	$(C_6H_5)_3SbCl_2$	XVI-893	423.97
565	**Antipyrene**	1-Ph-2, 3-diMe-pyrazolone-5	$C_{11}H_{12}ON_2$	XXIV-27	188.22
566	acetylsalicylate	pyrosal	$C_{20}H_{20}O_5N_2$	XXIV-32	368.38
567	chloralhydrate	hypnal; chloral-antipyrene	$Cl_3C\cdot CH(OH)_2\cdot C_{11}H_{12}ON_2$	XXIV-31	353.64
568	mandelate	tussol	$C_{11}H_{12}ON_2\cdot C_8H_8O_3$	....	340.37
569	**Apiole**	1-allyl-2, 5-diMeO-3, 4-methylenedioxybenzene	$C_{12}H_{14}O_4$	XIX-87	222.23
570	**Arabinose** (α) (*d* or *l*)	....	$C_4H_9O_4\cdot CHO$	I-859	150.13
571	phenylhydrazone (*l*)	....	$C_6H_5NH\cdot N:C_5H_{10}O_4$	XV-215	240.25
572	**Arabitol** (*d*)	pentanpentol	$C_5H_7(OH)_5$	I-531	152.15
573	**Arabonic acid**	....	$HO\cdot CH_2(CHOH)_3\cdot CO_2H$	III-473	166.13
574	**Arachidic acid**	eicosanoic acid	$CH_3(CH_2)_{18}\cdot CO_2H$	II-389	312.52
575	**Arginine** (*l*+)	guanidine-amino-valeric acid	$H_2N\cdot C(:NH)\cdot NH\cdot (CH_2)_3\cdot CH(NH_2)\cdot CO_2H$	IV-420	174.20
576	hydrochloride (*d*)	....	$C_6H_{14}O_2N_4\cdot HCl$	IV-423	210.67
577	**Arsacetin** (*p*)	acetyl arsanilic acid	$CH_3CO\cdot NH\cdot C_6H_4\cdot AsO(OH)_2$	XVI-880	259.08
578	Na salt	....	$C_8H_9O_4NAsNa\cdot 4H_2O$	XVI-880	353.13
579	**Arsenic** diethyl	ethyl cacodyl	$[(C_2H_5)_2As]_2$	IV-616	266.06
580	triphenyl	triphenylarsine	$As(C_6H_5)_3$	XVI-828	306.21
581	**Arseno-phenyl-glycine Na**	....	$(As\cdot C_6H_4\cdot NH\cdot CH_2\cdot CO_2Na)_2$	....	494.10
582	**Arsono-phenyl-glycinamide** (4)	....	$H_2N\cdot CO\cdot CH_2\cdot NH\cdot C_6H_4\cdot AsO(OH)_2$	*XVI-470	274.09
583	Na salt	tryparsamide	$C_2H_5ON_2\cdot C_6H_4\cdot AsO(ONa)_2\cdot 3H_3O$	*XVI-470	372.12
584	**Asarone**	propenyl-2,4,5-tri-MeO-benzene	$CH_3CH:CH\cdot C_6H_2(OCH_3)_3$	VI-1129	208.25
585	**Ascaridole**	....	$CH_3\cdot C_6H_6O_2\cdot CH:(CH_3)_2$	XIX-17	168.25
586	**Ascorbic acid** (*l*+)	vitamin C; redoxon; cevitamic acid	$O\cdot CO\cdot C(OH):C(OH)\cdot$ $CH\cdot CHOH\cdot CH_2OH$	....	176.12
587	*iso*-**Ascorbic acid** (*d*)	....	$C_6H_8O_6$	....	176.12
588	**Asparagin** (*l*)	....	$HO_2C\cdot CH(NH_2)\cdot CH_2\cdot CONH_2$	IV-476	132.12
589	**Aspartic acid** (*l*–)	amino-succinic acid	$HO_2C\cdot CH(NH_2)\cdot CH_2\cdot CO_2H$	IV-472	133.10
590	**Aspartic acid** (*dl*)	amino-succinic acid	$C_4H_7O_4N$	IV-483	133.10
591	**Atropic acid**	α-phenyl acrylic acid	$C_6H_5C(:CH_2)\cdot CO_2H$	IX-610	148.15

Arbutin, cf. glcde.
Arecoline, cf. alkd.
Aresol 3400
Arheol 5595
Aristol 5940

Armstrong's δ acid 4461
Armstrong and Wynne's acid II 4535
Arsanilic acid 515
Arsenic triethyl 6183
Arsenic trimethyl 6252

Arsphenamine 5592
Arsphenamine S 5593
Artamin 5234
Arthanitin, cf. glcde.
Arthriticin 2226

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
560	silver lf.	....	....	....	0.8 c.; 21 h.	i.	i.
561	nd./al.	....	150-3	....	i.	v. s.	v. s.
562	nd./aq.	....	d. 200	....	i.	v. s.	v. s.
563	tri. pr./pet.	$1.5^{12^{\circ}}$	50-3	>360 d.	i.; v. s. bz.	sl. s.	v. s.
564	col. nd.	....	143	....	v. sl. s.	i.	i.; s. bz.
565	mn./aq.	$1.088\frac{113^{\circ}}{4}$	113 (109)	319^{174mm}	100	100	sl. s.
566	col. pd.	....	64-5	....	$1^{25^{\circ}}$; $4^{80^{\circ}}$	$126^{25^{\circ}}$	$13^{25^{\circ}}$; s. bz.
567	col. rhb.	....	67-8	....	7.9^{14}	33	sl. s.
568	col. cr.	....	52-5	....	6.6	30	5
569	col. nd.	$1.02\frac{20^{\circ}}{4}$	30*	294	i.; s. bz.	s.; s. act.	s.; s. oil
570	rhb. pr.	$1.585\frac{20^{\circ}}{4}$	158.5-9.5	....	$46^{0^{\circ}}$	$0.5^{9^{\circ}}$, 90% al.	i.
571	col. nd.	....	151-3	....	$1.2^{15^{\circ}}$	$1.3^{15^{\circ}}$, abs.	v. sl. s.
572	pr. or warts	....	102-3	....	v. s.	$2^{12^{\circ}}$,90%al.	....
573	cr.	....	89	d., $-H_2O$	s.	....	....
574	col. lf.	....	77	328 sl. d.	i.	v. s. h. abs.	v s.
575	pr./66% al.	....	238 d.	....	$15^{21^{\circ}}$	sl. s.	i.
576	col. pl.	....	222-35 d.	softens 218	v. s.	....	....
577	lf.	....	>200	....	s. Na_2CO_3	v. sl. s. dil. HCl	....
578	wh. cr. pd.	....	....	....	$10^{20^{\circ}}$	$33^{50^{\circ}}$	....
579	lq.	>1	ign. in air	185-90	i.	v. s.	v. s.
580	pl./bz.	1.306	59-60	>360(CO_2)	i.; i. HCl	s.; v. s. bz.	v. s.
581	yel. pd.	....	d. in air	....	s.	....	....
582	pl./aq.	....	darkens 280	....	v. s. h.; s. h. ac.	v. sl. s. h.; i. c. chl.	i. c. act.
583	wh. pd.	....	....	....	50	sl. s.	i.; i. chl.
584	mn. nd./aq.	$1.165^{18^{\circ}}$	67	296	sl. s. h.; s. ac.	$7^{18^{\circ}}$, 165^{50}, 60% al.	s.; s. chl.
585	col. lq.	$0.999\frac{20^{\circ}}{20}$	expl. 250	115^{15mm}	i.	s.	expl. with a.
586	col. mn.	....	192	....	33; 1 gly.	4; i. pet.; i. fat	i.; i. bz.
587	col. cr.	....	168-71	....	v. s.	s.; i. act.	v. sl. s.
588	rhb.	$1.543\frac{15^{\circ}}{4}$	227-35**	235 d.	$3.1^{28^{\circ}}$	i. c. abs. al.	s. NH^3
589	rhb.	....	251-83 d.	....	$0.5^{16^{\circ}}$	i.	i.
590	mn. pr.	$1.663\frac{13^{\circ}}{13}$	271**	d. 290	$2.7^{175^{\circ}}$	i.	i.
591	mn. nd./aq.	....	106-7	267 d.	0.13 c.	s.; s. chl.	s.; s. CS_2

* Also modifications, m.p. 27.5 and 18-9. ** Sealed tube.

Artificial camphor 5319
Asaprol 4506
Asarin 584
Asaronic acid 6241
Asebogenol 5264
Asebotin, cf. glcde.
Asepsin 882
Aspidospermine, cf. alkd.
Aspirin 115
Athenon 3800
Aticine, cf. alkd.
Atisine, cf. alkd.
Atophan 5234
Atoquinol 212
Atoxylic acid 515
Atropine, cf. alkd.
Atroscine, cf. alkd.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
592	**Auramine**	4,4′-dimethylamino-benzophenonimide	$[(CH_3)_2NC_6H_4]_2C{:}NH$	XIV-91	267.36
593	**Aurin**	4′,4″-diOH-fuchsone	$(HOC_6H_4)_2C{:}C_6H_4{:}O$	VIII-361	290.30
594	**Azafrin**		$C_{27}H_{38}O_4$	XXX-115	426.57
595	**Azafrinone**		$C_{27}H_{36}O_4$	XXX-116	424.56
596	**Azelaic** acid	nonandioic acid	$(CH_2)_7(CO_2H)_2$	II-707	188.22
597	nitrile		$(CH_2)_7(CN)_2$	II-709	150.22
598	**Azo**-anisole (2,2′)	diMeO-azobenzene	$(CH_3O{\cdot}C_6H_4N{:})_2$	XVI-92	242.27
599	benzene	diphenyldiimide	$C_6H_5{\cdot}N{:}N{\cdot}C_6H_5$	XVI-8	182.22
600	benzoic acid (2,2′)		$(HO_2C{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-228	270.24
601	benzoic acid (3,3′)		$(HO_2C{\cdot}C_6H_4{\cdot}N{:})_2{\cdot}\frac{1}{2}H_2O$	XVI-233	279.24
602	benzoic acid (4,4′)		$(HO_2C{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-236	270.24
603	dicarbonamide		$(NH_2{\cdot}CO{\cdot}N{:})_2$	III-123	116.08
604	naphthalene (α,α′)		$C_{10}H_7{\cdot}N{:}N{\cdot}C_{10}H_7$	XVI-79	282.33
605	naphthalene (β,β′)		$C_{10}H_7{\cdot}N{:}N{\cdot}C_{10}H_7$	XVI-80	282.33
606	phenetole (2,2′)		$(C_2H_5O{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-92	270.32
607	phenetole (3,3′)		$(C_2H_5O{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-95	270.32
608	phenetole (4,4′)		$(C_2H_5O{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-113	270.32
609	phenol (2,2′)	dihydroxy-azobenzene	$(HO{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-91	214.22
610	phenol (3,3′)		$(HO{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-95	214.22
611	phenol (4,4′)		$(HO{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-110	214.22
612	toluene (2,2′)	dimethylazobenzene	$(CH_3{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-61	210.27
613	toluene (3,3′)		$(CH_3{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-64	210.27
614	toluene (4,4′)		$(CH_3{\cdot}C_6H_4{\cdot}N{:})_2$	XVI-67	210.27
615	**Azoxy**-benzene		$C_6H_5{\cdot}N({:}O){:}N{\cdot}C_6H_5$	XVI-622	198.22
616	benzoic acid (2,2′)		$(HO_2C{\cdot}C_6H_4)_2{:}N_2O$	XVI-644	286.24
617	benzoic acid (3,3′)		$(HO_2C{\cdot}C_6H_4)_2{:}N_2O$	XVI-646	286.24
618	benzoic acid (4,4′)		$(HO_2C{\cdot}C_6H_4)_2{:}N_2O$	XVI-647	286.24
619	naphthalene (α,α′)		$(C_{10}H_7N)_2O$	XVI-633	298.33
620	naphthalene (β,β′)		$(C_{10}H_7N)_2O$	XVI-633	298.33
621	**Barbituric acid**	malonyl urea	$CH_2CONHCONHCO{\cdot}2H_2O$	XXIV-467	164.12
622	**Bassorine**		$C_6H_{10}O_5$		162.14
623	**Behenic acid**	docosanoic acid	$CH_3{\cdot}(CH_2)_{20}{\cdot}CO_2H$	II-391	340.57
624	**Behenolic acid**	docosinoic acid	$C_8H_{17}C\vdots C(CH_2)_{11}{\cdot}CO_2H$	II-497	336.54
625	**Benzal** acetoacetic ester		$C_2H_3O{\cdot}C(C_7H_6){\cdot}CO_2C_2H_5$	X-731	218.24
626	acetone	Me-cinnamyl ketone	$C_6H_5{\cdot}C_2H_2{\cdot}CO{\cdot}CH_3$	VII-364	146.18
627	acetophenone	chalcone	$C_6H_5{\cdot}C_2H_2{\cdot}CO{\cdot}C_6H_5$	VII-479	208.25
628	acetophenone dibromide		$C_6H_5{\cdot}(CHBr)_2{\cdot}COC_6H_5$	VII-445	368.08
629	acetophenone dibromide	high m. p. form	$C_6H_5{\cdot}(CHBr)_2{\cdot}CO{\cdot}C_6H_5$	VII-445	368.08
630	amino-2-cresol (5)	(5; 1, 2)	$C_6H_5CH{:}N{\cdot}C_6H_3(CH_3){\cdot}OH)$		211.25
631	aminophenol (*p*)		$C_6H_5CH{:}N{\cdot}C_6H_4{\cdot}OH$	XIII-453	197.23
632	aniline	benzaldehyde anil	$C_6H_5CH{:}N{\cdot}C_6H_5$	XII-195	181.23

Aurantiin, cf. glcde.
Aurin 5573
Avenein, cf. glcde.
Avertin 6104
Avornin, cf. glcde.

Azamin-4B 733
Azo-aniline 1697
Azo-benzil 698
Azo-chloramide 1949
Azodermin 124

Azo-dinaphthylamine 251
Azo-phenylene 5104
Azo-resorcin 5551
Azo-resorufin 5554

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
592	col./al.	....	136	....	i.	7^{20°	2.3^{20°
593	rhb. red	....	308-10 d.	....	i.; i. bz.	s.	s.; s. alk.
594	or. nd./bz.	....	212-4	....	i.; s. alk.	sl. s.	i.; sl. s. bz.
595	or. cr./act.	....	131	....	....	....	....
596	lf. or nd.	$1.029_{4}^{20^\circ}$	106.5	286.5^{100mm}	0.2 c.; ∞ h.	v. s.	2.7^{15°
597	oil	0.941^{0°	....	$195\text{-}6^{19mm}$	i.	v. s.	v. s.
598	or. pr./ MeOH	....	153 (141)	....	i.; s. act.	s.; s. chl.	s.; s. bz.
599	or. mn.	$1.203_{4}^{20^\circ}$	68	297	i.	4.2^{20°	12^{20° lg.
600	yel. nd./al.	....	237 d.	....	sl. s. h.	v. s. h.	i. bz.
601	yel. nd./ac.	....	340 ±	d.	v. sl. s.	0.2 h.	sl. s.
602	red nd./ac.	....	d. 330 ±	....	v. sl. s.	v. sl. s.	v. sl. s.
603	or. red pd.	....	d. 180-200	....	v. sl. s. h.	i.	d. h. HCl
604	red nd./ac.	....	190	subl. >190	i.; s. ac.	v. sl. s.	v. s. bz.
605	red pr./chl.	....	204	subl. 210	i.	sl. s.	s. bz.
606	red pr./al.	....	131	240 d.	i.; s. HCl	s.	s.
607	yel. pr./al.	....	91	d.	i.; i. HCl	s.	s.
608	or. lf.	....	159-60	d.	v. s. chl.	s. h.	v. s.
609	yel. lf.	....	171-2	subl.	i.	0.3 c.	s.; s. KOH
610	brn./aq. al.	....	205	....	v. sl. s.	s. h.	s. Na_2CO_3
611	brn. tri.	....	215 d.	....	sl. s.	s.	s.; s. bz.
612	red mn./et.	....	55	....	i.; s. bz.	6.03^{15°	147.7^{17°
613	or. rhb.	....	54-5	....	i.	s.	s.
614	or. nd./lg.	....	144-5	....	i.	sl. s.	s.; s. lg.
615	yel. rhb.	$1.248_{20}^{20^\circ}$	36	d.	i.	11.4^{15°	43.5^{15° lg.
616	brn./al.	....	246-8 d.	....	v. sl. s. h.	s. h.	s. h.
617	nd. or lf.	....	320 d.	....	i.	sl. s.	sl. s.
618	yel. amor.	....	d. 240 ±	....	i.	i.	s. C_5H_5N
619	yel. rhb./al.	....	127	....	i.	s.	....
620	yel. rhb./al.	....	167-8	....	i.	....	....
621	col. pr./aq.	....	d. 245 ±	....	s. h.	sl. s.	s.; s. HCl
622	wh. amor.	....	....	....	v. sl. s.	i.; d. h. a.	i. $(NH_4)_2S$
623	col. nd.	....	80	306^{60mm}	i.	sl. s.	sl. s.
624	nd.	....	57.5	....	i.	v. s.	v. s.
625	rhb./al.	....	59-60	295-7 sl. d.	v. s. chl.	sl. s. c.	sl. s. c.
626	pl.	$1.035_{20}^{20^\circ}$	$4^{1}\text{-}2$	260-2	s. H_2SO_4	s.; s. chl.	s.; s. bz.
627	lt. yel. rhb.	$1.071_{4}^{62^\circ}$	62	345-8 sl. d.	i.	sl. s.	v. s.
628	nd./al.	....	108-9	....	....	1^{30°; s. h.	....
629	....	....	156-7	....	....	0.16^{30°	....
630	brn. fl.	....	210-11	....	i.	sl. s.	i.
631	lf./aq. al.	....	183	....	....	v. s.	....
632	yel. cr.	....	56 (48)	300 ±	i.	s.	s.

Badische acid 4551
Banana oil 398
Banisterine, cf. alkd.
Baptisin, cf. glcde.

Baptitoxine, cf. alkd.
Barbital 2124
Barytine, cf. alkd.
Baum's acid 4498

Bayer acid 4512 or 4553
Bebeerine, cf. alkd.
Beet sugar 5663
Benzacetin 29

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
633	**Benzal** azine	dibenzal hydrazine	$(C_6H_5CH{:}N\cdot)_2$	VII-225	208.25
634	bromide	benzylidene bromide	$C_6H_5\cdot CH{:}Br_2$	V-308	249.95
635	chloride	benzylidene chloride	$C_6H_5\cdot CH{:}Cl_2$	V-297	161.03
636	diacetate	benzylidene diacetate	$C_6H_5CH{:}(O_2CCH_3)_2$	VII-210	208.21
637	lactic acid	phenyl-hydroxy-crotonic acid	$C_6H_5\cdot CH{:}CH\cdot CHOH\cdot CO_2H$	X-308	178.18
638	malonic acid	....	$C_6H_5\cdot CH{:}C(CO_2H)_2$	IX-891	192.16
639	methylamine	....	$C_6H_5\cdot CH{:}N\cdot CH_3$	VII-213	119.16
640	phthalide	benzylidene phthalide	$C_7H_6{:}C\cdot C_6H_4\cdot CO\cdot O$	XVII-376	222.23
641	2-thiohydantoin (5)	....	$CO\cdot NH\cdot CS\cdot NH\cdot C{:}C_7H_6$	XXIV-400	204.24
642	**Benzaldehyde**	art. almond oil	$C_6H_5\cdot CH{:}O$	VII-174	106.12
643	oxime (α; ***anti***)	....	$C_6H_5CH{:}NOH$	VII-218	121.13
644	oxime (β, ***syn***)	....	$C_6H_5CH{:}NOH$	VII-221	121.13
645	oxime carboxylic anhydride (***o***)	benzoxazinone	$C_6H_4\cdot CH{:}N\cdot O\cdot CO$	XXVII-198	147.13
646	phenylhydrazone	....	$C_6H_5NH\cdot N{:}CH\cdot C_6H_5$	XV-134	196.24
647	**Benzamaron**	....	$C_6H_5CH[CH(C_6H_5)\cdot COC_6H_5]_2$	VII-849	480.57
648	***iso*-Benzamaron**	....	$C_{35}H_{28}O_2$	VII-849	480.57
649	**Benzamidine**	benzenylamidine	$C_6H_5C({:}NH)\cdot NH_2$	IX-280	120.15
650	**Benzanthracene** (1,2)	naphthanthracene	$C_{18}H_{12}$	V-718	228.28
651	**Benzarsonic acid** (***p***)	....	$(HO)_2OAs\cdot C_6H_4\cdot CO_2H$	XVI-876	246.04
652	**Benzaurine**	....	$C_6H_5C({:}C_6H_4O)\cdot C_6H_4OH$	VI-1145	274.30
653	**Benzazide**	benzoyl azide	$C_6H_5CO\cdot N_3$	IX-332	147.13
654	**Benzedrine**	***dl***-desoxy-norephedrine	$C_6H_5CH_2CH(NH_2)\cdot CH_3$	XII-1145	135.20
655	sulfate	....	$(C_9H_{13}N)_2\cdot H_2SO_4$	....	368.48
656	**Benzene**	benzol	C_6H_6	V-179	78.11
657	azo-***o***-cresol (5)	(1;4,3)	$C_6H_5\cdot N_2\cdot C_6H_3(OH)\cdot CH_3$	XVI-130	212.24
658	azo-***m***-cresol (6)	(1;4,2)	$C_6H_5\cdot N_2\cdot C_6H_3(OH)\cdot CH_3$	XVI-134	212.24
659	azodiphenylamine (***p***)	4-anilino-azobenzene	$C_6H_5\cdot N_2\cdot C_6H_4NHC_6H_5$	XVI-314	273.32
660	azo-α-naphthylamine (4)	....	$C_6H_5\cdot N_2\cdot C_{10}H_6\cdot NH_2$	XVI-361	247.29
661	azo-β-naphthylamine (1)	Yellow AB	$C_6H_5\cdot N_2\cdot C_{10}H_6\cdot NH_2$	XVI-369	247.29
662	azoresorcinol	(1;2,4); Sudan G	$C_6H_5\cdot N_2\cdot C_6H_3(OH)_2$	XVI-180	214.22
663	disulfone chloride	(1,3)	$C_6H_4{:}(SO_2Cl)_2$	XI-200	275.13
664	disulfonic acid (***m***)	....	$C_6H_4\cdot(SO_3H)_2\cdot 2\frac{1}{2}H_2O$	XI-199	283.27
665	disulfonic Na (***m***)	....	$C_6H_4(SO_3Na)_2\cdot 4H_2O$	XI-199	354.27
666	hexabromide (α, ***trans***)	hexabromo-cyclohexane	$C_6H_6Br_6$	V-25	557.60
667	hexacarboxylic acid	mellitic acid	$C_6(CO_2H)_6$	IX-1008	342.17
668	hexachloride (α, ***trans***)	hexachloro-cyclohexane	$C_6H_6Cl_6$	V-23	290.85

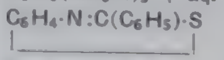
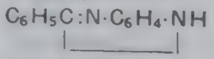
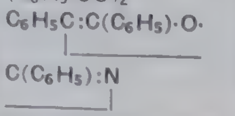
Benzaldehyde-anil 632
Benzaldehyde-cyanohydrin 4010
Benz-amide 713
Benz-aminobenzoic acid 746-8
Benz-anilide 715

Benz-triazole 252
Benzene-azimide 252
Benzene azoanisidine 246
Benzene azodimethylaniline 2431

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
633	yel. pr.	....	93	....	i. c.	s. h.	s.
634	oil	$1.51^{15°}$	....	140^{20mm}	i.	∞	∞
635	col. lq.	$1.295^{16°}$	−16.1	214	i.	∞	∞
636	pl./et.	....	45-6	154^{20mm}	s. dil. alk.	v. s.	v. s.
637	nd./aq.	....	137 ±	....	s. h.	i. bz., CS_2	sl. s.; i. lg.
638	cr./et.-CS_2	....	195-6 d.	....	v. s. h.	s.	sl. s.
639	col. lq.	....	....	180 ±	....	....	....
640	mn./al.	....	98-9	....	i. h.	v. s. h.	....
641	yel. nd./al.	....	258 sl. d.	....	....	....	....
642	col. lq.	$1.046\frac{20°}{4}$	−26*	179	0.3	∞	∞
643	pr.	$1.111\frac{20°}{4}$	35 (5)	117.5^{14mm}	sl. s.	v. s. bz.	v. s.
644	nd./et.	....	128-30	....	s. h.	v. sl. s. bz.	....
645	cr./bz.	....	d. 120	....	....	....	....
646	col.** mn.	....	155-6	....	s. bz.	s. h.	sl. s.
647	cr.	....	218-9	....	$1.6^{12°}$, bz.	....	....
648	cr.	....	179-80	....	$4.1^{12°}$, bz.	....	....
649	cr.	....	80	....	s.	v. s.	sl. s.
650	lf./al.-ac.	....	159-60	subl.	....	sl. s. h.	s. bz.
651	cr./aq.	....	d.-H_2O, 210	....	v. sl. s.	i.	i. ac.
652	r. pd.	....	....	....	i.; s. alk.	s.	s.
653	col. pl./act.	....	32	expl.	i.	sl. s.	s.
654	col. lq.	0.93	....	203	sl. s.; s. a.	s.; s. EtOAc	s.; s. chl.
655	wh. pd.	....	....	....	10	sl. s.	i.
656	col. lq.	$0.879\frac{20°}{4}$	5.5	80.1	$0.07^{22°}$	∞ abs. al.	∞
657	yel. nd./al.	....	129-30	....	v. s. h.; s. alk.	s.; s. chl.	s.; s. bz.
658	yel. nd./lg.	....	109†	....	....	s.; s. chl.	s.; s. bz.
659	yel. pr./et. al.	....	82	....	v. s. lig.	v. s.	v. s.
660	r. nd./al.	....	123	....	s. bz.	s.	s.
661	r. pl./al.	....	102-4	....	i.; s. oil	s.; s. CCl_4	s. ac.
662	r. nd./aq. al.	....	170‡	....	i.; s. alk.	v. s.	v. s.; v. s. bz.
663	mn./et.	....	63	210.7^{20mm}	d. 130°	s. h. d.	s.
664	delq. cr.	....	....	....	s.	....	....
665	col. nd.	....	....	....	s.	....	....
666	mn. pr.	....	212	....	....	sl. s.	sl. s.
667	nd./al.	....	286-8§	d.	v. s.	v. s.	s. h. H_2SO_4
668	mn. pr.	....	157-8	d. >158	$4.4^{15°}$, chl.	s.	$6.5^{18°}$, bz.

* Solidifies −56°.
** Pink on exposure to light.
† Crysts. +1 H_2O, m. 90°.
‡ Cryst. + ⅓ H_2O. m. 161°.
§ Sealed tube.

Benzene azonitromethane 4739
Benzene azophenol 3727-9
Benzene diazoanilide 1762
Benzene diazonium, cf. diazobenzene.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
669	**Benzene** hexachloride (*β, cis*)	....	$C_6H_6Cl_6$	V-23	290.85
670	indone	safranone	$C_{18}H_{12}ON_2$	XXIII-413	272.29
671	pentacarboxylic acid	....	$C_6H(CO_2H)_5 \cdot 5H_2O$	IX-1006	388.24
672	sulfinic acid	....	$C_6H_5 \cdot SO_2H$	XI-2	142.17
673	sulfinic Na	....	$C_6H_5 \cdot SO_2Na \cdot 2H_2O$	XI-6	200.19
674	sulfohydroxamic acid	Piloty's acid	$C_6H_5SO_2 \cdot NHOH$	XI-51	173.18
675	sulfonic acid	....	$C_6H_5 \cdot SO_3H$	XI-26	158.17
676	sulfonic Na	....	$C_6H_5SO_3Na \cdot H_2O$	XI-28	198.17
677	sulfonic amide	benzenesulfonamide	$C_6H_5 \cdot SO_2 \cdot NH_2$	XI-39	157.18
678	sulfonic chloride	benzenesulfonyl chloride	$C_6H_5 \cdot SO_2 \cdot Cl$	XI-34	176.62
679	1-sulfonic acid-(4-azo-5)-8-hydroxy-quinoline	sulfenazoxine	$HO_3S \cdot C_6H_4 \cdot N_2 \cdot C_9H_5N(OH)$	XXII-584	329.32
680	tetracarboxylic acid (1,2,3,4)	prehnitic acid	$C_6H_2(CO_2H)_4 \cdot 2H_2O$	IX-997	290.18
681	tetracarboxylic acid (1,2,3,5)	mellophanic acid	$C_6H_2(CO_2H)_4$	IX-997	254.15
682	tetracarboxylic acid (1,2,4,5)	pyromellitic acid	$C_6H_2(CO_2H)_4 \cdot 2H_2O$	IX-997	290.18
683	tricarboxylic acid (1,2,3)	hemimellitic acid	$C_6H_3(CO_2H)_3 \cdot 2H_2O$	IX-976	246.17
684	tricarboxylic acid (1,2,4)	trimellitic acid	$C_6H_3(CO_2H)_3$	IX-977	210.14
685	tricarboxylic acid (1,3,5)	trimesic acid	$C_6H_3(CO_2H)_3$	IX-978	210.14
686	trisulfonic acid	(1,3,5)	$C_6H_3(SO_3H)_3$ + aq.	XI-227	318.29
687	**Benzenyl**-aminothiophenol	*μ*-phenylbenzothiazole	 $C_6H_4 \cdot N{:}C(C_6H_5) \cdot S$	XXVII-74	211.27
688	aminoxime	....	$C_6H_5C(NOH)NH_2$	IX-304	136.15
689	naphthylamidine	*α*-naphthyl-benzamidine	$C_6H_5C({:}NH)NH \cdot C_{10}H_7$	XII-1233	246.30
690	phenylenediamine (1,2)	*α*-phenylbenzimidazole	 $C_6H_5C{:}N \cdot C_6H_4 \cdot NH$	XXIII-230	194.23
691	**Benzhydrol**	diphenyl carbinol	$(C_6H_5)_2CHOH$	VI-678	184.23
692	ether	....	$[(C_6H_5)_2CH]_2O$	VI-679	350.44
693	**Benzhydryl** amine	....	$(C_6H_5)_2CH \cdot NH_2$	XII-1323	183.24
694	benzoic acid (*p*)	....	$C_6H_5CH(OH) \cdot C_6H_4CO_2H$	X-346	228.24
695	**Benzidine** disulfonic acid (*o,o'*)	....	$[C_6H_3(NH_2) \cdot SO_3H]_2$	XIV-794	344.35
696	monosulfonic acid	(4;4',3)	$H_2N \cdot C_6H_4 \cdot C_6H_3(NH_2) \cdot SO_3H$	XIV-770	264.29
697	**Benzil**	dibenzoyl	$(C_6H_5 \cdot CO)_2$	VII-747	210.22
698	**Benzilam**	triphenyloxazole	 $C_6H_5C{:}C(C_6H_5) \cdot O \cdot C(C_6H_5){:}N$	XXVII-88	297.34
699	**Benzilic acid**	diphenyl glycolic acid	$(C_6H_5)_2C(OH) \cdot CO_2H$	X-342	228.24

Benzene hexahydride 1601
Benzene sulfonamide 677

Benzene sulfonyl chloride 678
Benzene tetrahydride 1609

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
669	col. cr./ xylene	$1.89^{19°}$	310-2	....	$0.13^{20°}$, chl.	v. sl. s.; $1^{22°}$bz.	v. sl. s. ac.
670	brn. met.	....	248-9	....	sl. s.	v. s.	i. alk.
671	rhb.	....	228-30; 238 (anh.)	....	v. s. h.	s.	sl. s.; i. bz.
672	pr./aq.	....	83-4	d. >100	v. s. h.; sl. s. c.	v. s.	v. s.
673	lf./aq.	....	....	....	s.	....	....
674	rhb. pl./aq.	....	126 ±	d. > m. p.	s. h.	s.; v. sl. s. bz.	s.; s. act.
675	col. nd.	....	65-6*	d.	v. s.	v. s.	i.; sl. s. bz.
676	nd./aq. al.	....	450 d.	....	$60^{30°}$	sl. s. h.	....
677	mn. nd./aq.	....	156	....	$0.43^{16°}$	v. s.	v. s.
678	cr.	$1.384^{15°}_{15}$	14.5	251.5	i.; d. h.	v. s.; d. h.	s.
679	or. nd./aq. al.	....	....	....	....	....	....
680	pr./aq.	....	237-50 d.	....	v. s.	....	sl. s.
681	cr./aq.	....	215-38 d.	....	v. s.	....	....
682	tri./aq.	....	269-71 d.	....	(anh.) $1.4^{16°}$	v. s.	....
683	pl./aq.	....	190 d.	....	$3.2^{19°}$; v. s. h.	....	s.
684	nd./aq.	....	216-8 d.	....	sl. s.	....	sl. s.
685	pr./aq.	....	375-80	subl.	$2.8^{22.5°}$	v. s.	s.
686	hyg. nd.	....	d. >100	....	s.	....	....
687	nd./al.	....	115	360 ± (sl. d.)	i.; s. HCl	sl. s.	s.; s. CS_2
688	mn./aq.	....	79-80	....	sl. s. c.	s.; s. bz.	s.; i. lg.
689	pl./aq.	....	141	....	i.	s.	s.
690	nd./aq.	....	291	....	sl. s.	s.	sl. s. chl., bz.
691	nd./lg.	....	68-9	$297\text{-}8^{48mm}$	$0.05^{20°}$	v. s.	v. s.
692	mn./bz.	....	109-10	267^{15mm}	....	sl. s. h.	v. s. bz.
693	lq.	$1.064^{21.5°}_{0}$	....	$301\text{-}2^{746mm}$	....	....	....
694	nd./aq.	....	164-5	d.	s. h.	s.	s.; sl. s. chl.
695	pr./aq. (+$3H_2O$)	....	d. >175	....	$0.08^{25°}$	i.	i.
696	lf.	....	....	....	v. sl. s. h.	v. sl. s.	v. sl. s.
697	trig. pr.	$1.23^{15°}$	95	346-8 (sl. d.)	i.	v. s.	v. s.
698	pr./al. et.	....	115	....	v. sl. s.	sl. s. c.	v. s.; s. h. ac.
699	nd./aq.	....	150	....	s. h.	s.	s.; s. H_2SO_4

* Cryst. +$1.5H_2O$, m.p. 43-4.

Benzenyl-amidine 649
Benzhydryl-aniline 384-5
Benzidine 1713-4
Benzidine (β) 1711

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
700	**Benzil**-oxime, di- (*syn*)	α-benzildioxime	$(C_6H_5C{:}NOH)_2$	VII-760	240.25
701	oxime, di-(*anti*)	β-benzildioxime	$(C_6H_5C{:}NOH)_2$	VII-761	240.25
702	oxime, di- (*amphi*)	γ-benzildioxime	$(C_6H_5C{:}NOH)_2\cdot C_2H_5OH$	VII-763	286.32
703	oxime, mono- (α)	....	$C_6H_5CO\cdot C({:}NOH)\cdot C_6H_5$	VII-757	225.24
704	oxime, mono- (β)	....	$C_{14}H_{11}O_2N\cdot\frac{1}{2}C_6H_6$	VII-758	264.29
705	oxime, mono- (β)	....	$C_{14}H_{11}O_2N$	VII-758	225.24
706	osazone (α) (*syn*)	....	$(C_6H_5C)_2\cdot(N\cdot NHC_6H_5)_2$	XV-173	390.47
707	osazone (β) (*anti*)	....	$(C_6H_5C)_2\cdot(N\cdot NHC_6H_5)_2$	XV-174	390.47
708	**Benzimidazole** (*o*)	....	$\underline{C_6H_4\cdot N{:}CH\cdot NH}$	XXIII-131	118.13
709	**Benzimidazolone** (*o*)	*o*-phenylene urea	$\underline{C_6H_4\cdot NH\cdot CO\cdot NH}$	XXIV-116	134.13
710	**Benzohydroxamic acid**	*N*-benzoyl hydroxylamine	$C_6H_5CO\cdot NHOH$	IX-301	137.13
711	**Benzoic** acid	....	$C_6H_5\cdot CO_2H$	IX-92	122.12
712	Na salt	sodium benzoate	$C_6H_5\cdot CO_2Na\cdot H_2O$	IX-107	162.12
713	amide	benzamide	$C_6H_5CO\cdot NH_2$	IX-195	121.13
714	anhydride	....	$(C_6H_5CO)_2O$	IX-164	226.22
715	anilide	benzanilide; *N*-Ph-benzamide	$C_6H_5NH\cdot COC_6H_5$	XII-262	197.23
716	nitrile	phenyl cyanide	$C_6H_5\cdot CN$	IX-275	103.12
717	**Benzoin** (*dl*)	....	$C_6H_5\cdot CHOH\cdot CO\cdot C_6H_5$	VIII-166	212.24
718	acetate	acetyl benzoin	$C_6H_5CO\cdot CH(C_6H_5)\cdot O_2C\cdot CH_3$	VIII-174	254.27
719	ethyl ether	....	$C_6H_5CH(OC_2H_5)\cdot CO\cdot C_6H_5$	VIII-174	240.29
720	oxime (α)	cupron	$C_{13}H_{12}O{:}C{:}NOH$	VIII-175	227.25
721	oxime (β)	....	$C_{13}H_{12}O{:}C{:}NOH$	VIII-175	227.25
722	phenylhydrazone (α)	....	$C_6H_5NHN{:}C(C_6H_5)\cdot CHOHC_6H_5$	XV-200	302.36
723	phenylhydrazone (β)	....	$C_6H_5NHN{:}C(C_6H_5)\cdot CHOHC_6H_5$	XV-200	302.36
724	**Benzophenone**	diphenyl ketone	$(C_6H_5)_2CO$	VII-410	182.21
725	anil	....	$(C_6H_5)_2C{:}N\cdot C_6H_5$	XII-201	257.32
726	chloride	diPh-diCl-methane	$(C_6H_5)_2CCl_2$	V-590	237.12
727	dicarboxylic acid	(2,2′)	$(HO_2C\cdot C_6H_4)_2{:}CO$	X-881	270.23
728	oxime	diphenyl ketoxime	$(C_6H_5)_2C{:}NOH$	VII-416	197.23
729	phenylhydrazone	....	$C_6H_5NHN{:}C(C_6H_5)_2$	XV-148	272.33
730	**Benzo**-phosphinic acid (*p*)	....	$HO_2C\cdot C_6H_4\cdot PO(OH)_2$	XVI-820	202.11

Benznaphthalide 765 Benzoic acid sulfamide 5671-3

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
700	lf.	....	235-7 d.	....	i.; s. NaOH	0.05^{17°	v. sl. s.
701	cr.	....	206-7 d.	....	sl. s. h.	15.3^{17°	v. s.
702	nd./al.	....	anh. 164-6	....	i.	$>15.3^{17^\circ}$	v. s.
703	lf./aq. al.	....	137-8	d. 200	i.	s. c.	s.
704	nd./bz.	....	70	....	v. sl. s.	v. s.	v. s.
705	....	....	113-4	....	....	....	....
706	yel. nd.	....	205-15	....	1.7^{19° act.	sl. s. c.	s.
707	nd.	....	225-35	....	2.4^{19° act.	sl. s.	sl. s.
708	rhb./al.	....	170	>360	sl. s.; s. a.	v. s.	sl. s.; s. alk.
709	lf./aq.	....	310-2	subl. >270	sl. s. h.	s.; sl. s. bz.	i. aq. a.
710	rhb.	....	131-2	expl.	2.25^{6°	v. s.	sl. s.; i. bz.
711	mn. pr.	$1.266_{4}^{15^\circ}$	121.7; subl. > 100	249.2	$0.21^{17.5^\circ}$; 2.2^{75°	46.6^{15°, abs. al.	66^{15°
712	col. cr.	....	$-H_2O$, 120	....	61^{25°; 77^{100°	2.3^{25°; 8.3^{78°	....
713	col. pr.	1.341	130	290	1.35^{25°	17.0^{25°, abs. al.	sl. s.
714	rhb./et.	$1.199_{4}^{15^\circ}$	42	360	i.; s. act.	s.; s. bz.	s.; s. chl.
715	lf./al.	1.31^{4°	163	$117\text{-}9^{10mm}$	i.	4^{30°, abs. al.	sl. s.
716	col. lq.	$1.001_{4}^{25^\circ}$	-12.9	190.7	1^{100°	∞	∞
717	mn.	....	133-7	$343\text{-}4^{768mm}$	v. sl. s. h.	s. h.; s. act.	sl. s.
718	pr./et. or al.	....	83	....	....	v. s.	v. s.
719	nd./lg.	....	62-3	....	v. s. bz.	v. s.	v. s.
720	pr./bz.	....	151-2	....	sl. s.	s.	s. NH_4OH
721	pr.	....	99	....	....	....	s.
722	col. nd.	....	155-8	....	i.	2.2^{20°	....
723	col. nd.	....	106	....	....	8.8^{20°	s.
724	col. rhb.	(α) 1.083^{54° (β) 1.108^{23°	(α) 48.5 (β) 26.5 (γ) 45.8 (δ) −51	305.4	i.	6.5^{15°; s. chl.	15^{13°
725	yel. rhb./et.	....	117 (112)	356-8	s. bz., CS_2	sl. s.	sl. s.
726	col. lq.	1.235^{19°	....	305 d.	d.	d.	s. bz.
727	cr.	....	150-5 d.	$-H_2O$ >160°	i.	s.	s.
728	cr./lg.	....	143-4	....	v. sl. s.	v. s. act.	v. s.
729	col. nd.	....	137-8	....	....	sl. s. h.	....
730	nd./aq.	....	>300	d. >300	s.	sl. s.	sl. s. HCl

Benzophenone oxide 6451

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
731	**Benzo**-pinacoline (*β*)	phenyl-trityl ketone	$(C_6H_5)_3C\cdot CO\cdot C_6H_5$	VII-544	348.42
732	pinacone	....	$[(C_6H_5)_2C\cdot OH]_2$	VI-1058	366.44
733	purpurin 4B	ditolyl-bis-(azo-naphthionic acid)	$[C_{10}H_5(NH_2)(SO_3Na)\cdot N:N\cdot C_6H_3(CH_3)\cdot]_2$	*XVI-342	724.71
734	thiazylhydrazine (2)	....	$\underline{C_6H_4N:C(N_2H_3)\cdot S\cdot}$	....	165.21
735	trichloride	phenyl chloroform	$C_6H_5CCl_3$	V-300	195.48
736	**Benzoxyl-2-dimethyl-amino-methyl-1-dimethyl-amino-butane (2)** HCl	alypin hydrochloride	$[(CH_3)_2N\cdot CH_2]_2:C:(C_2H_5)(O_2C\cdot C_6H_5)\cdot HCl$	IX-175	314.85
737	nitrate	alypin nitrate	$C_{16}H_{26}O_2N_2\cdot HNO_3$	*IX-92	341.40
738	**Benzoyl** acetic acid	....	$C_6H_5\cdot CO\cdot CH_2\cdot CO_2H$	X-672	164.15
739	acetic ester	ethyl benzoyl-acetate	$C_6H_5\cdot CO\cdot CH_2\cdot CO_2\cdot C_2H_5$	X-674	192.21
740	acetoacetic ester	....	$C_2H_3O\cdot CH(C_7H_5O)\cdot CO_2C_2H_5$	X-817	234.24
741	acetone	....	$C_6H_5CO\cdot CH_2\cdot CO\cdot CH_3$	VII-680	162.18
742	acetonitrile	ω-cyanoacetophenone	$C_6H_5\cdot CO\cdot CH_2\cdot CN$	X-680	145.15
743	acrylic acid (*β*)	....	$C_7H_5O\cdot CH:CH\cdot CO_2H\cdot H_2O$	X-726	194.18
744	alanine (*dl*)	....	$C_6H_5CO\cdot NH\cdot CH(CH_3)\cdot CO_2H$	IX-248	193.20
745	alanine (*l*)	....	$C_{10}H_{11}O_3N$	IX-248	193.20
746	aminobenzoic acid (*o*)	*N*-benzoyl-anthranilic acid	$C_7H_5O\cdot NH\cdot C_6H_4\cdot CO_2H$	XIV-340	241.24
747	aminobenzoic acid (*m*)	benzaminobenzoic acid	$C_7H_5O\cdot NH\cdot C_6H_4\cdot CO_2H$	XIV-397	241.24
748	aminobenzoic acid (*p*)	....	$C_7H_5O\cdot NH\cdot C_6H_4\cdot CO_2H$	XIV-433	241.24
749	auramine	....	$[(CH_3)_2N\cdot C_6H_4]_2C:N\cdot COC_6H_5$	XIV-95	371.46
750	benzoic acid (*o*)	....	$C_6H_5CO\cdot C_6H_4\cdot CO_2H\cdot H_2O$	X-747	244.24
751	benzoic acid (*m*)	....	$C_6H_5CO\cdot C_6H_4\cdot CO_2H$	X-752	226.22
752	benzoic acid (*p*)	....	$C_6H_5CO\cdot C_6H_4\cdot CO_2H$	X-753	226.22
753	bromide	....	$C_6H_5\cdot CO\cdot Br$	IX-195	185.03
754	carbinol	phenacyl alcohol	$C_6H_5CO\cdot CH_2OH$	VIII-90	136.14
755	chloride	....	$C_6H_5\cdot CO\cdot Cl$	IX-182	140.57
756	cyanide	....	$C_6H_5\cdot CO\cdot CN$	X-659	131.13
757	fluoride	....	$C_6H_5\cdot CO\cdot F$	IX-181	124.11
758	formic acid	phenylglyoxylic acid	$C_6H_5\cdot CO\cdot CO_2H$	X-654	150.13
759	glycolic acid	....	$C_7H_5O\cdot OCH_2\cdot CO_2H$	IX-167	180.15
760	hydrazine	....	$C_6H_5CO\cdot NH\cdot NH_2$	IX-319	136.15
761	hydrogen peroxide	....	$C_6H_5CO_2\cdot OH$	IX-178	138.12
762	iodide	....	$C_6H_5\cdot CO\cdot I$	IX-195	232.03
763	lactic acid (*dl*)	....	$CH_3\cdot CH(O_2C_7H_5)\cdot CO_2H$	IX-167	194.18
764	γ-(2-methylpiperidino)-propanol HCl	neothesin	$C_{16}H_{23}O_2N\cdot HCl$	....	297.82

Benzo-flavone 4479
Benzo-hydroquinone 2322
Benzo-γ-pyrone 1490
Benzo-pyrrole 3864
Benzo-quinoline 4518
Benzo-quinone 5541-2
Benzo-resorcin 2321
Benzo-salin 4143
Benzosol 3482
Benzo-thiophene 5912
Benzo-triazole 252
Benzozone 73
Benzol 656
Benzoxazinone 645
Benzoyl-acetophenone 1781

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
731	nd./al.	....	179-81	....	i.	v. sl. s. c.; 1.2 h.	s.
732	mn.	....	185-6 d.	....	....	2.5 h.	v. s.
733	cr.	....	....	....	s.	....	....
734	pa. yel. cr.	....	197-8	....	i.	s. h.	i.
735	col. lq.	1.380^{14°	–4.75	220.7	i.; d.	s.; s. bz.	s.
736	cr./act.	....	169 d.	....	v. s.; s. act.	s.; s. chl.	i.
737	col. pd.	....	163	....	v. s.	v. s.	v. sl. s.
738	nd./bz.	....	103-4 d.	....	s. h.	s.	s.
739	col. lq.	$1.111^{25^\circ}_{4}$	....	165-7^{20mm}	v. sl. s.	∞	∞
740	oil	....	....	175-6^{12mm} (sl. d.)	....	....	....
741	pr.	$1.090^{60^\circ}_{60}$	60-1	260-2 (sl. d.)	s. h.	v. s.	v. s.
742	pr./aq.	....	80.5	....	sl. s. c.	s.	s.; v. s. bz.
743	cr.	....	65; anh. 99	....	sl. s. c.	s.	s.
744	lf./et.	....	165-6	....	0.4 c.	v. s.	v. sl. s.
745	pl./aq.	....	150-1	....	1.1^{20°	v. s.	v. sl. s.
746	nd./al.	....	181-2	....	i.	s.	s.
747	pr./al.	....	248	....	sl. s.	s.	sl. s.
748	nd./al.	....	278	....	sl. s. h.	s.	s.; s. ac.
749	yel. nd./al.	....	179	....	....	0.16^{16°	0.93^{16° bz.
750	tri./aq.	....	93-4; anh. 128	....	sl. s.	....	....
751	lf./aq. al.	....	161-2	subl.	sl. s. h.	s.	s.
752	mn.	....	194	subl.	v. sl. s. c.	s.	s.
753	lq.	$1.570^{20^\circ}_{4}$	0 ±	218-9	d.	d. h.	∞
754	hex. pl./al.	1.013	85-6	118-20^{11mm}	sl. s. h.	v. s.	v. s.
755	col. lq.	$1.212^{20^\circ}_{4}$	–0.5	197.2	d.; s. bz.	d. h.	∞; s. CS_2
756	cr. pl.	....	33-4	208-10	i.	....	....
757	lq.	>1	....	161.5^{45mm}	sl. d. h.	d. h.	s.
758	pr.	....	65-6	148^{6mm}	s.	i. CS_2	s.
759	pr.	....	79	....	sl. s. c.; d. h.	s.	s.
760	pl./aq.	....	112.0-2.5	d.	s.	s.; sl. s. bz.	sl. s.
761	lf./lg.	....	41-3	97-100^{13mm}	i.	s.	s.
762	nd.	....	3	135^{25mm}	d. h.	d. h.	s.
763	pl.	....	112	....	0.25 c.; d. h.	v. s.	v. s.
764	wh. cr. pd.	....	171-3	....	100	s.; s. chl.	i.

Benzoyl-anisole 4070
Benzoyl-anthranilic acid (*N*) 746
Benzoyl-azide 653
Benzoyl-ecgonine, cf. alkd.
Benzoyl-eugenol 3220
Benzoyl-formaldoxime 4874
Benzoyl-glucose, cf. glcd.
Benzoyl-glycine 3664
Benzoyl-guaiacol 3482
Benzoyl-hydroquinone 2322
Benzoyl-hydroxylamine (*N*) 710
Benzoyl-naphthalene 5210-1

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Benzoyl				
765	α-naphthylamine	benznaphthalide	$C_6H_5CO\cdot NH\cdot C_{10}H_7$	XII-1233	247.28
766	peroxide	....	$(C_6H_5CO)_2O_2$	IX-179	242.22
767	phenylhydrazine (α, α′)	....	$C_6H_5N(COC_6H_5)\cdot NH_2$	XV-250	212.24
768	phenylhydrazine	(α, β)	$C_6H_5NH\cdot NHCOC_6H_5$	XV-255	212.24
769	phthalic acid (1;2,3)	....	$C_6H_5CO.C_6H_3.(CO_2H)_2\cdot H_2O$	X-880	288.25
770	piperidine (*N*)	....	$C_7H_5O\cdot N\cdot \underbrace{CH_2(CH_2)_4}$	XX-46	189.25
771	propionic acid (β)	....	$C_7H_5O\cdot CH_2\cdot CH_2\cdot CO_2H$	X-696	178.18
772	terephthalic acid	(1;2,5)	$C_{13}H_8O(CO_2H)_2$	X-881	270.23
773	2-thiohydantoin (1)	....	$\underbrace{CH_2\cdot CO\cdot NH\cdot CS\cdot N\cdot}_{C_7H_5O}$	*XXIV-294	220.24
774	thiourea	....	$C_7H_5O\cdot NH\cdot CS\cdot NH_2$	IX-219	180.22
775	toluidide (*o*)	*N*-tolylbenzamide (*o*)	$C_7H_5O\cdot NH\cdot C_6H_4\cdot CH_3$	XII-795	211.25
776	toluidide (*m*)	....	$C_7H_5O\cdot NH\cdot C_6H_4\cdot CH_3$	XII-861	211.25
777	toluidide (*p*)	....	$C_7H_5O\cdot NH\cdot C_6H_4\cdot CH_3$	XII-926	211.25
778	urea (*N*)	....	$C_6H_5CO\cdot NHCONH_2$	IX-215	164.16
779	**Benzoylene urea**	2,4-diketotetrahydro-quinazoline	$\underbrace{C_6H_4\cdot NH\cdot CO\cdot NH\cdot CO}$	XXIV-373	162.14
780	**Benzyl** acetamide (*N*)	acetyl-benzylamine	$CH_3CO\cdot NH\cdot CH_2C_6H_5$	XII-1044	149.19
781	acetate	....	$C_6H_5CH_2O\cdot COCH_3$	VI-435	150.17
782	alcohol	phenyl carbinol	$C_6H_5\cdot CH_2OH$	VI-428	108.13
783	amine	ω-aminotoluene	$C_6H_5CH_2\cdot NH_2$	XII-1013	107.15
784	aminophenol (*p*)	....	$C_6H_5CH_2\cdot NH\cdot C_6H_4OH$	XIII-448	199.24
785	aminophenol HCl	(*p*)	$C_{13}H_{13}ON\cdot HCl\cdot H_2O$	XIII-448	253.72
786	aniline	phenyl-benzylamine	$C_6H_5CH_2\cdot NH\cdot C_6H_5$	XII-1023	183.24
787	arsonic acid	....	$C_6H_5CH_2\cdot AsO(OH)_2$	XVI-872	216.05
788	azide	....	$C_6H_5\cdot CH_2\cdot N_3$	V-350	133.15
789	benzoate	....	$C_6H_5CO_2\cdot CH_2\cdot C_6H_5$	IX-121	212.24
790	benzoic acid (*o*)	....	$C_6H_5\cdot CH_2\cdot C_6H_4\cdot CO_2H$	IX-676	212.24
791	benzoic acid (*m*)	....	$C_6H_5\cdot CH_2\cdot C_6H_4\cdot CO_2H$	IX-676	212.24
792	benzoic acid (*p*)	....	$C_6H_5\cdot CH_2\cdot C_6H_4\cdot CO_2H$	IX-677	212.24
793	bromide	ω-bromotoluene	$C_6H_5\cdot CH_2\cdot Br$	V-306	171.04
794	butyrate	....	$C_2H_5CH_2CO_2CH_2\cdot C_6H_5$	VI-436	178.22
795	carbamate	....	$NH_2\cdot CO_2\cdot CH_2C_6H_5$	VI-437	151.16
796	chloride	ω-chlorotoluene	$C_6H_5\cdot CH_2\cdot Cl$	V-292	126.58
797	chloroacetate	....	$ClCH_2CO_2\cdot CH_2C_6H_5$	VI-435	184.62
798	cinnamate	cinnamein	$C_8H_7\cdot CO_2\cdot C_7H_7$	IX-584	238.27
799	cyanamide	....	$C_6H_5\cdot CH_2\cdot NH\cdot CN$	XII-1051	132.16
800	cyanide	phenylacetonitrile	$C_6H_5\cdot CH_2\cdot CN$	IX-441	117.14
801	cyanurate (***iso***)	....	$(C_6H_5CH_2N\cdot CO)_3$	XXVI-255	399.43
802	diphenyl (*o*)	....	$C_6H_5CH_2\cdot C_6H_4\cdot C_6H_5$	V-708	244.32
803	diphenyl (*p*)	....	$C_6H_5CH_2\cdot C_6H_4\cdot C_6H_5$	V-708	244.32
804	diphenylamine	diphenyl-benzylamine	$(C_6H_5)_2N\cdot CH_2C_6H_5$	XII-1033	259.33
805	disulfide	dibenzyl-disulfide	$(C_6H_5\cdot CH_2)_2S_2$	VI-465	246.37

Benzoyl-nitromethane 4594
Benzoyl-persulfide 1779
Benzoyl-pseudotropine, cf. alkd.
Benzoyl-pyrogallol 6224

Benzoyl-resorcin 2321
Benzoyl-salicin, cf. glcde.
Benzoyl-sulfimide 5579
Benzoyl-*pseudo*-tropine, cf. alkd.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
765	nd./aq. al.	....	161-2	....	s. ac.	v. sl. s. abs.	....
766	rhb./et.	....	108 d.	expl.	i.	sl. s. c.; s. h.	s.; s. bz.
767	nd./aq.	....	70	....	sl. s. c.	v. s.	v. s.
768	pr./al.	....	168	....	sl. s. h.	s. h.; s. chl.	sl. s.
769	nd./aq.	....	$-H_2O$, 100	$-2H_2O > 100$	s. h.	s.	v. sl. s. bz.
770	col. tri.	....	48	320-1	i.	s.	s.
771	nd./aq.	....	116	sl. d.	s. h.	s.	s.; i. lg.
772	cr./al.	....	>290	....	i.	s.	s.
773	cr./al.	....	165 d.	....	....	....	....
774	pr./aq. al.	....	169-70	....	sl. s. c.	s.	i.
775	rhb.	1.205^{15°	145-6	....	sl. s. h.	s.	....
776	mn./aq. al.	1.170^{15°	....	....	....	13^{15° abs.	....
777	rhb./al.	1.202^{15°	157-8	232	i.	4.2^{18° abs.	....
778	nd./al.	....	214-5	....	s. h.	1, c,; 4, h.	i.
779	col. nd.	....	353-4	....	0.013^{23°	v. sl. s.	s. alk.
780	lf./et.	....	60-1	>300	sl. s. pet.	v. s.	v. s.
781	col. lq.	1.057^{17°	−51.5	213.5	i.	∞	∞
782	col. lq.	$1.043^{20^\circ}_{4}$	−15.3	204.7	4^{17°	∞; ∞ chl.	∞
783	lq.	$0.982^{20^\circ}_{4}$	....	184.5	∞	∞	∞
784	lf.	....	89	....	v. sl. s.	v. s.	v. s. bz.; s. NaOH
785	pr./aq.	....	172 (anh.)	....	s. h.	s.	i.
786	mn. pr.	$1.065^{25^\circ}_{25}$	37-8	306^{759mm}	i.	s. h. Me al.	s.; s. chl.
787	nd.	....	167	d.	0.34^{23°; 3.5^{97°	0.87^{23°; 5.9^{70°	....
788	oil	1.066^{25°	....	108^{23mm}	i.	∞	∞
789	nd. or lf.	1.122 (lq.)	21	323-4	i.; ∞ chl.	∞; s. oil	∞
790	nd./aq. al.	....	114-7	subl.	sl. s.	s.; s. chl.	s.; s. bz.
791	lf./aq. al.	....	107-8	subl.	sl. s.	s.; s. chl.	s.
792	lf./aq. al.	....	155-7	subl.	sl. s.	s.; s. chl.	s.
793	col. lq.	1.443^{17°	−4	198-9	i.; sl. d.	∞	∞
794	col. lq.	$1.016^{16^\circ}_{18}$	....	238-40	i.	v. s.	v. s.
795	cr.	....	86	d.	v. sl. s.	s.	s.
796	col. lq.	$1.100^{20^\circ}_{20}$	−39	179.4	i.	∞; ∞ chl.	∞
797	col. oil	$1.222^{4^\circ}_{4}$	....	147.5^{9mm}	....	....	....
798	pr.	....	39	244^{25mm}	i.	s.	s.
799	pl./et.	....	43	....	i.	v. s.	v. s.
800	col. lq.	$1.018^{20^\circ}_{4}$	−23.8	233-4	i.	∞	∞
801	nd./al.	....	157	>320	i. o.	s.	sl. s.
802	mm.	....	54	$283\text{-}7^{110mm}$	v. s. bz.	s.	v. s.
803	lf.	$1.171^{0^\circ}_{4}$	85	$285\text{-}6^{110mm}$	v. s. bz.	sl. s.	v. s.
804	nd.	....	86-7	....	v. sl. s.	s. h.	s.
805	lf./al.	....	71-2	d. >270	v. sl. s.	s. h.	s.; s. bz.

Benzyl, cf. also dibenzyl.
Benzyl-acetic acid 3704
Benzyl-acetoacetic ester 2983
Benzyl-carbamide 844
Benzyl-carbinol 5187
Benzyl-cellosolve 3449
Benzyl citrate 6085

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
806	**Benzyl** ether	dibenzyl ether	$(C_6H_5\cdot CH_2)_2O$	VI-434	198.25
807	formate	....	$HCO_2\cdot CH_2\cdot C_6H_5$	VI-435	136.14
808	hydrazine	....	$C_6H_5\cdot CH_2\cdot NH\cdot NH_2$	XV-531	122.17
809	hydroxybenzoate (*p*)	....	$HO\cdot C_6H_4\cdot CO_2\cdot C_7H_7$	....	228.24
810	hydroxylamine (α)	....	$C_6H_5\cdot CH_2\cdot O\cdot NH_2$	VI-440	123.15
811	hydroxylamine (β)	....	$C_6H_5\cdot CH_2\cdot NH\cdot OH$	XV-17	123.15
812	imino-(4-methoxyphenyl) methane	anisalbenzylamine	$C_6H_5CH_2N{:}CH\cdot C_6H_4\cdot OCH_3$	XII-1043	225.28
813	iodide	ω-iodotoluene	$C_6H_5\cdot CH_2\cdot I$	V-314	218.05
814	lactate	....	$CH_3CHOHCO_2\cdot C_7H_7$	....	180.20
815	malonic acid	....	$C_6H_5CH_2\cdot CH(CO_2H)_2$	IX-868	194.18
816	mercaptan	....	$C_6H_5\cdot CH_2\cdot SH$	VI-453	124.19
817	naphthalene (α)	Ph-naphthylmethane	$C_6H_5\cdot CH_2\cdot C_{10}H_7$	V-689	218.28
818	naphthalene (β)	Ph-naphthylmethane	$C_6H_5\cdot CH_2\cdot C_{10}H_7$	V-690	218.28
819	α-naphthyl ether	....	$C_6H_5\cdot CH_2\cdot O\cdot C_{10}H_7$	....	234.28
820	β-naphthyl ether	....	$C_6H_5\cdot CH_2\cdot O\cdot C_{10}H_7$	VI-642	234.28
821	α-naphthyl ketone	....	$C_6H_5\cdot CH_2\cdot CO\cdot C_{10}H_7$	VII-512	246.29
822	phenanthracene (9)	....	$C_7H_7\cdot C_6H_3{:}C_2H_2{:}C_6H_4$	*V-359	268.34
823	phenol (*o*)	HO-diPh-methane	$C_6H_5\cdot CH_2\cdot C_6H_4\cdot OH$	VI-675	184.23
824	phenol (*p*)	4-hydroxy-ditane	$C_6H_5\cdot CH_2\cdot C_6H_4\cdot OH$	VI-675	184.23
825	phenyl carbamate (*p*)	butolan	$C_7H_7\cdot C_6H_4O_2C\cdot NH_2$	*VI-325	227.25
826	phenylhydrazine (α,α)	....	$(C_7H_7)(C_6H_5)N\cdot NH_2$	XV-532	198.26
827	phenylhydrazine HCl	(α,α)	$C_{13}H_{12}N\cdot NH_2\cdot HCl$	XV-533	234.72
828	phenylnitrosamine	nitroso-benzylaniline	$C_6H_5CH_2\cdot N(NO)\cdot C_6H_5$	XII-1071	212.24
829	propionate	....	$C_2H_5CO_2\cdot CH_2C_6H_5$	VI-436	164.20
830	pyridine (2)(α)	....	$C_6H_5\cdot CH_2\cdot C_5H_4N$	XX-425	169.22
831	pyridine (3)(β)	....	$C_6H_5\cdot CH_2\cdot C_5H_4N$	XX-426	169.22
832	pyrrole (*N*)	....	$C_4H_4N\cdot CH_2\cdot C_6H_5$	XX-164	157.21
833	salicylate	....	$HOC_6H_4CO_2\cdot CH_2C_6H_5$	X-80	228.24
834	succinate (mono)	....	$C_7H_7O_2C(CH_2)_2\cdot CO_2H$	VI-436	208.22
835	sulfone	dibenzyl sulfone	$(C_6H_5\cdot CH_2)_2SO_2$	VI-456	246.31
836	sulfoxide	....	$(C_6H_5\cdot CH_2)_2SO$	VI-456	230.31
837	tartronic acid	....	$C_7H_7\cdot C(OH)(CO_2H)_2$	X-515	210.18
838	*iso*-thiocyanate	benzyl mustard oil	$C_6H_5\cdot CH_2\cdot N{:}CS$	XII-1059	149.20
839	thiourea	....	$C_6H_5CH_2\cdot NH\cdot CS\cdot NH_2$	XII-1051	166.24
840	*iso*-thiourea	....	$C_7H_7\cdot S\cdot C({:}NH)\cdot NH_2$	VI-461	166.24
841	*iso*-thiourea HCl	....	$C_8H_{10}N_2S\cdot HCl$	VI-461	202.70
842	toluene (*m*)	phenyl-tolylmethane	$C_7H_7\cdot C_6H_4\cdot CH_3$	V-607	182.25
843	toluene (*p*)	....	$C_7H_7\cdot C_6H_4\cdot CH_3$	V-607	182.25
844	urea	benzyl carbamide	$C_6H_5CH_2\cdot NH\cdot CO\cdot NH_2$	XII-1050	150.18
845	**Beryllium** diethyl	....	$(C_2H_5)_2Be$	IV-645	67.14
846	**Betaine**†	trimethyl glycine; oxyneurine	$(CH_3)_3\underline{N\cdot CH_2\cdot CO\cdot O}$	IV-346	117.15
847	hydrochloride	acidol; lycine	$C_5H_{11}O_2N\cdot HCl$	IV-348	153.61
848	**Betulin**	....	$C_6H_6O_3$	....	126.11

† See also alkaloids table.

Benzyl-ethyl-aniline 2984
Benzyl-ethyl ether 2986
Benzyl fumarate 1785
Benzyl maleate 1788
Benzyl-methyl ether 4145
Benzyl mustard oil 838
Benzyl phthalate 1789
Benzyl succinate 1790
Benzyl sulfide 1791

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
806	lq.	$1.036^{16°}$	....	295-8	i.	s. h.	s.
807	col. lq.	$1.081^{23°}$	3.6	$202\text{-}3^{747mm}$	i.	s.	∞
808	col. oil	....	26	135^{29mm}	∞	∞	∞
809	wh. pd.	....	110-2	....	i.	v. s.	s.
810	oil	....	....	$118\text{-}9^{30mm}$	....	....	....
811	nd./pet.	....	57-8	123^{50mm}	s.	....	....
812	col. cr./pet.	....	89-91	....	....	....	....
813	cr.	$1.734^{25°}$	24.1	93^{10mm}	i.	s.	s.
814	col. lq.	....	....	$136\text{-}8^{10mm}$	....	....	....
815	cr./et.	....	121	d. 180	s.	s.	s.; s. h. bz.
816	col. lq.	$1.058^{20°}$	....	194-5	....	....	....
817	lf./al.	$1.165^{0°}$	58-9	350	s. chl., bz.	1.6 c., 3 h.	50 c.
818	mn. pr.	$1.176^{0°}$	35.5	350	....	v. s. h.	v. s. bz.
819	col. cr.	....	76-7	....	i.	s. h.	s.
820	lf./al.	....	98-9	....	s. chl., bz.	s.	s.
821	pl/al.	....	57	....	i.	s.	s.
822	lf./al.	....	91-2	....	i.	....	....
823	col. oil	....	52(21)	312	v. s. h.	s.	s.; s. alk.
824	nd./al.	....	84	320-2	s. h.	s.	s.; s. alk.
825	wh. cr./al.	....	144	....	sl. s.	s. h.	s. bz.
826	col. oil	....	....	$216\text{-}8^{38mm}$	....	....	....
827	nd./aq.	....	167-70	....	....	....	....
828	yel. nd./al	....	58	....	s. chl., lg.	s.	s.
829	lq.	$1.036\frac{16.5°}{17.5}$	....	220-2	i.	....	....
830	lq.	$1.054\frac{20°}{0}$	....	276^{742mm}	i.	v. s.	v. s.
831	lq.	$1.061\frac{20°}{0}$	34	287^{742mm}	i.	v. s.	v. s.
832	....	....	<37.5	246-7	i.	s.	s.
833	col. oil	$1.176\frac{19.5°}{15}$	....	208^{26mm}	v. sl. s.	∞	∞
834	cr.	....	59	....	i.	s.	s.
835	nd./al. + bz.	....	150-1	290(sl. d.)	i.	sl. s.	s. bz.
836	lf./al.	....	133-4	d. 210	s. h.	v. s.	v. s.
837	pr.	....	147 d.	....	s.	s.	s.
838	lq.	$1.125\frac{15°}{4}$	....	243	i.	....	s.
839	pr./aq.	....	162-4	....	i. c.	1.5 c.	....
840	nd./bz.	....	103-4 d.	....	s. chl., bz.	s.	s.
841	pl./HCl	....	176(148)	....	s.	s.	i.
842	lq.	$0.997^{17.5°}$	....	275^{747mm}	....	s.	s.
843	lq.	$0.994^{18°}$	-30	285-6	v. s. chl.	v. s.	v. s.
844	nd./al.	....	147-8	d. 200	$1.7^{45°}$	$3.1^{23°}$, act.	$0.05^{22.5°}$
845	col. lq.	....	-11-3	185-8	d.	d.	....
846	pr./al.	....	293 d.	....	$157^{19°}$	$8.6^{18°}$	i.
847	col. mn./al.	....	227-8 d.	....	60	0.6	i.; i. chl.
848	nd./al.	....	258	subl. sl. d.	i.; i. CS_2	0.7, c.; 4.27, h.	0.4, c.; 3, h.

Benzyl tartrate 1792
Benzylidene, cf. also benzal.
Berberine, cf. alkd.
Berberonic acid 5507
Bergamol 3975

Beta acid 559
Beta C acid 4534
Beta gamma acid 4537
Betaine, cf. alkd.
Betol 4569

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
849	**Betulinic acid**	....	$C_{36}H_{54}O_6$	....	582.79
850	**Bilifuscin**	bile pigment	$C_{16}H_{10}O_4N_2$	....	294.26
851	**Bilirubin**	principal bile pigment	$(C_{16}H_{18}O_3N_2)_2$	....	572.64
852	**Biliverdin**	bile pigment	$C_{32}H_{36}O_8N_4$	....	604.64
853	**Biotin**	vitamin H	$C_{10}H_{15}O_3N_2S$	....	243.30
854	methyl ester	....	$C_{11}H_{18}O_3N_2S$	....	258.33
855	**Bismuth** triethyl	triethyl bismuthine	$(C_2H_5)_3Bi$	IV-622	296.18
856	trimethyl	trimethyl bismuthine	$(CH_3)_3Bi$	IV-622	254.10
857	triphenyl	triphenyl bismuthine	$(C_6H_5)_3Bi$	XVI-898	440.30
858	triphenyl dichloride	triphenylbismuthine dichloride	$(C_6H_5)_3Bi:Cl_2$	XVI-899	511.21
859	**Biuret**	allophanamide	$NH(CONH_2)_2$†	III-70	103.08
860	**Borneol** (*d* or *l*)	....	$C_{10}H_{17}OH$	VI-75	154.24
861	**Bornyl** acetate (*d*)	....	$C_{10}H_{17}O\cdot CO\cdot CH_3$	VI-78	196.28
862	amine (*d*)	....	$C_{10}H_{17}\cdot NH_2$	XII-45	153.26
863	α-bromo-*iso*-valerate (*d*)	brovalol; valisan; eubornyl	$(CH_3)_2CH\cdot CHBr\cdot CO_2C_{10}H_{17}$	VI-79	317.27
864	chloride‡	*iso*-bornyl chloride	$C_{10}H_{17}Cl$	V-97	172.69
865	dibromo-dihydrocinnamate	adamon	$C_6H_5(CHBr)_2CO_2\cdot C_{10}H_{17}$	*IX-202	444.21
866	salicylate (*d*)	salit	$HO\cdot C_6H_4\cdot CO_2\cdot C_{10}H_{17}$	X-76	274.35
867	*iso*-valerate (*d*)	bornyval	$(CH_3)_2CHCH_2CO_2\cdot C_{10}H_{17}$	VI-79	238.36
868	*iso*-valeryl-glycollate	neobornyval	$(CH_3)_2CHCH_2CO_2\cdot CH_2\cdot CO_2\cdot C_{10}H_{17}$	....	296.39
869	*iso*-**Bornyl**-*n*-**valerate** (*d*)	gynoval	$CH_3(CH_2)_3CO_2\cdot C_{10}H_{17}$	VI-88	238.36
870	**Bornylene** (*l*)	....	$C_{10}H_{16}$	V-155	136.23
871	**Boron** triethyl	....	$(C_2H_5)_3B$	IV-641	98.00
872	trimethyl	....	$(CH_3)_3B$	IV-641	55.92
873	**Brassidic acid**	....	$C_{21}H_{41}\cdot CO_2H$	II-474	338.56
874	**Brazilein**	....	$C_{16}H_{12}O_3\cdot H_2O$	XVIII-194	302.27
875	**Brazilin**	....	$C_{16}H_{14}O_5$	XVII-194	286.27
876	**Bromal**	tribromo-acetaldehyde	$Br_3C\cdot CH:O$	I-626	280.78
877	hydrate	....	$Br_3C\cdot CH(OH)_2$	I-626	298.79
878	**Bromo**-acenapththene (5)	....	$C_{12}H_9Br$	V-587	233.11
879	acetamide (*N*)	acetbromamide	$CH_3\cdot CO\cdot NHBr\cdot H_2O$	II-181	155.99
880	acetanilide (*o*)	....	$Br\cdot C_6H_4\cdot NH\cdot CO\cdot CH_3$	XII-632	214.07
881	acetanilide (*m*)	....	$Br\cdot C_6H_4\cdot NH\cdot CO\cdot CH_3$	XII-634	214.07
882	acetanilide (*p*)	asepsin	$Br\cdot C_6H_4\cdot NH\cdot CO\cdot CH_3$	XII-642	214.07
883	acetic acid	....	$Br\cdot CH_2\cdot CO_2H$	II-213	138.96
884	acetoacetanilide (α)	....	$CH_3CO\cdot CHBr\cdot CO\cdot NH\cdot C_6H_5$	XII-519	256.10
885	aceto-β-naphthone (ω)	....	$C_{10}H_7\cdot CO\cdot CH_2Br$	....	249.11
886	acetone	....	$Br\cdot CH_2\cdot CO\cdot CH_3$	I-657	136.99
887	acetophenone (ω)	phenacyl bromide	$C_6H_5CO\cdot CH_2\cdot Br$	VII-283	199.05

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† Cryst. $+1H_2O$/aq.; $-H_2O$, 110°.

‡ See also pinene hydrochloride.

Bi-, cf. also di.
Bile acid 1479
Bile pigments 850-2
Bilineurine 1488
Biloptin 2384
Bindschedler's green 5833
Biohenin 1722
Biphenyl 2695
Bismark brown 6058
Bistriazo-ethane 1761
Biuret-amidine 2081
Biuret base 6209
Bixin 4933
Blue cross gas 2712
Bonoform 5739
Bordeaux DH 3732

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
849	wh. pd.	....	195	....	v. sl. s.	s.	....
850	br. pd.	....	183	....	v. sl. s.	s.; v. s. alk.	v. sl. s.
851	or. pd.	....	192	....	i.; s. alk.; s. bz.	v. sl. s.; s. CS_2	v. sl. s.; s. chl.
852	gn. pd.	....	....	....	i.; s. alk.	s.; s. bz.; s. CS_2	v. sl. s.; i. chl.
853	nd.	....	230-2	....	s. NaOH	....	....
854	cr./al. et.	....	166-7	....	i.	s.; s. Me al.	s.
855	col. oil	1.82	....	*107^{79mm}	i.	v. s.	v. s.
856	col. oil	$2.30^{18°}$	....	*110	i.	v. s.	v. s.
857	mn./al.	$1.952^{15°}_{4}$	77-8	242^{14mm}	i.; v. s. chl.	v. sl. s.	s.; s. act.
858	pr./chl. al.	....	141.5	....	v. s. bz.	v. sl. s.	v. sl. s.
859	nd./al.	....	192-3 d.	....	$1.25^{0°}$; $45^{106°}$	s.	....
860	col. cr.	$1.011^{20°}_{4}$	208-9	212-3	v. sl. s.	v. s.; s. bz.	v. s.
861	rhb./pet.	$0.991^{15°}$	29	226-7	i.	s.	s.
862	col. cr.	....	163	200	i.	v. s.	v. s.
863	col. oil	1.18	....	163	i.	s.	s.; s. chl.
864	col. cr.	....	161.5	....	i.	v. sl. s. c.	v. s.
865	col. cr./al.	....	75 ±	....	i.; s. h. chl.	s. h.	s. h.
866	cr.	....	44-5	$230\text{-}5^{50mm}$	i.; ∞ oil	∞; ∞ chl.	∞
867	col. lq.	$0.951^{20°}$	....	255-60	i.	s.	s.
868	col. oil	1.03	....	283-5 d.	i.; s. oil	v. s.; v. s. bz.	v. s.
869	col. lq.	$0.953^{18°}_{4}$	....	$143\text{-}5^{18mm}$	v. sl. s.; s. act.	s.; s. chl.	s.; s. bz.
870	col. cr.	....	113	146^{740mm}	i.	s. Me al.	s. toluene
871	col. lq.	$0.696^{23°}$	−92.9	95	v. sl. s.	....	....
872	col. gas	....	−160	−20	v. sl. s.	v. s.	v. s.
873	lf./al.	$0.859^{57°}$	61-2	282^{30mm}	$0.7^{25°}$	v. sl. s. c.	sl. s.
874	rhd. red	....	softens 130-40	....	sl. s. h.	s. alk.	s. d. H_2SO_4
875	cr./abs. al.	....	250	....	s.; s. alk.	s.	s.
876	yel. lq.	$2.665^{25°}_{4}$	....	174 d.	forms hydr.	s.	s.
877	cr.	$2.566^{40°}_{4}$	53.5	....	s.	s.; s. chl.	s.; s. glyc.
878	yel. cr.	$1.437^{55°}$	51-2	336.4	i.	s.	v. s.
879	pl. + H_2O	....	70-80	m. anh. 108	s.	s.	v. s.
880	nd./al.	....	99	....	i.	s.	s.
881	nd./aq. al.	....	87.5	....	....	v. s.	v. s.
882	mn. pr.	1.717	166-7	....	sl. s. h.	s.; s. bz.	s. chl.
883	pl. or rhb.	$1.934^{50°}_{50}$	49-50	208	$\infty^{25°}$	$\infty^{25°}$	$\infty^{25°}$
884	col. lf./al.	....	138 d.	....	v. sl. s.; s. alk.	v. s.	sl. s.; sl. s. chl.
885	red fl.	....	80-2	....	i.	sl. s.	v. s.
886	lq.	$1.634^{23°}$	−54	136.5^{725mm}	v. sl. s.	v. s.	v. s.
887	rhb.	$1.647^{20°}_{4}$	50	119	i.; s. bz.	v. s.	v. s.

* Explodes when heated in air.

Bordeaux S 3732
Bornyval 867
Bourbonal 3188
Brilliant cotton blue 6345
Brilliant green base 5762
Bromacetol 1866
Bromanil 5726
Brom cresol green 5718
Brom cresol purple 1832
Bromisoval 1009
Brom phenol blue 5724
Brom-tetragnost 5723
Brom thymol blue 1879
Bromolia 3094
Brometone 6102
Bromo-acetonitrile 954

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
888	**Bromo** acetophenone (*p*)	Me-*p*-Br-phenyl ketone	$Br\cdot C_6H_4\cdot CO\cdot CH_3$	VII-283	199.05
889	acettoluidide	3;1,4	$Br\cdot C_6H_3(CH_3)\cdot NH\cdot CO\cdot CH_3$	XII-991	228.09
890	acetyl bromide	....	$Br\cdot CH_2\cdot CO\cdot Br$	II-215	201.87
891	acetylene	bromo-ethyne	$CH\vdots C\cdot Br$(or $C{:}CHBr$)	I-245	104.94
892	allyl alcohol (*β*)	....	$CH_2{:}CBr\cdot CH_2OH$	I-439	136.99
893	aniline (*o*)	....	$Br\cdot C_6H_4\cdot NH_2$	XII-631	172.03
894	aniline (*m*)	....	$Br\cdot C_6H_4\cdot NH_2$	XII-633	172.03
895	aniline (*p*)	....	$Br\cdot C_6H_4\cdot NH_2$	XII-636	172.03
896	aniline (*p*) HCl	....	$Br\cdot C_6H_4\cdot NH_2\cdot HCl$	XII-637	208.50
897	anisole (*o*)	....	$CH_3O\cdot C_6H_4\cdot Br$	VI-197	187.04
898	anisole (*p*)	....	$CH_3O\cdot C_6H_4\cdot Br$	VI-199	187.04
899	anthraquinone (1)	....	$C_6H_4{:}(CO)_2{:}C_6H_3Br$	VII-789	287.11
900	anthraquinone (2)	....	$C_6H_4{:}(CO)_2{:}C_6H_3Br$	VII-789	287.11
901	antipyrine (*p*)	bromopyrine	$BrC_6H_4\cdot C_5H_7ON_2$	XXIV-33	267.13
902	benzene	phenyl bromide	C_6H_5Br	V-206	157.02
903	benzene sulfonic acid (*o*)	....	$Br\cdot C_6H_4\cdot SO_3H$	XI-56	237.08
904	benzene sulfonic acid (*p*)	....	$Br\cdot C_6H_4\cdot SO_3H$	XI-57	237.08
905	benzene sulfonyl chloride	....	$Br\cdot C_6H_4\cdot SO_2Cl$	XI-57	255.53
906	benzoic acid (*o*)	....	$Br\cdot C_6H_4\cdot CO_2H$	IX-347	201.03
907	benzoic acid (*m*)	....	$Br\cdot C_6H_4\cdot CO_2H$	IX-349	201.03
908	benzoic acid (*p*)	....	$Br\cdot C_6H_4\cdot CO_2H$	IX-351	201.03
909	benzonitrile (*p*)	*p*-Br-phenyl cyanide	$Br\cdot C_6H_4\cdot CN$	IX-354	182.03
910	benzoyl bromide (*m*)	....	$Br\cdot C_6H_4\cdot CO\cdot Br$	....	263.93
911	benzoyl chloride (*p*)	....	$Br\cdot C_6H_4\cdot CO\cdot Cl$	IX-353	219.48
912	benzyl bromide (*p*)	....	$Br\cdot C_6H_4\cdot CH_2Br$	V-308	249.95
913	benzyl chloride (*o*)	ω-Cl-2-Br-toluene	$Br\cdot C_6H_4\cdot CH_2Cl$	*V-155	205.49
914	benzyl chloride (*p*)	....	$Br\cdot C_6H_4\cdot CH_2Cl$	V-307	205.49
915	*iso*-butyl benzene (*p*)	....	$Br\cdot C_6H_4\cdot C_4H_9$	V-415	213.12
916	*tert*-butyl phenol	(4;2,1)	$(CH_3)_3C\cdot C_6H_3(Br)OH$	....	229.12
917	butyric acid (*α*)(*dl*)	....	$C_2H_5\cdot CHBr\cdot CO_2H$	II-281	167.01
918	*iso*-butyric acid (*α*)	....	$(CH_3)_2CBr.CO_2H$	II-295	167.01
919	camphor (3)(*d*)	α-bromocamphor	$\underbrace{C_8H_{14}\cdot CO\cdot CHBr}$	VII-120	231.14
920	*n*-caproic acid (*α*)	....	$CH_3(CH_2)_3\cdot CHBr\cdot CO_2H$	II-325	195.06
921	cinnamic acid (*α*) (*cis*)	bromo-allocinnamic acid	$C_6H_5\cdot CH{:}CBr\cdot CO_2H$	IX-600	227.06
922	cinnamic acid (*α*) (*trans*)	....	$C_6H_5\cdot CH{:}CBr\cdot CO_2H$	IX-599	227.06
923	cinnamic acid (*β*) (*cis*)	bromo-allocinnamic acid	$C_6H_5\cdot CBr{:}CH\cdot CO_2H$	IX-598	227.06

Bromo-acetylamino-toluene 889
Bromo-allocinnamic acid 921, 923

Bromo-allyl bromide 1869
Bromo-allylene 5342

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
888	col. lf./al.	....	50-1	$255^{736\text{mm}}$	i.; s. bz.	s.; s. CS_2	v. s.; s. ac.
889	nd./bz.	....	116-7	....	....	....	....
890	lq.	$2.317^{21.5°}_{21.5}$	....	149-50	d.	d.	....
891	poisonous gas	....	....	−2	5000-6000 cc.$^{15°}$, CH_2CBr_2	s.	....
892	lq.	$1.6^{15°}$	....	153-4	....	....	....
893	cr.	....	31-2	229	i.	v. s.	s.
894	cr.	$1.579^{20.4°}_{4}$	18.5	251	i.	s.	s.
895	rhb.	$1.80^{15\text{-}20°}$	63-4	....	i. c.	v. s.	v. s.
896	mn. pr.	....	....	....	s.	s.	i.
897	oil	....	....	218-21	....	s.	....
898	cr.	$1.494^{9°}$	12-13	215	....	s.	....
899	yel. nd./bz.	....	188	subl.	s. H_2SO_4	....	....
900	cr./am. al.	....	204-5	....	....	....	....
901	col. mn./aq.	....	122	$300^{9\text{mm}}$ ±	s. h.	s.; s. chl.	sl. s.
902	col. lq.	$1.495^{20°}_{4}$	−30.6	156.2	i.	s.	∞; ∞ chl.
903	delq. nd.	....	....	....	v. s.	v. s.	i.
904	delq. nd.	....	102-3	$155^{25\text{mm}}$	s.	s.	i.
905	tri. pr./et.	....	75-6	$153^{15\text{mm}}$	d. h.	d. h.	....
906	nd./aq.	....	148-50	subl.	$0.18^{25°}$	s.	s.
907	nd.	....	154-5	>280	$0.04^{25°}$	s.	s.
908	mn. pr.	....	251-3	....	sl. s. h.	s.	s.
909	nd./aq. or al.	....	112-3	....	s. h.	s.	v. s.
910	col. lq.	....	....	$118\text{-}22^{8\text{mm}}$	....	....	....
911	nd./pet.	....	42	245-7 sl. d.	d.; v. s. bz.	v. s. lg.	s.
912	nd./al.	....	61	....	v. sl. s.	s. h.	s.
913	col. lq.	....	....	$124\text{-}6^{20\text{mm}}$	i.	v. s.	v. s.
914	nd./al.	....	41	236	i.	v. s. h.	v. s.
915	lq.	....	<−18	$232\text{-}3^{739\text{mm}}$	....	....	....
916	lq.	$1.338^{25°}_{25}$	<−20*	$109\text{-}29^{5\text{mm}}$	i.	∞; ∞ Me al.	∞ bz., act.
917	col. oil	$1.567^{20°}_{20}$	−4	$127\text{-}8^{25\text{mm}}$	6.6	s.	s.
918	pl.	$1.523^{60°}_{60}$	48	198-200	forms oil	s.	s.
919	cr.	$1.449^{20°}_{4}$	77-8	274(sl. d.)	i.	$20^{26°}$	v. s.
920	lq.	....	....	$128\text{-}31^{10\text{mm}}$	s.	s.	s.
921	rhb./aq.	....	120-1	$110^{0.6\text{mm}}$	s. h.	s.	s. bz.
922	nd./aq.	....	131-2	$121^{0.6\text{mm}}$	v. sl. s. h.	∞	∞
923	mn./al.	....	160	$110^{0.6\text{mm}}$	sl. s. h.; sl. d.	sl. s. c.	s.; s. h. bz.

* Crysts. $+1H_2O$, m.p. 51-2°.

Bromo-aminotoluene 1002-3

Bromo-aspirin 76

Bromo-butane 1057-60

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
924	**Bromo** cinnamic acid (β) (*trans*)	....	$C_6H_5 \cdot CBr:CH \cdot CO_2H$	IX-597	227.06
925	crotonic acid (β)	....	$CH_3 \cdot C(Br):CH \cdot CO_2H$	II-419	165.00
926	cymene (2)	(4;2,1)	$(CH_3)_2CH \cdot C_6H_3(Br) \cdot CH_3$	V-423	213.12
927	diethylaniline (*p*)	....	$Br \cdot C_6H_4 \cdot N(C_2H_5)_2$	XII-638	228.14
928	diiodo-methane	....	$BrCHI_2$	I-72	346.77
929	dimethylaniline (*p*)	....	$Br \cdot C_6H_4 \cdot N(CH_3)_2$	XII-637	200.08
930	dinitrobenzene	(4;1,2)	$Br \cdot C_6H_3(NO_2)_2$	V-266	247.02
931	dinitrobenzene	(4;1,3)	$Br \cdot C_6H_3(NO_2)_2$	V-266	247.02
932	dinitrobenzoic acid	(4;3,5,1)	$Br \cdot C_6H_2(NO_2)_2CO_2H$	IX-416	291.03
933	diphenyl (*o*)	....	$Br \cdot C_6H_4 \cdot C_6H_5$	V-580	233.11
934	diphenyl (*p*)	....	$Br \cdot C_6H_4 \cdot C_6H_5$	V-580	233.11
935	diphenyl ether (*p*)	....	$Br \cdot C_6H_4 \cdot O \cdot C_6H_5$	*VI-105	249.11
936	ethyl acetate (β)	....	$CH_3CO_2 \cdot CH_2 \cdot CH_2Br$	II-128	167.01
937	ethyl benzene (β)	Ph-Et-bromide	$C_6H_5 \cdot CH_2 \cdot CH_2Br$	V-356	185.07
938	ethyl benzene (α)	Ph-Et-bromide	$C_6H_5 \cdot CH(Br)CH_3$	V-355	185.07
939	ethyl ethyl ether	β-Br-diethyl ether	$BrCH_2CH_2 \cdot O \cdot C_2H_5$	I-338	153.03
940	ethyl phthalimide (β)(*N*)	phthalimino-Et-bromide	$C_6H_4(CO)_2N \cdot CH_2 \cdot CH_2Br$	XXI-461	254.09
941	fumaric acid	....	$CH:CBr(CO_2H)_2$	II-745	194.98
942	furan (2)	....	$Br \cdot C_4H_3O$	XVII-27	146.98
943	furoic acid (3)	....	$Br \cdot C_4H_2O \cdot CO_2H$	XVIII-284	190.99
944	hydroquinone	....	$Br \cdot C_6H_3(OH)_2$	VI-852	189.02
945	iodobenzene (*o*)	....	$Br \cdot C_6H_4 \cdot I$	V-223	282.93
946	iodobenzene (*m*)	....	$Br \cdot C_6H_4 \cdot I$	V-223	282.93
947	iodobenzene (*p*)	....	$Br \cdot C_6H_4 \cdot I$	V-223	282.93
948	iodo-ethane (1,1)	....	$CH_3 \cdot CHBrI$	I-98	234.89
949	iodo-ethane (1,2)	....	$BrCH_2 \cdot CH_2I$	I-98	234.89
950	iodo-methane	....	$BrCH_2I$	I-71	220.86
951	maleic acid	....	$CH:CBr(CO_2H)_2$	II-754	194.98
952	malonic acid	....	$BrCH(CO_2H)_2$	II-594	182.97
953	mesitylene	(2;1,3,5)	$Br \cdot C_6H_2(CH_3)_3$	V-408	199.09
954	methyl cyanide	bromo-acetonitrile	$BrCH_2 \cdot CN$	II-216	119.96
955	methyl acetate	....	$CH_3 \cdot CO_2 \cdot CH_2Br$	II-152	152.99
956	naphthalene (α)	α-naphthyl bromide	$C_{10}H_7Br$	V-547	207.07
957	naphthalene (β)	β-naphthyl bromide	$C_{10}H_7Br$	V-548	207.07
958	α-naphthol (4,1)	....	$Br \cdot C_{10}H_6 \cdot OH$	VI-613	223.07
959	β-naphthol (1,2)	....	$Br \cdot C_{10}H_6 \cdot OH$	VI-650	223.07
960	nitrobenzene (*o*)	....	$Br \cdot C_6H_4 \cdot NO_2$	V-247	202.02
961	nitrobenzene (*m*)	....	$Br \cdot C_6H_4 \cdot NO_2$	V-248	202.02
962	nitrobenzene (*p*)	....	$Br \cdot C_6H_4 \cdot NO_2$	V-248	202.02
963	3-nitrobenzene-1-sulfonic acid (4)	(4;3,1)	$Br \cdot C_6H_3(NO_2) \cdot SO_3H$	XI-74	282.08
964	3-nitrobenzoic acid (2)	(2;3,1)	$Br \cdot C_6H_3(NO_2) \cdot CO_2H$	IX-406	246.03
965	nitroethane (1,1)	....	$CH_3 \cdot CHBr \cdot NO_2$	I-101	153.98
966	nitromethane	....	$Br \cdot CH_2 \cdot NO_2$	I-77	139.95

Bromo-cumene 986
Bromo-cyanogen 1590
Bromo-cyclohexane 1612
Bromo-diethyl ether 939
Bromo-ethane 2989
Bromo-ethanol 3193
Bromo-ethylene 6434
Bromo-ethyl phenyl ether 969-71
Bromo-ethyne 891
Bromo-heptane 3545
Bromo-hexadecane 1276
Bromo-hexahydrobenzene 1612
Bromo-hexane 3641-3
Bromo-hydrin 3193, 6278
Bromo-hydroxydiphenyl 977

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
924	nd./aq.	....	134-5	$122^{0.6mm}$	sl. s. h.	s.	s. h. bz.
925	nd./lg.	....	95-7	....	sl. s. c.	v. s.; v. s. bz.	v. s.; v. s. CS_2
926	lq.	$1.253^{25^\circ}_{25}$	<-20	233-5	i.; ∞^{25° act.	50^{25° Me al.	∞; ∞ bz.
927	yel. red/ac.	....	33	270	i.	v.s.	v.s.
928	yel. cr.	....	60	110^{25mm}	sl. s. pet.	....	soln. d. in light
929	lf./al.	....	55	264	i.	v. s.	v. s.
930	mn. pr.	....	59.4(34.8)	....	i.	s. h.	s.
931	yel. cr.	....	75.3	....	....	v. s. h.	....
932	pr./aq. H_2SO_4	....	181	....	sl. s.	v. s.	v. s.
933	lq.	....	<-20	296-8	i.	s.	v. s.
934	cr./al.	....	90-1	310	i.; 100^{25° bz.	s.; 3^{25° Me al.	34^{25°
935	lq.	1.449^{13°	....	305	....	....	....
936	col. lq.	$1.514^{20^\circ}_{4}$	-13.8	162-3	i.	∞	∞
937	lq.	....	....	$217\text{-}8^{734mm}$	....	....	....
938	lq.	1.311^{23°	....	200-10 d.	i.	s.	s.
939	col. lq.	$1.357^{20^\circ}_{4}$	....	127-8	sl. s.	∞	∞
940	nd./al.	....	82-3	d.	....	....	....
941	lf./aq.	....	185-6	d.	v. s.	....	....
942	lq.	1.650	....	101-2	i.	s.	....
943	nd./aq.	....	128-9	....	1.3^{20°	s.; v. sl. s. CS_2	s.; v. sl. s. lg.
944	lf./pet.	....	113	subl.	v. s.	v. s.	v. s.
945	col. lq.	$2.257^{25^\circ}_{4}$	5.0(2.1)	257.4^{754mm}	i.	v. sl. s.	v. sl. s. ac.
946	col. lq.	....	-9.3	252^{754mm}	i.	v. sl. s.	v. sl. s. ac.
947	pl./al. et.	....	91-2	251.5^{754mm}	i.	v. sl. s. c.	sl. s.
948	lq.	2.452^{16°	<-20	142-3	....	....	....
949	long nd.	2.516^{29°	28	163	....	v. s. h.	....
950	lq.	2.926^{17°	....	138-40	....	....	....
951	nd. or pr.	....	128*	d.	v. s.	v. s.	v. s.
952	nd./et.	....	112-3 d.	....	....	v. s.	v. s.
953	lq.	1.319^{10°	-1	225-30	....	....	....
954	yel. oil	1.771	....	148-50	....	....	s.
955	col. lq.	1.195^{14°	....	$130\text{-}3^{750mm}$	i.; sl. d.	s.	s.
956	col. oil	$1.482^{20^\circ}_{4}$	5-6	281.1	i.; ∞ bz.	∞ abs. al.	∞
957	lf./al.	1.605^{0°	59	281-2	i.; s. bz.	6^{20°, 92% al.	v. s.; v. s. chl.
958	nd./aq. al.	....	127-8	....	....	....	....
959	rhb. pr.	....	83-4	d. 130	....	....	....
960	yel. cr.	$1.623^{80^\circ}_{4}$	43	261	i.	v. s.	s.
961	rhb.	$1.704^{20^\circ}_{4}$	56.4	256-7	i.	s.	s.
962	tri.	$1.938^{0^\circ}_{4}$	126-7	255-6	i.	1.4 c.	s.
963	yel. nd.	....	87-8	....	s.	s.	i.
964	cr./aq. al.	....	136-8	....	....	....	....
965	lq.	....	....	146-7	i.	....	....
966	lq.	....	....	152.5^{765mm}	i.	s. alk.	....

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* Heated slowly, m.p. 136-8°; rapidly, m.p. 140-1°.

Bromo-methane 4147
Bromo-methylacetophenone 4333
Bromo-methyl-*p*-tolyl ketone 4333
Bromo-nitrotoluene 4681
Bromo-nonane 4927
Bromo-octane 4973-4
Bromo-pentadecane 5063
Bromo-pentane 427-31

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
967	**Bromo** phenacyl bromide (*p*)	diBr-acetophenone	$Br\cdot C_6H_4\cdot CO\cdot CH_2Br$	VII-285	277.96
968	phenanthrene (9)	....	$C_{14}H_9Br$	V-671	257.13
969	phenetole (*β*)	*β*-PhO-ethyl bromide	$Br\cdot CH_2CH_2\cdot O\cdot C_6H_5$	VI-142	201.07
970	phenetole (*o*)	....	$Br\cdot C_6H_4\cdot O\cdot C_2H_5$	VI-197	201.07
971	phenetole (*p*)	....	$Br\cdot C_6H_4\cdot O\cdot C_2H_5$	VI-199	201.07
972	phenol (*o*)	....	$Br\cdot C_6H_4\cdot OH$	VI-197	173.02
973	phenol (*m*)	....	$Br\cdot C_6H_4\cdot OH$	VI-198	173.02
974	phenol (*p*)	....	$Br\cdot C_6H_4\cdot OH$	VI-198	173.02
975	phenylhydrazine (*p*)	....	$Br\cdot C_6H_4\cdot NH\cdot NH_2$	XV-434	187.05
976	phenylhydrazine HCl	(*p*)	$Br\cdot C_6H_4\cdot N_2H_3\cdot HCl$	XV-435	223.51
977	phenylphenol	(1;3,4)	$C_6H_5\cdot C_6H_3(Br)OH$	....	249.11
978	phthalic acid	(3;1,2)	$Br\cdot C_6H_3(CO_2H)_2$	IX-821	245.04
979	(tere)-phthalic acid	(2;1,4)	$Br\cdot C_6H_3(CO_2H)_2$	IX-848	245.04
980	propionic acid (*α*)	(*dl*)	$CH_3\cdot CHBr\cdot CO_2H$	II-254	152.99
981	propionic acid (*β*)	....	$BrCH_2\cdot CH_2\cdot CO_2H$	II-256	152.99
982	propionyl bromide (*α*)	....	$CH_3\cdot CHBr\cdot CO\cdot Br$	II-256	215.89
983	*n*-propyl acetate (*β*)	....	$CH_3CO_2\cdot CH_2\cdot CHBr\cdot CH_3$	....	181.04
984	*n*-propyl acetate (*γ*)	....	$CH_3CO_2\cdot (CH_2)_3Br$	**II-139	181.04
985	*n*-propyl benzene (*p*)	....	$Br\cdot C_6H_4\cdot (CH_2)_2CH_3$	V-391	199.09
986	*iso*-propyl benzene (*p*)	*p*-bromocumene	$Br\cdot C_6H_4\cdot CH(CH_3)_2$	V-395	199.09
987	*n*-propyl phenyl ether (*γ*)	....	$C_6H_5\cdot O\cdot (CH_2)_3Br$	VI-142	215.09
988	propylene (1)(*α*)	1-bromo-propene-1	$CH_3\cdot CH:CHBr$	I-200	120.99
989	propylene (1)(*β*)	1-bromo-propene-1	$CH_3\cdot CH:CHBr$	I-200	120.99
990	propylene (2)	2-bromo-propene-1	$CH_3\cdot CBr:CH$	I-200	120.99
991	pyridine (2)	*α*-bromo-pyridine	$Br\cdot C_5H_4N$	XX-233	158.01
992	pyridine (3)	*β*-bromo-pyridine	$Br\cdot C_5H_4N$	XX-233	158.01
993	salicylic acid (5)	(5;2,1)	$Br\cdot C_6H_3(OH)CO_2H$	X-107	217.03
994	styrene (*α*)	....	$C_6H_5\cdot CBr:CH_2$	V-477	183.05
995	styrene (*ω*)	*isomer No. 1*	$C_6H_5\cdot CH:CHBr$	V-477	183.05
996	styrene (*ω*)	*isomer No. 2*	$C_6H_5\cdot CH:CHBr$	V-477	183.05
997	succinic acid (*dl*)	....	$(\cdot CH_2CHBr\cdot)(CO_2H)_2$	II-621	197.00
998	sulfalein	di-Na-phenol-tetra-bromo-phthalein-disulfonate	$Br_4C_6\cdot CO\cdot O\cdot C:$ $(C_6H_3OHSO_3Na)_2$	....	838.04
999	toluene (*o*)	*o*-tolyl bromide	$Br\cdot C_6H_4\cdot CH_3$	V-304	171.04
1000	toluene (*m*)	....	$Br\cdot C_6H_4\cdot CH_3$	V-305	171.04
1001	toluene (*p*)	....	$Br\cdot C_6H_4\cdot CH_3$	V-305	171.04
1002	*o*-toluidine (5)	(5;2,1)	$Br\cdot C_6H_3(NH_2)CH_3$	XII-838	186.06
1003	*p*-toluidine (3)	(3;4,1)	$Br\cdot C_6H_3(NH_2)CH_3$	XII-991	186.06
1004	triiodomethane	....	$BrCI_3$	I-74	472.69
1005	trinitromethane	....	$BrC(NO_2)_3$	I-79	229.95

Bromo-phenylacetophenone 5214
Bromo-phenyl-cyanide 909
Bromo-phenyl-ethyl ether 970-1
Bromo-picrin 4688
Bromo-propane 5388-9
Bromo-propyl alcohol 5460, 627

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
967	nd.	....	109-10	....	i.	s. h.	s.
968	pr./al.	$1.409_{4}^{10^\circ}$	63	>360; subl.	v. s. ac.	....	v. s. CS_2
969	cr.	....	35	240-50 d.	i.	s.	s.
970	lq.	....	....	218-22	....	s.	s.
971	lq.	....	4	227-33	....	....	....
972	col. lq.	1.553^{30°	5.6	194-5	s.; s. alk.	s.; ∞ chl.	∞
973	cr.	....	32-3	236-7	s. alk.	s.	s.
974	tet. cr.	1.588^{80°	63.5	238	1.4^{15°	v. s.; 88^{25° act.	v. s.; 40^{25° bz.
975	nd./al.	....	106-7	....	s. bz.	s.	s.
976	cr./aq.	....	....	....	s. h.	....	....
977	cr.	....	94-6	....	i.; 32^{25°bz.	125^{25°	v. s.
978	nd./aq.	....	178.5 ($-H_2O$)	....	s.	s.	s.; v. sl. s. chl.
979	nd./al.	....	299	....	0.18^{24°; s. h.	s.	i.; i. bz.
980	pr.	$1.700_{4}^{20^\circ}$	25.7(-3.9)	205.5 sl. d.	v. s.	v. s.	v. s.
981	pl.	....	62.5	$140\text{-}2^{45mm}$	v. s.	v. s.	v. s.
982	lq.	$2.061_{4}^{16^\circ}$	....	152-4	....	....	....
983	col. lq.	....	....	$51\text{-}3^{9mm}$	....	....	....
984	col. lq.	....	....	$88\text{-}90^{22mm}$	....	....	....
985	col. lq.	....	....	220	....	....	....
986	lq.	$1.365_{4}^{22^\circ}$	<-20	216-8	....	....	....
987	col. lq.	$1.365_{15}^{16^\circ}$	....	$211\text{-}2^{200mm}$	....	....	....
988	lq.	$1.434_{4}^{15.8^\circ}$	-113	59-60	....	....	....
989	lq.	$1.417_{4}^{15.8^\circ}$	-76.5	63.3	....	....	....
990	lq.	$1.397_{4}^{15.8^\circ}$	-125	48.4	....	....	....
991	lq.	1.657^{15°	....	193-4	sl. s.	....	....
992	col. lq.	1.632^{10°	....	$173\text{-}4^{758mm}$	sl. s.	s.	s.
993	nd./aq. al.	....	165-6	subl. >100	0.3^{80°	85^{25°	70^{25°
994	oil	$1.406_{4}^{20^\circ}$	-43.5	160^{75mm}	....	....	....
995	lq.	$1.422_{4}^{20^\circ}$	7	221 sl. d.	i.	∞	∞
996	lq.	$1.427_{4}^{20^\circ}$	-7.5	108^{26mm}	i.	∞	∞
997	col.	2.073	160-1	....	19^{15°	s.	....
998	wh. pd.	....	....	....	s.	i.	i. act.
999	col. lq.	$1.422_{4}^{20^\circ}$	-28	181.8	i.	s.; ∞ bz.	∞^{25°
1000	col. lq.	$1.410_{4}^{20^\circ}$	-39.8	183.7	i.	s.; ∞ bz.	s.
1001	cr./al.	$1.390_{4}^{20^\circ}$	28.5	184-5	i.	s.	∞^{25°
1002	rhb./al.	....	58-9	240	v. sl. s.	s.	....
1003	lf.	1.5^{20°	16-8	240	i.	s.	s.
1004	cr.	....	113	....	....	....	....
1005	lq.	$2.044_{4}^{15^\circ}$	17-8	$55\text{-}6^{12mm}$	0.4^{25°	....	....

Bromo-propylene 199
Bromo-propyne 5342
Bromo-pyrine 901
Bromo-toluene (ω) 793

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1006	**Bromo** *n*-valeric acid (α)	....	$CH_3(CH_2)_2CHBr\cdot CO_2H$	II-302	181.04
1007	*iso*-valeric acid	(α)(*dl*)	$(CH_3)_2CHCHBr\cdot CO_2H$	II-317	181.04
1008	*iso*-valeryl-*p*-phenetidine (α) (*d*)	phenoval	$(CH_3)_2CHCHBr\cdot CO\cdot NH\cdot C_6H_4\cdot O\cdot C_2H_5$	*XIII-163	300.20
1009	*iso*-valeryl urea (α)	bromural; bromisoval	$(CH_3)_2CHCHBr\cdot CO\cdot NH\cdot CO\cdot NH_2$	III-63	223.08
1010	xylene (3;1,2)	bromo-*o*-xylene (3)	$Br\cdot C_6H_3(CH_3)_2$	V-365	185.07
1011	xylene (4;1,2)	bromo-*o*-xylene (4)	$Br\cdot C_6H_3(CH_3)_2$	V-365	185.07
1012	xylene (2;1,3)	bromo-*m*-xylene (2)	$Br\cdot C_6H_3(CH_3)_2$	V-374	185.07
1013	xylene (4;1,3)	bromo-*m*-xylene (4)	$Br\cdot C_6H_3(CH_3)_2$	V-374	185.07
1014	xylene (5;1,3)	bromo-*m*-xylene (5)	$Br\cdot C_6H_3(CH_3)_2$	V-374	185.07
1015	xylene (2;1,4)	bromo-*p*-xylene (2)	$Br\cdot C_6H_3(CH_3)_2$	V-385	185.07
1016	**Bromoform**	tribromo-methane	$CHBr_3$	I-68	252.77
1017	**Bryonane**	laurane	$C_{20}H_{42}$	I-174	282.54
1018	**Butadiene** (1,2)	methyl-allene	$CH_3\cdot CH:C:CH_2$	I-249	54.09
1019	**Butadiene** (1,3)	erythrene	$CH_2:CH\cdot CH:CH_2$	I-249	54.09
1020	**Butandiolamine**	2-NH_2-2-Me-propandiol-1,3	$CH_3\cdot C(NH_2):(CH_2OH)_2$	IV-303	105.14
1021	**Butane** (*n*)	diethyl	$CH_3\cdot CH_2\cdot CH_2\cdot CH_3$	I-118	58.12
1022	**Butane** (*iso*)	trimethyl-methane	$(CH_3)_3CH$	I-124	58.12
1023	**Butanolamine**	2-NH_2-butanol-1	$C_2H_5\cdot CH(NH_2)\cdot CH_2OH$	IV-291	89.14
1024	*iso*-**Butanolamine**	2-NH_2-2-Me-propanol-1	$(CH_3)_2C(NH_2)\cdot CH_2OH$	....	89.14
1025	**Butoxy**-cinchoninic acid diethylethylene-diamide HCl	nupercaine; percaine	$C_4H_9O\cdot C_9H_5N\cdot CO\cdot NH(CH_2)_2N:(C_2H_5)_2\cdot HCl$	....	379.92
1026	ethoxyethyl bromide (2)(β)	....	$C_4H_9O\cdot (CH_2)_2\cdot O\cdot (CH_2)_2Br$	....	225.13
1027	ethyl phthalate	....	$C_6H_4(CO_2CH_2CH_2\cdot O\cdot C_4H_9)_2$	....	366.44
1028	ethyl salicylate (β)(*n*)	....	$HOC_6H_4CO_2\cdot CH_2\cdot CH_2\cdot O\cdot C_4H_9$	....	238.27
1029	**Butyl** acetate (*n*)	....	$CH_3CO_2\cdot CH_2CH_2\cdot C_2H_5$	II-130	116.16
1030	acetate (*sec*)	....	$CH_3CO_2\cdot CH(CH_3)\cdot C_2H_5$	II-131	116.16
1031	acetate (*iso*)	....	$CH_3CO_2\cdot CH_2CH:(CH_3)_2$	II-131	116.16
1032	acetate (*tert*)	....	$CH_3CO_2\cdot C(CH_3)_3$	II-131	116.16
1033	acetoacetate (*n*)	....	$CH_3COCH_2CO_2C_4H_9$	....	158.19
1034	alcohol (*n*)	butanol-1	$C_2H_5\cdot CH_2\cdot CH_2OH$	I-367	74.12
1035	alcohol (*sec*)	butanol-2	$C_2H_5\cdot CHOH\cdot CH_3$	I-371	74.12
1036	alcohol (*iso*)	2-methyl-propanol-1	$(CH_3)_2CH\cdot CH_2OH$	I-373	74.12
1037	alcohol (*tert*)	2-methyl-propanol-2	$(CH_3)_3COH$	I-379	74.12
1038	allylbarbituric acid (*iso*)	sandoptal	$C_4H_9(C_3H_5):C_4H_2O_3N_2$	....	224.25
1039	amine (*n*)	....	$C_2H_5\cdot CH_2\cdot CH_2\cdot NH_2$	IV-156	73.14

Bromo-xylene 6485-7
Bromural 1009
Bronner's acid 4552
Brovalol 863
Brucine, cf. alkd.
Bryonin, cf. glcde.
Butadiyne 1679
Butanal 1160
Butandioic acid 5653
Butandiol 2329-32
Butandione 1667
Butanoic acid 1166
Butanol 1034-5
Butanone 4232
Butanoxime 4233
Butantetrol 2894
Butanthiol 1103
Butenal 1559
Butendioic acid 3314, 3995
Butene 1147-9

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1006	lq.	....	....	$126\text{-}30^{27mm}$	sl. s.	v. s.	s.
1007	col. pr./et.	....	44	230 sl. d.	1.4 c.	v. s.	s.
1008	col. cr./aq. al	....	151	....	i.; sl. s. gly.	s. h.; v. sl. s. bz.	sl. s.; sl. s. chl.
1009	lf./toluene	....	160	subl.	2 c.; s. h.	s.	s.; s. alk.
1010	col. lq.	$1.365_{4}^{20°}$	....	213-4	i.	....	....
1011	col. lq.	$1.369_{15}^{15°}$	−0.2	214.5	i.	....	....
1012	col. lq.	....	<−10	206 ±	i.	....	....
1013	col. lq.	....	....	205-7	i.	....	....
1014	col. lq.	$1.362^{20°}$	<−20	204	....	....	....
1015	lf. or pl.	$1.356_{4}^{20°}$	9-10	205.5^{755mm}	....	....	....
1016	col. lq.	$2.890_{4}^{20°}$	8-9	150.5	0.1 c.	∞; ∞ bz.	∞; ∞ chl.
1017	nd.	....	69	400	v. s. pet.	v. s. h. abs.	v. s. bz.
1018	lq.	$0.652^{20°}$	−136.3	10.3	i.	∞	∞
1019	col. gas	$0.621_{4}^{20°}$	−108.9	−4.41	i.	∞	∞
1020	cr.	....	109-11	$151\text{-}2^{10mm}$	$250^{20°}$	$25^{20°}$	0.1
1021	col. gas	$0.579^{20°}$ (lq.)	−138.3	−0.50	$15_{772}^{17°}$ cc.	$1883_{775}^{17°}$ cc.	$2980_{773}^{18°}$ cc.
1022	col. gas	$0.557^{20°}$ (lq.)	−159.6	−11.7	$13_{772}^{17°}$ cc.	$1320_{775}^{17°}$ cc.	$2790_{773}^{18°}$ cc.
1023	lq.	$0.944_{20}^{20°}$	−2	174-8	∞	∞	∞
1024	col. cr.	$0.934_{20}^{20°}$	30-1	165	∞	∞	∞
1025	wh. cr.	....	90*	....	200; s. chl.	s.; sl. s. bz.	i.; s. act.
1026	col. lq.	....	....	$107\text{-}9^{12mm}$	....	....	....
1027	col. lq.	....	....	$189\text{-}91^{2mm}$	....	....	....
1028	col. lq.	$1.077_{25}^{25°}$	<−20	$186\text{-}93^{23mm}$	i.; ∞ bz.	∞; ∞ chl.	∞
1029	col. lq.	$0.882^{20°}$	−76.3	125.1^{740mm}	0.7	∞	∞
1030	col. lq.	$0.865_{4}^{25°}$	....	$111.5\text{-}2.5^{744mm}$	i.	∞	∞
1031	col. lq.	$0.871_{4}^{20°}$	−98.9	118	$0.6^{25°}$	∞	∞
1032	col. lq.	$0.866_{4}^{20°}$	....	$95\text{-}6^{750mm}$	i.	∞	∞
1033	col. lq.	....	....	$98\text{-}100^{16mm}$	i.	s.	s.
1034	col. lq.	$0.810_{4}^{20°}$	−79.9	117	$9^{15°}$	∞	∞
1035	col. lq.	$0.808_{4}^{20°}$	−114.7	99.5	$12.5^{20°}$	∞	∞
1036	col. lq.	$0.805^{17.5°}$	−108	107-8	$10^{15°}$	∞	∞
1037	lq. or rhb.	$0.779^{26°}$	25.0-5.5	82.9	∞	∞	∞
1038	wh. cr. pd	....	138-9	....	sl. s.	s.; s. chl.	s.; s. act.
1039	col. lq.	$0.739_{4}^{25°}$	−50	77.8	∞	∞; ∞ gly.	∞

* Free base, m. 97-8°; s. al., aq., bz.; i. et.

Butenoic acid 1557-8, 2943, 6427
Butenol 1565, 4422
Butenyl chloride (*iso*) 4060
Butesin 1043
Butine, cf. butyne
Butoben 1093
Butolan 825
Butoxy-benzene 1116
Butter yellow 2431 or 2438
Butyl, cf. also dibutyl.
Butyl adipate 1883

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1040	**Butyl** amine (*sec*)	....	$(C_2H_5)(CH_3){:}CH\cdot NH_2$	IV-160	73.14
1041	amine (*iso*)	....	$(CH_3)_2CH\cdot CH_2\cdot NH_2$	IV-163	73.14
1042	amine (*tert*)	....	$(CH_3)_3C\cdot NH_2$	IV-173	73.14
1043	*p*-aminobenzoate (*n*)	butesin	$H_2N\cdot C_6H_4\cdot CO_2C_4H_9$	....	193.24
1044	aminobenzoate picrate	butesin picrate	$(C_{11}H_{15}O_2N)_2\cdot C_6H_3O_7N_3$	....	615.58
1045	*p*-aminobenzoate (*iso*)	cycloform	$H_2N\cdot C_6H_4\cdot CO_2C_4H_9$	*XIV-567	193.24
1046	aniline (*n*)	....	$C_6H_5\cdot NH\cdot C_4H_9$	XII-168	149.23
1047	aniline (*iso*)	....	$C_6H_5\cdot NH\cdot C_4H_9$	XII-168	149.23
1048	arsonic acid (*n*)	....	$C_4H_9\cdot AsO(OH)_2$	**IV-997	182.04
1049	benzene (*n*)	....	$C_6H_5\cdot C_4H_9$	V-413	134.21
1050	benzene (*sec*)	....	$C_6H_5\cdot C_4H_9$	V-414	134.21
1051	benzene (*iso*)	....	$C_6H_5\cdot C_4H_9$	V-414	134.21
1052	benzene (*tert*)	triMe-Ph-methane	$C_6H_5\cdot C(CH_3)_3$	V-415	134.21
1053	benzoate (*n*)	....	$C_6H_5CO_2\cdot C_4H_9$	IX-112	178.22
1054	benzoate (*iso*)	....	$C_6H_5CO_2\cdot C_4H_9$	IX-113	178.22
1055	*o*-benzoylbenzoate (*n*)	....	$C_6H_5\cdot CO\cdot C_6H_4\cdot CO_2\cdot C_4H_9$	....	282.32
1056	benzyl ether (*n*)	....	$C_4H_9\cdot O\cdot CH_2C_6H_5$	....	164.24
1057	bromide (*n*)	1-bromo-butane	$C_2H_5\cdot CH_2\cdot CH_2Br$	I-119	137.03
1058	bromide (*sec*)	2-bromo-butane	$C_2H_5\cdot CHBr\cdot CH_3$	I-119	137.03
1059	bromide (*iso*)	1-Br-2-Me-propane	$(CH_3)_2CH\cdot CH_2Br$	I-126	137.03
1060	bromide (*tert*)	2-Br-2-Me-propane	$(CH_3)_3CBr$	I-127	137.03
1061	β-bromoallyl barbituric acid	pernoston	$(CH_2{:}CBr\cdot CH_2)\cdot(C_4H_9){:}C_4H_2O_3N_2$	....	303.16
1062	*n*-butyrate (*n*)	....	$C_3H_7CO_2\cdot C_4H_9$	II-271	144.21
1063	*n*-butyrate (*iso*)	....	$C_3H_7CO_2\cdot C_4H_9$	II-271	144.21
1064	*iso*-butyrate (*iso*)	....	$(CH_3)_2CHCO_2\cdot C_4H_9$	II-291	144.21
1065	caproate	....	$C_5H_{11}CO_2\cdot C_4H_9$	II-323	172.26
1066	caprylate	....	$C_7H_{15}CO_2\cdot C_4H_9$	II-348	200.31
1067	carbamate (*n*)	....	$NH_2\cdot CO_2\cdot C_4H_9$	*III-14	117.15
1068	carbamate (*iso*)	....	$NH_2\cdot CO_2\cdot C_4H_9$	III-29	117.15
1069	carbitol acetate	β-BuO-β-EtO-ethyl-acetate	$CH_3CO(OC_2H_4)_2\cdot O\cdot C_4H_9$	....	204.26
1070	catechol (*p*)(*tert*)	(4;1,2)	$(CH_3)_3C\cdot C_6H_3(OH)_2$	....	166.21
1071	cellosolve (*n*)	2-BuO-ethanol-1	$C_4H_9\cdot O\cdot CH_2CH_2OH$	**I-519	118.17
1072	chloride (*n*)	1-chloro-butane	$C_2H_5\cdot CH_2\cdot CH_2Cl$	I-118	92.57
1073	chloride (*sec*)	2-chloro-butane	$C_2H_5\cdot CHCl\cdot CH_3$	I-119	92.57
1074	chloride (*iso*)	1-Cl-2-Me-propane	$(CH_3)_2CH\cdot CH_2Cl$	I-124	92.57
1075	chloride (*tert*)	2-Cl-2-Me-propane	$(CH_3)_3C\cdot Cl$	I-125	92.57
1076	chloroacetate (*n*)	....	$Cl\cdot CH_2\cdot CO_2\cdot C_4H_9$	II-198	150.61
1077	chloroformate (*n*)	*n*-Bu-chlorocarbonate	$Cl\cdot CO_2\cdot C_4H_9$	....	136.58
1078	chloroformate (*iso*)	*iso*-Bu-chlorocarbonate	$Cl\cdot CO_2\cdot C_4H_9$	III-12	136.58
1079	*o*-cresol (*p*)(*tert*)	2-Me-4-*tert*-Bu-phenol	$(CH_3)_3C\cdot C_6H_3(CH_3)\cdot OH$	....	164.24
1080	*o*-cresyl ether (*n*)	*n*-Bu-*o*-tolyl ether	$CH_3\cdot C_6H_4\cdot O\cdot C_4H_9$	VI-353	164.24
1081	crotonate (*n*)	....	$CH_3CH{:}CHCO_2\cdot C_4H_9$	....	142.19
1082	crotonate (*iso*)	....	$CH_3CH{:}CHCO_2\cdot C_4H_9$	....	142.19
1083	*iso*-cyanide (*iso*)	*iso*-Bu-carbylamine	$(CH_3)_2CH\cdot CH_2\cdot NC$	IV-167	83.13

Butyl borate 6117
Butyl carbamide 1138-9
Butyl carbinol (*n*) 404
Butyl carbinol (*iso*) 406
Butyl carbinol (*sec*) 411
Butyl carbinol (*tert*) 410
Butyl carbitol 2232

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1040	col. lq.	$0.724^{20°}_{4}$	−104	66^{772mm}	∞	∞	∞
1041	col. lq.	$0.732^{20°}_{20}$	−85	68-9	∞	∞	∞
1042	col. lq.	$0.698^{18°}_{4}$	−67.5	45.2	....	∞	....
1043	wh. cr. pd.	....	58-9	$173\text{-}4^{8mm}$	0.013	s.; s. chl.	s.; s. oil
1044	yel. amor. pd./bz.	....	109-10	....	0.05	s.; s. chl.	s.; s. bz.
1045	nd./lg.	....	65	....	0.022	s.; s. act.	s.; s. bz.
1046	lq.	....	....	235^{720mm}	i.	v. s.	v. s.
1047	oil	$0.940^{20°}_{4}$	....	231-2	$0.01^{15°}$	v. s.	v. s.
1048	col. fl.	....	158-9	....	s.	s.	i.
1049	lq.	$0.860^{20°}$	−88.0	183.3	i.	s.	s.
1050	lq.	$0.862^{20°}$	−75.5	173.3	i.	s.	s.
1051	lq.	$0.853^{20°}$	−51.5	172.8	i.	s.	s.
1052	col. lq.	$0.867^{20°}_{4}$	−57.9	169.1	i.	s.	s.
1053	col. oil	$1.005^{25°}_{25}$	−22	248.5-9.5	i.	s.	s.
1054	col. oil	$0.997^{25°}_{25}$	....	241.5	i.	∞	∞
1055	col. lq.	....	....	$229\text{-}32^{15mm}$	....	....	....
1056	col. lq.	$0.931^{10°}_{4}$	....	216-20	i.	∞	∞
1057	lq.	$1.277^{20°}_{4}$	−112.4	101.6	$0.06^{16°}$	∞	∞
1058	lq.	$1.251^{25°}_{4}$	−112	91.3	i.	....	....
1059	lq.	$1.258^{25°}_{4}$	−118.5	91.5	$0.06^{18°}$	∞	∞
1060	lq.	$1.211^{20°}_{4}$	−16.2	73.3; d. 210	$0.06^{18°}$	∞	∞
1061	wh. cr. pd.	....	130-3	....	v. sl. s.	s.; s. alk.	s.
1062	col. lq.	$0.872^{20°}_{20}$	....	165.7^{736mm}	i.	∞	∞
1063	col. lq.	$0.863^{18°}_{4}$	....	156.9	i.	∞	∞
1064	col. lq.	$0.875^{0°}_{4}$	−80.7	148-9	i.	∞	∞
1065	col. lq.	$0.882^{0°}_{0}$	....	204.3	i.	....	....
1066	col. lq.	$0.880^{0°}_{0}$	....	240.5	....	....	....
1067	wh. fl.	....	53-4	203-4d.	i.	s.	v. s.
1068	col. lf.	$0.956^{76°}_{4}$	65	206-7	i.	s.	s.
1069	col. lq.	$0.981^{20°}_{20}$	....	246	$6.5^{20°}$	....	....
1070	col. cr.	$1.049^{60°}_{25}$	56-7	285	$0\ 2^{80°}$	s.; v. s. act.	$240^{25°}$
1071	col. lq.	$0.903^{20°}_{4}$	....	171.2	∞	∞	∞
1072	col. lq.	$0.887^{20°}$	−131	77.9^{763mm}	$0.07^{12.5°}$	∞	∞
1073	col. lq.	$0.871^{20°}_{4}$	....	67.8^{767mm}	i.	∞	∞
1074	col. lq.	$0.884^{15°}$	−131.2	68.9	i.	∞	∞
1075	lq.	$0.847^{15°}$	−26.5	51-2	i.	∞	∞
1076	col. lq.	$1.081^{15°}$	....	175	....	....	....
1077	col. lq.	$1.074^{25°}_{4}$	....	140-5	d.	d.	∞
1078	lq.	$1.045^{18.5°}_{15}$	....	128.8	slow d.	slow d.; ∞ chl.	∞; ∞ bz.
1079	lq.	$0.969^{30°}_{25}$	27	$137\text{-}8^{25mm}$	i.; ∞ CCl_4	∞ Me al.	∞; ∞ bz.
1080	col. lq.	$0.944^{0°}_{0}$	....	223	....	....	....
1081	lt. yel. lq.	....	....	175-80	....	....	....
1082	lt. yel. oil	....	....	170-2	....	....	....
1083	lq.	$0.787^{4°}$	<−60	114-7	sl. s.	s.	s.

Butyl carbonate 1892-4
Butyl chlorocarbonate 1077-8
Butyl citrate 6119
Butyl cyanide (*n*) 6405
Butyl cyanide (*iso*) 6413
Butyl cyanide (*tert*) 6246

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Butyl				
1084	diethanolamine (*n*)	....	$C_4H_9{\cdot}N(CH_2CH_2OH)_2$	IV-285	161.24
1085	fluoride (*iso*)	1-F-2-Me-propane	$(CH_3)_2CH{\cdot}CH_2F$	I-124	76.11
1086	formate (*n*)	....	$HCO_2{\cdot}CH_2CH_2C_2H_5$	II-21	102.13
1087	formate, ortho (*n*)	triBu-orthoformate	$HC(O{\cdot}CH_2CH_2C_2H_5)_3$	....	232.35
1088	formate (*sec*)	....	$HCO_2CH(CH_3){\cdot}C_2H_5$	**II-30	102.13
1089	formate (*iso*)	....	$HCO_2{\cdot}CH_2{\cdot}CH(CH_3)_2$	II-21	102.13
1090	furoate (*n*)	....	$C_4H_3O{\cdot}CO_2{\cdot}C_4H_9$	....	168.19
1091	β-furylacrylate (*n*)	....	$C_4H_3O{\cdot}CH{:}CH{\cdot}CO_2{\cdot}C_4H_9$	....	194.22
1092	(*o*)-hydroxy-benzoate	*n*-Bu-salicylate	$HO{\cdot}C_6H_4{\cdot}CO_2{\cdot}C_4H_9$	....	194.22
1093	*p*-hydroxy-benzoate (*n*)	butoben	$HO{\cdot}C_6H_4{\cdot}CO_2{\cdot}C_4H_9$	....	194.22
1094	α-hydroxy-*iso*-butyrate (*n*)	....	$(CH_3)_2C(OH){\cdot}CO_2{\cdot}C_4H_9$	....	160.21
1095	iodide (*n*)	1-iodo-butane	$C_2H_5{\cdot}CH_2{\cdot}CH_2I$	I-123	184.03
1096	iodide (*sec*)	2-iodo-butane	$C_2H_5{\cdot}CHI{\cdot}CH_3$	I-123	184.03
1097	iodide (*iso*)	1-iodo-2-Me-propane	$(CH_3)_2CH{\cdot}CH_2I$	I-128	184.03
1098	iodide (*tert*)	2-iodo-2-Me-propane	$(CH_3)_3CI$	I-129	184.03
1099	lactate (*n*)	....	$CH_3CHOHCO_2{\cdot}C_4H_9$	....	146.18
1100	lactate (*iso*)	....	$CH_3CHOHCO_2{\cdot}C_4H_9$	**III-188	146.18
1101	levulinate (*n*)	....	$CH_3CO(CH_2)_2CO_2{\cdot}C_4H_9$	....	172.22
1102	malonic acid	....	$C_4H_9{\cdot}CH(CO_2H)_2$	II-673	160.17
1103	mercaptan (*n*)	butanthiol-1	$C_2H_5(CH_2)_2{\cdot}SH$	I-370	90.18
1104	mercaptan (*iso*)	2-Me-propanthiol-1	$(CH_3)_2CH{\cdot}CH_2{\cdot}SH$	I-378	90.18
1105	mercaptan (*tert*)	....	$(CH_3)_3C{\cdot}SH$	I-383	90.18
1106	*o*-methoxybenzoate (*n*)	....	$CH_3O{\cdot}C_6H_4{\cdot}CO_2{\cdot}C_4H_9$	....	208.25
1107	nitrate (*iso*)	....	$C_4H_9{\cdot}O{\cdot}NO_2$	I-377	119.12
1108	nitrite (*n*)	....	$C_4H_9{\cdot}O{\cdot}NO$	I-369	103.12
1109	nitrite (*iso*)	....	$(CH_3)_2CHCH_2{\cdot}O{\cdot}NO$	I-377	103.12
1110	oleate (*n*)	....	$C_{17}H_{33}CO_2{\cdot}C_4H_9$	**II-439	338.56
1111	oxamate (*n*)	....	$H_2N{\cdot}CO{\cdot}CO_2{\cdot}C_4H_9$	....	145.16
1112	phenoxy-ethanol	(β)(*p-tert*)	$(CH_3)_3C{\cdot}C_6H_4{\cdot}O{\cdot}CH_2{\cdot}CH_2OH$	....	194.26
1113	phenylacetate (*n*)	....	$C_6H_5{\cdot}CH_2{\cdot}CO_2{\cdot}C_4H_9$	....	192.25
1114	phenylacetate (*iso*)	....	$C_6H_5{\cdot}CH_2{\cdot}CO_2{\cdot}C_4H_9$	IX-435	192.25
1115	phenyl carbinol (*n*)	....	$C_6H_5{\cdot}CHOH{\cdot}C_4H_9$	....	164.24
1116	phenyl ether (*n*)	*n*-BuO-benzene	$C_4H_9{\cdot}O{\cdot}C_6H_5$	VI-143	150.21
1117	phenyl ketone (*n*)	valerophenone	$C_4H_9{\cdot}CO{\cdot}C_6H_5$	VII-327	162.22
1118	phenyl ketone (*iso*)	*iso*-valerophenone	$C_4H_9{\cdot}CO{\cdot}C_6H_5$	VII-329	162.22
1119	phenol (*m*)(*tert*)	....	$(CH_3)_3C{\cdot}C_6H_4{\cdot}OH$	....	150.21
1120	phenol (*p*)(*tert*)	....	$(CH_3)_3C{\cdot}C_6H_4{\cdot}OH$	VI-524	150.21
1121	*o*-phenylphenol (*tert*)	(1;2,5)	$C_6H_5{\cdot}C_6H_3(OH){\cdot}C(CH_3)_3$	....	226.30
1122	phthalate (*n*) (mono)	....	$HO_2C{\cdot}C_6H_4{\cdot}CO_2{\cdot}C_4H_9$	....	222.23
1123	propionate (*n*)	....	$C_2H_5{\cdot}CO_2{\cdot}C_4H_9$	II-241	130.18
1124	propionate (*sec*)	....	$C_2H_5{\cdot}CO_2{\cdot}C_4H_9$	II-241	130.18
1125	propionate (*iso*)	....	$C_2H_5{\cdot}CO_2{\cdot}C_4H_9$	II-241	130.18

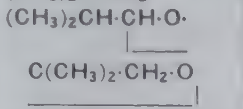
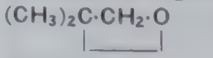
Butyl dibromosuccinate 1896
Butyl disulfide 1897
Butyl ether 1898-9
Butyl ethylene 3655, 3657
Butyl malate 1902
Butyl maleate 1903

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1084	col. lq.	$0.968_{4}^{20^\circ}$	....	$273\text{-}5^{741mm}$	∞	∞	∞ ; ∞ bz.
1085	gas	....	....	16 ±	....	....	....
1086	lq.	0.911^{0°	....	106.9	v. sl. s.	∞	∞
1087	lq.	$0.869_{4}^{20^\circ}$	....	245-7	....	....	....
1088	lq.	$0.882_{4}^{20^\circ}$	....	97	sl. s.	∞	∞
1089	lq.	$0.885_{4}^{20^\circ}$	−95.3	98.2	1.1^{22°	∞	∞
1090	col. lq.	$1.056_{4}^{20^\circ}$	....	$118\text{-}20^{25mm}$	i.	∞	∞
1091	col. lq.	$1.048_{4}^{20^\circ}$	....	121^{5mm}	i.	s.	....
1092	col. lq.	....	5.9	259-60	....	....	....
1093	wh. pd.	....	68-9	....	0.02	s.	s.; s. chl.
1094	col. lq.	....	....	$64\text{-}5^{5mm}$	....	....	....
1095	lq.	$1.617_{4}^{20^\circ}$	−103.5	129.9	i.	∞	∞
1096	lq.	1.595^{20°	−104	118-9	i.	∞	∞
1097	lq.	$1.606_{4}^{20^\circ}$	−90.7	120	i.	∞	∞
1098	lq.	$1.370_{15}^{18.5^\circ}$	−34	99	i.	∞	∞
1099	col. lq.	0 968	....	$75\text{-}6^{6mm}$	sl. s.	∞	∞
1100	col. lq.	$0.964_{4}^{30^\circ}$	....	$60\text{-}2^{7mm}$	....	....	....
1101	lq.	$0.974_{4}^{20^\circ}$	....	237.8	....	....	....
1102	pr./aq.	....	101.5	d. 150	v. s.	v. s.	v. s.
1103	col. lq.	$0.837_{4}^{25^\circ}$	−116	97-8	sl. s.	v. s.	v. s.
1104	lq.	$0.836_{4}^{20^\circ}$	<−79	88	v. sl. s.	s.	s.
1105	lq.	....	....	65-7	....	....	....
1106	col. lq.	....	....	$185\text{-}6^{20mm}$	....	....	....
1107	lq.	$1.015_{4}^{20^\circ}$	....	122.9	i.	∞	∞
1108	lq.	0.911^{0°	....	77-9	....	∞	∞
1109	lq.	$0.870_{20}^{20^\circ}$	....	67-8	sl. s.; d.	∞	....
1110	lq.	0.868^{25°	....	$227\text{-}8^{15mm}$	i.	s.	s.
1111	wh. nd.	....	87-8	....	i	s. h.	sl. s.
1112	col. lq.	$1.014_{25}^{25^\circ}$	13	$147\text{-}56^{8mm}$	i.; ∞ act.	∞ Me al.	∞ bz.
1113	col. lq.	....	....	$128\text{-}32^{18mm}$	....	....	....
1114	col. lq.	....	....	247	....	....	....
1115	col. lq.	....	....	$128\text{-}30^{8mm}$	....	....	....
1116	col. lq.	$0.930_{4}^{20^\circ}$	....	210.3	i.	s.	s.
1117	lq.	....	....	248.5	i.	s.	s.
1118	lq.	$0.993^{17.5^\circ}$	....	$227\text{-}8^{720mm}$	i.	∞	∞
1119	col. cr.	....	40.6	240	....	....	....
1120	nd./aq.	$0.908_{4}^{113^\circ}$	99	236-8	s.	s.	s.
1121	col. cr.	$1.022_{25}^{25^\circ}$	50	$196\text{-}9^{25mm}$	i.; v. s. bz.	v. s. Me al.; v. s. act.	v. s.; v. s. CCl_4
1122	col. cr.	....	73-7	....	s. h.	s.	v. s.
1123	col. lq.	0.883^{15°	−89.6	146	i.	∞	∞
1124	col. lq.	$0.866_{4}^{20^\circ}$	....	132.0-2.5	i.	∞	∞
1125	col. lq.	$0.888_{4}^{0^\circ}$	−71	136.8	i.	∞	∞

Butyl malonate 1904
Butyl mustard oil 1133-6

Butyl oxalate 1905-6
Butyl phosphate 6121

Butyl phthalate 1908

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Butyl				
1126	pyrrole (*n*)(*N*)	....	$C_4H_4N\cdot C_4H_9$	....	123.19
1127	ricinoleate (*n*)	....	$HO\cdot C_{17}H_{32}CO_2\cdot C_4H_9$	III-388	354.56
1128	ricinoleate (*iso*)	....	$HO\cdot C_{17}H_{32}CO_2\cdot C_4H_9$	III-388	354.56
1129	stearate (*n*)	....	$C_{17}H_{35}CO_2\cdot C_4H_9$	**II-352	340.57
1130	stearate (*iso*)	....	$C_{17}H_{35}CO_2\cdot C_4H_9$	*II-173	340.57
1131	thiocyanate (*n*)	....	$C_2H_5CH_2CH_2\cdot S\cdot CN$	**III-122	115.19
1132	thiocyanate (*iso*)	....	$(CH_3)_2CHCH_2\cdot S\cdot CN$	III-177	115.19
1133	*iso*-thiocyanate (*n*)	butyl mustard oil	$C_2H_5CH_2CH_2\cdot N:CS$	IV-158	115.19
1134	*iso*-thiocyanate	(*sec*)(*d*)	$C_4H_9\cdot N:CS$	IV-161	115.19
1135	*iso*-thiocyanate (*iso*)	*iso*-Bu mustard oil	$(CH_3)_2CHCH_2\cdot N:CS$	IV-171	115.19
1136	*iso*-thiocyanate (*tert*)	....	$(CH_3)_3C\cdot N:CS$	IV-175	115.19
1137	*p*-toluene sulfonate (*n*)	....	$CH_3\cdot C_6H_4\cdot SO_2\cdot O\cdot C_4H_9$	....	228.30
1138	urea (*n*)(*N*)	*n*-Bu carbamide	$C_4H_9\cdot NH\cdot CO\cdot NH_2$	*IV-371	116.16
1139	urea (*iso*)(*N*)	....	$C_4H_9\cdot NH\cdot CO\cdot NH_2$	IV-168	116.16
1140	urethane (*n*)(*N*)	Et *N*-*n*-Bu carbamate	$C_4H_9\cdot NH\cdot CO_2\cdot C_2H_5$	IV-158	145.20
1141	urethane (*iso*)	....	$C_4H_9\cdot NH\cdot CO_2\cdot C_2H_5$	IV-168	145.20
1142	*n*-valerate (*n*)	....	$CH_3(CH_2)_3CO_2\cdot C_4H_9$	II-301	158.23
1143	*iso*-valerate (*n*)	....	$(CH_3)_2CHCH_2CO_2\cdot C_4H_9$	**II-275	158.23
1144	*iso*-valerate (*sec*)	....	$(CH_3)_2CHCH_2CO_2\cdot C_4H_9$	II-312	158.23
1145	*iso*-valerate (*iso*)	....	$C_4H_9CO_2\cdot C_4H_9$	II-312	158.23
1146	2-xenyl-di (*p*-*tert*-butylphenyl) phosphate (5-*tert*)	phosphen 11	$(CH_3)_3C\cdot C_{12}H_8\cdot O\cdot PO[O\cdot C_6H_4\cdot C(CH_3)_3]_2$	....	570.68
1147	**Butylene** (α)	butene-1	$C_2H_5\cdot CH:CH_2$	I-203	56.10
1148	**Butylene** (β)(*cis*)	butene-2	$CH_3\cdot CH:CH\cdot CH_3$	I-205	56.10
1148.1	**Butylene** (β)(*trans*)	butene-2	$CH_3\cdot CH:CH\cdot CH_3$	I-205	56.10
1149	**Butylene** (γ) (*iso*)	2-methyl-propene-1	$(CH_3)_2C:CH_2$	I-207	56.10
1150	*iso*-butyracetal (*iso*)	....	 $(CH_3)_2CH\cdot CH\cdot O\cdot C(CH_3)_2\cdot CH_2\cdot O$	....	144.21
1151	chlorohydrin (β, γ)	3-chloro-butanol-2	$CH_3CHCl\cdot CHOH\cdot CH_3$	I-373	108.57
1152	chlorohydrin (α) (*iso*)	1-chloro-2-Me-propanol-2	$(CH_3)_2C(OH)\cdot CH_2Cl$	I-382	108.57
1153	chlorohydrin (β) (*iso*)	2-chloro-2-Me-propanol-1	$(CH_3)_2CCl\cdot CH_2OH$	I-378	108.57
1154	glycol (*iso*)	2-Me-propandiol-1,2	$(CH_3)_2COH\cdot CH_2OH$	I-480	90.12
1155	oxide (*iso*)	α, α diMe-ethylene oxide	 $(CH_3)_2C\cdot CH_2\cdot O$	XVII-11	72.10
1156	**Butyne-1**	ethyl-acetylene	$C_2H_5\cdot C\vdots CH$	I-249	54.09
1157	**Butyne-2**	crotonylene	$CH_3\cdot C\vdots C\cdot CH_3$	I-249	54.09
1158	**Butyrchloral**	triCl-butaldehyde	$CH_3\cdot CHCl\cdot CCl_2\cdot CHO$	I-664	175.45
1159	hydrate	butylchloral hydrate	$CH_3\cdot CHCl\cdot CCl_2\cdot CH(OH)_2$	I-664	193.47
1160	**Butyraldehyde** (*n*)	butanal	$C_2H_5\cdot CH_2\cdot CHO$	I-662	72.10
1161	oxime (*n*)	butyraldoxime	$C_2H_5\cdot CH_2\cdot CH:NOH$	I-663	87.12

Butyl salicylate 1092
Butyl sebacate 1909
Butyl succinate 1910-2
Butyl sulfate 1913
Butyl sulfide 1914-6
Butyl sulfite 1917
Butyl sulfone 1918
Butyl tartrate 1919-20
Butyl-toluene 4158-60

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1126	yel. lq.	....	....	$91\text{-}2^{55mm}$	....	....	....
1127	lq.	0.906^{22°	....	275^{13mm}	i.	....	s.
1128	lq.	0.903^{22°	....	262^{9mm}	i.	s.	s.
1129	col. lq.	$0.855\text{-}8^{25^\circ}_{25}$	27.5(19.5)	$220\text{-}5^{25mm}$	0.3^{25°	s.	s.
1130	waxy	....	25	....	i.	....	....
1131	col. lq.	0.956^{25°	....	185-6	i.	s.	s.
1132	col. lq.	....	−59	175.4	i.	∞	....
1133	lq.	$0.956^{11.2^\circ}$	....	165^{724mm}	i.	s.	s.
1134	lq.	$0.943^{20^\circ}_{4}$	....	159-63	i.	s.	s.
1135	lq.	$0.964^{14^\circ}_{4}$	....	162	i.	s.	s.
1136	lq.	0.919^{10°	10.5	140^{770mm}	i.	s.	s.
1137	lq.	$1.120^{20^\circ}_{4}$	....	$174\text{-}5^{10mm}$	....	....	....
1138	col. nd./bz.	....	96	....	s.	s.	s.
1139	nd./act.	....	140.5-1.5	....	sl. s. act.	sl. s. bz.	v. sl. s.
1140	col. lq.	0.951^{15°	−22	202-3	....	s.	s.
1141	col. lq.	$0.943^{20^\circ}_{4}$	<−65	$95\text{-}6^{15mm}$	i.	s.	....
1142	lq.	$0.870^{15^\circ}_{4}$	−93	186	v. sl. s.	∞	∞
1143	lq.	$0.862^{25^\circ}_{4}$	....	168.8	....	....	....
1144	col. lq.	$0.848^{20^\circ}_{4}$	....	$163\text{-}4^{752mm}$	i.	∞	∞
1145	col. lq.	$0.874^{0^\circ}_{4}$	....	168.7	i.	∞	∞
1146	resin	$1.07^{60^\circ}_{4}$	....	$300\text{-}25^{5mm}$	i.; ∞ CCl_4	∞ ; ∞ act.	∞ bz.
1147	col. gas	lq. 0.60^{20°	−185.4	−6.3	i.	v. s.	v. s.
1148	col. gas	lq. 0.62^{20°	−138.9	3.7	....	....	....
1148.1	col. gas	lq. 0.60^{20°	−105.6	0.88			
1149	col. gas	lq. 0.59^{20°	−140.4	−6.9	s. H_2SO_4	....	....
1150	lq.	$0.890^{20^\circ}_{4}$	....	138	<1	....	....
1151	col. lq.	1.105^{20°	....	136-7.5	6.6^{20°	....	....
1152	col. lq.	$1.061^{20^\circ}_{4}$	−20	127-9	sl. s.	s. HCl	....
1153	col. lq.	....	....	132-3 sl. d.	s. HCl	....	....
1154	lq.	$0.994^{20^\circ}_{4}$	....	178.6	∞	....	....
1155	lq.	$0.805^{20^\circ}_{4}$	....	52.4	5.8	s.	s.
1156	col. lq.	0.65^{20°	−125.8	8.7	i.	s.	s.
1157	col. lq.	0.693^{20°	−32.2	27.0	i.	....	....
1158	lq.	$1.396^{20^\circ}_{4}$	....	$164\text{-}5^{750mm}$	....	....	....
1159	rhb.	1.694^{4°	78 sl. d.	d.	s. h.	v. s.	....
1160	col. lq.	$0.817^{20^\circ}_{4}$	−99	75.7	4	∞	∞
1161	lq.	....	....	152^{715mm}	....	....	....

Butyl-tolyl ether 1080
Butylene bromide 1821, 1824-5
Butylene chloride 1972, 1976
Butylene chloride (*iso*) 4060
Butylene glycol 2329-30, 2332
Butylidene dichloride 1971, 1974
Butyn 1890
Butynedioic acid 134
Butynoic acid 5871

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Butyraldehyde				
1162	trimer	para-butyraldehyde	$(C_4H_8O)_3$	*XIX-807	216.31
1163	**Butyraldehyde** (*iso*)	2-Me-propanal	$(CH_3)_2CH \cdot CHO$	I-671	72.10
1164	semicarbazone (*iso*)	....	$C_3H_7 \cdot CH{:}N_3CH_3O$	III-103	129.16
1165	trimer	(para)	$(C_4H_8O)_3$	XIX-390	216.31
1166	**Butyric** acid (*n*)	butanoic acid	$C_2H_5 \cdot CH_2 \cdot CO_2H$	II-264	88.10
1167	acid (*iso*)	2-Me-propanoic acid	$(CH_3)_2CH \cdot CO_2H$	II-288	88.10
1168	amide (*n*)	*n*-butyramide	$C_2H_5 \cdot CH_2 \cdot CO \cdot NH_2$	II-275	87.12
1169	amide (*iso*)	*iso*-butyramide	$(CH_3)_2CH \cdot CO \cdot NH_2$	II-293	87.12
1170	anhydride (*n*)	....	$(C_2H_5 \cdot CH_2 \cdot CO)_2O$	II-274	158.19
1171	anhydride (*iso*)	....	$[(CH_3)_2CH \cdot CO]_2O$	II-292	158.19
1172	anilide (*n*)	*n*-butyranilide	$C_3H_7CO \cdot NHC_6H_5$	XII-252	163.21
1173	chloride (*n*)	butyryl chloride	$C_2H_5 \cdot CH_2 \cdot CO \cdot Cl$	II-274	106.55
1174	chloride (*iso*)	....	$(CH_3)_2CH \cdot CO \cdot Cl$	II-293	106.55
1175	nitrile (*n*)	*n*-butyronitrile	$C_2H_5 \cdot CH_2 \cdot CN$	II-275	69.10
1176	nitrile (*iso*)	*iso*-propyl cyanide	$(CH_3)_2CH \cdot CN$	II-294	69.10
1177	**Butyroin**	....	$C_3H_7 \cdot CHOH \cdot CO \cdot C_3H_7$	I-840	144.21
1178	**Cacodyl**	....	$(CH_3)_2{:}As \cdot As{:}(CH_3)_2$	IV-615	209.96
1179	chloride	diMe-chloroarsine	$(CH_3)_2AsCl$	IV-607	140.44
1180	sulfide	....	$[(CH_3)_2As]_2S$	IV-608	242.02
1181	trichloride	....	$(CH_3)_2AsCl_3$	IV-612	211.35
1182	**Cacodylic** acid	....	$(CH_3)_2AsO \cdot OH$	IV-610	137.99
1183	oxide	....	$[(CH_3)_2As]_2O$	IV-608	225.96
1184	**Cadaverine**	pentamethylene diamine	$H_2N \cdot (CH_2)_5 \cdot NH_2$	IV-266	102.18
1185	**Cadmium** diethyl	....	$(C_2H_5)_2Cd$	IV-677	170.53
1186	dimethyl	....	$(CH_3)_2Cd$	IV-677	142.48
1187	**Calciferol**	vitamin D_2	$C_{28}H_{43}OH$	....	396.63
1188	**Camphane**	....	$C_{10}H_{18}$	V-93	138.24
1189	**Camphene** (*dl*)	....	$C_{10}H_{16}$	V-156	136.23
1190	**Campholic acid**	(*d* or *l*)	$C_{10}H_{18}O_2$	IX-34	170.24
1191	**Camphor** (*d*)	....	$C_{10}H_{16}O$	VII-101	152.23
1192	dichloride (3)(α)	chlorocamphor	$C_{10}H_{16}Cl_2$	VII-117	207.14
1193	dichloride (3)(α')	....	$C_{10}H_{16}Cl_2$	VII-117	207.14
1194	dichloride (3)(β)	....	$C_{10}H_{16}Cl_2$	VII-117	207.14
1195	oxime	....	$C_9H_{16}C{:}NOH$	VII-112	167.24
1196	sulfonic acid	(10 or 6) Reychler	$C_{10}H_{15}O \cdot SO_3H$	XI-315	232.29
1197	**Camphoric** acid (*dl*)	paracamphoric acid	$C_8H_{14}(CO_2H)_2$	IX-760	200.23
1198	acid (*d*)	....	$C_8H_{14}(CO_2H)_2$	IX-745	200.23
1199	acid (*iso*)(*l*)	....	$C_8H_{14}(CO_2H)_2$	IX-762	200.23
1200	anhydride (*dl*)	....	$C_{10}H_{14}O_3$	XVII-459	182.21
1201	**Camphoronic acid** (*l*)	....	$C_9H_{14}O_6$	II-837	218.20
1202	acid (*iso*)	....	$C_9H_{14}O_6$	II-835	218.20
1203	**Camphyl** amine (α)	....	$C_8H_{13} \cdot CH_2 \cdot CH_2 \cdot NH_2$	XII-40	153.26
1204	amine (β)	....	$C_8H_{13} \cdot CH_2 \cdot CH_2 \cdot NH_2$	XII-40	153.26
1205	**Capric** acid	decanoic acid	$CH_3 \cdot (CH_2)_8 \cdot CO_2H$	II-355	172.26
1206	aldehyde	decanal	$CH_3 \cdot (CH_2)_8 \cdot CH{:}O$	I-711	156.26
1207	nitrile	nonyl cyanide	$CH_3 \cdot (CH_2)_8 \cdot CN$	II-356	153.26
1208	**Caproic** acid (*n*)	hexanoic acid	$CH_3 \cdot (CH_2)_4 \cdot CO_2H$	II-321	116.16

Butyramide 1168-9
Butyranilide 1172
Butyrolactam 3936

Butyrophenone 5439-40
Butyrone 2786
Butyryl chloride 784-5

C β acid 4534
Cacodyl hydride 2456
Caffeic acid 2335

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1162	oil	0.918	<−20	115-7^{17mm}	....	....	....
1163	col. lq.	$0.794^{20^\circ}_{4}$	−65.9	63-4^{757mm}	11^{20°	∞ ; ∞ chl.	∞ ; ∞ bz.
1164	lf.	....	125.5-6.0	....	s. bz.	s.	i. pet.
1165	nd./al.	....	59-60	195 sl. d.	i.	s.	v. s.
1166	col. lq.	$0.964^{20^\circ}_{4}$	−4.7	163.5^{757mm}	∞	∞	∞
1167	col. lq.	$0.949^{20^\circ}_{4}$	−47	154.5	20^{20°	∞ ; ∞ chl.	∞
1168	rhb.	1.032	115-6	216	16.3^{15°	s.	sl. s.
1169	mn. pl.	1.013	129-30	216-20	v. s.	s.	sl. s.
1170	col. lq.	$0.968^{20^\circ}_{20}$	−75	199.5^{760mm}	d.	d.	∞
1171	col. lq.	$0.950^{25^\circ}_{4}$	−53.5	181.5^{734mm}	d.	d.	∞
1172	mn. pr.	1.134	92	189^{15mm}	i.	s.	s.
1173	col. lq.	$1.028^{20^\circ}_{4}$	−89	101-2	d.	d.	s.
1174	col. lq.	$1.017^{20^\circ}_{4}$	−90	92	d.	d.	s.
1175	col. lq.	$0.794^{20^\circ}_{4}$	−112.6	117-8	....	....	....
1176	col. lq.	....	....	107-8	sl. s.	v. s.	v. s.
1177	lq.	$0.911^{16.7^\circ}_{4}$	....	180-90	....	....	....
1178	col. oil	1.447^{15°	−5	163	v. sl. s.	s.	s.
1179	col. lq.	$1.505^{12^\circ}_{4}$	<−45	106.5	i.	∞	i.
1180	oil	....	<−40	211	v. sl. s.	s.	s.
1181	cr./et.	....	50 d.	....	d.; s. CS_2	d. abs. al.	s. abs. et.
1182	tri.	....	200	....	82.9^{22°	19.5^{15°	i. abs. et.
1183	col. lq.	1.486^{15°	−57	150	sl. s.	s.	s.
1184	syrup	$0.873^{25^\circ}_{4}$	9	178-80	v. s.	v. s.	sl. s.
1185	col. lq.	$1.653^{22^\circ}_{4}$	−21	64$^{19.5mm}$	....	....	∞
1186	col. lq.	$1.985^{17^\circ}_{4}$	−4 5	105.5^{758mm}	o.	....	∞
1187	cr./act.	....	115-7	....	i.; s. act.	s.; s. chl.	s.
1188	pr.	....	152-3	160^{763mm}	i.	s. h.	s.
1189	er.	0.822^{78°	50	159-60	i.	s.	s.
1190	mn./80% al.	....	106-7	255-60	0.02^{19°	64.5^{15°, 80% al.	s.
1191	trig.	$0.999^{9^\circ}_{9}$	178-9	209.1^{759mm}	0.1	120^{12°	v. s.
1192	mn.	....	93-4	244-7 sl. d.	sl. s. h.	v. s. h.	v. s.
1193	....	....	117	....	220^{18°	....	....
1194	pr./al.	....	132 5	....	v. s. bz.	s.	v. s. ac.
1195	mn./al.	1.011^{16°	119-20	249-54 sl. d.	i.	v. s.	v. s.
1196	pr./ac.	....	195-6	....	v. s.	sl. s. ac.	v. sl. s.
1197	mn.	1.228	202-3	....	0.8^{25°; 10^{100°	s.	s.
1198	mn.	1.186	187	....	$0\ 6^{12^\circ}$	s.	i. chl.
1199	cr./aq. al.	1.243	172	....	0.34^{20°	$47\ 5^{20^\circ}$, abs. al.	....
1200	nd./al.	....	221-3	270	25 chl.	1.5	4
1201	nd./aq.	....	164-5	195-210^{13mm}	12.5^{16°	75.8^{16°, abs. al.	7.4^{16°, abs. et.
1202	tri.	....	170	....	s.	s.	s.
1203	lq.	$0.874^{17.8^\circ}_{4}$	....	194-6	....	....	....
1204	lq.	$0.870^{20^\circ}_{20}$	....	205.5-6.5	....	....	....
1205	col. nd.	0.889^{37°	31.5	268-70	0.003^{15°	s.; s. chl.	s.; s. bz.
1206	lq.	0.828^{15°	....	207-9^{755mm}	....	....	....
1207	col. lq.	....	....	235-7	....	....	....
1208	oily lq.	$0.922^{20^\circ}_{4}$	−1.5	202^{761mm}	1.10^{20°	s.	s.

Caffeine, cf. alkd.
Cajeputole 3217
Camphor, anemone or pulsatilla 510
Camphor, artificial 5319
Camphor chloride 1252
Cane sugar 5663
Canidine, cf. alkd.
C.A.P. gas 1303
Caprinone 2682

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1209	**Caproic** acid (*iso*)	2-Me-pentanoic-5 acid	$(CH_3)_2CH\cdot(CH_2)_2\cdot CO_2H$	II-327	116.16
1210	acid	3-Me-pentanoic-1 acid	$C_2H_5\cdot CH(CH_3)\cdot CH_2\cdot CO_2H$	II-331	116.16
1211	acid	2-Me-pentanoic-1 acid	$C_2H_5\cdot CH_2\cdot CH(CH_3)\cdot CO_2H$	II-326	116.16
1212	aldehyde (*n*)	hexanal	$CH_3\cdot(CH_2)_4\cdot CH{:}O$	I-688	100.16
1213	amide	caproamide	$C_5H_{11}\cdot CO\cdot NH_2$	II-324	115.17
1214	anhydride (*n*)	....	$(C_5H_{11}CO)_2O$	II-324	214.30
1215	anilide (*n*)	*n*-caproanilide	$C_5H_{11}CO\cdot NH\cdot C_6H_5$	XII-255	191.26
1216	chloride (*n*)	*n*-caproyl chloride	$CH_3\cdot(CH_2)_4\cdot CO\cdot Cl$	II-324	134.61
1217	nitrile (*n*)	*n*-amyl cyanide	$CH_3\cdot(CH_2)_4\cdot CN$	II-324	97.16
1218	nitrile (*iso*)	*iso*-amyl cyanide	$(CH_3)_2CH(CH_2)_2CN$	II-329	97.16
1219	**Capryl** acetate†	(*sec*)-octyl acetate	$CH_3CO_2\cdot C_8H_{17}$	II-134	172.26
1220	**Caprylic** acid (*n*)	octanoic acid	$CH_3\cdot(CH_2)_6\cdot CO_2H$	II-347	144.21
1221	acid	2-Et-hexanoic acid	$CH_3(CH_2)_3CH(C_2H_5)\cdot CO_2H$	II-349	144.21
1222	aldehyde (*n*)	octaldehyde	$CH_3\cdot(CH_2)_6\cdot CH{:}O$	I-704	128.21
1223	amide (*n*)	caprylamide	$C_7H_{15}CO\cdot NH_2$	II-349	143.22
1224	anhydride (*n*)	....	$(C_7H_{15}CO)_2O$	II-348	270.40
1225	chloride (*n*)	octanoyl chloride	$CH_3\cdot(CH_2)_6\cdot CO\cdot Cl$	II-348	162.66
1226	nitrile (*n*)	heptyl cyanide	$CH_3\cdot(CH_2)_6\cdot CN$	II-349	125.21
1227	**Capsaicine**	(2;1,4)	$CH_3O\cdot C_6H_3(OH)\cdot CH_2\cdot NH\cdot CO\cdot C_9H_{17}$	*XIII-322	305.40
1228	**Carbamic** acid	known only in derivs.	$H_2N\cdot CO\cdot OH$	III-20	61.04
1229	chloride	urea chloride	$H_2N\cdot CO\cdot Cl$	III-31	79.49
1230	**Carbasone**	*p*-carbamylamino-phenyl-arsonic acid	$H_2NCONH\cdot C_6H_4\cdot AsO{:}(OH)_2$	XVI-880	260.07
1231	**Carbazole**	diphenyleneimine; dibenzopyrrole	$\underbrace{C_6H_4\cdot NH\cdot C_6H_4}$	XX-433	167.20
1232	**Carbitol**	diethylene glycol mono-Et ether	$HO\cdot(CH_2)_2\cdot O\cdot(CH_2)_2\cdot O\cdot C_2H_5$	**I-520	134.17
1233	acetate	....	$CH_3CO_2\cdot C_6H_{13}O_2$	**II-155	176.21
1234	**Carbodiphenyl-imide**	(α)	$C_6H_5\cdot N{:}C{:}N\cdot C_6H_5$	XII-449	194.23
1235	(β)	....	$C_6H_5\cdot N{:}C{:}N\cdot C_6H_5$	XII-450	194.23
1236	**Carbohydrazide**	carbazide	$(H_2N\cdot NH)_2{:}CO$	III-121	90.09
1237	**Carbon** dioxide	carbonic anhydride	CO_2	III-4	44.01
1238	disulfide	....	CS_2	III-197	76.13
1239	monoxide	....	CO	I-720	28.01
1240	suboxide	dioxo-allene	$O{:}C{:}C{:}C{:}O$	I-805	68.03
1241	subsulfide	....	$S{:}C{:}C{:}C{:}S$	III-207	100.15
1242	tetrabromide	tetrabromomethane	CBr_4	I-69	331.67
1243	tetrachloride	tetrachloromethane	CCl_4	I-65	153.84

† See also Nos. 4959-60.

Caproamide 1213
Caproanilide 1215
Caproic isonitrile 453
Caprone 1743
Caprophenone (*iso*) 481-2
Capryl alcohol 4962
Caprylamide 1223
Caprylamine 4970-2
Caprylene 4984
Caprylidene 4991
Caprylone 2265
Carbamic nitrile 1577
Carbamide 6386
Carbamides, cf. ureas.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1209	col. oil	$0.925_{4}^{20^\circ}$	−35	207.7	v. sl. s.	s.	s.
1210	col. lq.	0.924^{19°	....	197-8	....	....	....
1211	col. lq.	$0.928_{0}^{18^\circ}$	....	193^{748mm}	0.57^{17°	....	....
1212	col. lq.	$0.834_{20}^{20^\circ}$	....	128.6	0.5^{20°	....	....
1213	pl.	0.999	100-1	....	s. h.	s.	s.
1214	col. oil	0.928^{17°	−40.6	241-3 sl. d.	....	s.	....
1215	pr./al.	1.112	95	....	....	v. s.	v. s.
1216	col. lq.	$0.981_{4}^{15^\circ}$	−87.3	$153\text{-}4^{738mm}$	d.	d.; s. chl.	s.
1217	col. lq.	0.809^{20°	−79.4	$162\text{-}3^{750mm}$	i.	v. s.	v. s.
1218	lq.	$0.804_{4}^{20^\circ}$	−43	155.5^{760mm}	i.	■	∞
1219	col. lq.	$0.863_{4}^{14^\circ}$	....	$194\text{-}5^{744mm}$	i.	s.	s.
1220	col. lf.	$0.910_{4}^{20^\circ}$	16	237.5	0.25^{100°; 0.07^{15°	s.; s. chl.; s. pet.	s.; s. CS_2
1221	lq.	$0.908_{20}^{20^\circ}$	<0	226.9	0.25^{20°	....	....
1222	lq.	0.821^{20°	....	167-70	....	....	....
1223	col. lf.	....	105-10	>200 d.	0.45^{100°	s.	s.
1224	lq.	$0.907_{4}^{18^\circ}$	−1	280-5	....	s.	....
1225	col. iq.	0.973^{8°	....	$194\text{-}6^{756mm}$	d.	d.	s.
1226	lq.	0.820^{13°	....	198-200	....	....	....
1227	cr./aq. al.	....	64-5	>210, in vac.	i. c.; s. bz.	s.; s. alk.	s.; s. chl.
1228	....	....	....	....	....	....	....
1229	col. lq.	....	50 ±	61-2 d.	d.	d.	....
1230	col. cr.	....	174	....	i.	s. alk.	i. HCl
1231	lf. or pl.	....	244.8	354.8	i.; s. bz.; s. chl.	0.92^{14°; 3.88 h.	sl. s.; s. pet.
1232	col. lq.	$0.990_{20}^{20^\circ}$	....	201.9	∞	v. s.	s.
1233	col. lq.	$1.011_{20}^{20^\circ}$	−25 ±	217.7	∞	∞	∞
1234	syrup	....	....	330-1	v. s. bz.	....	....
1235	cr.	....	168-70	....	v. sl. s. bz.	v. sl. s.	v. sl. s.
1236	nd./aq. al.	....	154	....	i. bz.	i. chl.	i.
1237	col. gas	1.53 (A) 1.101^{-37° (lq.) 1.56^{-79° solid	$-56^{5.2 atm.}$	subl. −78.5	179.7^{0° cc. See special tablo	s. a.	s. alk.
1238	col. lq.	$1.263_{4}^{20^\circ}$ 2.63 (A)	−108.6	46.3	0.2^{0°; 0.014^{50°	∞	∞
1239	poison. gas	$0.814_{4}^{195^\circ}$	−207	−192	0.0044^{0°; 3.5^{0° cc.	s.	s. Cu_2Cl_2
1240	gas	1.114^{0°	−107	7^{761mm}	d.	....	s.
1241	red lq.	....	....	in vac. 60-70*	v. s. bz.	v. s.	v. s.
1242	col. mn.	3.42	α48.4 β90.1	189.5	i.	s.	s.
1243	col. lq.	$1.595_{4}^{20^\circ}$	−22.6	76.8	0.097^{0°; 0.08^{20°	∞	∞

* Partial polymerization.

Carbamidine 3488
Carbamyl-choline chloride 2865
Carbamyl-phenylsemicarbazide 1569
Carbanilide 2759
Carbazide 1236
Carbazotic acid 6310
Carbinol 4100
Carbocinchomeronic acid 5506, 5509
Carbolic acid 5118
Carbon dichloride 5741
Carbon hexachloride 3564
Carbon oxysulfide 1248

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1244	**Carbon** tetrafluoride	tetrafluoro-methane	CF_4	I-59	88.01
1245	tetraiodide	tetraiodo-methane	CI_4	I-74	519.69
1246	**Carbonyl** bromide	....	$O:C:Br_2$	III-20	187.84
1247	chloride	phosgene	$O:C:Cl_2$	III-13	98.92
1248	sulfide	carbon oxysulfide	$O:C:S$	III-131	60.07
1249	**Carbothialdine**	....	$NH_2CS \cdot S \cdot N(CHCH_3)_2$	XXVI-9	162.27
1250	**Carnine**	....	$C_7H_8O_3N_4 \cdot H_2O$	....	214.18
1251	**Carnosine**	*N*(α)-β-alanyl-histidine	$N_2C_3H_3 \cdot CH_2 \cdot CH \cdot (CO_2H) \cdot NHC_3H_6ON$	XXV-516	226.23
1252	**Carotene** (α)(*d*)	provitamin A	$C_{40}H_{56}$	XXX-91	536.85
1253	**Carotene** (β)(*dl*)	provitamin A	$C_{40}H_{56}$	XXX-87	536.85
1254	**Carotene** (γ)(*dl*)	provitamin A	$C_{40}H_{56}$	XXX-92	536.85
1255	**Carvacrol**	2-Me-5-*iso*-Pr-phenol	$(CH_3)(C_3H_7)C_6H_3 \cdot OH$	VI-527	150.21
1256	**Carvacrylamine** (2;1,4)	2-NH₂-*p*-cymene	$H_2N \cdot C_6H_3(CH_3) \cdot C_3H_7$	XII-1171	149.23
1257	**Carvenone** (*dl*)	....	$C_{10}H_{16}O$	VII-78	152.23
1258	**Carvo**-menthene (*d*)	*p*-menthene-1	$C_{10}H_{18}$	V-84	138.24
1259	menthol	....	$C_{10}H_{19}OH$	VI-26	156.26
1260	menthone	....	$C_{10}H_{18}O$	VII-34	154.24
1261	**Carvone** (*d*)	anise oil	$C_{10}H_{14}O$	VII-153	150.21
1262	oxime	carvoxime	$C_{10}H_{14}O:NOH$	VII-156	165.23
1263	**Cedrene**	....	$C_{15}H_{24}$	V-461	204.34
1264	**Cedriret**	cörulignone	$[(CH_3O)_2C_6H_2 \cdot O \cdot]_2$	VIII-537	304.29
1265	**Cellosolve**	2-ethoxy-ethanol-1	$C_2H_5O(CH_2)_2OH$	I-467	90.12
1266	acetate	....	$CH_3CO_2C_4H_9O$	II-141	132.16
1267	**Cellulose**	....	$(C_6H_{10}O_5)x$	....	162.14
1268	acetate, penta-	....	$C_6H_5(O_2CCH_3)_5$	....	372.32
1269	acetate, tetra-	....	$C_6H_6O(O_2CCH_3)_4$	....	330.28
1270	acetate, tri-	....	$C_6H_7O_2(O_2CCH_3)_3$	....	288.25
1271	**Cerotene**	....	$C_{26}H_{52}$	I-227	364.68
1272	**Cerotic acid**	....	$C_{25}H_{51} \cdot CO_2H$	II-394	396.68
1273	**Ceryl alcohol**	....	$C_{26}H_{53} \cdot OH$	I-432	382.69
1274	**Cetyl** acetate	*n*-hexadecyl acetate	$CH_3CO_2 \cdot C_{16}H_{33}$	II-136	284.47
1275	alcohol	hexadecanol	$CH_3(CH_2)_{14}CH_2OH$	I-429	242.43
1276	bromide	hexadecyl bromide	$CH_3(CH_2)_{14}CH_2Br$	I-172	305.34
1277	iodide (*n*)	1-iodohexadecane	$CH_3(CH_2)_{14}CH_2I$	I-172	352.34
1278	palmitate	....	$C_{15}H_{31}CO_2 \cdot C_{16}H_{33}$	II-373	480.83
1279	**Chaulmoogric acid**	....	$C_5H_7 \cdot (CH_2)_{12} \cdot CO_2H$	IX-80	280.44
1280	**Chavibetol** (*iso*) (5;1,2)	propenyl guaiacol	$CH_3 \cdot CH:CH \cdot C_6H_3 \cdot (OH)OCH_3$	VI-956	164.20
1281	**Chloral**	trichloro-acetaldehyde	$Cl_3C \cdot CH:O$	I-616	147.40
1282	alcoholate	....	$Cl_3C \cdot CH(OH) \cdot OC_2H_5$	I-621	193.47
1283	ammonia	....	$Cl_3C \cdot CH(OH)NH_2$	I-624	164.43
1284	cyanohydrine	tri-Cl-lactic nitrile	$Cl_3C \cdot CHOH \cdot CN$	III-288	174.43
1285	formamide	chlor(al)amide	$Cl_3C \cdot CHOH \cdot NH \cdot CO \cdot H$	II-27	192.44

Carbonyl-disulfethyl 2163
Carbostyril 3820
Carbostyril (*iso*) 3826
Carbylamines, cf. *iso*-cyanides.
Cardiazol 5079

Carminic acid, cf. glcde.
Carotin 1252-4
Carpaine, cf. alkd.
Carpiline, cf. alkd.
Carvoxime 1262

Casella's acid 4510
Casella's acid F 4553
Catechin 2312
Catechol 2312
Catechol diethyl ether 2091

Cebione 586
Cellon 5739
Cephaeline, cf. alkd.
Cerane 3568
Cerberin, cf. glcde.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1244	gas	1.96^{-184°	−184	−128	sl. s.	....	....
1245	red, cubic	$4.32^{20.2^\circ}$	d.	subl. in vac. 90-100	i.; d. h.	d. h.	s.
1246	col. lq.	2.45^{15°	−80	64-5	v. sl. d.	....	....
1247	poison. gas	$1.392_{4}^{19^\circ}$	−104	$8.2^{756\text{mm}}$	v. sl.; sl. d.	v. s. bz.	v. s. ac.
1248	col. gas	2.105(A) 1.24^{-87}	−138.2	$-50.2^{760\text{mm}}$	80^{14° cc.	s.	s.
1249	cr./al.	....	....	....	i.	s. h.	i.; s. a.
1250	cr.	....	d. 230-9	....	s. h.	i.	i.
1251	col. nd./al.	....	254 d.	....	32.3^{25°	sl. s.	....
1252	red cr./pet.	$1.000_{20}^{20^\circ}$	187	....	i.; v. s. chl.	sl. s.; s.bz.	s.; s. CS_2
1253	red/bz.-al.	$1.000_{20}^{20^\circ}$	184	....	i.; v. s. chl.	sl. s.; s. bz.	s.; s. CS_2
1254	red pr.	....	177-8	....	i.; s. chl.	s. bz.	s. CS_2
1255	col. lq.	$0.977_{4}^{20^\circ}$	0.5	238	v. sl. s.	∞	∞
1256	oil	0.994^{20°	−16	241	v. sl. s.	s.	s.
1257	lq.	$0.926_{4}^{20^\circ}$	....	233	i.	....	....
1258	lq.	0.829^{20°	....	174-6	....	....	....
1259	oil	$0.908_{4}^{20^\circ}$	....	220	....	....	....
1260	oil	....	....	222-3	....	....	....
1261	col. lq.	$0.961_{4}^{20^\circ}$	....	$230^{755\text{mm}}$	i.	∞ ; 20, 60% al.	∞
1262	mn. pl./al.	1.016^{73°	71-2	....	s.	s.	....
1263	col. lq.	0.939^{15°	....	$262\text{-}3^{750\text{mm}}$	....	....	....
1264	b. bl. nd.	....	d.	....	i.	s. phenol	s. H_2SO_4
1265	col. lq.	$0.931_{4}^{20^\circ}$	−70	135.1	∞	∞ ; ∞ chl.	∞ ; ∞ act.
1266	col. lq.	$0.975_{4}^{20^\circ}$	....	156.3	22	∞	∞
1267	amor.	1.3-1 4	....	....	i.; *	i.	i.
1268	amor.	....	....	....	i.	s. ac.	....
1269	amor.	....	softens 150 ±	....	i.; i. act.	i.; s. ac.	i.; s. chl.
1270	fl.	....	....	....	i.	s. ac.	i.; s. chl.
1271	cr.	....	57-8	....	....	....	....
1272	col. cr.	$0.836_{4}^{79^\circ}$	82.5	....	i.	v. s. h.	s. h.
1273	cr.	....	80	....	i.	s.	....
1274	nd.	0.858^{20°	22-3	$200\text{-}1^{15\text{mm}}$	i.	v. sl. s. c.	....
1275	lf.	$0.818_{4}^{50^\circ}$	49-50	$189.5^{15\text{mm}}$	i.	s.	s.; s. chl.
1276	col. lq.	....	15	....	....	....	....
1277	lf.	$1.123_{4}^{20^\circ}$	22-3	$211^{15\text{mm}}$	i.	s.	s.
1278	lf.	$0.832_{4}^{50^\circ}$	53-4	....	i.; v. s. bz.	$0\ 05^{22^\circ}$	21^{22°
1279	lf./al.	....	68	$247\text{-}8^{20\text{mm}}$	i.	v. sl. s.	s.; s. chl.
1280	cr.	....	95-6	$147^{19\text{mm}}$	....	....	....
1281	col. lq.	$1.505_{4}^{25^\circ}$	−57 ±	$97.6^{768\text{mm}}$	v. s.	∞	∞
1282	nd.	1.143^{40°	56-7 (50)	115-6	s.	s.	s.
1283	col. nd.	....	63-4	100 ±, d.	v. sl. s.	s.; s. bz.	v. s.
1284	col. cr./aq.	....	61	215-20 sl. d.	s.	s.	s.
1285	col. cr.	....	116-8	d.	5; d. h.	40; d. h.	v. s.

* Soluble in $Cu(NH_3)_4(OH)_2$.

Cerulignone 1264
Cetane 3569
Cetylene 3572
Cevadine, cf. alkd.
Cevitamic acid 586
CG (choky) gas 1247
Chalkone 627
Chaulmestrol 3014
Chavicol 211
Chelerythrine, cf. alkd.
Chelidonine, cf. alkd.
Chi acid 554
Chicago acid 344
Chinicine, cf. alkd.
Chinidine, cf. alkd.
Chinosol 3827
Chinotine, cf. alkd.
Chinovin, cf. glcds.
Chloral-amide 1285

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1286	**Chloral** hydrate	....	$Cl_3C\cdot CH(OH)_2$	I-619	165.42
1287	imide (trimer)	tri-Cl-ethylidene-imide	$(Cl_3C\cdot CH:NH)_3$	XXVI-9	439.25
1288	urethane	ural(ine)	$C_2H_2OCl_3\cdot NHCO_2\cdot C_2H_5$	III-24	236.49
1289	**Chloralose** (α)	glucochloral	$Cl_3C\cdot CH:O_2:C_6H_7O\cdot (OH)_3$	XXXI-151	309.54
1290	**Chloramine T**	chlorazone (1,4)	$CH_3\cdot C_6H_4\cdot S:O\cdot (ONa):NCl\cdot H_2O$	XI-107	245.66
1291	**Chloro-** acenaphthene	(3)	$Cl\cdot C_{10}H_5(CH_2)_2$	*V-276	188.65
1292	acetal	....	$ClCH_2\cdot CH(OC_2H_5)_2$	I-611	152.62
1293	acetaldehyde	2-chloro-ethanal	$ClCH_2\cdot CH:O$	I-610	78.50
1294	acetamide	....	$ClCH_2\cdot CO\cdot NH_2$	II-199	93.52
1295	acetamide (*N*)	acetochloramide	$CH_3\cdot CO\cdot NHCl$	II-181	93.52
1296	acetanilide (*o*)	....	$Cl\cdot C_6H_4\cdot NH\cdot COCH_3$	XII-599	169.61
1297	acetanilide (*m*)	....	$Cl\cdot C_6H_4\cdot NH\cdot COCH_3$	XII-604	169.61
1298	acetanilide (*p*)	....	$Cl\cdot C_6H_4\cdot NH\cdot COCH_3$	XII-611	169.61
1299	acetic acid	....	$Cl\cdot CH_2\cdot CO\cdot OH$	II-194	94.50
1300	acetic anhydride	....	$(Cl\cdot CH_2\cdot CO)_2O$	II-199	170.99
1301	acetone	....	$Cl\cdot CH_2\cdot CO\cdot CH_3$	I-653	92.53
1302	acetophenone (*p*)	....	$Cl\cdot C_6H_4\cdot CO\cdot CH_3$	VII-281	154.59
1303	acetophenone (ω)	phenacyl chloride	$C_6H_5\cdot CO\cdot CH_2Cl$	VII-282	154.59
1304	acetyl chloride	....	$Cl\cdot CH_2\cdot CO\cdot Cl$	II-199	112.95
1305	acetylene	chloro-ethyne	$CH\vdots C\cdot Cl$ (or $C:CHCl$)	I-244	60.49
1306	acrylic acid (α)	....	$CH_2:CCl\cdot CO_2H$	II-401	106.51
1307	acrylic acid (β)	....	$ClCH:CH\cdot CO_2H$	II-400	106.51
1308	2-amino-thiophenol hydrochloride	(4;1,2)	$Cl\cdot C_6H_3(SH)\cdot NH_2\cdot HCl$	....	196.10
1309	aniline (*o*)	2-chloroaniline	$Cl\cdot C_6H_4\cdot NH_2$	XII-597	127.57
1310	aniline (*m*)	3-chloroaniline	$Cl\cdot C_6H_4\cdot NH_2$	XII-602	127.57
1311	aniline (*p*)	4-chloroaniline	$Cl\cdot C_6H_4\cdot NH_2$	XII-607	127.57
1312	*o*-anisidine	4-Cl-2-NH_2-anisole	$Cl\cdot C_6H_3(OCH_3)NH_2$	XIII-383	157.60
1313	*o*-anisidine HCl	....	$C_7H_8ONCl\cdot HCl$	....	194.06
1314	anisole (*p*)	....	$Cl\cdot C_6H_4\cdot OCH_3$	VI-186	142.58
1315	anthranilic acid	5-Cl-2-NH_2-benzoic	$Cl\cdot C_6H_3(NH_2)CO_2H$	XIV-365	171.58
1316	anthraquinone (1)	....	$C_6H_4(CO)_2C_6H_3Cl$	VII-787	242.65
1317	anthraquinone (2)	....	$C_6H_4(CO)_2C_6H_3Cl$	VII-787	242.65
1318	benzaldehyde (*o*)	....	$Cl\cdot C_6H_4\cdot CH:O$	VII-233	140.57
1319	benzaldehyde (*m*)	....	$Cl\cdot C_6H_4\cdot CH:O$	VII-234	140.57
1320	benzaldehyde (*p*)	....	$Cl\cdot C_6H_4\cdot CH:O$	VII-235	140.57
1321	benzamide (*o*)	....	$Cl\cdot C_6H_4\cdot CO\cdot NH_2$	IX-336	155.58
1322	benzamide (*m*)	....	$Cl\cdot C_6H_4\cdot CO\cdot NH_2$	IX-338	155.58
1323	benzamide (*p*)	....	$Cl\cdot C_6H_4\cdot CO\cdot NH_2$	IX-341	155.58
1324	benzene	phenyl chloride	$C_6H_5\cdot Cl$	V-199	112.56
1325	benzene-3,5-disulfonic acid	(1;3,5)	$Cl\cdot C_6H_3(SO_3H)_2$	*XI-49	272.68

Chloral-antipyrine 567
Chloramide 1285
Chloranil 5746
Chloranol, a mixt. of 1386 and 4117
Chlorazene 1290
Chlorazine 1290
Chlorazone 1290
Chloretone 6145
Chlorex 1996
Chlornol 1386

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1286	mn. pr.	$1.619_{4}^{50^\circ}$	51.7*	96.3^{764} d.	474^{17°	v. s.	s.; s. h. CS_2
1287	rhb./bz.-al.	....	150-5** d.	....	i.; s. bz.	2; s. chl.	s.; s. oil
1288	lf./al.-et.	....	103 sl. d.	....	i.; d. h.	s.	s.
1289	col. nd./al. or et.	....	187	....	0.9^{15°	6.6^{21°; 0.07^{21° chl.	v. s.
1290	yel. wh. pd.	....	anh. expl. 175-80	....	14c.; 50 h.	d.; i. bz.	i.; i. chl.
1291	nd./al.	$1.195_{4}^{70^\circ}$	69-70	319^{771mm}	....	....	....
1292	lq.	1.026^{15°	....	157	sl. s.	∞	∞
1293	lq.	....	....	85^{748mm}	....	....	....
1294	mn. pr.	....	120-1	224-5 d.	10^{24°	9.5^{24° abs.	v. sl. s.
1295	lf.	....	110	....	v. s.	....	s.
1296	nd./aq. ac.	....	88	....	i.	s.	s. bz.
1297	nd./aq. ac.	....	72.5	....	s. CS_2	s.	s. bz.
1298	rhb.	1.385^{22°	175-6	....	sl. s.	s.	v. s.
1299	col. cr.	$1.58_{20}^{20^\circ}$	α61.2 β56.3 γ50 δ43.8(?)	189.5	v. s.; v. s. bz.	s.; s. chl.	s.
1300	pr./bz.	....	46	163^{116mm}	v. sl. s. lg.	sl. s. bz.	v. s.
1301	col. lq.	1.162^{16°	−44.5	121	∞	∞	∞
1302	cr.	1.188^{20°	20	232	i.	∞	∞
1303	rhb.	1.324^{15°	54.0	245-7	i.; s. bz.	v. s.	v. s.
1304	col. lq.	$1.498_{20}^{20^\circ}$	....	105	d.	d.	....
1305	gas	....	expl.	−30	....	....	....
1306	nd.	....	65	subl.	s.	s.	s.
1307	lf.	....	84-5	....	s.	s.	s.
1308	yel. cr.	....	208 d.	....	s.	s.	i.
1309	lq.	$1.213_{4}^{20^\circ}$	0	210.5	i.; s. a.	....	s.
1310	lq.	$1.216_{4}^{20^\circ}$	−10.4	230^{767mm}	i.; s. a.	....	s.
1311	rhb.	1.427^{19°	70-1	230-1	s. h.	s.; s. act.	s.; s. CS_2
1312	nd.	....	83-4	....	i. pet.	s.	s.
1313	col. nd.	....	....	....	s.	sl. s.	i.
1314	lq.	....	<−18	198	i.	s.	s.; s. chl.
1315	nd./al.	....	211-2	....	i.; v. s. act.	10^{25°; s. bz.	i. c.
1316	yel. nd./al.	....	162	subl.	i.; s. ac.	sl. s. h.	s. h. bz.
1317	nd./al.	....	208-9	....	i.	s. h. bz.	s. ac.
1318	nd.	1.29^{8°	11	208^{748mm}	v. sl. s.	v. s.	v. s.
1319	pr.	1.250^{15°	17-8	213-4	v. sl. s.	v. s.	v. s.
1320	pr.	1.196^{61°	47.8	213^{748mm}	s. h.	v. s.	v. s.
1321	rhb.	1.34^{18°	142.5	....	s. h.	s.	s.
1322	nd.	....	134.5	....	s. h.	s.	s.
1323	nd./et.	....	179	....	s. h.	v. s.	v. s.
1324	col. lq.	$1.107_{4}^{20^\circ}$	−45.2	132.1	0.049^{20°	∞; ∞ bz.	∞
1325	hyg. nd.	....	d. 100	....	....	....	....

* Variable m. p., depends upon dissociation.
** Mn. pr./al., m. p. 105-6.

Chloro-acetcacetanilide 41
Chloro-acetonitrile 1399
Chloro-allylene 5343
Chloro-aminoanisole 1312
Chloro-aminotoluene 1469-70
Chloro-anthranilic acid 1315

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1326	**Chloro** benzene sulfonic acid (1,4)	....	$Cl\cdot C_6H_4\cdot SO_3H$	XI-54	192.62
1327	benzoic acid (***o***)	....	$Cl\cdot C_6H_4\cdot CO_2H$	IX-334	156.57
1328	benzoic acid (***m***)	....	$Cl\cdot C_6H_4\cdot CO_2H$	IX-337	156.57
1329	benzoic acid (***p***)	chlorodracylic acid	$Cl\cdot C_6H_4\cdot CO_2H$	IX-340	156.57
1330	benzonitrile (***p***)	....	$Cl\cdot C_6H_4\cdot CN$	IX-341	137.57
1331	benzophenone (***p***)	....	$Cl\cdot C_6H_4\cdot CO\cdot C_6H_5$	VII-419	216.66
1332	benzothiazole (2)	....	$\underbrace{C_6H_4\cdot N:C(Cl)\cdot S}$	XXVII-44	169.63
1333	benzoxazole (2)	....	$\underbrace{C_6H_4\cdot N:C(Cl)\cdot O}$	XXVII-43	153.57
1334	benzoyl chloride	(1,2)	$Cl\cdot C_6H_4\cdot CO\cdot Cl$	IX-336	175.02
1335	benzoyl chloride	(1,3)	$Cl\cdot C_6H_4\cdot CO\cdot Cl$	IX-338	175.02
1336	benzoyl chloride	(1,4)	$Cl\cdot C_6H_4\cdot CO\cdot Cl$	IX-341	175.02
1337	benzyl bromide	(1,2)	$Cl\cdot C_6H_4\cdot CH_2Br$	*V-155	205.49
1338	benzyl bromide	(1,4)	$Cl\cdot C_6H_4\cdot CH_2Br$	V-307	205.49
1339	benzyl chloride	(1,4)	$Cl\cdot C_6H_4\cdot CH_2Cl$	V-297	161.03
1340	bromobenzene	(1,3)	$Cl\cdot C_6H_4\cdot Br$	V-209	191.47
1341	bromobenzene	(1,4)	$Cl\cdot C_6H_4\cdot Br$	V-209	191.47
1342	bromoethane (1,1)	ethylidene chlorobromide	$CH_3\cdot CHClBr$	I-89	143.43
1343	bromoethane (1,2)	....	$Cl\cdot CH_2\cdot CH_2\cdot Br$	I-89	143.43
1344	bromomethane	....	$Cl\cdot CH_2Br$	I-67	129.40
1345	buta-1,3-diene (2)	chloroprene	$CH_2:CCl\cdot CH:CH_2$	....	88.54
1346	***tert***-butylphenol	(4;1,2)	$C_4H_9\cdot C_6H_3(OH)Cl$	....	184.66
1347	butyric acid (α)(***dl***)	....	$C_2H_5\cdot CHCl\cdot CO_2H$	II-276	122.55
1348	butyric acid (β)(***dl***)	....	$CH_3\cdot CHCl\cdot CH_2\cdot CO_2H$	II-277	122.55
1349	butyric acid (γ)	....	$Cl\cdot(CH_2)_3\cdot CO_2H$	II-278	122.55
1350	***iso***-butyric acid (α)	....	$(CH_3)_2CCl\cdot CO_2H$	II-295	122.55
1351	butyronitrile (γ)	....	$Cl\cdot(CH_2)_3\cdot CN$	II-278	103.55
1352	camphor (α)†	3-Cl-*d*-camphor	$Cl\cdot C_{10}H_{15}O$	VII-117	186.68
1353	coumarin (6)	....	$Cl\cdot \underbrace{C_6H_3\cdot(CH)_2\cdot CO\cdot O}$	XVII-331	180.59
1354	***m***-cresol (***o***)	2-Cl-3-OH-toluene	$CH_3\cdot C_6H_3(OH)Cl$	....	142.58
1355	***m***-cresol (***p***)	4-Cl-3-OH-toluene	$CH_3\cdot C_6H_3(OH)Cl$	*VI-187	142.58
1356	***m***-cresol (6)	6-Cl-3-OH-toluene	$CH_3\cdot C_6H_3(OH)Cl$	VI-381	142.58
1357	***p***-cresol (***o***)	2-Cl-4-OH-toluene	$CH_3\cdot C_6H_3(OH)Cl$	VI-402	142.58
1358]	crotonic acid (α)	....	$CH_3\cdot CH:CCl\cdot CO_2H$	II-414	120.54
1359	dibromoethane	(1,1,1)	$CH_3\cdot CClBr_2$	I-92	222.33
1360	dibromoethane	(1,1,2)	$BrCH_2\cdot CHClBr$	I-92	222.33
1361	dibromomethane	....	$ClCHBr_2$	I-68	208.31
1362	diethyl ether (β)	....	$C_2H_5O\cdot CH_2\cdot CH_2Cl$	I-337	108.57
1363	diiodomethane	....	$ClCHI_2$	I-72	302.32
1364	dinitrobenzene	(3;1,2)	$Cl\cdot C_6H_3(NO_2)_2$	*V-137	202.56
1365	dinitrobenzene (α)	(4;1,2)	$Cl\cdot C_6H_3(NO_2)_2$	V-262	202.56
1366	dinitrobenzene	(2;1,3)	$Cl\cdot C_6H_3(NO_2)_2$	V-263	202.56
1367	dinitrobenzene (α)	(4;1,3)	$Cl\cdot C_6H_3(NO_2)_2$	V-263	202.56

† See also Nos. 1192-4.

Chloro-biphenyl 1373-5
Chloro-bromopropane 6279
Chloro-bromotoluene 913-4
Chloro-butane 1072-5
Chloro-***iso***-butylene 1567, 4060
Chlorocarbonates, cf. chloroformates.
Chloro-cyanogen 1591

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1326	nd.	....	68	$147\text{-}8^{0.1mm}$	s.	s.	i.; i. bz.
1327	mn./aq.	$1.544^{20°}$	141-2	....	$0.208^{25°}$	s.	s.
1328	pr.	....	158	....	$0.041^{25°}$ s.h.	s.	s.
1329	tri.	$1.541^{24°}$	242-3	subl.	$0.008^{25°}$	s.	s.
1330	nd./al.	....	93-4	223^{750mm}	i.; v. s. bz.	v. s.	v. s.
1331	nd./et.-al.	....	77-8	332^{771mm}	i.; $95^{25°}$ bz.	$3^{25°}$ Me al.	$57^{25°}$
1332	lq.	....	24 ±	248	....	s.	....
1333	cr.	....	7	201-2 d.	i.	s. HCl	....
1334	lq.	....	−4	$229\text{-}30^{773mm}$	d.	d.	....
1335	lq.	....	....	225	d.	d.	....
1336	lq.	1.377	15-6	220-2	d.	d.	....
1337	col. lq.	....	....	$112\text{-}4^{15mm}$	....	....	....
1338	nd./al.	....	49-50	....	v. s. bz.	s.; v. s. ac.	v. s.
1339	nd.	....	29	213-4	i.	v. s. h.	v. s.
1340	col. oil	$1.630^{20°}_{4}$	−21	195-6	i.	v. s.	v. s.
1341	mn. pr.	$1.576^{71°}_{4}$	67.4	196.3	i.	s. h.	s.
1342	lq.	$1.667^{16°}$	....	82.7	....	....	....
1343	lq.	$1.689^{19°}$	−16.6	106.7	$0.69^{30°}$	....	....
1344	col. lq.	$1.991^{19°}$	< −55	68-9	....	....	....
1345	col. lq.	$0.958^{10°}_{20}$	....	59.4	sl. s.	∞	∞
1346	lq.	$1.112^{25°}_{25}$	< −20*	234-51	i.; ∞ chl.	∞ Me al.	∞; ∞ bz.
1347	oily lq.	....	....	101.3^{15mm}	s. h.	∞	∞
1348	col. cr.	$1.186^{20°}_{4}$	16.0-16.5	$109\text{-}10^{17mm}$	....	s.	s.
1349	cr.	1.250^{10mm}	16	116^{13mm} sl. d.	....	s.	s.
1350	col. cr.	....	31	118^{50mm}	v. s.	....	....
1351	lq.	$1.162^{10°}$	....	195-7	i.	s.	s.
1352	mn. cr.	....	93-4	244-7 sl. d.	v. sl. s. h.	s. h.; s. bz.	s.; s. chl.
1353	nd./al.	....	161-2	....	i. aq. NH_3	s. h.; v. s. CS_2	s. h.; v. s. bz.
1354	cr./pet.	....	55-6	....	sl. s.	s.	s.
1355	col. pr.	$1.215^{15°}$	46	196	i.	s.	s.
1356	col. cr./lg.	....	66	235	i.; s. bz.	s.; s. chl.	s.; s. act.
1357	col. nd.	....	55	228	sl. s.	s.	s.; s. bz.
1358	nd.	....	99.2-99.5	212	$2^{13°}$	v. s.	v. s.
1359	lq.	$2.134^{16°}$	....	$123\text{-}4^{753mm}$	....	....	....
1360	lq.	$2.268^{16°}$	....	162.5-3.0	....	....	....
1361	col. lq.	$2.445^{15°}$	−22 ±	120^{730} sl. d.	....	....	....
1362	lq.	$0.989^{20°}_{4}$	....	107-8	....	....	....
1363	col. lq.	3.170°	−4	200 ±, d.	....	....	....
1364	cr./et.	....	86.8	....	i.	s.	s.
1365	cr./et.	....	α36.3 β37.1 γ38.3 δ26	315 d.	i.	v. s. h.	v. s.
1366	yel. nd./al.	....	87-8	....	i.	s.	s.
1367	rhb./et.	α$1.697^{22°}$ β$1.680^{20°}_{4}$	α53.4 β43 γ27	315 sl. d.	i.; s. bz.	s. h.	s.; s. CS_2

* Crysts. $+H_2O$, m. p. 18°.
Chloro-cyclohexane 1613
Chloro-cymene 1572

Chloro-decane 1646
Chloro-dimethylacetophenone 2524

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Chloro				
1368	dinitrobenzene	(5;1,3)	$Cl\cdot C_6H_3(NO_2)_2$	V-264	202.56
1369	dinitrobenzene	(2;1,4)	$Cl\cdot C_6H_3(NO_2)_2$	V-264	202.56
1370	dinitrobenzoic acid	(5;2,3,1)	$Cl\cdot C_6H_2(NO_2)_2CO_2H$	IX-415	246.57
1371	dinitrobenzoic acid	(5;3,4,1)	$Cl\cdot C_6H_2(NO_2)_2CO_2H$	IX-416	246.57
1372	dinitrophenol (*α*)	(4;2,6,1,)	$Cl\cdot C_6H_2(NO_2)_2OH$	VI-260	218.56
1373	diphenyl (*o*)	chloro-biphenyl	$Cl\cdot C_6H_4\cdot C_6H_5$	V-579	188.65
1374	diphenyl (*m*)	xenyl chloride	$Cl\cdot C_6H_4\cdot C_6H_5$	V-579	188.65
1375	diphenyl (*p*)	....	$Cl\cdot C_6H_4\cdot C_6H_5$	V-579	188.65
1376	ethoxy diphenyl	(2)(*β*)	$C_6H_5\cdot C_6H_4\cdot O(CH_2)_2Cl$	....	232.70
1377	ethyl acetate (*β*)	....	$CH_3CO_2\cdot CH_2\cdot CH_2Cl$	II-128	122.55
1378	ethylbenzene (*o*)	....	$Cl\cdot C_6H_4\cdot C_2H_5$	....	140.61
1379	ethylbenzene (*m*)	alkazene 20	$Cl\cdot C_6H_4\cdot C_2H_5$	....	140.61
1380	ethylbenzene (*p*)	....	$Cl\cdot C_6H_4\cdot C_2H_5$	V-354	140.61
1381	ethyl 2-chloro-4-*tert*-butyl-phenyl ether (*β*)	(4;2,1)	$(CH_3)_3C\cdot C_6H_3(Cl)\cdot O\cdot CH_2CH_2Cl$	....	247.16
1382	ethyl chloroformate	*β*-chloroethyl chlorocarbonate	$Cl\cdot CO\cdot O\cdot CH_2CH_2Cl$	III-11	142.98
1383	ethyl *p*-toluenesulfonate (*β*)	....	$CH_3\cdot C_6H_4\cdot SO_2\cdot OCH_2CH_2Cl$	....	234.70
1384	fumaric acid	....	$CH{:}CCl(CO_2H)_2$	II-744	150.52
1385	furoic acid (5)	5-chloro-pyromucic	$Cl\cdot C_4H_2O\cdot CO_2H$	XVIII-282	146.53
1386	hydroquinone	(2;1,4)	$Cl\cdot C_6H_3(OH)_2$	VI-849	144.56
1387	iodobenzene (*o*)	....	$Cl\cdot C_6H_4\cdot I$	V-220	238.47
1388	iodobenzene (*m*)	....	$Cl\cdot C_6H_4\cdot I$	V-220	238.47
1389	iodobenzene (*p*)	....	$Cl\cdot C_6H_4\cdot I$	V-221	238.47
1390	iodoethane (1,1)	....	$CH_3\cdot CHClI$	I-98	190.43
1391	iodoethane (2,1)	....	$ClCH_2\cdot CH_2I$	I-98	190.43
1392	iodo-hydroxy-quinoline	(5,7,8); nioform	$Cl\cdot I\cdot OH\cdot C_6H{:}C_3H_3N$	XXI-98	305.52
1393	iodomethane	....	$Cl\cdot CH_2\cdot I$	I-71	176.40
1394	4-ketodihydro-quinazoline (2)	....	$\underline{C_6H_4\cdot N{:}C(Cl)\cdot NH\cdot CO}$	....	180.59
1395	lepidine (*α*)	2-Cl-4-Me-quinoline	$C_6H_4{:}C_3HN(CH_3)Cl$	XX-396	177.63
1396	maleic acid	....	$CH{:}CCl(CO_2H)_2$	II-752	150.52
1397	malonic acid	....	$ClCH(CO_2H)_2$	II-592	138.51
1398	methyl acetate	....	$CH_3CO_2\cdot CH_2Cl$	II-152	108.53
1399	methyl cyanide	chloro-acetonitrile	$ClCH_2\cdot CN$	II-201	75.50
1400	methyl ether	....	$ClCH_2\cdot O\cdot CH_3$	I-580	80.52
1401	methyl-ethyl ketone	1-Cl-2-butanone	$ClCH_2\cdot CO\cdot C_2H_5$	I-669	106.55
1402	naphthalene (*α*)	*α*-naphthyl chloride	$C_{10}H_7Cl$	V-541	162.61
1403	naphthalene (*β*)	*β*-naphthyl chloride	$C_{10}H_7Cl$	V-541	162.61
1404	*α*-naphthol (2,1)	....	$Cl\cdot C_{10}H_6\cdot OH$	VI-611	178.61
1405	*α*-naphthol (4,1)	....	$Cl\cdot C_{10}H_6\cdot OH$	VI-611	178.61
1406	*β*-naphthol (1,2)	....	$Cl\cdot C_{10}H_6\cdot OH$	VI-648	178.61
1407	nitroaniline	(4;2,1)	$Cl\cdot C_6H_3(NO_2)NH_2$	XII-729	172.57
1408	nitroaniline HCl	(4;2,1)	$C_6H_5O_2N_2Cl\cdot HCl$	....	209.04
1409	nitroaniline	(4;3,1)	$Cl\cdot C_6H_3(NO_2)NH_2$	XII-731	172.57

Chloro-dracylic acid 1329
Chloro-ethane 3015
Chloro-ethanol 3194
Chloro-ethylbenzene 5191
Chloro-ethyl chlorocarbonate 1382
Chloro-ethyl phenyl ether 1426
Chloro-ethylene 6435
Chloro-ethyne 1305
Chloro-heptane 3546-7
Chloro-hexahydrobenzene 1613

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1368	col. nd./al.	....	59	vol. in steam	....	v. s.	v. s.
1369	yel. cr./lg.	....	60	....	i.	s.	s.
1370	nd./aq.	....	199-200	expl.	$0.26^{11°}$	....	....
1371	pr./bz.	....	159	....	v. s. act.	s.	v. s.
1372	yel. mn./al.	$1.74^{22°}$	81-2	subl.	v. sl. s. h.	s.	s.; s. chl.
1373	cr.	....	34	267-8	i.	v. s. lg.	....
1374	cr.	....	89	284-5	....	....	....
1375	lf.	....	77.5	282	i.	s. lig.	....
1376	col. cr.	$1.142^{60°}_{25}$	54-7	323	v. sl. s.	$12^{25°}$ Me al.	v. s. bz., act.
1377	col. lq.	$1.152^{25°}_{25}$	<-20	145	$3^{25°}$	∞	∞
1378	lq.	$1.055^{25°}_{25}$	−81	179.2	i.	∞	∞
1379	col. lq.	$1.045^{25°}_{25}$	<−70	183	i.; ∞ bz.	∞ ; ∞ act.	∞ ; ∞ CCl_4
1380	lq.	$1.044^{25°}_{25}$	−62	184.6	i.	∞	∞
1381	col. lq.	$1.149^{25°}_{25}$	<−20	$176\text{-}80^{18mm}$	i.; ∞ bz.	∞ ; ∞ act.	∞ ; ∞ CCl_4
1382	lq.	$1.383^{20°}_{4}$	....	152.5^{752mm}	i.; d.	v. s.	v. s.
1383	col. lq.	....	19-20	....	....	....	....
1384	pl./ac.	....	191.5-2.5	....	v. s.	v. s.	v. s.
1385	lf.	....	176-7	....	$0.3^{20°}$	s.	s.
1386	mn.	....	106	263 sl. d.	v. s.	v. s.	v. s.
1387	col. oil	$1.952^{25°}_{4}$	0.7	234-5	....	....	....
1388	yel. lq.	....	....	230	....	....	....
1389	col. lf./al.	$1.886^{57°}_{4}$	56-7	227.6^{751mm}	i.	s.	....
1390	lq.	$2.054^{19°}$	....	117-9	....	....	....
1391	lq.	$2.134^{15.3°}_{0}$	−15.6	140.1	....	....	....
1392	yel. nd./ ac.	....	177-8	....	i.; s. h. ac.	2.5	s.; s. chl.
1393	oil	$2.49^{20°}$	....	109	....	....	....
1394	nd.	....	212	....	i.; s. NaOH	s.	s. act.
1395	nd./aq. al.	....	69	296	i.	s.	s.; s. chl.
1396	col. cr.	....	114-5	....	....	v. s.	v. s.
1397	pr.	....	133	....	v. s.	v. s.	v. s.
1398	col. lq.	$1.195^{14°}$	....	$115\text{-}6^{757mm}$	d.	....	....
1399	lq.	$1.193^{20°}$	....	124	....	....	....
1400	lq.	$1.070^{20°}_{4}$	−103.5	59.5^{759mm}	d.	d. h.	....
1401	lq.	$1.08^{13°}$	....	139^{755mm}	i.	....	....
1402	col. lq.	$1.194^{20°}_{4}$	−20	259.3	i.	s.; ∞ CS_2	∞ ; ∞ bz.
1403	lf./al.	$1.266^{16°}$	56-7	$264\text{-}6^{751mm}$	i.	v. s.	v. s.
1404	nd., lg.	....	65-70	....	....	v. s.	v. s.
1405	nd./aq. al.	....	117-20	....	....	v. s.	v. s.
1406	cr./aq.	....	70-1	....	....	v. s.	v. s. bz.
1407	or. nd./aq.	....	116-7	....	v. sl. s. lg.	v. s.	v. s.
1408	or. pr.	....	....	....	sl. s.	s.	i.
1409	yel. nd./aq.	....	102-3	....	sl. s. h.	s.; s. chl.	s.

Chloro-hexane 3644-7
Chloro-hydrin 3194, 3395, 6280
Chloro-hydroxydiphenyl 1436-8
Chloro-hydroxytoluene 1354-7
Chloro-isobutylene 1567, 4060
Chloro-mercuri-phenol 4034-5
Chloro-methane 4183
Chloro-methyl ethyl ketone 1401
Chloro-methylquinoline 1395

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1410	**Chloro** nitroaniline	(2;4,1)	$Cl\cdot C_6H_3(NO_2)NH_2$	XII-733	172.57
1411	nitroaniline HCl	(2;4,1)	$C_6H_5O_2N_2Cl\cdot HCl$	XII-733	209.04
1412	nitrobenzene (*o*)	nitrochlorobenzene	$Cl\cdot C_6H_4\cdot NO_2$	V-241	157.56
1413	nitrobenzene (*m*)	nitrochlorobenzene	$Cl\cdot C_6H_4\cdot NO_2$	V-243	157.56
1414	nitrobenzene (*p*)	nitrochlorobenzene	$Cl\cdot C_6H_4\cdot NO_2$	V-243	157.56
1415	nitrobenzene sulfonic acid	(6;3,1)	$Cl\cdot C_6H_3(NO_2)SO_3H\cdot 2H_2O$	XI-73	273.65
1416	nitroethane (1,1)	....	$CH_3\cdot CHClNO_2$	I-101	109.52
1417	nitroethane (1,2)	....	$ClCH_2\cdot CH_2NO_2$	I-101	109.52
1418	nitronaphthalene	(1,4)	$Cl\cdot C_{10}H_6\cdot NO_2$	V-555	207.61
1419	nitronaphthalene	(7,1)	$Cl\cdot C_{10}H_6\cdot NO_2$	V-556	207.61
1420	nitropropane	(1,1)	$C_2H_5\cdot CH(Cl)NO_2$	I-116	123.54
1421	nitropropane	(2,2)	$(CH_3)_2C(Cl)NO_2$	I-116	123.54
1422	nitrosoethane (1,1)	....	$CH_3\cdot CH(Cl)NO$	I-99	93.52
1423	pentabromoethane	....	$ClCBr_2\cdot CBr_3$	I-95	459.06
1424	phenetole (*o*)	....	$Cl\cdot C_6H_4\cdot O\cdot C_2H_5$	VI-184	156.61
1425	phenetole (*p*)	....	$Cl\cdot C_6H_4\cdot O\cdot C_2H_5$	VI-187	156.61
1426	phenetole (β)	....	$C_6H_5\cdot O\cdot CH_2CH_2Cl$	VI-142	156.61
1427	phenol (*o*)	....	$Cl\cdot C_6H_4\cdot OH$	VI-183	128.56
1428	phenol (*m*)	....	$Cl\cdot C_6H_4\cdot OH$	VI-185	128.56
1429	phenol (*p*)	....	$Cl\cdot C_6H_4\cdot OH$	VI-186	128.56
1430	phenol sulfonic acid	(4;1,2)	$Cl\cdot C_6H_3(OH)\cdot SO_3H\cdot H_2O$	XI-234	226.63
1431	phenol sulfonate Na	(4;1,2)	$C_6H_4OCl(SO_3Na)$	XI-234	230.61
1432	phenoxyacetic acid	(1,2)	$Cl\cdot C_6H_4\cdot O\cdot CH_2CO_2H$	....	186.59
1433	phenylenediamine	(2;1,4)	$Cl\cdot C_6H_3(NH_2)_2$	XIII-117	142.59
1434	phenylenediamine	(2;1,4) HCl	$C_6H_7N_2Cl\cdot 2HCl$	XIII-117	215.52
1435	phenylphenacyl bromide	(4;1′,4′)	$Cl\cdot C_6H_4\cdot C_6H_4\cdot CO\cdot CH_2Br$	....	309.59
1436	*o*-phenylphenol (2)	(2;6,1)	$C_6H_5\cdot C_6H_3(Cl)OH$	....	204.65
1437	*o*-phenylphenol (4)	(2;4,1)	$C_6H_5\cdot C_6H_3(Cl)OH$	....	204.65
1438	*p*-phenylphenol (2)	(4;2,1)	$C_6H_5\cdot C_6H_3(Cl)OH$	....	204.65
1439	phenyl-4-toluenesulfonate (2)	(4,1;1′,2′)	$CH_3\cdot C_6H_4\cdot SO_3\cdot C_6H_4\cdot Cl$	....	282.74
1440	phenyl-4-toluenesulfonate (4)	(4,1;1′,4′)	$CH_3\cdot C_6H_4\cdot SO_3\cdot C_6H_4\cdot Cl$	....	282.74
1441	phthalic acid	(4;1,2)	$Cl\cdot C_6H_3(CO_2H)_2$	IX-816	200.58
1442	propionic acid (α)	(*dl*)	$CH_3\cdot CHCl\cdot CO_2H$	II-248	108.53
1443	propionic acid (β)	....	$ClCH_2\cdot CH_2\cdot CO_2H$	II-249	108.53
1444	propionyl chloride	(β)	$ClCH_2\cdot CH_2\cdot CO\cdot Cl$	II-250	126.98
1445	propyl acetate (β)	....	$CH_3CO_2\cdot CH_2\cdot CHCl\cdot CH_3$	II-129	136.58
1446	propyl acetate (γ)	....	$CH_3CO_2\cdot (CH_2)_2CH_2Cl$	*II-58	136.58
1447	*iso*-propyl acetate	(β)	$CH_3CO_2\cdot CH(CH_3)\cdot CH_2Cl$	II-130	136.58
1448	propyl chloroformate (γ)	γ-chloropropyl chlorocarbonate	$Cl\cdot CO_2\cdot (CH_2)_2CH_2Cl$	**III-10	157.00
1449	propyl *p*-toluenesulfonate (γ)	....	$CH_3\cdot C_6H_4\cdot SO_3\cdot (CH_2)_2CH_2Cl$	....	248.72

Chloro-nitrophenol 4698-4706
Chloro-nitrotoluene 4682
Chloro-nonane 4928
Chloro-octane 4975-6
Chloro-pentane 442-8
Chloro-phenylacetophenone 5215
Chloro-picrin 4697
Chloro-prene 1345
Chloro-propane 5400-1
Chloro-propanol 5462
Chloro-propene 202, 5345-6
Chloro-propyl alcohol 6280
Chloro-propyl alcohol (*iso*) 5462
Chloro-propyl chlorocarbonate 1448
Chloro-propylene 202, 5345-6
Chloro-propylene oxide 2879
Chloro-propyne 5343
Chloro-pyromucic acid 1385
Chloro-succinimide 5659
Chloro-thymol 5939
Chloro-toluene (ω) 796
Chloro-trinitrobenzene 5308
Chloro-xenol 1436-8

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1410	yel. nd./ aq.	....	107-8	....	sl. s. 50% ac.	s.; i. lg.	s.; s. CS_2
1411	pl.	....	....	....	d.	....	....
1412	mn. nd.	$1.305^{80^\circ}_{4}$	32.5	245.5^{753mm}	i.; s. bz.	s. h.	s.
1413	yel. rhb./al.	$1.343^{50^\circ}_{4}$	44.4(23.7)	235.6	i.; s. chl.	v. s. h.	v. s.; s. ac.
1414	mn. pr.	1.298^{91°	83-4	242^{761mm}	i.	v. s. h.	v. s.
1415	tri./aq.	....	$-2H_2O$, 110	d. 165-70	v. s.	v. sl. s.	sl. s.
1416	col. lq.	$1.258^{20^\circ}_{20}$	....	$124-5^{758mm}$	<0.4	s. alk.	....
1417	col. lq.	1.4057°	....	173-4	i.	d. HCl	....
1418	yel. nd./al.	....	85(60-1)	....	i.	s.	s.
1419	yel. nd./al.	....	116	....	i.	s.	s.
1420	lq.	$1.209^{20^\circ}_{20}$	....	140-3	$<0.8^{20^\circ}$	....	....
1421	lq.	$1.193^{20^\circ}_{20}$	....	134 sl. d.*	$<0.5^{20^\circ}$	s.; i. alk.	s.
1422	col. lf. or b. lq.	....	65	....	i. c. NaOH	v. s. Me al.	v. s.; v. s. pet.
1423	cr.	....	170 d.	....	....	....	....
1424	col. lq.	....	....	208	s. bz.	s.	s.
1425	lq.	....	21	212	....	s.	s.
1426	col. lq.	$1.147^{25^\circ}_{25}$	27-8	221^{754mm}	v. sl. s.	v. s.; s. bz.	v. s.; s. act.
1427	col. lq.	$1.241^{18\ 2^\circ}_{15}$	$\alpha 7$; $\beta 0$; $\gamma 4.1$	175-6	2.85^{20°	s.	s. alk.
1428	nd.	1.268^{25°	32-3	214	2.6^{20°	s.	s.
1429	nd.	$1.306^{20^\circ}_{4}$	41-3	217	2.71^{20°	v. s.	v. s.
1430	hyg. pl./ aq.	....	75-6	....	v. s.; i. bz.	v. sl. s.; i. chl.	v. sl. s.
1431	nd./aq.	....	....	....	s.	sl. s.	....
1432	col. nd./aq.	....	146-7	....	0.5^{80°	21^{25°	9^{25°; i. bz.
1433	nd./bz. lg.	....	64	....	s.	....	....
1434	nd.	....	....	....	....	....	....
1435	col. nd.	....	126-7	....	i.	s. h.	i.
1436	col. lq.	$1.234^{25^\circ}_{25}$	6	317-8	i.; s. alk.	∞	∞
1437	yel. nd.	....	67-71	312	i.; s. CCl_4	85^{25°	250^{25°
1438	col. cr.	....	78-80	323	0.03^{25°; s. al.	$>100^{25^\circ}$ act.	$>100^{25^\circ}$
1439	col. rhb.	....	68-70	....	....	....	....
1440	col. rhb.	....	78-80	....	i.	s. h.	v. s.
1441	nd./al.	....	150.5	$-H_2O$, >150	s.	s.	....
1442	col. lq.	1.306^{9°	<-20	186	∞	∞	∞
1443	col. lf.	....	40-2.5	$203-5^{764mm}$	v. s.	v. s.	v. s.
1444	col. lq.	1.331^{13°	....	$143-5^{763mm}$	i. c.; d. h.	s.; d. h.	v. s.
1445	col. lq.	1.098^{20°	....	$152-3^{750mm}$	i.	s.	s.
1446	lq.	1.250^{19°	....	$163-5^{747mm}$	....	....	....
1447	col. lq.	....	....	149-50	....	....	....
1448	lt. yel. lq.	$1.295^{25^\circ}_{20}$	....	177	d.	d.	....
1449	col. lq.	....	....	$150-1^{2.5mm}$	....	....	....

* Explodes on rapid heating.

Chloro-xylene 6488-90
Chloroprene 1345
Chlorylene 6155
Choky gas 1247
Cholaic acid 5697
Cholalic acid 1487
Cholesterin 1480
Choline sinapate,
cf. alkd.
Cholyl-cholic acid 3440
Cholyl-glycine 3440
Chondodendrine, cf. alkd.
C. H. Q. 1386
Chromogen-I 2359
Chromotrope-2B 4647
Chromotrope acid 2359
Chromotropic acid 2359
Chrysanthranol 2296
Chrysatropic acid 5604
Chrysazin 2301
Chrysazin carboxylic acid 2306
Chrysazol 2294
Chryseic acid 4776

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Chloro				
1450	pyridine (2)(α)	....	$Cl\cdot C_5H_4N$	XX-230	113.55
1451	pyridine (3)(β)	....	$Cl\cdot C_5H_4N$	XX-230	113.55
1452	pyridine (4)(γ)	....	$Cl\cdot C_5H_4N$	XX-231	113.55
1453	quinoline (2)	....	$Cl\cdot C_9H_6N$	XX-359	163.60
1454	quinoline (3)	....	$Cl\cdot C_9H_6N$	XX-359	163.60
1455	quinoline (4)	....	$Cl\cdot C_9H_6N$	XX-360	163.60
1456	quinoline (5)	....	$Cl\cdot C_9H_6N$	XX-360	163.60
1457	quinoline (6)	....	$Cl\cdot C_9H_6N$	XX-360	163.60
1458	quinoline (7)	....	$Cl\cdot C_9H_6N$	XX-361	163.60
1459	quinoline (8)	....	$Cl\cdot C_9H_6N$	XX-361	163.60
1460	resorcinol	(4;1,3)	$Cl\cdot C_6H_3(OH)_2$	....	144.56
1461	salicylaldehyde	(5;2,1)	$Cl\cdot C_6H_3(OH)CHO$	VIII-53	156.57
1462	styrene (α)	....	$C_6H_5\cdot CCl:CH_2$	V-476	138.59
1463	styrene (ω)	....	$C_6H_5\cdot CH:CHCl$	V-476	138.59
1464	succinic acid (***dl***)	....	$(CHCl\cdot CH_2):(CO_2H)_2$	II-619	152.54
1465	tetrabromoethane	(1,1,2,2)	$Br_2CH\cdot CBr_2Cl$	I-95	380.15
1466	toluene (***o***)	tolyl chloride	$Cl\cdot C_6H_4\cdot CH_3$	V-290	126.58
1467	toluene (***m***)	tolyl chloride	$Cl\cdot C_6H_4\cdot CH_3$	V-291	126.58
1468	toluene (***p***)	tolyl chloride	$Cl\cdot C_6H_4\cdot CH_3$	V-292	126.58
1469	***o***-toluidine (***m***)	(5;1,2)	$Cl\cdot C_6H_3(CH_3)NH_2$	XII-835	141.60
1470	***p***-toluidine (***m***)	(3;1,4)	$Cl\cdot C_6H_3(CH_3)NH_2$	XII-989	141.60
1471	tribromoethane	(1,1,2)	$BrCH_2\cdot CClBr_2$	I-94	301.24
1472	tribromomethane	....	$Cl\cdot CBr_3$	I-68	287.22
1473	vinylarsine dichloride	Lewisite	$ClCH:CH\cdot AsCl_2$	....	207.32
1474	***o***-xylene (3)	xylyl chloride (***o***)	$Cl\cdot C_6H_3(CH_3)_2$	V-363	140.61
1475	***o***-xylene (4)	(4;1,2)	$Cl\cdot C_6H_3(CH_3)_2$	V-363	140.61
1476	***p***-xylene (2)	(2;1,4)	$Cl\cdot C_6H_3(CH_3)_2$	V-384	140.61
1477	**Chloroform**	trichloromethane	$CHCl_3$	I-61	119.39
1478	**Chlorogenin** (pseudo)	....	$C_{27}H_{44}O_4$	....	432.62
1479	**Choleic acid**	deoxycholic acid	$C_{24}H_{40}O_4$	....	392.56
1480	**Cholesterol**	cholesterin	$C_{27}H_{45}OH\cdot H_2O$	....	404.65
1481	**Cholesterol**(eppiallo)	... .	$C_{27}H_{45}OH$	....	386.64
1482	**Cholesterol** (*iso*)	....	$C_{27}H_{45}OH$	....	386.64
1483	**Cholesteryl** acetate	....	$CH_3CO_2\cdot C_{27}H_{45}$	....	428.67
1484	benzoate	....	$C_6H_5CO_2\cdot C_{27}H_{45}$	....	490.74
1485	benzoate (*iso*)	....	$C_6H_5CO_2\cdot C_{27}H_{45}$	....	490.74
1486	propionate	....	$C_2H_5CO_2\cdot C_{27}H_{45}$	....	442.70
1487	**Cholic acid**†	cholalic acid	$C_{23}H_{36}(OH)_3CO_2H\cdot H_2O$	....	426.58
1488	**Choline**	bilineurine	$(CH_3)_3N(OH)CH_2\cdot CH_2OH$	IV-277	121.18
1489	chloride	....	$C_5H_{14}ON\cdot Cl$	IV-280	139.63
1490	**Chromone**	benzo-γ-pyrone	$\underline{C_6H_4\cdot CO\cdot CH:CH\cdot O}$	XVII-327	146.14
1491	**Chrysammic acid** (2,4,5,7;1,8)	tetranitrochrysazine	$(NO_2)_4C_{14}H_2(OH)_2O_2$	VIII-461	420.20
1492	**Chrysarobine**	dihydroxy-methylanthranol	$C_{15}H_{12}O_3$	VIII-335	240.25
1493	**Chrysene**	....	$C_{18}H_{12}$	V-718	228.28

† See also No. 3440.

Chrysoidine 1698
Chrysoidine orange 1699
Chrysaphanol 1495
Cicutine, cf. alkd.
Cignolin 2296
Cincholepidine 4370
Cinchomeronic acid 5499, 5501
Cinchonamine, cf. alkd.
Cinchonidine, cf. alkd.
Cinchonine, cf. alkd.
Cinchophen 5234
Cinchotine, cf. alkd.
Cinchovatine, cf. alkd.
Cineole 3217
Cinnamein 798

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1450	oil	1.205^{15°	....	166^{714mm}	s.	....	....
1451	lq.	....	....	148^{744mm}	s.	....	....
1452	lq.	....	....	147-8	s.	....	....
1453	nd./aq. al.	....	37-8	275^{751mm}	i.; v. s. bz.	s.; v. s. lg.	v. s.
1454	hyg. lq.	....	....	255^{743mm}	....	....	....
1455	cr.	$1.251^{20^\circ}_{4}$	34	$260\text{-}1^{744mm}$	s. HCl	v. s.	v. s.
1456	nd.	....	45	256	....	....	....
1457	nd.	....	40-1	$261\text{-}2^{740mm}$	....	....	....
1458	nd./al.	....	31-2	267-8	....	....	....
1459	yel. oil	....	<-20	288	....	v. s.	v. s.
1460	wh. amor. pd.	....	105-7	....	s.	s.	s.
1461	pl./al.	....	99	....	i.; s. alk.	s.	s.
1462	lq.	$1.102^{18^\circ}_{4}$	–23	199	i.	s.	s.
1463	lq.	$1.110^{18^\circ}_{4}$	....	199	i.	s.	s.
1464	col. cr.	1.679	153-4	....	v. s.	v. s. ac.	v. sl. s. chl.
1465	cr.	3.366^{16°	32-3	$200\text{-}5^{285mm}$	v. s. chl.	v. s.	v. s.
1466	col. lq.	$1.082^{20^\circ}_{4}$	–34	159.5	i.; ∞ bz.	s.; ∞ chl.	∞
1467	col. lq.	$1.072^{20^\circ}_{4}$	–47.8	161.6	i.; ∞ bz.	s.; ∞ chl.	∞
1468	col. lq.	$1.070^{20^\circ}_{4}$	7.5	162.2	i.; ∞ bz.	s.; ∞ chl.	∞
1469	lf./al.	....	29-30	$236\text{-}8^{730mm}$	....	....	....
1470	lq.	1.151^{20°	7	222-3	i.	....	....
1471	lq.	2.602^{16°	....	$165\text{-}7^{285mm}$	i.	....	....
1472	lf.	2.71^{15°	55	160	i.	....	....
1473	col. lq.	$1.888^{20^\circ}_{4}$	....	190	i.	....	....
1474	col. lq.	....	<-20	189.5	i.	∞	∞
1475	col. lq.	$1.069^{15^\circ}_{15}$	<-20	191.5	....	....	....
1476	col. lq.	....	....	186.8	....	....	....
1477	col. lq.	1.489^{20°	–63.5	61.2	0.82^{20°	∞	∞
1478	cr.	....	268-70	....	i.	sl. s.	v. sl. s.
1479	col. cr./al.	....	172	....	sl. s. c.	s.; s. alk.	s. ac.; s.act.
1480	rhb./al.	1.067	149-51 (anh.)	$\text{subl.}^{1.0mm}$	0.26^{20°	1.1^{17°; 11^{78°	18; s. bz.
1481	nd./act.	....	84	....	i.; s. bz.	s.; s. chl.	v. s.
1482	nd./et.	....	137-8	....	s. h. ac.	s. h.	v. s.
1483	col. nd.	....	113-4	....	i.	sl. s. h.	v. s.
1484	tet. cr.	....	146.6	....	....	v. sl. s. h.	s.
1485	wh. pd.	....	191-5	....	....	sl. s. h.	s.
1486	col. fl.	....	95-7	....	i.	sl. s.	s.
1487	rhb. cr./aq.	....	195 (anh.)	....	0.03; s. ac.	5; s. act.	1.4; s. alk.
1488	syrup	....	....	....	v. s.	v. s. abs.	i.
1489	syrup or hyg. cr.	....	247 d. ...	subl. in vac. 200	v. s.	v. s.	....
1490	nd./pet.	....	58-9	....	i.; s. bz.	s.	s.; s. chl.
1491	yel. mn.	....	d.	expl.	v. sl. s. h.	s.	s.
1492	yel. lf.	....	202-6	....	i. aq. Na_2CO_3	sl. s. c.; s. H_2SO_4	sl. s. c. bz.
1493	col. rhb.	....	253-4	448	i.	0.1^{16° abs.	v. sl. s.

Cinnamene 5646
Cinnamic acid dibromide 1830
Cinnamide 1502
Cinnamol 5646
Cinnamon oil 1501
Cinnamone 1775
Cinnamoyl cocaine, cf. alkd.
Cinnamoyl ecgonine methyl ester, cf. alkd.
Cinnamyl cocaine, cf. alkd.
Cinnamyl eugenol 3221
Cinnamylidene acetophenone 1506
Cinnyl cinnamate 1508
Citramide 1517
Citrene 3973
Citridic acid 141
Citronin-A 3241

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1494	**Chrysin**	5,7-diOH-flavone	$C_{15}H_{10}O_4$	XVIII-124	254.23
1495	**Chrysophanic acid**	2,4-diOH-2-Me-anthraquinone	$C_{14}H_5(OH)_2(CH_3)O_2$	VIII-470	254.23
1496	**Chrysoquinone**	....	$C_{10}H_6(CO)_2C_6H_4$	VII-827	258.26
1497	**Cinnamic** acid (*cis*)	allocinnamic acid	$C_6H_5 \cdot CH:CH \cdot CO_2H$	IX-591	148.15
1498	acid (*trans*)	β-phenyl-acrylic acid	$C_6H_5 \cdot CH:CH \cdot CO_2H$	IX-572	148.15
1499	Na salt	....	$C_6H_5 \cdot CH:CH \cdot CO_2Na$	IX-580	170.14
1500	acid (*iso*)	....	$C_6H_5 \cdot CH:CH \cdot CO_2H$	IX-592	148.15
1501	aldehyde	phenyl acrolein	$C_6H_5 \cdot CH:CH \cdot CHO$	VII-348	132.15
1502	amide	cinnamide	$C_6H_5 \cdot C_2H_2 \cdot CO \cdot NH_2$	IX-587	147.17
1503	anhydride	....	$(C_6H_5CH:CH \cdot CO)_2O$	IX-586	278.29
1504	carboxylic acid (*o*)	....	$(\cdot C_6H_4C_2H_2 \cdot)(CO_2H)_2$	IX-898	192.16
1505	chloride	....	$C_6H_5 \cdot CH:CH \cdot CO \cdot Cl$	IX-587	166.60
1506	**Cinnamal acetophenone**	cinnamylidene acetophenone	$C_6H_5 \cdot (CH:CH)_2 \cdot CO \cdot C_6H_5$	VII-499	234.28
1507	**Cinnamyl** alcohol	styryl carbinol	$C_6H_5 \cdot CH:CH \cdot CH_2OH$	VI-570	134.17
1508	cinnamate	styracin	$C_8H_7CO_2 \cdot C_9H_9$	IX-585	264.31
1509	**Cinnamoyl-*p*-hydroxyphenyl urea**	elbon	$C_6H_5 \cdot CH:CH \cdot CO_2 \cdot C_6H_4 \cdot NHCONH_2$	....	282.29
1510	**Citraconic** acid (*cis*)	methyl-maleic acid	$CH_3 \cdot C(CO_2H):CH \cdot CO_2H$	II-768	130.10
1511	anhydride	....	$CH_3 \cdot C:CH \cdot CO \cdot O \cdot CO$	XVII-440	112.08
1512	**Citral** (*α*)	geranial	$C_9H_{15} \cdot CHO$	I-753	152.23
1513	semicarbazone	....	$C_{10}H_{16}:N \cdot NHCONH_2$	III-109	209.29
1514	**Citramalic acid** (*dl*)	methyl-malic acid	$CH_3 \cdot C(OH)(CO_2H) \cdot CH_2 \cdot CO_2H$	III-444	148.11
1515	**Citric** acid	....	$HO_2C \cdot CH_2 \cdot C(OH) \cdot (CO_2H) \cdot CH_2 \cdot CO_2H$	III-556	192.12
1516	acid (*iso*)	....	$HO_2C \cdot CHOH \cdot CH \cdot (CO_2H) \cdot CH_2CO_2H$	III-555	192.12
1517	amide	citramide	$C_3H_5O(CONH_2)_3$	III-569	189.17
1518	**Citronellal** (*d*)	rhodinal	$C_9H_{17} \cdot CHO$	I-745	154.24
1519	**Citronellol** (*d*)	2,6-dimethyl-octene-1-ol-8	$C_{10}H_{20}O$	I-451	156.26
1520	**Citronellyl acetate**	....	$C_{12}H_{22}O_2$	II-139	198.30
1521	**Citrulline** (*dl*)	α-NH₂-δ-carbamidovaleric acid	$NH_2CONH(CH_2)_3 \cdot CH \cdot (NH_2) \cdot CO_2H$	....	175.19
1522	Cu salt	....	$(C_6H_{12}O_3N_3)_2Cu$	....	411.93
1523	**Cofebrin** hydrochloride	2,4-diOH-phenyl-propanolamine HCl	$(HO)_2C_6H_3 \cdot CH(OH) \cdot CH(NH_2) \cdot CH_3 \cdot HCl$	....	219.67
1524	**Collidine** (*α*)	2-Me-4-Et-pyridine	$CH_3 \cdot C_5H_3N \cdot C_2H_5$	XX-248	121.18
1525	**Collidine** (*β*)	4-Me-3-Et-pyridine	$CH_3 \cdot C_5H_3N \cdot C_2H_5$	XX-250	121.18
1526	**Collidine** (*γ*)	2,4,6-triMe-pyridine	$(CH_3)_3C_5H_2N$	XX-250	121.18
1527	**Congo red**	diPh-bis-azonaphthionic acid	$[C_{10}H_5(NH_2)(SO_3Na) \cdot N:N \cdot C_6H_4]_2$	XVI-410	696.66

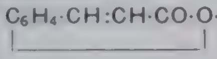
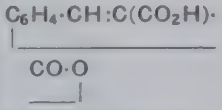
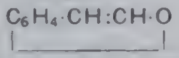
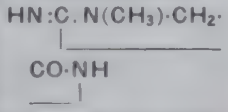
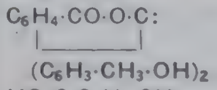
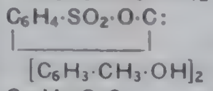
Citrophen 5108
Citropten 3971
Citrylidene acetone 3915
Claus and Volz *o*-acid 4512
Clavicepsin, cf. glcde.
Cleve's acids 4545-7
CN (cry now) gas 1303
Cocaine, cf. alkd.
Coclaurine, cf. alkd.
Codamine, cf. alkd.
Codeine, cf. alkd.
Coerulignone 1264
Coffearin, cf. alkd.
Colchicine, cf. alkd.
Colocynthin, cf. glcde.
Cologne spirit 2946
Colognegite 1247
Colonial spirit 4100
Columbamine, cf. alkd.
Columbian spirit 4100
Conchinine, cf. alkd.
Conessine, cf. alkd.
Conhydrine, cf. alkd.
Conicine, cf. alkd.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Water	Alcohol	Ether
1494	yel. pl.	....	275	subl.	i.; s. alk.	0.6 c.; 2.5 h.	sl. s.; i. bz.
1495	yel. lf./al.	....	195	subl. sl. d.	i. c.; s. bz.	s. h.; s. act.	sl. s.; sl. s. pet.
1496	or. nd.	....	235-40	subl.	i.	s. h.	v. sl. s.
1497	mn. pr.	1.284^{4°	68	125^{19mm}	....	....	s. pet.
1498	mn. pr.	1.245	133	300	0.04^{18°	24^{20° abs.	v. s.
1499	wh. cr. pd.	....	d. >115	....	9 c.; 5 h.	0.6	s. gly.
1500	mn. pr.	....	58-9(42)	256 d.	16.6 c. pet.	s.	s.
1501	lq.	$1.110^{20^\circ}_{20}$	−7.5	252 ±, sl. d.	v. sl. s.	4, 50% al.	∞
1502	nd./bz.	....	145-6	....	sl. s. h.	s.	s.
1503	nd./al.	....	135-6	....	i.	v. sl. s. c.	v. s. h. bz.
1504	nd./et.	....	173-5 d.	$-H_2O$, d.	v. sl. s.	s.; i. bz.	v. sl. s.
1505	cr.	....	35-6	251-3 sl. d.	d.	s. CCl_4	s. pet.
1506	yel. nd./al.	....	α102; β235	....	s. H_2SO_4	sl. s.	sl. s.
1507	nd.	$1.040^{35^\circ}_{35}$	33	257.5	sl. s.	v. s.	v. s.
1508	nd. or pr.	$1.085^{16.5^\circ}$	44	....	i.	4 c.; 33 h.	33; s. bz.
1509	wh. cr. pd.	....	204	....	i.; i. alk.	s.; s. act.	s. oil
1510	nd.	1.617	92-3	....	360^{25°	s.; v. sl. s. chl.	s.; i. bz.; i. CS_2
1511	lq.	$1.25^{15^\circ}_{4}$	7-8	213-4	d.	v. s.	v. s.
1512	col. oil	$0.890^{17^\circ}_{4}$	....	228-9 sl. d.	i.	∞	∞
1513	cr./ac.	....	α164 β171*	....	....	....	....
1514	mn. pr.	....	117-9	....	s.; i. bz.	v. s. abs.	v. s. act.
1515	cr.**	$1.542^{20^\circ}_{4}$	153	d.	133 c.	76^{15°, abs.	2.2^{15°, abs.
1516	cr.	....	d. 100	....	s.	....	....
1517	cr./aq.	....	210-5 d.	....	2.7^{18°; 33.3^{100°	i.	i.
1518	col. oil	$0.855^{17.5^\circ}$	....	204-8	v. sl. s.	∞	∞
1519	col. oil	$0.848^{20^\circ}_{4}$	....	224-5	v. sl. s.	∞	∞
1520	col. lq.	$0.893^{17.5^\circ}$	....	$172\text{-}3^{34mm}$	....	....	....
1521	col. pr./aq. Me al.	....	202-26 ±	....	s.	i. abs.	i.
1522	cr./aq.	....	257-8 d.	....	i. c.	....	....
1523	wh. cr. pd.	....	178-9 d.	....	66	7	i.
1524	lq.	0.935^{0°	....	177.8^{758mm}	sl. s. c.; v. sl. s. h.	s.	s.; s. bz.
1525	lq.	0.966^{0°	....	$195\text{-}6^{753mm}$	i.	s.	v. s.
1526	lq.	0.917^{15°	....	171-2	sl. s. h.	v. s.	....
1527	red	....	....	....	sl. s. h.	sl. s. h. alk.	i.

* Mixture of $\alpha + \beta$, m. p. 135°.

** Crysts./aq. $+1H_2O$; $-H_2O$, 100-32°.

Coniferin, cf. glcde.
Coniine, cf. alkd.
Conquinine, cf. alkd.
Convallamarin, cf. glcde.
Convallarin, cf. glcde.
Convolvulin, cf. glcde.
Conydrine, cf. alkd.
Conyrine 5443
Coprosterol 2276
Corallin(e) 5931
Cordianine 181
Cordol 6110
Coriamyrtin, cf. glcde.
Coriandrol 3974
Corn sugar 3618
Cornutine, cf. alkd.
Corporin 5334
Corulignone 1264
Corybulbine, cf. alkd.
Corycavine, cf. alkd.
Corydaline, cf. alkd.
Corynine, cf. alkd.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1528	**Coniferin**	....	$C_{16}H_{22}O_8 \cdot 2H_2O$	....	378.37
1529	**Coniferyl alcohol**	....	$C_{10}H_{12}O_3$	VI-1131	180.20
1530	**Conylene**	octadiene-x,x	C_8H_{14}	I-258	110.19
1531	**Coumaric** acid (*o*) (*trans*)	*o*-hydroxy-cinnamic acid	$HOC_6H_4 \cdot C_2H_2 \cdot CO_2H$	X-288	164.15
1532	acid (*m*)	*m*-hydroxy-cinnamic	$HOC_6H_4 \cdot C_2H_2 \cdot CO_2H$	X-294	164.15
1533	acid (*p*)	*p*-hydroxy-cinnamic	$HOC_6H_4 \cdot C_2H_2 \cdot CO_2H$	X-297	164.15
1534	**Coumarin**	....	$C_9H_6O_2$	XVII-328	146.14
1535	**Coumarin** (*iso*)	....	 $C_6H_4 \cdot CH{:}CH \cdot CO \cdot O \cdot$	XVII-333	146.14
1536	3-carboxylic acid	....	 $C_6H_4 \cdot CH{:}C(CO_2H) \cdot$ $CO \cdot O$	XVIII-429	190.15
1537	**Coumarinic acid** (*o*)(*cis*)	*o*-hydroxy-cinnamic acid	$HO \cdot C_6H_4 \cdot CH{:}CH \cdot CO_2H$	X-291	164.15
1538	**Coumarone**	....	 $C_6H_4 \cdot CH{:}CH \cdot O$	XVII-54	118.13
1539	**Creatine**	methyl-guanyl-glycine	$HN{:}C(NH_2)N(CH_3) \cdot CH_2 \cdot CO_2H \cdot H_2O$	IV-363	149.15
1540	**Creatinine**	methyl-glyco-cyamidine	 $HN{:}C.\,N(CH_3) \cdot CH_2 \cdot$ $CO \cdot NH$	XXIV-245	113.12
1541	picrate	....	$C_4H_7ON_3 \cdot C_6H_3O_7N_3$	XXIV-246	342.23
1542	picrate	....	$C_4H_7ON_3 \cdot 2C_6H_3O_7N_3$	XXIV-246	571.34
1543	**Creosol**	(3;1,4)	$CH_3O \cdot C_6H_3(CH_3)OH$	VI-878	138.16
1544	**Cresidine**	2-NH_2-4Me-anisole	$CH_3 \cdot C_6H_3(OCH_3)NH_2$	XIII-602	137.18
1545	**Cresol** (*o*)	*o*-methyl-phenol	$CH_3 \cdot C_6H_4 \cdot OH$	VI-349	108.13
1546	**Cresol** (*m*)	*m*-methyl-phenol	$CH_3 \cdot C_6H_4 \cdot OH$	VI-373	108.13
1547	**Cresol** (*p*)	*p*-methyl-phenol	$CH_3 \cdot C_6H_4 \cdot OH$	VI-389	108.13
1548	phthalein (*o*)	....	 $C_6H_4 \cdot CO \cdot O \cdot C{:}$ $(C_6H_3 \cdot CH_3 \cdot OH)_2$	XVIII-153	346.36
1549	phthalin (*o*)	(4′,4″-diOH, 2-CO_2H, 3′,3″-diMe)	$HO_2C \cdot C_6H_4 \cdot CH{:}(C_6H_3 \cdot CH_3 \cdot OH)_2$	X-456	348.38
1550	sulfonphthalein (*o*)	cresol red	 $C_6H_4 \cdot SO_2 \cdot O \cdot C{:}$ $[C_6H_3 \cdot CH_3 \cdot OH]_2$	XIX-91	382.41
1551	sulfonphthalein (*m*)	metacresol purple	$C_{21}H_{18}O_5S$	....	382.41
1552	**Cresyl**† acetate (*o*)	*o*-tolyl acetate	$CH_3 \cdot C_6H_4 \cdot O_2CCH_3$	VI-355	150.17
1553	acetate (*m*)	cresatin	$CH_3 \cdot C_6H_4 \cdot O_2CCH_3$	VI-379	150.17
1554	*p*-toluenesulfonate (*o*)	(4;1′,2′)	$CH_3 \cdot C_6H_4 \cdot SO_3C_6H_4 \cdot CH_3$	XI-100	262.31
1555	**Crocetin** (*α*)	gardenin	$C_{20}H_{24}O_4$	XXX-106	328.39
1556	**Croconic acid**	crocic acid	$C_5O_3(OH)_2 \cdot 3H_2O$	VIII-488	196.11
1557	**Crotonic** acid (*α*)	butenoic acid	$CH_3 \cdot CH{:}CH \cdot CO_2H$	II-408	86.09
1558	acid (*β*) (*cis*)	*iso*-crotonic acid	$CH_3 \cdot CH{:}CH \cdot CO_2H$	II-412	86.09
1559	aldehyde (*α*)	2-butene-1-al	$CH_3 \cdot CH{:}CH \cdot CHO$	I-728	70.09
1560	amide	crotonamide	$CH_3 \cdot CH{:}CH \cdot CONH_2$	II-412	85.10
1561	anhydride	....	$(CH_3 \cdot CH{:}CH \cdot CO)_2O$	II-411	154.16

† See also under tolyl.
Corytuberine, cf. alkd.
Cotarnine, cf. alkd.
Cotoin 2347
Cotton red-4B 733

Cresatin 1553
Cresol purple 1551
Cresol red 1550
Cresorcinol 2371
Cresot(in)ic acid 3836, 3839, 3841

Cresyl-, cf. also tolyl.
Cresyl benzoate 6013-5
Cresyl ethyl ether 3173-5
Cresyl ethyl sulfide 3176
Cresyl methyl ether 4399-4401

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1528	nd.	....	185 (anh.)	d.	0.5 c.; v. s. h.	sl. s. abs.	i.
1529	pr.	....	73-4	....	sl. s. h.	s.	s.
1530	lq.	0.761^{15°	....	126^{738mm}	....	s.	....
1531	nd./aq.	....	207-8	subl.	sl. s. c.	s.	v. sl. s.
1532	pr./aq.	....	191	....	s. h.	s.	s.; s. bz.
1533	cr./aq.	....	206-7 d.	....	s. h.	v. s. h.	v. s.; i. lg.
1534	rhb./et.	$0.935^{20^\circ}_{4}$	70	290-1	0.3 c.; 2 h.	v. s.	s.
1535	pl./bz.	....	47	$285\text{-}6^{719mm}$ sl. d.	i.; s. CS_2	v. s.; v. s. bz.	v. s.
1536	col. nd./ aq.	....	189-90 d.	>290, $-CO^2$	v. sl. s.; 0.7^{25° bz.	0.9^{25°; 0.1^{25° CCl_4	v. sl. s.; v.sl.s.act.
1537	unstable	changes to coumarin	....	....	....	....	....
1538	oil	$1.078^{15^\circ}_{15}$	<-18	173-4	i.	i. alk.	s.
1539	mn./aq.	....	295 (anh.)	$-H_2O$, 100	1.4^{18°	0.01^{17°	i.
1540	mn.	....	260 d.	....	8.7^{16°	1^{16° abs.	s. h. al.
1541	yel. nd./aq.	....	220	....	....	....	....
1542	yel. pl./al.	....	161-6	....	....	....	....
1543	pr.	$1.092^{20^\circ}_{20}$	5.5	$221\text{-}2^{765mm}$	v. sl. s.	∞; ∞ chl.	∞; ∞ bz.
1544	nd./pet.	....	93-4	235	v. sl. s.	s.; s. bz.	s.
1545	cr.	$1.048^{20^\circ}_{4}$	30.8	190.8	2.5	∞^{30°	∞^{30°
1546	lq.	$1.034^{20^\circ}_{4}$	11.7	202.8	0.5	∞	∞
1547	pr.	$1.035^{20^\circ}_{4}$	34 6	202.3	1.8	∞^{36°	∞^{36°
1548	red yel. cr./al.	....	213-4	....	sl. s. h.; s. al. KOH	s.; s. al. NH_3	s.; v. sl. s. bz.
1549	nd.	....	217-8	....	....	....	....
1550	red cr./ac.	....	....	....	sl. s.	s.	s. alk.
1551	gn. fl.	....	....	....	sl. s.	sl. s.	i.
1552	col. lq.	....	....	208	v. sl. s.	v. s.	v. s.
1553	col. lq.	....	....	212	s. h.	v. s.	v. s.
1554	nd.	....	....	53-4	....	....	....
1555	red rhb.	....	283-5 d.	....	s. Ac_2O	s. dil. alk.	i. 10% alk.
1556	yel. lf.	....	$-3H_2O$, 100	....	s.	s.	....
1557	col. mn.	$0.964^{79.7^\circ}$	72	189	8.3^{15°	s. h. lg.	....
1558	nd.	$1.031^{15^\circ}_{4}$	15.5	170-1 d.	∞^{25°	s.	....
1559	col. lq.	$0.853^{20^\circ}_{20}$	-69	102.2	18	∞	∞
1560	nd./act.	....	159-60	....	2.8 c.	v. s. 0.08 c. bz.	0.09 c.
1561	col. lq.	1.040^{20°	....	$246\text{-}8^{766mm}$	....	....	....

Cresyl methyl sulfide 4402
Cresyl phosphate 6351-3
Cresyl phosphite 6354-5
Cresyl phthalate 2841
Cresyl salicylate 6038-40
Cresyl thiophosphate 6356-8
Cresylic acid, mixt. of 1545-7
Croceic acid 4512
Crocein(e) acid 4512
Crocic acid 1556
Crocin, cf. glcde.
Crotonaldehyde 1559

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1562	**Crotonic** chloride	....	$CH_3\cdot CH:CH\cdot CO\cdot Cl$	II-411	104.54
1563	nitrile	propenyl cyanide	$CH_3\cdot CH:CH\cdot CN$	II-412	67.09
1564	**Crotonyl** acetate	crotyl acetate	$CH_3CO_2\cdot C_4H_7$	II-137	114.14
1565	alcohol	2-butene-1-ol	$CH_3\cdot CH:CH\cdot CH_2OH$	I-442	72.10
1566	chloride	crotyl chloride	$CH_3\cdot CH:CH\cdot CH_2Cl$	I-205	90.55
1567	chloride (*iso*)	*iso*-crotyl chloride	$(CH_3)_2C:CH\cdot Cl$	I-209	90.55
1568	iodide	1-iodo-butene-2	$CH_3\cdot CH:CH\cdot CH_2I$	I-206	182.02
1569	**Cryogenine**	3-semicarbazido-benzamide	$H_2N\cdot CO\cdot NH\cdot NH\cdot C_6H_4\cdot CO\cdot NH_2$	....	194.19
1570	**Cryptoxanthin**	provitamin A	$C_{40}H_{56}O$	XXX-93	552.85
1571	**Cuminyl** alcohol	cumin alcohol (*p*)	$(CH_3)_2CH\cdot C_6H_4\cdot CH_2OH$	VI-543	151.21
1572	chloride	1′-chlorocymene	$C_3H_7\cdot C_6H_4\cdot CH_2Cl$	V-423	168.66
1573	**Cumyl** phenol (*p*)	(1,4)	$HO\cdot C_6H_4\cdot C(CH_3)_2\cdot C_6H_5$	....	212.28
1574	**Cupferon**	....	$C_6H_5\cdot N(NO)\cdot ONH_4$	XVI-669	155.16
1575	**Curcumin**	....	$C_{21}H_{20}O_6$	VIII-554	368.37
1576	**Cyamelide**	....	$(CNOH)_x$ or $(CNOH)_3$	III-35	$(43.03)_x$
1577	**Cyanamide**	carbamic nitrile	$H_2N\cdot CN$	III-75	42.04
1578	**Cyananilide**	phenyl cyanamide	$C_6H_5\cdot NH\cdot CN\cdot \frac{1}{2}H_2O$	XII-368	127.14
1579	**Cyanic acid**	....	HOCN†	III-33	43.03
1580	**Cyanine**	1,1′-di-*iso*-amyl-4, 4′-quinocyanine iodide	$C_{29}H_{35}N_2I$	XXIII-299	538.51
1581	**Cyano**-acetamide	....	$NC\cdot CH_2\cdot CO\cdot NH_2$	II-589	84.08
1582	acetanilide	....	$C_6H_5\cdot NH\cdot CO\cdot CH_2CN$	XII-294	160.17
1583	acetic acid	nitrilomalonic acid	$HO_2C\cdot CH_2\cdot CN$	II-583	85.06
1584	acetoacetic ester	....	$CH_3CO\cdot CH(CN)\cdot CO_2\cdot C_2H_5$	III-796	155.15
1585	benzoic acid (*p*)	....	$HO_2C\cdot C_6H_4\cdot CN$	IX-845	147.13
1586	benzyl chloride (*o*)	....	$ClCH_2\cdot C_6H_4\cdot CN$	IX-468	151.59
1587	propionic acid (*α*)	....	$CH_3\cdot CH(CN)\cdot CO_2H$	II-630	99.09
1588	**Cyanogen**	oxalic nitrile	$NC\cdot CN$	II-549	52.04
1589	**Cyanogen** (para)	....	$(CN)_x$	II-553	$(26.02)_x$
1590	bromide	....	$Br.CN$	III-39	105.93
1591	chloride	....	$Cl\cdot CN$	III-38	61.48
1592	iodide	....	$I\cdot CN$	III-41	152.94
1593	sulfide	....	$NC\cdot S\cdot CN$	III-180	84.10
1594	**Cyanuric acid**	....	$(HNCO)_3\cdot 2H_2O$	XXVI-239	165.11
1595	**Cyclo**-butane	tetramethylene	$\underbrace{CH_2\cdot CH_2\cdot CH_2\cdot CH_2}$	V-17	56.10
1596	heptane	suberane	$\underbrace{CH_2\cdot (CH_2)_5\cdot CH_2}$	V-29	98.18
1597	heptanone	suberone	$\underbrace{CH_2\cdot (CH_2)_5\cdot CO}$	VII-13	112.17

† HOCN in aq.; NH:C:O (isocyanic acid) as vapor or in ether soln.

Crotonic acid dibromide 1826-7
Crotonic acid dichloride 1978-9
Crotonyl, cf. also crotyl.
Crotonyl chloride 1562
Crotonylene 1157
Crotyl, cf. also crotonyl.
Crotoyl alcohol 1565
Cry now gas 1303
Cryptopine, cf. alkd.
Crystal violet base 3592
Crystal violet dye salt 3593
Crystal violet leuco base 3595
Cumene 5379
Cumene (pseudo) 6254
Cumenol 5433-5
Cumenol (pseudo) 6265
Cumic acid 5383, 5385
Cumic alcohol 1571
Cumidine 5375
Cumidine (pseudo) 6250
Cumin alcohol 1571
Cuminic acid 5383, 5385
Cuminic aldehyde 5377
Cuminic amide 5386
Cumylic acid 6259

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1562	col. lq.	1.091^{20°	....	$124\text{-}5^{759mm}$	....	....	....
1563	col. lq.	$0.826^{23^\circ}_{4}$	−51.5	122	d.	d.	....
1564	col. lq.	$0.919^{20^\circ}_{4}$	....	128.5-9.5	2.3	s.	s.
1565	col. lq.	$0.853^{20^\circ}_{4}$	<−30	121-2	16.6	∞	....
1566	col. lq.	$0.934^{20^\circ}_{4}$	....	84	i.	∞	∞
1567	lq.	$0.919^{20^\circ}_{4}$	....	68	<0.1; d. h.	....	....
1568	lq.	1.682^{0°	....	132-3 d.	....	....	....
1569	col. cr.	....	172 ±	....	1	s.; s. act.	s.; s. chl.
1570	pr./bz.-al.	....	168-9	....	i.	s. CS_2	s.; s. chl.
1571	lq.	$0.975^{25^\circ}_{25}$	....	247-8	i.	∞	∞
1572	lq.	$1.020^{23^\circ}_{4}$	....	225-9	....	....	....
1573	col. nd.	....	74-5	187^{10mm}	i.; s. bz.	v. s.	s.; s. act.
1574	col. nd./al.	....	163-4	subl.	v. s.	s. h.	....
1575	red yel. pr.	....	183	....	i.; 0.05 bz.; s. alk.	sl. s. c.; s. ac.	v. sl. s.; i. lg.
1576	wh. amor.	....	....	....	0.01^{15°	i.; sl. s. NH_4OH	i.
1577	col. nd.	$1.073^{19^\circ}_{4}$	44-5	140^{19mm}	v. s.	v. s.	v. s.
1578	cr.	....	47	....	sl. s.	v. s.	v. s.
1579	col. gas	1.140^{0° (lq.)	−80	-64^{0mm}	sl. s.	s. ac.	s.
1580	hyg., mn., gn.	....	100 ±	d. >150	i.; s. chl.	s. h.	i.; s. act.
1581	nd./al.	....	118-9	d.	15 c.	2 c.	....
1582	cr./al.	....	199-200	....	0.03^{25°	....	....
1583	col. hyg. cr.	....	65-6	$108^{0.15mm}$ d. 165	s.	s.	s.
1584	col. nd.	$1.111^{20^\circ}_{4}$ (lq.)	26	195-7	v. sl. s.	v. s.	v. s.
1585	lf./al.	....	219	....	s. h.	s.	s.; s. h. ac.
1586	mn. pr.	....	60-1.5	252^{759mm}	s. h.	s.	....
1587	oil	1.14^{20°	....	$142\text{-}5^{11mm}$	s.	s.	....
1588	col. gas	$0.866^{17\ 2^\circ}$ 1.804 (A)	−34.4	−21	450^{20° cc.	2300^{20° cc.	500^{20° cc.
1589	brn. bl.	....	$(CN)_2$ at 860	....	i.	i.	sl. s. alk.
1590	nd.	$2.015^{20^\circ}_{4}$	52	61.3^{750mm}	s.	s.	s.
1591	poison. gas	1.222^{0°	−6.5	12.5-13	2500^{20° cc.	$10{,}000^{20^\circ}$ cc.	5000^{20° cc.
1592	col. nd.	....	146.5*	subl. >m. p.	s. h.	v. s.	v. s.
1593	pl. or lf.	....	60	d.	v. s. d.	s.	s.
1594	mn./aq.	2.50^{19° anh.	>360	d. to HNCO	0.27^{17°	0.1^{22°	....
1595	col. gas	$0.703^{0^\circ}_{4}$	−50	$11\text{-}12^{726mm}$	i.	v. s.	v. s. act.
1596	oil	$0.810^{20^\circ}_{4}$	−12	118-20	i.	....	....
1597	lq.	0.950^{21°	....	179-81	i.	s.	s.

* Sealed tube.

Cupreine, cf. alkd.
Cupron 720
Curangin, cf. glcde.
Cuscohygrine, cf alkd.
Cuskhygrine, cf. alkd.
Cuspidatin, cf. glcde.
Cyanacetic ester 3030
Cyanethyl carbonate 3032
Cyano-acetophenone (ω) 742
Cyano-benzene 716
Cyano-diallylamine 1682
Cyano-diethylamine 2143
Cyano-furan 3345
Cyano-guanidine 2080
Cyano-phenyl chloride (*iso*) 5168
Cyano-propyl alcohol 3758
Cyano-propylene oxide 2880
Cyanuramide 4019
Cyanuric acid (*iso*) 3313
Cyanuric chloride 6172
Cyclamin, cf. glcde.
Cyclo-form 1045

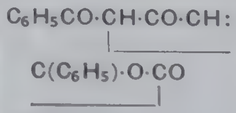
No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1598	**Cyclo** heptene	suberene	$CH_2(CH_2)_4CH{:}CH$	V-65	96.17
1599	hexadiene-1,3	*o*-dihydrobenzene	C_6H_8	V-113	80.12
1600	hexadiene-1,4	*p*-dihydrobenzene	C_6H_8	V-113	80.12
1601	hexane	benzene hexahydride	$CH_2\cdot(CH_2)_4\cdot CH_2$	V-20	84.16
1602	hexanhexol	*d*-inositol	$(CHOH)_6$	VI-1192	180.16
1603	hexanhexol	*i*-inositol; dambose	$(CHOH)_6$	VI-1192	180.16
1604	hexanhexone	triquinoyl	$(CO)_6\cdot 8H_2O$	VII-907	312.19
1605	hexanol	hexahydro-phenol	$CH_2\cdot(CH_2)_4\cdot CHOH$	VI-5	100.16
1606	hexanone	pimelin ketone	$CH_2(CH_2)_4\cdot CO$	VII-8	98.14
1607	hexanone oxime	....	$CH_2(CH_2)_4C{:}NOH$	VII-10	113.16
1608	hexanpentol	*d*-quercitol	$CH_2(CHOH)_4\cdot CHOH$	VI-1186	164.16
1609	hexene	benzene tetrahydride	$CH_2(CH_2)_3CH{:}CH$	V-63	82.14
1610	hexyl acetate	....	$CH_3CO_2\cdot C_6H_{11}$	VI-7	142.19
1611	hexyl anisole (*p*)	....	$CH_3O\cdot C_6H_4\cdot C_6H_{11}$	....	190.27
1612	hexyl bromide	....	$C_6H_{11}Br$	V-24	163.06
1613	hexyl chloride	chloro-cyclohexane	$C_6H_{11}Cl$	V-21	118.61
1614	hexyl iodide	....	$C_6H_{11}I$	V-25	210.07
1615	hexyl phenol (*o*)	....	$HO\cdot C_6H_4\cdot C_6H_{11}$	....	176.25
1616	hexyl phenol (*p*)	....	$HO\cdot C_6H_4\cdot C_6H_{11}$	VI-583	176.25
1617	octane	octamethylene	$CH_2\cdot(CH_2)_6\cdot CH_2$	V-35	112.21
1618	pentadiene-1,3	....	$CH_2\cdot CH{:}CH\cdot CH{:}CH$	V-112	66.10
1619	pentane	pentamethylene	$CH_2\cdot(CH_2)_3\cdot CH_2$	V-19	70.13
1620	pentanone	keto-pentamethylene	$CH_2\cdot(CH_2)_3\cdot CO$	VII-5	84.11
1621	propane	trimethylene	$CH_2\cdot CH_2\cdot CH_2$	V-15	42.08
1622	**Cymene** (*o*)	isopropyl-toluene	$CH_3\cdot C_6H_4\cdot CH(CH_3)_2$	V-419	134.21
1623	**Cymene** (*m*)	*iso*-cymene	$CH_3\cdot C_6H_4\cdot CH(CH_3)_2$	V-419	134.21
1624	**Cymene** (*p*)	cymene	$CH_3\cdot C_6H_4\cdot CH(CH_3)_2$	V-420	134.21
1625	**Cysteine** (*l*)	....	$HS\cdot CH_2\cdot CH(NH_2)\cdot CO_2H$	IV-506	121.15
1626	hydrochloride	....	$C_3H_7O_2NS\cdot HCl$	IV-506	157.62
1627	**Cystine** (*l*)	....	$[HO_2C\cdot CH(NH_2)\cdot CH_2S\cdot]_2$	IV-507	240.29
1628	**Daphnetin**	7,8-diOH-coumarin	$O\cdot CO\cdot CH{:}CH\cdot C_6H_2{:}(OH)_2$	XVIII-100	178.14
1629	**Deca**-chlorodiphenyl	....	$Cl_5C_6\cdot C_6Cl_5$	V-580	498.69
1630	diene-1,3	....	$CH_3\cdot(CH_2)_5\cdot CH{:}CH\cdot CH{:}CH_2$	I-260	138.24
1631	hydronaphthalene	"Decalin" (*cis*)	$C_{10}H_{18}$	V-92	138.24
1632	hydronaphthalene	"Decalin" (*trans*)	$C_{10}H_{18}$	V-92	138.24

Cyclo-hexane carboxylic acid 3577
Cyclo-hexylamine 326
Cyclo-hexyl benzene 5179
Cystamin 3599
Cysteine thioformacetal 2854
Cystogen 3599
Cytisine, cf. alkd.
D. A. gas 2712
Dagenan 5668
Dahl's acid 4550-1

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1598	oil	$0.823^{20^\circ}_{4}$	....	114-5	i.	s.	s.
1599	lq.*	$0.842^{20^\circ}_{30}$	-98	79-80	i.	s.	s.
1600	lq.*	$0.848^{20^\circ}_{4}$	-90 ±	85.5	i.	s.	s.
1601	col. lq.	$0.779^{20^\circ}_{4}$	6.5	80.7	i.; ∞ act.	∞; ∞ bz.	∞; 57^{25° Me al.
1602	mn.	....	253	319 in vac.	4.5^{15°	v. sl. s.	i.
1603	mn./aq.	1.752	253	319^{15mm}	2^{12°	i. abs.	i.
1604	nd./aq. HNO^3	....	95-100 d.	....	v. sl. s.; s. alk.	v. sl. s.	v. sl. s.
1605	col. hyg. nd.	$0.962^{20^\circ}_{4}$	23.9	160-1	3.6^{20°	s.	s.
1606	col. oil	$0.947^{10^\circ}_{4}$	-45	155-6	s.	s.	s.
1607	pr./lg.	....	89-90	204 sl. d.	s.; sl. s. lg.	v. s.	v. s.
1608	mn./aq.	1.585^{13°	234-5	....	s.	s. h.	i.
1609	lq.	$0.810^{20^\circ}_{4}$	-103.7	83.3	v. sl. s.	v. s.	v. s.
1610	oil	$0.985^{0^\circ}_{4}$	....	174^{750mm}	i.	∞	∞
1611	yel. rhb.	....	58-9	....	i.	s.	v. s.
1612	col. lq.	$1.324^{20^\circ}_{20}$	....	165^{714mm} sl. d.	i.	s.	s.
1613	col. lq.	$0.977^{10^\circ}_{4}$	-43.9	142	i.	∞ bz.	∞
1614	lq.	$1.626^{15^\circ}_{15}$	....	192^{742mm}	....	....	....
1615	cr.	....	50-5	148^{10mm}	v. sl. s.	v. s.	v. s.; s. CCl_4
1616	col. nd./bz.	....	132-3	$155\text{-}8^{13mm}$	i.; 4^{25° bz.	70^{25° act.	40^{25°
1617	cr.	$0.839^{20^\circ}_{4}$	14.4	$150\text{-}1^{709mm}$	....	....	....
1618	col. lq.	$0.805^{19^\circ}_{4}$	-85	41-2	i.	∞	∞
1619	col. oil	$0.740^{20^\circ}_{4}$	93.8	49.3	i.	....	....
1620	oil	0.948^{20°	-58.2	129-30	sl. s.	....	....
1621	col. gas	0.720^{-79°	-126.6	-34^{749mm}	i.	s.	s.
1622	col. lq.	$0.877^{20^\circ}_{4}$	-71.6	178.3	i.	s.	s.
1623	col. lq.	$0.861^{20^\circ}_{4}$	-63.8	175.2	i.	s.	s.
1624	col. lq.	$0.857^{20^\circ}_{4}$	-68.0	177.1	i.	s.	s.
1625	cr. pd.	....	....	....	s.	s. NH_3	s. ac.
1626	col. cr.	....	175-8 d.	....	v. s.	s.	s. act.
1627	pl./aq. HCl	....	d. 258-61	....	0.01^{19°	i.	s. alk.
1628	yel. nd./aq. al.	....	255-6	subl.	s. h.	v. s. h.; i. chl.	v. sl. s.; i. bz.
1629	rhb.	....	340	....	i.	v. sl. s.	v. sl. s.
1630	lq.	0.750^{20°	....	168-70	....	....	....
1631	lq.	$0.895^{18^\circ}_{4}$	-51	193.3	i.	s.	s.
1632	lq.	$0.872^{20^\circ}_{4}$	-32	185.3	i.	s.	s.

* Probably mixt. of isomers.

Dahlin 3872
Dambose 1603
Daphnin, cf. glcde.
Datiscin, cf. glcde.
Datiscosid, cf. glcde.
Daturine, cf. alkd.

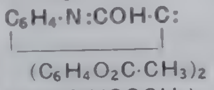
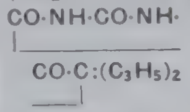
No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1633	**Deca** hydroquinoline	. . . .	$C_9H_{17}N$	XX-156	139.23
1634	methylene glycol	decandiol-1,10	$HOCH_2(CH_2)_8CH_2OH$	I-494	174.28
1635	**Decane** (*n*)	. . . .	$CH_3{\cdot}(CH_2)_8{\cdot}CH_3$	I-168	142.28
1636	**Decane** (*iso*)	2-methyl-nonane	$(CH_3)_2CH(CH_2)_6CH_3$	I-168	142.28
1637	**Decane**	2,6-di Me-octane	$(CH_3)_2CH(CH_2)_3{\cdot}CH(CH_3){\cdot}C_2H_5$	I-168	142.28
1638	**Decane** (di-*iso*-amyl)	2,7-di Me-octane	$[(CH_3)_2CH{\cdot}CH_2CH_2]_2$	I-169	142.28
1639	**Decyl** acetate (*n*)	. . . .	$CH_3CO_2{\cdot}C_{10}H_{21}$	II-135	200.31
1640	alcohol (*n*)(***prim***)	decanol-1	$CH_3(CH_2)_8CH_2OH$	I-425	158.28
1641	alcohol (***sec***)	decanol-4	$C_2H_5{\cdot}CH_2{\cdot}CHOH{\cdot}(CH_2)_5{\cdot}CH_3$	I-426	158.28
1642	alcohol (***tert***)	2-Et-octanol-3	$(C_2H_5)_2COH(CH_2)_4{\cdot}CH_3$	I-426	158.28
1643	alcohol (***tert***)	4-Pr-heptanol-4	$(C_2H_5{\cdot}CH_2)_3COH$	I-426	158.28
1644	alcohol(***prim***)	2,6-di Me-3-methylolheptane	$(CH_3)_2CH{\cdot}CH(CH_2{\cdot}OH)(CH_2)_2{\cdot}CH{:}(CH_3)_2$	I-427	158.28
1645	amine (*n*)	. . . .	$CH_3(CH_2)_8CH_2NH_2$	IV-199	157.29
1646	chloride (*n*)(***prim***)	1-chlorodecane	$CH_3(CH_2)_8CH_2Cl$	I-168	176.73
1647	iodide (*n*)(***prim***)	1-iododecane	$CH_3(CH_2)_8CH_2I$	I-168	268.19
1648	nitrate (*n*)	. . . .	$C_9H_{19}CH_2{\cdot}O{\cdot}NO_2$	I-425	203.28
1649	nitrite (*n*)	. . . .	$C_9H_{19}CH_2{\cdot}O{\cdot}NO$	I-425	187.28
1650	**Decylene** (*α*)	decene-1	$CH_2{:}CH(CH_2)_7CH_3$	I-223	140.26
1651	**Decylene**	2,7-di Me-octene-2	$(CH_3)_2CH(CH_2)_3{\cdot}CH{:}C(CH_3)_2$	I-224	140.26
1652	**Decylene**	2-Me-5-Et-heptene-5	$(CH_3)_2CH(CH_2)_2{\cdot}C(C_2H_5){:}CHCH_3$	I-224	140.26
1653	**Decylene**	3,3,5-trimethyl-heptene-4	$C_2H_5{\cdot}C(CH_3)_2CH{:}C(CH_3){\cdot}C_2H_5$	I-224	140.26
1654	glycol	. . . .	$CH_3{\cdot}CHOH{\cdot}C(C_2H_5){\cdot}(C_4H_9)CH_2OH$	. . . .	174.28
1655	**Deguelin**	. . . .	$C_{23}H_{22}O_6$	. . . .	394.41
1656	**Dehydracetic acid**	6-Me-3-aceto-2,4-pyrandione	$C_8H_8O_4$	XVII-559	168.14
1657	**Dehydro**-androsterone	dehydro-*iso*-androsterone	$C_{19}H_{28}O_2$	. . . .	288.41
1658	benzoylacetic acid	. . . .	 $C_6H_5CO{\cdot}CH{\cdot}CO{\cdot}CH{:}C(C_6H_5){\cdot}O{\cdot}CO$	XVII-575	292.28
1659	**Desoxalic acid**	. . . .	${\cdot}CHOH{\cdot}C(OH)_2{:}(CO_2H)_3$	III-586	194.10
1660	**Desoxybenzoin**	phenyl-benzyl-ketone	$C_6H_5{\cdot}CO{\cdot}CH_2{\cdot}C_6H_5$	VII-431	196.24
1661	**Dextrin**	starch gum	$(C_6H_{10}O_5)_x$	. . . .	(162.14)
1662	**Diacetamide**	. . . .	$(CH_3CO)_2NH$	II-181	101.10
1663	**Diacetone** alcohol	diacetone	$(CH_3)_2COH{\cdot}CH_2{\cdot}CO{\cdot}CH_3$	I-836	116.16
1664	amine	2-NH₂-2-Me-pentanone-4	$(CH_3)_2C(NH_2)CH_2{\cdot}CO{\cdot}CH_3$	IV-322	115.17
1665	amine acid oxalate	. . . .	$C_6H_{13}ON{\cdot}C_2H_2O_4{\cdot}H_2O$	IV-322	223.22
1666	glucose	glucose bis-di Me-ketal	$C_{12}H_{20}O_6$	. . . .	260.28

Decalin 1631-2
Decanal 1206
Decandioic acid 5605
Decanediol 1634
Decanoic acid 1205
Decanol 1640-4
Decanone 4326, 5414
Decene 1650-3
Decyl cyanide 6381
Dehydranone 1656
Dehydro-morphine, cf. alkd.
Dekaline 1631-2
Delphinine, cf. alkd.
Delta acid 4533, 4553
Deoxy-cholic acid 1479

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1633	pr./lg.	....	48.2-8.5	204^{714mm}	s. h.	v. s.	v. s.
1634	nd./aq. al.	....	72-3	179^{15mm}	i. c.	s.; i. pet.	s. h.
1635	col. lq.	$0.730^{20°}$	−29.7	174.0	i.	∞	∞
1636	col. lq.	$0.728^{20°}_{4}$	−74.7	166.8	....	....	....
1637	col. lq.	$0.730^{20°}_{4}$	....	159.0	....	....	....
1638	col. lq.	$0.725^{20°}_{4}$	−49.2	159.7	....	....	....
1639	col. lq.	....	....	187-90	i.	s.	s.; s. bz.
1640	col. oil	$0.830^{20°}_{4}$	7	232.9	....	s.	....
1641	col. oil	$0.826^{20°}_{0}$	....	210-1	....	....	....
1642	col. oil	....	....	199	....	....	....
1643	col. oil	$0.834^{21°}_{4}$	....	190-2	....	....	....
1644	col. oil	$0.849^{0°}$	....	210-2	....	....	....
1645	cr.	....	17	216-8	i.	....	....
1646	lq.	$0.887^{20°}$	....	$180\text{-}90^{720mm}$	i.	....	....
1647	lq.	$1.260^{16°}_{4}$	....	132^{15mm}	....	....	....
1648	lq.	$0.951^{0°}_{4}$	....	$127\text{-}8^{11mm}$	....	....	....
1649	lq.	....	....	$105\text{-}8^{12mm}$	....	....	....
1650	col. lq.	$0.740^{30°}$	....	172	i.	∞	∞
1651	col. lq.	$0.748^{20°}_{0}$	....	$159\text{-}62^{650mm}$	i.	....	....
1652	col. lq.	$0.752^{11°}_{4}$	....	$157\text{-}8^{750mm}$	i.	....	....
1653	col. lq.	$0.773^{21°}_{21}$	....	157.5^{759mm}	....	....	....
1654	lq.	$0.945^{20°}_{20}$	....	130^{3mm}	sl. s.	....	....
1655	pa. gn./al.	....	171	....	i.	s.	....
1656	rhb.	....	108.5-9.0	269.9	$0.1^{20°}$; s. h.	v. s. h.	s.
1657	col. cr.	....	148(138)	....	i.	s.	s.
1658	yel. nd./al.	....	171-2	....	i.; s. cht.; s. NH_4OH	sl. s.; s. bz.; s. alk.	s.; sl. s. lg.; s. CS_2
1659	hyg. cr.	....	d. 45	....	v. s.	v. s.	....
1660	pl./al.	....	60	320-2	sl. s. h.	v. s.	v. s.
1661	amor.	1.038	....	....	s.	i. abs.	i.
1662	col. nd.	....	78-9	222.5-3.5	v. s.	sl. s. lg.	sl. s.
1663	lq.	$0.931^{25°}$	−47	167.9	∞	∞	∞
1664	col. lq.	....	....	$25^{0.14mm}$ d. h.	s.	∞	∞
1665	pr./aq.	....	125-6	....	v. s. h.	s. h.	....
1666	col. mn. nd./lg.	....	110-1	....	s.	s.	s.; s. act.

Deseptyl 527
Destriol 2902
Destrone 2903
Dextrose 3618
Dextrose pentaacetate 3362-3

Diabetic sugar 3618
Diacetanilide 1670
Diacetin 3383
Diacetoethyl acetate 3034
Diacetone 1663

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1667	**Diacetyl**	butandione	$CH_3\cdot CO\cdot CO\cdot CH_3$	I-769	86.09
1668	acetone	....	$(CH_3CO\cdot CH_2)_2CO$	I-808	142.15
1669	*p*-aminophenol	....	$CH_3CO_2\cdot C_6H_4\cdot NHCOCH_3$	XIII-464	193.20
1670	aniline (*N*)	*N*-Ph-diacetamide	$C_6H_5N:(COCH_3)_2$	XII-250	177.20
1671	benzidine	....	$(CH_3CO\cdot NH\cdot C_6H_4)_2$	XIII-227	268.30
1672	carbinol	....	$(CH_3CO)_2:CHOH$	I-852	116.11
1673	glucose	....	$(CH_3CO)_2:C_6H_{10}O_6$	....	264.23
1674	monomethoxime	....	$CH_3CO\cdot C(:NOCH_3)\cdot CH_3$	I-772	115.13
1675	oxyphenyl-isatin	isacen	 $C_6H_4\cdot N:COH\cdot C:$ $(C_6H_4O_2C\cdot CH_3)_2$	....	401.40
1676	phenylenediamine	(*o*)	$C_6H_4(NHCOCH_3)_2$	XIII-20	192.21
1677	phenylenediamine	(*p*)	$C_6H_4(NHCOCH_3)_2$	XIII-97	192.21
1678	urea (*sym*)	....	$(CH_3CO\cdot NH)_2CO$	*III-29	144.13
1679	**Diacetylene**	butadiyne	$HC{\vdots}C\cdot C{\vdots}CH$	I-266	50.06
1680	**Diallyl** amine	....	$(CH_2:CH\cdot CH_2)_2:NH$	IV-208	97.16
1681	barbituric acid (5,5)	dial	 $CO\cdot NH\cdot CO\cdot NH\cdot$ $CO\cdot C:(C_3H_5)_2$	*XXIV-422	208.21
1682	cyanamide	....	$(C_3H_5)_2:N\cdot CN$	**IV-666	122.17
1683	oxalate	....	$(CO\cdot O\cdot C_3H_5)_2$	II-540	170.16
1684	sulfide	thioallyl ether	$(CH_2:CH\cdot CH_2)_2S$	I-440	114.20
1685	trisulfide	....	$(C_3H_5)_2S_3$	I-441	178.32
1686	**Dialuric acid**	tartronyl urea	$C_4H_4O_4N_2$	XXV-85	144.09
1687	**Diamino**-anisole	(1;2,4)	$CH_3O\cdot C_6H_3(NH_2)_2$	*XIII-204	138.17
1688	anisole HCl	(1;2,4)	$C_7H_{10}ON_2\cdot 2HCl$	*XIII-204	211.10
1689	anisole HCl	(1;2,5)	$C_7H_{10}ON_2\cdot 2HCl$	....	211.10
1690	anthraquinone (1,4)	....	$C_6H_4(CO)_2C_6H_2:(NH_2)_2$	XIV-197	238.24
1691	anthraquinone (1,5)	....	$(H_2N\cdot C_6H_3)_2(CO)_2$	XIV-203	238.24
1692	anthraquinone (1,8)	....	$(H_2N\cdot C_6H_3)_2(CO)_2$	XIV-212	238.24
1693	anthraquinone (2,3)	....	$C_6H_4(CO)_2C_6H_2:(NH_2)_2$	XIV-215	238.24
1694	anthraquinone (2,6)	....	$H_2NC_6H_3(CO)_2C_6H_3\cdot NH_2$	XIV-215	238.24
1695	anthraquinone (2,7)	....	$H_2NC_6H_3(CO)_2C_6H_3\cdot NH_2$	XIV-216	238.24
1696	azobenzene (2,2′)	....	$(H_2N\cdot C_6H_4\cdot N:)_2$	XVI-303	212.25
1697	azobenzene (4,4′)	azoaniline	$(H_2N\cdot C_6H_4\cdot N:)_2$	XVI-334	212.25
1698	azobenzene (2,4)	chrysoidine	$(H_2N)_2C_6H_3\cdot N_2\cdot C_6H_5$	XVI-383	212.25
1699	azobenzene HCl	chrysoidine orange	$C_{12}H_{12}N_4\cdot HCl$	XVI-383	248.71
1700	benzoic acid (2,3)	....	$(H_2N)_2C_6H_3\cdot CO_2H$	XIV-447	152.15
1701	benzoic acid (2,4)	....	$(H_2N)_2C_6H_3\cdot CO_2H$	XIV-448	152.15
1702	benzoic acid (2,5)	....	$(H_2N)_2C_6H_3\cdot CO_2H$	XIV-448	152.15

Diacetoxy-ethane 3214
Diacetyl-, cf. also acetyl.
Diacetyl-dioxime 2490
Diacetyl-disulfide 85
Diacetyl-fluorescein 3253
Diacetyl-hydroquinone 3716
Diacetyl-methane 68
Diacetyl-monoxime 4888
Diacetyl-monoxime methyl ether 1674
Diacetyl-morphine, cf. alkd.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1667	yel. gn. lq.	$0.981^{18.5°}_{4}$	....	87-8	$25^{15°}$	∞	∞
1668	col. lf.	$1.068^{40°}_{40}$	49	121^{10mm}	s. aq. Na_2CO_3	v. s.	v. s.
1669	lf./aq.	....	150-1	....	....	....	....
1670	pl./lg.	....	37-8	$199\text{-}200^{100mm}$	sl. s. c.	s. bz.	s. lg.
1671	nd./ac.	....	330-1	subl. d.	i.	v. sl. s.	v. sl. s.
1672	rhb. nd.	....	67-72	....	v. s. alk.	s. lg.	....
1673	lt. yel. amor.	....	....	....	v. s.	s.	i. bz.
1674	yel. lq.	....	....	125	....	....	....
1675	col. cr.	....	241-2	....	i.; i. dil. HCl	sl. s.	i.
1676	nd./aq.	....	185-6	....	s. h.; s. chl.	s.; s. a.	v. sl. s.
1677	cr./ac.	....	303-5	....	v. sl. s.	v. sl. s.	v. sl. s.
1678	nd./50% ac.	....	153.5	d. 170-80	v. sl. s.	s.	....
1679	gas	$0.736^{0°}_{4}$ ..	−36	9-10	$466^{25°}$cc.	....	....
1680	lq.	....	....	111-2	....	....	....
1681	col. lf./aq.	....	171-3	....	0.33 c.; 2 h.	s.; i. pet.	s.; s. act.
1682	col. lq.	....	....	$140\text{-}5^{90mm}$	i.	s.; s. bz.	s.
1683	oil	$1.055^{15.5°}$	....	217^{759mm}	i.	s.	....
1684	col. oil	$0.888^{27°}_{4}$	−83	138.6^{758mm}	sl. s.	∞	∞
1685	lq.	$1.085^{15°}$	....	$112\text{-}2^{16mm}$	....	....	....
1686	pr.	....	214 d.	....	sl. s. c.	....	....
1687	nd./et.	....	67-8	....	....	....	....
1688	tan, rhb.	....	....	....	v. s.	i.	i.
1689	wh. pd.	....	....	....	v. s.	s.	i.
1690	cr./al.	....	268	....	s. h.	s.	v. s. bz.
1691	red nd.	....	319	subl.	v. sl. s.	sl. s.	sl. s.
1692	cr./al.	....	262	....	i.	s.	sl. s.
1693	cr./ $PhNO_2$	....	>320	....	s. H_2SO_4	sl. s. chl.	s. C_5H_5N
1694	red pr./ C_5H_5N	....	310-20 d.	....	s. H_2SO_4	sl. s. h.	i. chl.
1695	or. nd./al.	....	>330	subl.	i.	sl. s.	s. conc. a.
1696	red lf./al.	....	134	....	v. sl. s.	s. h.	v. s.; v. s. act.
1697	yel. nd./ aq. al.	....	241-3	....	v. sl. s.	s.	sl. s. bz., sl. s. lg.
1698	yel. cr.	....	117.5	....	sl. s. h.	s.	s.; v. s. chl.
1699	bl. cr. or red pd.	....	....	....	s.	s.	....
1700	nd.	....	190-1 d.	....	v. sl. s.	....	....
1701	cr.	....	140	....	v. sl. s.	....	....
1702	pr./aq.	....	d. 200	....	v. sl. s. h.	v. sl. s.	v. sl. s.

Diacetyl-peroxide 106
Diacetyl-resorcinol 5552
Dial 1681
Diallyl-, cf. also allyl.
Diallyl 3574
Dialuramide 6384
Diamine-H 5261
Diamine-P 5260
Diamino-benzene 5256-61
Diamino-benzene sulfonic acid 5262

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Diamino				
1703	benzoic acid (3,4)	....	$(H_2N)_2C_6H_3 \cdot CO_2H$	XIV-450	152.15
1704	benzoic acid (3,5)	....	$(H_2N)_2C_6H_3 \cdot CO_2H \cdot H_2O$	XIV-453	170.17
1705	benzoic HCl (3,5)	....	$(H_2N)_2C_6H_3 \cdot CO_2H \cdot 2HCl$	XIV-453	225.08
1706	benzophenone (2,2′)	....	$(NH_2 \cdot C_6H_4)_2CO$	XIV-87	212.24
1707	benzophenone (3,3′)	....	$(NH_2 \cdot C_6H_4)_2CO$	XIV-88	212.24
1708	benzophenone (4,4′)	....	$(NH_2 \cdot C_6H_4)_2CO$	XIV-88	212.24
1709	2-butyloxy-5,5′-azopyridine (2′,6′)	niazo; neotropin	$C_4H_9O \cdot C_5H_3(N) \cdot N_2 \cdot C_5H_2(N)(NH_2)_2$	....	286.33
1710	diphenyl (2,2′)	....	$H_2N \cdot C_6H_4 \cdot C_6H_4 \cdot NH_2$	XIII-210	184.23
1711	diphenyl (2,4′)	diphenyline	$H_2N \cdot C_6H_4 \cdot C_6H_4 \cdot NH_2$	XIII-211	184.23
1712	diphenyl (3,3′)	....	$H_2N \cdot C_6H_4 \cdot C_6H_4 \cdot NH_2$	XIII-213	184.23
1713	diphenyl (4,4′)	benzidine	$(H_2N \cdot C_6H_4)_2 \cdot H_2O$†	XIII-214	202.25
1714	diphenyl (4,4′)	benzidine	$(H_2N \cdot C_6H_4)_2$‡	XIII-214	184.23
1715	diphenyl (4,4′) HCl	benzidine HCl	$(H_2N \cdot C_6H_4)_2 \cdot 2HCl$	XIII-219	257.16
1716	diphenyl H_2SO_4	benzidine sulfate	$(H_2N \cdot C_6H_4)_2 \cdot H_2SO_4$	XIII-219	282.31
1717	diphenylamine (2,4)	....	$C_6H_4 \cdot NH \cdot C_6H_3(NH_2)_2$	XIII-295	199.25
1718	diphenylamine (4,4′)	....	$(H_2N \cdot C_6H_4)_2NH$	XIII-110	199.25
1719	diphenylethane (4,4′)	diamino-dibenzyl	$(H_2N \cdot C_6H_4 \cdot CH_2)_2$	XIII-248	212.28
1720	diphenyl ether	(4,4′)	$H_2N \cdot C_6H_4 \cdot O \cdot C_6H_4 \cdot NH_2$	XIII-441	200.23
1721	diphenylmethane	4,4′-diaminoditane	$(H_2N \cdot C_6H_4)_2CH_2$	XIII-238	198.26
1722	hydrazobenzene (*p*)	biphenin	$(H_2N \cdot C_6H_4 \cdot NH)_2$	XV-653	214.26
1723	phenol (2,4)	....	$(NH_2)_2C_6H_3 \cdot OH$	XIII-549	124.14
1724	phenol (2,4) HCl	amidol	$(NH_2)_2C_6H_3OH \cdot 2HCl$	XIII-550	197.07
1725	phenol (2,5)	....	$(NH_2)_2C_6H_3 \cdot OH$	XIII-553	124.14
1726	phenol (3,4)	....	$(NH_2)_2C_6H_3 \cdot OH$	XIII-564	124.14
1727	phenol (3,5)	....	$(NH_2)_2C_6H_3 \cdot OH$	XIII-567	124.14
1728	phenylacetic acid HCl	....	$(NH_2)_2C_6H_3CH_2 \cdot CO_2H \cdot 2HCl$	....	239.11
1729	stilbene (2,2′)(α)	....	$(H_2N \cdot C_6H_4 \cdot CH:)_2$	XIII-267	210.27
1730	stilbene (2,2′)(β)	....	$(H_2N \cdot C_6H_4 \cdot CH:)_2$	XIII-267	210.27
1731	stilbene (4,4′)	....	$(H_2N \cdot C_6H_4 \cdot CH:)_2$	XIII-267	210.27
1732	stilbene-disulfonic acid	(4,4′-diNH₂-2,2′-diS)	$[H_2N \cdot C_6H_3(SO_3H) \cdot CH]_2$	XIV-798	370.39
1733	triphenylmethane	(4,4′); diamino-tritane	$(H_2N \cdot C_6H_4)_2CH \cdot C_6H_5$	XIII-274	274.35
1734	**Diamyl** amine (*n*)	....	$(C_5H_{11})_2NH$	*IV-378	157.29
1735	amine (*iso*)	....	$(C_5H_{11})_2NH$	IV-182	157.29
1736	amine (*d*)	....	$[C_2H_5CH(CH_3) \cdot CH_2]_2NH$	IV-179	157.29
1737	carbonate (*n*)	amyl carbonate	$(C_5H_{11}O)_2CO$	....	202.29
1738	carbonate (*iso*)	*iso*-amyl carbonate	$(C_5H_{11}O)_2CO$	III-7	202.29
1739	benzene§	....	$(C_5H_{11})_2C_6H_4$	V-470	218.37

† Cryst. from aq. < 60°; ‡ cryst. from aq. > 80°.
§ Mixt. of isomers.

Diamino-butane 5474
Diamino-caproic acid 3986
Diamino-chlorobenzene 1433
Diamino-dibenzyl 1719
Diamino-diphenylsulfide 5886
Diamino-ditane 1721
Diamino-naphthalene 4571-9
Diamino-propane 5464, 6282

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1703	lf.	....	210 d.	....	s. h.	....	....
1704	nd./aq.	....	228-36 (anh.)	- H_2O, 110	$1.1^{8°}$	s.	s.
1705	nd.	....	253?	....	s.	s.	....
1706	yel. lf./aq. al.	....	134-5	....	i.	s.	....
1707	lt. yel. nd./al.	....	173-4	....	v. sl. s.	s.	s.
1708	yel. nd./aq. al.	....	237-9	....	v. sl. s. h.	s.	s.
1709	red cr.	....	129	....	sl. s.	s.	s.
1710	nd./al.	....	81	....	....	....	....
1711	nd./aq. al.	....	45	363	v. sl. s.	s.	s.
1712	oil	....	....	....	v. sl. s.	....	s.
1713	cr./aq.	....	105-20	....	....	....	....
1714	cr./aq.	....	127.5-8.7	$400\text{-}1^{740\text{mm}}$	1 h.	1 h.	2.2abs.
1715	col. lf.	....	....	....	s., d.	s.; i. HCl	i.
1716	col. pl.	....	....	....	$0.0008^{100°}$	v. sl. s. h.	i.
1717	nd.	....	130	....	....	....	....
1718	lf./aq.	....	158	d.	sl. s.	s.	s.
1719	pl./aq.	....	134-5	subl. sl. d.	sl. s. h.	v. s.	....
1720	cr./al.	....	186-7 d.	....	i.	$i.^{25°}$; $15^{25°}$ act.	i. bz.; i. CCl_4
1721	nd./aq.	....	93-4	$249\text{-}53^{15\text{mm}}$	sl. s. c.	s.	s.
1722	yel. cr.	....	145	....	s. h.	s.	s.
1723	lf.	....	78-80 d.	....	s. ac.	s.; s. alk.	sl. s.
1724	nd.	....	....	....	s.	sl. s.	....
1725	cr.	....	68	....	....	....	....
1726	cr.	....	167-8 d.	....	....	....	....
1727	pr.	....	168-70	....	s.	....	sl. s.
1728	tan nd.	....	....	....	v. s.	sl. s.	i.
1729	yel. pr./al.	....	176	....	s. bz.	s.	s.
1730	red nd./aq.	....	123	....	....	....	....
1731	yel. lf./al.	....	227-8	sl. d.	sl. s. h.	s. Me al.	sl. s. bz.
1732	yel. nd.	....	....	....	v. sl. s.	....	....
1733	cr./et.	....	139*	....	v. sl. s.	s.	s.
1734	col. lq.	....	....	$202\text{-}3^{745\text{mm}}$	v. sl. s.	v. s.	∞
1735	col. lq.	$0.767^{\frac{21}{4}°}$	−44	188-90	sl. s.	s.; s. chl.	∞
1736	col. lq.	$0.788^{0°}$	....	182-4	sl. s.	s.	s.
1737	col. lq.	....	....	$130\text{-}2^{20\text{mm}}$	....	....	....
1738	col. lq.	$0.912^{15°}$	....	233	....	....	....
1739	col. lq.	....	....	265 ±	i.	s.	s.

* Crysts. $+1C_6H_6$/bz., m. p. 104-6°.

Diamino-propanol 3384
Diamino-toluene 6003, 6005, 6007
Diamino-tritane 1733
Diamino-valeric acid 5000
Diamol 1724 or 5260
Diamond green-G base 5672
Diamorphine, cf. alkd.
Di-*iso*-amyl 1638

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1740	**Diamyl** ether (*n*)	amyl ether	$(C_5H_{11})_2O$	*I-193	158.28
1741	ether (*iso*)	*iso*-amyl ether	$[(CH_3)_2CH(CH_2)_2]_2O$	I-401	158.28
1742	hydroquinone (*tert*)	....	$[C_2H_5C(CH_3)_2]_2{:}C_6H_2(OH)_2$	VI-952	250.37
1743	ketone (*n*)	caprone	$(C_5H_{11})_2CO$	I-714	170.29
1744	ketone (*iso*)	....	$(C_5H_{11})_2CO$	I-714	170.29
1745	oxalate (*iso*)	....	$(CO_2\cdot C_5H_{11})_2$	II-540	230.30
1746	phthalate (*n*)	amyl phthalate	$C_6H_4(CO_2\cdot C_5H_{11})_2$	....	306.39
1747	phthalate (*iso*)	....	$C_6H_4(CO_2\cdot C_5H_{11})_2$	....	306.39
1748	succinate (*n*)	amyl succinate	$(CH_2CO_2\cdot C_5H_{11})_2$	**II-551	258.35
1749	succinate (*iso*)	....	$(CH_2CO_2\cdot C_5H_{11})_2$	II-611	258.35
1750	succinate (*act*)	....	$(CH_2CO_2\cdot C_5H_{11})_2$	II-611	258.35
1751	sulfide (*n*)	amyl sulfide	$(C_5H_{11})_2S$	....	174.34
1752	sulfide (*iso*)	....	$(C_5H_{11})_2S$	I-405	174.34
1753	sulfide, di- (*n*)	amyl disulfide	$(C_5H_{11}S)_2$	....	206.40
1754	sulfide, di- (*iso*)	....	$(C_5H_{11}S)_2$	I-406	206.40
1755	sulfite (*n*)	amyl sulfite	$(C_5H_{11}O)_2SO$	....	222.34
1756	sulfone (*iso*)	amyl sulfone	$(C_5H_{11})_2SO_2$	I-406	206.34
1757	tartrate (*iso*)	amyl tartrate	$(HO\cdot CH\cdot CO_2\cdot C_5H_{11})_2$	*III-179	290.35
1758	**Dianisalacetone**	....	$(CH_3OC_6H_4CH{:}CH)_2CO$	VIII-354	294.33
1759	**Dianisidine** (*o*)	(3,3′-MeO; 4,4′-NH_2)	$(CH_3O\cdot C_6H_3\cdot NH_2)_2$	XIII-807	244.28
1760	**Dianisyl**-phenetyl-guanidine HCl	guanicaine	$(C_{23}H_{25}O_3N_3\cdot HCl$	XIII-487	427.92
1761	**Diazidoethane** (1,2)	1,2-bistriazo-ethane	$(CH_2N_3)_2$	I-103	112.10
1762	**Diazo**-aminobenzene	benzene-di-azoanilide	$C_6H_5\cdot N{:}N\cdot NHC_6H_5$	XVI-687	197.23
1763	aminonaphthalene	(β)	$C_{10}H_7\cdot N_2\cdot NH\cdot C_{10}H_7$	....	297.34
1764	aminotoluene	(2,2′)	$C_7H_7\cdot N_2NHC_7H_7$	XVI-703	225.28
1765	benzene chloride	....	$C_6H_5\cdot N_2Cl$	XVI-431	140.57
1766	benzene cyanide	....	$C_6H_5\cdot N_2CN$	XVI-432	131.13
1767	benzene nitrate	....	$C_6H_5\cdot N_2NO_3$	XVI-432	167.12
1768	benzene perbromide	....	$C_6H_5N(Br_3){:}N$	XVI-431	344.86
1769	benzene sulfonic acid (*o*)	....	$\underline{C_6H_4\cdot N_2\cdot O\cdot SO_2}$	XVI-557	184.17
1770	benzene sulfonic acid (*m*)	....	$\underline{C_6H_4\cdot N_2\cdot O\cdot SO_2}$	XVI-559	184.17
1771	benzene sulfonic acid (*p*)	sulfanilic acid diazide	$\underline{C_6H_4\cdot N_2\cdot O\cdot SO_2}$	XVI-561	184.17
1772	methane	....	CH_2N_2	XXIII-25	42.04
1773	salicylic acid (5)	....	$HO_2C\cdot C_6H_2(OH)N_2$	....	164.12
1774	uracil (5)	....	$\underline{CO\cdot NH\cdot CO\cdot NH\cdot}$ $\underline{CH{:}C\cdot N{:}N\cdot OH}$	XXV-565	156.10
1775	**Dibenzalacetone**	cinnamone	$(C_6H_5\cdot CH{:}CH)_2CO$	VII-500	234.28
1776	**Dibenzamide**	....	$(C_6H_5\cdot CO)_2NH$	IX-213	225.24
1777	**Dibenzanthracene**	(1,2,5,6)	$C_{22}H_{14}$	*V-369	278.33

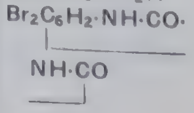
Dianilino-methane 4431
Diathesin 3750
Diatol 2138

Diazine 5477, 5482, 5513
Diazo-acetic ester 3035
Diazo-benzeneimide 6079

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Water	Alcohol	Ether
1740	lq.	$0.774_{4}^{20^\circ}$	–69	190	i.	∞	∞
1741	col. lq.	$0.777_{4}^{20^\circ}$	....	173.4	i.	∞ ; ∞ chl.	∞
1742	cr./bz.	....	185	....	i. aq. NaOH	s.; s. chl.	s.; v. sl. s. lg.
1743	lf.	$0.825_{4}^{20^\circ}$	14.5	228	i.	v. s.	v. s.
1744	yel. oil	....	....	226	i.	s.	s.
1745	col. lq.	$0.968_{11}^{11^\circ}$	....	265-7	i.	s.	s.
1746	col. lq.	$0.821_{4}^{25^\circ}$	....	$204\text{-}6^{11mm}$	....	....	....
1747	col. lq.	1.03	....	225^{40mm}	i.	s.	s.
1748	col. lq.	$0.961_{4}^{20^\circ}$	–9	172^{16mm}	....	....	....
1749	col. lq.	0.961^{13°	....	289.9^{728mm}	i.	s.	s.
1750	col. lq.	$0.959_{4}^{20^\circ}$	....	$178\text{-}80^{25mm}$	i.	s.	s.
1751	col. lq.	....	....	$103\text{-}5^{12mm}$	....	....	....
1752	lq.	$0.843_{4}^{20^\circ}$	....	216	i.	∞	∞
1753	yel. lq.	....	....	$128\text{-}30^{12mm}$	....	....	....
1754	lq.	0.918^{18°	....	250 sl. d.	....	....	....
1755	col. lq.	....	....	$136\text{-}8^{15mm}$	....	....	....
1756	nd.	....	31	295	v. sl. s.	v. s.	v. s.
1757	lq.	$1.063_{4}^{14.8^\circ}$	....	195^{16mm}	i.	....	....
1758	yel. lf./EtOAc	....	129-30	....	s. chl., s. bz.	sl. s.	sl. s.
1759	col. lf.	....	131.5	....	i.; s. bz.	s.	s.
1760	col. cr.	....	176	....	6	s.	i. oil
1761	oil	$1.170^{24.9^\circ}$	....	53^{9mm}	....	....	....
1762	yel. lf./al.	....	96-8	d. 150; expl.	i.; v. s. bz.	s. h.	v. s.
1763	red nd./xylene	....	156	....	s. H_2SO_4	....	....
1764	or. cr.	....	51	....	0.05	....	....
1765	hyg. cr./al. et.	....	expl.	....	v. s.	s. abs.	i.; s. act.
1766	yel.	....	69	....	sl. s.	....	....
1767	nd./al. et.	1.37	expl.	....	v. s.	sl. s.	i.
1768	yel. lf.	....	63.5 d.	....	i. d.	sl. s. d.	i. d.
1769	col.	....	expl.	....	d. h.	d. h.	....
1770	col. nd./aq.	....	expl.	....	s.; d. 60°	d. h.	....
1771	col. nd./aq.	....	expl.	....	s. h.	i.; d. h.	s. dil. alk.
1772	gas	expl. 200°	–145	–23	d.		s.
1773	yel. cr.	....	expl. 155	....	s. c.	s. Na_2CO_3	i.
1774	red or yel. pl./aq.	....	expl.	....	d. h. a.	....	....
1775	lt. yel. mn.	....	112	d.	v. s. act.	s. h.	sl. s.
1776	rhb./bz.	....	148	....	0.12^{15°	s.	s.
1777	lf./ac.	....	262	subl.	sl. s. ac.	v. s. bz.	i.

Diazo-ethyl acetate 3035
Diazo-resorcinol 5551

Diazo-resorufine 5554
Dibenzal-hydrazine 633

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1778	**Dibenzeneazoresorcinol**	....	$(C_6H_5 \cdot N_2)_2 : C_6H_2(OH)_2$	XVI-185	318.32
1779	**Dibenzoyl** disulfide	....	$(C_6H_5 \cdot CO)_2S_2$	IX-424	274.34
1780	ethylenediamine	....	$(C_6H_5CO \cdot NHCH_2)_2$	IX-262	268.30
1781	methane	β-hydroxy chalkone	$(C_6H_5 \cdot CO)_2CH_2$	VII-769	224.25
1782	**Dibenzyl**-acetic acid	....	$(C_6H_5CH_2)_2 : CHCO_2H$	IX-682	240.29
1783	amine	....	$(C_6H_5 \cdot CH_2)_2NH$	XII-1035	197.27
1784	aniline	....	$(C_6H_5 \cdot CH_2)_2N \cdot C_6H_5$	XII-1037	273.36
1785	fumarate	benzyl fumarate	$(:CH \cdot CO_2 \cdot CH_2C_6H_5)_2$	VI-437	296.31
1786	hydroxylamine (β,β)	....	$(C_6H_5CH_2)_2 : NOH$	XV-19	213.27
1787	ketone	α,α′-diphenyl acetone	$(C_6H_5CH_2)_2 : CO$	VII-445	210.26
1788	maleate	benzyl maleate	$(:CH \cdot CO_2 \cdot CH_2C_6H_5)_2$	VI-437	296.31
1789	phthalate (*o*)	benzyl phthalate	$C_6H_4(CO_2 \cdot C_7H_7)_2$	IX-802	346.36
1790	succinate	....	$(\cdot CH_2CO_2 \cdot C_7H_7)_2$	VI-436	298.32
1791	sulfide	....	$(C_6H_5CH_2)_2S$	VI-455	214.31
1792	tartrate (*d*)	....	$(CHOHCO_2C_7H_7)_2$	....	330.32
1793	**Dibromo**-acetamide	....	$Br_2CH \cdot CO \cdot NH_2$	II-219	216.88
1794	acetamide (*N*)	acetdibromamide	$CH_3 \cdot CO \cdot NBr_2$	II-182	216.88
1795	acetic acid	....	$Br_2CH \cdot CO_2H$	II-218	217.87
1796	acetylene	dibromoethyne	$BrC{\vdots}CBr$	I-246	183.85
1797	aminophenol	(4;2,6,1)	$NH_2 \cdot C_6H_2Br_2OH$	XIII-517	266.94
1798	aniline (2,3)	....	$Br_2C_6H_3 \cdot NH_2$	XII-655	250.94
1799	aniline (2,4)	....	$Br_2C_6H_3 \cdot NH_2$	XII-655	250.94
1800	aniline (2,6)	....	$Br_2C_6H_3 \cdot NH_2$	XII-659	250.94
1801	aniline (3,4)	....	$Br_2C_6H_3 \cdot NH_2$	XII-660	250.94
1802	aniline (3,5)	....	$Br_2C_6H_3 \cdot NH_2$	XII-660	250.94
1803	anthracene (9,10)	....	$C_{14}H_8Br_2$	V-665	336.04
1804	anthranilic acid	(3,5)	$Br_2C_6H_2(NH_2)CO_2H$	XIV-371	294.95
1805	anthraquinone (1,3)	....	$Br_2C_{14}H_6O_2$	*VII-414	366.02
1806	anthraquinone (1,5)	....	$Br_2C_{14}H_6O_2$	VII-789	366.02
1807	anthraquinone (2,6)	....	$Br_2C_{14}H_6O_2$	VII-790	366.02
1808	anthraquinone (β)	(2,3)	$Br_2C_6H_2(CO)_2C_6H_4$	VII-790	366.02
1809	anthraquinone (α)	(2,7)	$BrC_6H_3(CO)_2C_6H_3Br$	VII-790	366.02
1810	barbituric acid	(5,5); dibromin	$Br_2C(CONH)_2CO$	XXIV-472	285.90
1811	benzene (*o*)	....	$C_6H_4Br_2$	V-210	235.92
1812	benzene (*m*)	....	$C_6H_4Br_2$	V-211	235.92
1813	benzene (*p*)	....	$C_6H_4Br_2$	V-211	235.92
1814	benzoic acid (2,3)	....	$Br_2C_6H_3 \cdot CO_2H$	IX-357	279.93
1815	benzoic acid (2,4)	....	$Br_2C_6H_3 \cdot CO_2H$	IX-358	279.93
1816	benzoic acid (2,5)	....	$Br_2C_6H_3 \cdot CO_2H$	IX-358	279.93
1817	benzoic acid (2,6)	....	$Br_2C_6H_3 \cdot CO_2H$	IX-358	279.93
1818	benzoic acid (3,4)	....	$Br_2C_6H_3 \cdot CO_2H$	IX-359	279.93
1819	benzoic acid (3,5)	....	$Br_2C_6H_3 \cdot CO_2H$	IX-359	279.93
1820	benzoylene urea (6,8)	....	 $Br_2C_6H_2 \cdot NH \cdot CO \cdot$ / $NH \cdot CO$	....	319.96

Dibenzo-furane 2763
Dibenzo-pyranol 6453
Dibenzo-pyrone 6451
Dibenzo-pyrrole 1231
Dibenzo-thioxine 5129

Dibenzoyl 697
Dibenzoyl-resorcinol 5553
Dibenzyl-, cf. also benzyl.
Dibenzyl 2717
Dibenzyl disulfide 805

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1778	red nd./ chl.-al.	....	221-2	....	s. h. chl.	i.	v. sl. s. dil. alk.
1779	pr./CS_2	....	133-5	d.	i.; i. NH_4OH	sl. s. h.	sl. s. h.; s. CS_2
1780	nd./al.	....	250-1	d.	i.	0.08^{22°	....
1781	rhb./al.	....	78(72-3)*	219-21$^{18\text{mm}}$	i.	$4.4^{19.5^\circ}$	s.
1782	nd./aq.	....	85-6	....	v. sl. s. h.	s.; s. bz.	s.; s. ac.
1783	col. oil	$1.028^{25^\circ}_{25}$	−26	268-71$^{250\text{mm}}$	i.	s.	s.
1784	pr./al.	....	70-1	>300 sl. d.	i.	v. s. h.	v. s.
1785	col. pr./lg.	....	64	239$^{14\text{mm}}$	i.	s.	v. sl. s. c.
1786	nd.	....	124	....	sl. s. h.	s.	s.
1787	cr./aq. al.	....	34-5	330.6	....	....	....
1788	oil	....	....	241$^{14\text{mm}}$	....	....	....
1789	pr./al.	....	42-3	274$^{12\text{mm}}$	v. sl. s.	s.	s.
1790	col. lf./al.	....	45-6	238$^{14\text{mm}}$	i.	s.	s.; s. bz.
1791	rhb./et.	$1.071^{50^\circ}_{50}$	49	....	i.	s.	s.
1792	cr.	1.204^{72°	50 ±	250-70$^{4\text{mm}}$	....	....	....
1793	nd.	....	156	....	....	....	....
1794	yel. nd.	....	100	....	s. h.	s.	s.
1795	col. cr.	....	48-50	232-4 d.	v. s.	v. s.	v. s.
1796	poison. lq.	2 ±	expl. with trace O_2	76.5 in CO_2	i.	s.	s.
1797	nd./al.	....	192-3	....	i.; s. bz.	s.	sl. s.
1798	pl./aq. al.	....	43	....	v. sl. s.	v. s.	v. s.
1799	rhb.	2.260^{20°	....	79.5	....	s.	s. ac.
1800	nd./al.	....	83-4	262-4	....	v. s. abs.	v. s.
1801	lf./aq. al.	....	80-1	subl. 100	i.	s.	....
1802	nd.	....	56.5	....	....	....	....
1803	yel. nd.	....	221	subl.	s. h. bz.	v. sl. s.	v. sl. s.
1804	nd./al.	....	235-6	....	i.; s. alk.	s.	s.
1805	yel. nd./ac.	....	210	....	s. H_2SO_4	v. sl. s.	v. sl. s.
1806	nd.	....	....	....	....	....	....
1807	yel. cr./ Am. al.	....	289-90	....	....	v. sl. s.	s. h. bz.
1808	yel. nd.	....	269-70	subl.	s. bz.	v. sl. s.	s. chl.
1809	yel. nd./ac.	....	245	....	....	v. sl. s. h.	sl. s. h. ac.
1810	cr./aq. HNO_3	....	234	....	3	s.	s.
1811	col. lq.	$1.956^{20^\circ}_{4}$	1.8	221-2	i.	s.	s.
1812	col. lq.	$1.952^{20^\circ}_{4}$	−6.9	219$^{755\text{mm}}$	i.	s.	s.
1813	col. pl./al.	2.261^{18°	87-8	218.6$^{758\text{mm}}$	i.; s. chl.	1.6; s. bz.	71^{25°
1814	nd./aq.	....	147-9	....	s. h. lg.	....	....
1815	lf./aq.	....	171-2	subl.	sl. s. h.	....	....
1816	nd./aq.	....	153	....	v. sl. s. c.	s.	s.
1817	nd./aq.	....	146-7	....	s. h.	v. s.	v. s.; v. s. chl.
1818	nd./aq.	....	232-3	subl.	v. sl. s. c.	s.	s.
1819	nd./aq.	....	219-20	subl.	v. sl. s. c.	v. s.	sl. s. c. bz.
1820	yel. nd./ glycol	....	305-6	....	i.; i. aq. NaOH	i.; s. h. glycol	i.; s. h. $PhNO_2$

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* Enol form, two m. p's.; keto, m. p. 81°.

Dibenzyl ether 806
Dibenzyl sulfone 835
Dibromide of cinnamic acid 1830
Dibromin 1810
Dibromo-acetophenone 967

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Dibromo				
1821	butane (1,2)	α-butylene bromide	$C_2H_5 \cdot CHBr \cdot CH_2Br$	I-120	215.94
1822	butane (1,3)	....	$CH_3CHBr \cdot CH_2CH_2Br$	I-120	215.94
1823	butane (1,4)	....	$Br(CH_2)_4Br$	I-120	215.94
1824	butane (2,3)(*dl*)	β-butylene bromide	$(CH_3 \cdot CHBr \cdot)_2$	**II-84	215.94
1825	butane (*iso*)	1,2-diBr-2-Me-propane	$(CH_3)_2CBr \cdot CH_2Br$	I-127	215.94
1826	butyric acid (α,β)	crotonic acid diBr	$CH_3(CHBr)_2CO_2H$	II-284	245.92
1827	butyric acid	*iso*-crotonic diBr	$CH_3(CHBr)_2CO_2H$	II-285	245.92
1828	camphor (α,α′)	(3,3-diBr-*d*)	$Br_2C_9H_{14}CO$	VII-125	310.04
1829	cinnamic acid (α,β)	"α-acid"	$C_6H_5CBr{:}CBrCO_2H$	IX-601	305.97
1830	cinnamic acid (*dl*)	†	$C_6H_5(CHBr)_2CO_2H$	IX-518	307.99
1831	*o*-cresol (4,6)	(4,6;2,1)	$Br_2C_6H_2(CH_3)OH$	VI-360	265.95
1832	*o*-cresolsulfonphthalein	bromcresol purple	$C_{21}H_{16}O_5Br_2S$	....	540.23
1833	diphenyl (4,4′)	....	$BrC_6H_4 \cdot C_6H_4Br$	V-580	312.02
1834	diphenyl ether (4,4′)	....	$(Br \cdot C_6H_4)_2O$	VI-200	328.02
1835	diphenylsulfone	(4,4′)	$(Br \cdot C_6H_4)_2SO_2$	VI-331	376.11
1836	ethane (1,1)	ethylidenedibromide	$CH_3 \cdot CHBr_2$	I-90	187.88
1837	ethane (1,2)	ethylene bromide	$BrCH_2 \cdot CH_2Br$	I-90	187.88
1838	fluorescein	(2,4)	$C_{20}H_{10}O_5Br_2$	XIX-228	490.11
1839	fluorescein	(4,5)	$C_{20}H_{10}O_5Br_2$	XIX-228	490.11
1840	fumaric acid	....	$({:}CBr \cdot CO_2H)_2$	II-747	273.89
1841	gallic acid	(2,6;3,4,5;1)	$Br_2C_6(OH)_3CO_2H \cdot H_2O$	X-490	345.95
1842	hexane (1,2)	α-hexylene dibromide	$CH_3(CH_2)_3CHBr \cdot CH_2Br$	I-144	243.99
1843	hexane (1,5)	....	$CH_3CHBr \cdot (CH_2)_3 \cdot CH_2Br$	I-145	243.99
1844	hexane (1,6)	hexamethylene diBr	$(\cdot CH_2 \cdot CH_2 \cdot CH_2Br)_2$	I-145	243.99
1845	hexane	3,3-dibromo-2,2-dimethyl-butane	$(CH_3)_3C \cdot CBr_2 \cdot CH_3$	I-151	243.99
1846	hexane	3,4-dibromo-2,2-dimethyl-butane	$(CH_3)_3C \cdot CHBr \cdot CH_2Br$	I-151	243.99
1847	hexane	2,3-dibromo-2,3-dimethyl-butane	$(CH_3)_2CBr \cdot CBr(CH_3)_2$	I-152	243.99
1848	8-hydroxyquinoline (5,7)	....	$Br_2C_9H_4(OH)N$	XXI-97	302.97
1849	iodomethane	....	$ICHBr_2$	I-71	299.77
1850	maleic acid	....	$({:}CBr \cdot CO_2H)_2$	II-756	273.89
1851	malonic acid	....	$Br_2C(CO_2H)_2$	II-595	261.88
1852	naphthalene (1,4)	β-dibromonaphthalene	$C_{10}H_6Br_2$	V-549	285.98
1853	α-naphthol (2,4)	....	$Br_2C_{10}H_5 \cdot OH$	VI-614	301.98
1854	nitromethane	....	$Br_2CH \cdot NO_2$	I-77	218.86
1855	nitrophenol (2,6;4)	....	$Br_2{:}C_6H_2(NO_2)OH$	VI-247	296.92
1856	pentane (1,4)	....	$CH_3 \cdot CHBr \cdot CH_2 \cdot CH_2 \cdot CH_2Br$	I-131	229.96
1857	pentane (1,5)	pentamethylene diBr	$Br(CH_2)_5Br$	I-131	229.96

†Dibromide of cinnamic acid.

Dibromo-diphenyl 1833
Dibromo-ethene 131-3
Dibromo-ethylbenzene 5647
Dibromo-ethylene 131-3
Dibromo-ethyne 1796

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1821	lq.	$1.820_{0}^{20^\circ}$	−65	166	i.	∞	....
1822	lq.	$1.807^{18.5^\circ}$	....	174-5	....	....	....
1823	col. lq.	$1.819_{0}^{8.5^\circ}$	−20	197-8	....	....	....
1824	col. lq.	$1.783_{4}^{20^\circ}$	−34.5	157-8	i.	....	....
1825	col. lq.	1.759^{20°	−70.3	$148\text{-}9^{737mm}$	i.	....	....
1826	mn. nd.	....	87	....	sl. s. c.	v. s.	v. s.
1827	nd.	....	58-9	....	sl. s. c.	v. s.	v. s.
1828	col. rhb./lg.	$1.854_{4}^{21.6^\circ}$	64	subl. >64	i.; s. lg.	22^{20° abs.	s.; s. bz.
1829	pl./chl. pet.	....	138-9 *	....	i.	s.; s. chl.	s.; sl. s. pet.
1830	mn./chl.	....	199-201	d.	i.; d. h.	s.	s.
1831	nd.	....	56-7	....	v. sl. s.	s.; s. alk.	s.; s. bz.
1832	pink pd.	....	241-2	....	v. sl. s.	s.; s. alk.	i.
1833	mn. pr.	1.897	164-5	355-60	i.	v. sl. s. h.	v. s. bz.
1834	cr.	....	53-4	338-40	v. s. bz.	s.	s.
1835	mn. nd./al.	....	172	....	....	sl. s. h.	....
1836	lq.	$2.055_{4}^{20^\circ}$	....	108-10	i.	v. s.	v. s.
1837	col. lq.	$2.180_{4}^{20^\circ}$	10	131.5	0.43^{30°	∞	∞
1838	red cr. + EtOH/al.	....	300 ± (anh.)	....	i.; s. ac.	s. h.	v. sl. s.
1839	red cr./al.	....	285	....	sl. s.; s. ac.	s. h.	v. sl. s.
1840	cr./aq.	....	227-9 d.	....	....	v. s.	v. s.
1841	cr./aq.	....	150	$-H_2O$, 120	12.4^{15°; 200^{100°	s.; i. chl.	s.
1842	lq.	$1.596^{13.5^\circ}$	....	87^{16mm}	....	....	....
1843	lq.	$1.599_{4}^{20^\circ}$	....	$153\text{-}4^{100mm}$	....	....	....
1844	lq.	1.595^{15°	....	243	....	....	....
1845	cr.	....	187 **	subl.	....	....	....
1846	col. lq.	1.616^{0°	....	$91\text{-}2^{14mm}$	i.; v. s. bz.	v. s.	v. s.; v. s. chl.
1847	long nd.	1.811^{15°	173**	....	d.	s.	v. s.; s. bz.
1848	nd./al.	....	196	subl.	i. c.	sl. s.; s. a.	s.; s. bz.
1849	tablets	....	22.5	$101\text{-}4^{50mm}$	soln. d. by light	sl. s. pet.	....
1850	nd./et.	....	123.5	....	v. s.	v. s.	v. s.; i. chl.
1851	pr. or nd.	....	136-7 d.	....	v. s.	v. s.	v. s.
1852	nd./al.	....	82-3	310 d.	....	1.3^{11°	v. s.
1853	nd./al.	....	111	....	i.	s.	s.; s. ac.
1854	lq.	....	....	$58.5\text{-}60^{13mm}$	....	....	....
1855	col. pr./al.	....	143-4	d. >145	v. sl. s.; v. sl. s. bz.	s. h.; sl. s. ac.	s. h.; s. h. CS_2
1856	lq.	$1.622_{4}^{20^\circ}$	....	$196\text{-}8^{746}$ d.	....	....	....
1857	lq.	1.706^{18°	−35	221^{763} sl. d.	....	....	....

* β or allo-acid, m. 100°.
** In sealed tube.

Dibromo-hydrin 3388-9
Dibromo-methane 4428
Dibromo-pene 1869

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1858	**Dibromo** pentane	2,3-dibromo-2-methyl-butane	$(CH_3)_2CBr\cdot CHBr\cdot CH_3$	I-137	229.96
1859	phenol (2,4)		$Br_2C_6H_3\cdot OH$	VI-202	251.92
1860	phenol (2,6)		$Br_2C_6H_3\cdot OH$	VI-202	251.92
1861	phenol (3,4)		$Br_2C_6H_3\cdot OH$	VI-203	251.92
1862	phenol (3,5)		$Br_2C_6H_3\cdot OH$	VI-203	251.92
1863	propane (1,1)	propylidene diBr	$C_2H_5\cdot CHBr_2$	I-109	201.91
1864	propane (1,2)	propylene bromide	$CH_3\cdot CHBr\cdot CH_2Br$	I-109	201.91
1865	propane (1,3)	trimethylene diBr	$BrCH_2\cdot CH_2\cdot CH_2Br$	I-110	201.91
1866	propane (2,2)	bromacetol	$(CH_3)_2CBr_2$	I-111	201.91
1867	propionic acid (α,α)		$CH_3\cdot CBr_2\cdot CO_2H$	II-257	231.89
1868	propionic acid (α,β)		$CH_2Br\cdot CHBr\cdot CO_2H$	II-258	231.89
1869	propylene (β,γ)	epidibromohydrin (α)	$CH_2{:}CBr\cdot CH_2Br$	I-201	199.89
1870	propylene (α,γ)	epidibromohydrin (β)	$CH_2Br\cdot CH{:}CHBr$	I-201	199.89
1871	propyne-1 (1,3)		$CH_2Br\cdot C\vdots CBr$	I-248	197.88
1872	pyridine (2,5)		$Br_2C_5H_3N$	XX-233	236.91
1873	pyridine (2,6)		$Br_2C_5H_3N$		236.91
1874	pyridine (3,5)(α)		$Br_2C_5H_3N$	XX-233	236.91
1875	pyruvic acid		$CHBr_2\cdot CO\cdot CO_2H$	III-624	245.88
1876	quinonechloroimide	(2,6)	$Cl\cdot N{:}C_6H_2{:}OBr_2$	VII-640	299.37
1877	succinic acid (*allo*)		$Br_2C_2H_2(CO_2H)_2$	II-625	275.90
1878	succinic acid (*meso*)		$(CHBr\cdot CO_2H)_2$	II-623	275.90
1879	thymol-sulfon-phthalein	bromthymol blue	$C_{27}H_{28}O_5Br_2S$	*XIX-650	624.39
1880	toluene (2,5)		$Br_2C_6H_3\cdot CH_3$	V-308	249.95
1881	tyrosine (3,5)	*l* (−)	$C_9H_9O_3NBr_2\cdot 2H_2O$	XIV-619	375.03
1882	*m*-xylene (4,6)		$Br_2C_6H_2(CH_3)_2$	V-374	263.98
1883	**Dibutyl** adipate (*n*)	butyl adipate	$(CH_2CH_2CO_2\cdot C_4H_9)_2$		258.35
1884	amine (*n*)		$(C_4H_9)_2NH$	IV-157	129.24
1885	amine (*sec*)		$(C_4H_9)_2NH$	IV-162	129.24
1886	amine (*iso*)		$(C_4H_9)_2NH$	IV-166	129.24
1887	aminoethyl alcohol (β)(*n*)		$(C_4H_9)_2N\cdot CH_2\cdot CH_2OH$		173.29
1888	aminopropyl alcohol (β)(*n*)		$(C_4H_9)_2N\cdot CH(CH_3)\cdot CH_2OH$		187.32
1889	aminopropyl alcohol (γ)(*n*)		$(C_4H_9)_2N\cdot CH_2CH_2\cdot CH_2OH$		187.32
1890	aminopropyl-*p*-aminobenzoate H_2SO_4	butyn	$H_2N\cdot C_6H_4\cdot CO_2\cdot (CH_2)_3\cdot N(C_4H_9)_2\cdot \frac{1}{2}H_2SO_4$		355.47
1891	aniline (*n*)(*N*)		$C_6H_5N(C_4H_9)_2$	*XII-160	205.33
1892	carbonate (*n*)	butyl carbonate	$CO(OC_4H_9)_2$	III-6	174.23
1893	carbonate (*iso*)		$CO(OC_4H_9)_2$	III-6	174.23
1894	carbonate (*sec*)		$CO(OC_4H_9)_2$	III-6	174.23
1895	cyanamide (*n*)		$(C_4H_9)_2N\cdot CN$	**IV-635	154.25
1896	α,α'-dibromo-succinate (*n*)		$(CHBrCO_2C_4H_9)_2$		388.11
1897	disulfide (*n*)		$C_4H_9\cdot S\cdot S\cdot C_4H_9$	**I-400	178.34
1898	ether (*n*)	butyl ether	$(C_2H_5\cdot CH_2\cdot CH_2)_2O$	I-369	130.22

Dibromo-propanol 3388-9
Dibromo-propyl alcohol 3388-9
Dibromo-sulfobenzide 1835
Dibromo-xylene (ω) 6491-3

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Water	Alcohol	Ether
1858	lq.	1.573^{25°	7	170-3 sl. d.	....	....	....
1859	cr.	....	40	238-9	0.2^{15°	v. s.	v. s.
1860	nd./aq.	....	55-6	162^{21mm}	....	v. s.	v. s.
1861	nd./aq.	....	79-80	....	....	v. s.	v. s.
1862	cr./lg.	....	81	....	v. sl. s.	v. s.	v. s.
1863	lq.	....	....	130 ±	....	....	....
1864	col. lq.	$1.933^{20^\circ}_{4}$	−55.5	141.6	0.25^{20°	s.	v. s.
1865	lq.	$1.987^{15^\circ}_{4}$	−34.4	167.5	0.168^{30°	s.	s.
1866	lq.	1.783^{20°	....	114.5^{740mm}	....	....	....
1867	rhb.	....	61	200-21 sl. d.	....	....	....
1868	pl.	....	64 (51)	220-40 d.	1945^{11mm}	v. s.	304^{10°
1869	lq.	$1.934^{20^\circ}_{4}$	....	140-2	....	....	....
1870	lq.	$1.995^{25^\circ}_{4}$	−52	155-6	....	....	....
1871	lq.	2.137^{0°	....	$73\text{-}4^{30mm}$	....	....	....
1872	nd./al.	....	94-5	subl.	i.	s.	s.
1873	cr.	....	118-9	....	....	....	....
1874	cr./al.	....	110-2; subl. >100	222	sl. s. h.	s. h.	s.; s. H_2SO_4
1875	nd./et.	....	93	....	s.	....	....
1876	yel. pr./al.	....	83	d. 121	0.0006	sl. s. h.	sl. s. h. ac.
1877	cr.	....	170	d. 180	$>2^{17^\circ}$	v. s.	v. s.
1878	cr.	....	255-6 * d.	subl. >250	2.0^{17°	v. s.; v. sl. s. chl.	v. s.
1879	yel. cr.	....	....	....	v. sl. s.; s. a.	s.	i.; s. alk.
1880	lq.	1.813^{19°	<−20	236	i.	....	....
1881	rhb./aq.	....	245 ±, d.	$-2H_2O$, 120	5^{16°; 3.9^{100°	v. sl. s.; s. a.	i.; s. alk.
1882	cr.	....	72	255-6	i.	v. s. h.	....
1883	col. lq.	$0.965^{20^\circ}_{4}$	−38	183^{14mm}	i.	∞	∞
1884	col. lq.	$0.768^{20^\circ}_{20}$	....	159^{761mm}	v. s.	∞	∞
1885	col. lq.	$0.783^{0^\circ}_{0}$	−104.5	132^{758mm}	v. s.	....	....
1886	col. lq.	$0.741^{25^\circ}_{4}$	−70	139-40	v. sl. s.	s.	s.
1887	col. lq.	....	....	$91\text{-}6^{7mm}$	....	....	....
1888	col. lq.	....	....	$80\text{-}6^{6mm}$	....	....	....
1889	col. lq.	....	....	$110\text{-}6^{8mm}$	....	....	....
1890	wh. pd.	....	98-100	....	100; sl. s. chl.	s.; s. act.	i.
1891	lq.	....	....	262.8	i.	∞	∞
1892	col. lq.	0.924^{20°	....	207^{740mm}	i.	s.	....
1893	col. lq.	0.919^{15°	....	190	i.	....	....
1894	col. lq.	....	....	178-80	....	....	....
1895	lq.	....	....	$128\text{-}30^{20mm}$	i.	s.	s.
1896	col. lq.	....	....	$171\text{-}4^{8mm}$	....	....	....
1897	col. lq.	$0.930^{20^\circ}_{4}$	....	$117\text{-}8^{20mm}$	i.	∞	∞
1898	lq.	$0.769^{20^\circ}_{20}$	−98	142.4	<0.05	∞	∞

* In sealed tube.

Dibutyl carbinol (*n*) 4921

Dibutyl carbinol (*iso*) 4925

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
1899	**Dibutyl** ether (*iso*)	*iso*-butyl ether	$[(CH_3)_2CH\cdot CH_2]_2O$	I-376	130.22
1900	ketone (*n*)	nonanone-5	$(C_2H_5\cdot CH_2\cdot CH_2)_2CO$	I-709	142.23
1901	ketone (*iso*)	valerone	$(C_4H_9)_2CO$	I-710	142.23
1902	*l*-malate (−)(*n*)	butyl malate	$C_4H_4O_5(C_4H_9)_2$	III-433	246.30
1903	maleate (*n*)	butyl maleate	$(CHCO_2C_4H_9)_2$	....	228.28
1904	malonate (*n*)	butyl malonate	$CH_2(CO_2C_4H_9)_2$	II-581	216.27
1905	oxalate (*n*)	....	$(CO_2C_4H_9)_2$	II-540	202.24
1906	oxalate (*iso*)	....	$(CO_2C_4H_9)_2$	II-540	202.24
1907	phenyl-phenyl-phosphate (*tert*) (*p*)	phosphen-2	$(C_4H_9\cdot C_6H_4O)_2PO\cdot O\cdot C_6H_5$	....	438.49
1908	*o*-phthalate (*n*)	butyl phthalate	$C_6H_4(CO_2C_4H_9)_2$	....	278.34
1909	sebacate (*n*)	butyl sebacate	$[(CH_2)_4CO_2C_4H_9]_2$	II-719	314.45
1910	succinate (*n*)	butyl succinate	$(CH_2CO_2C_4H_9)_2$	**II-551	230.30
1911	succinate (*iso*)	....	$(CH_2CO_2C_4H_9)_2$	II-611	230.30
1912	succinate (*sec*)	....	$(CH_2CO_2C_4H_9)_2$	II-611	230.30
1913	sulfate (*n*)	butyl sulfate	$(C_4H_9O)_2SO_2$	....	210.28
1914	sulfide (*n*)	butyl sulfide	$(C_2H_5\cdot CH_2CH_2)_2S$	I-370	146.28
1915	sulfide (*sec*)	....	$(C_4H_9)_2S$	I-373	146.28
1916	sulfide (*iso*)	....	$[(CH_3)_2CH\cdot CH_2]_2S$	I-379	146.28
1917	sulfite (*n*)	butyl sulfite	$(C_4H_9O)_2SO$	**I-397	194.28
1918	sulfone (*n*)	butyl sulfone	$(C_4H_9)_2SO_2$	I-371	178.28
1919	tartrate (*d*)(*n*)	butyl tartrate	$(CHOH\cdot CO_2C_4H_9)_2$	III-518	262.30
1920	tartrate (*d*)(*iso*)	....	$(CHOH\cdot CO_2C_4H_9)_2$	III-518	262.30
1921	thiourea (*n*)	....	$(C_4H_9\cdot NH)_2CS$	....	188.33
1922	urea (*n*)(*N,N*)	....	$(C_4H_9)_2N\cdot CO\cdot NH_2$	*IV-372	172.27
1923	**Di-*iso*-butylene** †	....	$(CH_3)_2C{:}CH\cdot C(CH_3)_3$	I-222	112.21
1924	**Dicapryl adipate**	(*n*)(*sec*)	$[\cdot(CH_2)_2CO_2CH\cdot(CH_3)\cdot(CH_2)_5\cdot CH_3]_2$	**II-575	370.56
1925	**Dichloro-**acetal	....	$Cl_2CH\cdot CH(OC_2H_5)_2$	I-614	187.07
1926	acetaldehyde	2,2-dichloro-ethanal	$Cl_2CH\cdot CHO$	I-613	112.95
1927	acetamide	....	$Cl_2CH\cdot CO\cdot NH_2$	II-205	127.97
1928	acetic acid	....	$Cl_2CH\cdot CO_2H$	II-202	128.95
1929	acetone (*α*)(*uns*)	....	$Cl_2CH\cdot CO\cdot CH_3$	I-654	126.98
1930	acetone (*β*)(*sym*)	....	$(ClCH_2)_2CO$	I-655	126.98
1931	acetyl chloride	....	$Cl_2CH\cdot CO\cdot Cl$	II-204	147.40
1932	aniline (2,3)	....	$Cl_2C_6H_3\cdot NH_2$	XII-621	162.02
1933	aniline (2,4)	....	$Cl_2C_6H_3\cdot NH_2$	XII-621	162.02
1934	aniline (2,5)	....	$Cl_2C_6H_3\cdot NH_2$	XII-625	162.02
1935	aniline (2,6)	....	$Cl_2C_6H_3\cdot NH_2$	XII-626	162.02
1936	aniline (3,4)	....	$Cl_2C_6H_3\cdot NH_2$	XII-626	162.02
1937	aniline (3,5)	....	$Cl_2C_6H_3\cdot NH_2$	XII-626	162.02
1938	aniline sulfonic	3,6-diCl-sulfanilic	$Cl_2C_6H_2(NH_2)SO_3H$	XIV-707	242.08
1939	anthracene (2,3)	....	$C_{14}H_8Cl_2$	V-664	247.12
1940	anthracene (9,10)	....	$C_{14}H_8Cl_2$	V-664	247.12
1941	anthraquinone (1,3)	....	$C_6H_4(CO)_2C_6H_2Cl_2$	VII-787	277.10
1942	anthraquinone (1,4)	....	$C_6H_4(CO)_2C_6H_2Cl_2$	VII-787	277.10
1943	anthraquinone (1,5)	....	$(ClC_6H_3)_2(CO)_2$	VII-787	277.10
1944	anthraquinone (1,6)	....	$(ClC_6H_3)_2(CO)_2$	*VII-412	277.10
1945	anthraquinone (1,8)	....	$(ClC_6H_3)_2(CO)_2$	VII-788	277.10
1946	anthraquinone (2,3)	....	$C_6H_4(CO)_2C_6H_2Cl_2$	VII-788	277.10
1947	anthraquinone (2,6)	....	$(ClC_6H_3)_2(CO)_2$	VII-788	277.10
1948	anthraquinone (2,7)	....	$(ClC_6H_3)_2(CO)_2$	VII-788	277.10

† See also octylene.

Dibutyl mercury 4042

Dibutyl urethane 3038

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1899	lq.	0.762^{15°	....	122-2.5	i.	∞	∞
1900	lq.	$0.827^{13^\circ}_{4}$	−5.9	187.7	i.; v. s. CS_2	v. s. chl.	v. s.
1901	oil	$0.805^{21^\circ}_{4}$	....	168.1	<0.06	∞	∞
1902	lq.	$1.038^{20^\circ}_{4}$	....	170-1^{13mm}	v. sl. s.	....	....
1903	col. lq.		....	141-2^{9mm}	....	....	....
1904	lq.	$0.981^{20^\circ}_{4}$	....	251.5	i.	s.	s.
1905	col. lq.	$0.986^{20^\circ}_{4}$	−29.6	245.5	i.	s.	s.
1906	col. lq.	1.002^{14°	....	228-9	i.	s.	s.
1907	col. lq.	$1.11^{25^\circ}_{25}$	<0	260-75^{5mm}	i.; ∞ CCl_4	v. s.	∞ bz.
1908	col. lq.	1.045^{21°	....	340	0.04^{25°	∞ ; ∞ bz.	∞ ; ∞ act.
1909	lq.	0.933^{15°	....	344-5	....	....	....
1910	lq.	0.965^{20°	−29.3	274.5	....	....	....
1911	col. lq.	0.974^{15°	....	265-6	....	....	....
1912	col. lq.	$0.974^{20^\circ}_{4}$	....	256-7^{750mm}	....	....	....
1913	col. lq.	$1.059^{25^\circ}_{25}$	....	130-2^{11mm}	i.	....	....
1914	lq.	$0.839^{16^\circ}_{0}$	−79.7	182	i.	....	....
1915	lq.	0.832^{23°	....	165	....	....	....
1916	lq.	0.836^{10°	−105.5	172-3^{747mm}	i.	∞	∞
1917	col. lq.	1.001^{14°	....	108-10^{15mm}	....	....	....
1918	pl./aq.	....	44	....	v. sl. s.	....	....
1919	pr.	1.098^{15°	22-2.5	200-3^{18mm}	....	....	....
1920	cr.	$1.031^{75^\circ}_{4}$	73-4	323-5	....	....	....
1921	col. nd./al.	....	66-7	....	i.	s.	sl. s.
1922	col. hyg. cr.	....	149-50	118-9^{2mm}	....	s.	s.
1923	col. lq.	$0.721^{20^\circ}_{4}$	−106.5	104.9	....	....	....
1924	lt. yel. lq.	$0.914^{20^\circ}_{4}$	....	192-4^{3mm}	....	....	....
1925	lq.	1.138^{14°	....	186	....	....	....
1926	col. lq.*	....	....	88-90	i.	....	....
1927	mn. pr.	....	98	233-4^{745mm}	v. s. h.	v. s.	v. s.
1928	lq.	$1.560^{25^\circ}_{25}$	9.7 (−4)	194.4	∞	∞	∞
1929	lq.	1.234^{15°	....	120	v. sl. s.	s.	s.
1930	pl. or nd.	$1.383^{46^\circ}_{4}$	45	173.0-3.4	s.	v. s.	v. s.
1931	lq.	....	....	107-8	d.	d.	∞
1932	nd./lg.	....	23-4	252	sl. s. bz.	s.	v. sl. s.
1933	rhb.	$1.567^{20^\circ}_{4}$	62-3	245^{759mm}	sl. s.	s.	s.
1934	nd./lg.	....	50	251	v. sl. s.	s.	s.
1935	nd./al.	....	39	....	....	....	....
1936	nd./lg.	....	71.5	272	i.; sl. s. bz.	70^{25°	v. s.
1937	nd.	....	50.5	259-60	i.	s.	....
1938	nd./aq.	....	....	....	s. h.	....	....
1939	yel. lf.	....	261	subl. sl. d.	s. ac.	s. h.	....
1940	yel. nd.	....	209-10	....	s. bz.	sl. s.	sl. s.
1941	yel. nd./ac.	....	208-9	....	i.; s. ac.	i.	s. $PhNO_2$
1942	yel. nd./ac.	....	187.5	....	i., s. h. bz.	v. sl. s.	v. sl. s.
1943	yel. nd./ ac.	....	251	....	i.; s. H_2SO_4	sl. s.	s. PhMe
1944	yel. nd./ac.	....	203-4	....	i.	....	....
1945	pa. yel. nd.	....	202-3	....	s. PhMe	sl. s.	s. $PhNO_2$
1946	yel. nd./ac.	....	268-70	....	i.	sl. s.	s. h. bz.
1947	yel. nd./ac.	....	282	....	i.	....	....
1948	yel. nd.	....	210-1	....	i.	s. PhOMe	....

* Polymerizes on standing.

Dicetyl 2866

Dichloro-acetoacetanilide 42

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Dichloro				
1949	azo-dicarbonamide	azochloramide	$[Cl\cdot N:C(NH_2)\cdot N:]_2$	....	183.01
1950	azoxybenzene	(4,4′)	$(ClC_6H_4)_2N_2O$	XVI-625	267.11
1951	barbituric acid (5,5)	dichloromalonylurea	$Cl_2C(CONH)_2CO$	XXIV-472	196.99
1952	benzene (*o*)	....	$C_6H_4Cl_2$	V-201	147.01
1953	benzene (*m*)	....	$C_6H_4Cl_2$	V-202	147.01
1954	benzene (*p*)	....	$C_6H_4Cl_2$	V-203	147.01
1955	benzene sulfonic acid (2,5)	....	$Cl_2C_6H_3\cdot SO_3H$	XI-55	227.07
1956	benzene sulfonyl chloride (3,4)	....	$Cl_2C_6H_3\cdot SO_2Cl$	*XI-16	245.52
1957	benzidine (3,3′)	....	$(H_2N\cdot C_6H_3Cl)_2$	XIII-234	253.13
1958	benzidine HCl	(3,3′)	$C_{12}H_{10}N_2Cl_2\cdot 2HCl$	XIII-234	326.06
1959	benzoic acid (2,3)	....	$Cl_2C_6H_3\cdot CO_2H$	IX-342	191.02
1960	benzoic acid (2,4)	....	$Cl_2C_6H_3\cdot CO_2H$	IX-342	191.02
1961	benzoic acid (2,5)	....	$Cl_2C_6H_3\cdot CO_2H$	IX-342	191.02
1962	benzoic acid (2,6)	....	$Cl_2C_6H_3\cdot CO_2H$	IX-343	191.02
1963	benzoic acid (3,4)	....	$Cl_2C_6H_3\cdot CO_2H$	IX-343	191.02
1964	benzoic acid (3,5)	....	$Cl_2C_6H_3\cdot CO_2H$	IX-344	191.02
1965	benzophenone (2,4′)	....	$(Cl\cdot C_6H_4)_2CO$	VII-420	251.11
1966	benzophenone (4,4′)	....	$(Cl\cdot C_6H_4)_2CO$	VII-420	251.11
1967	benzoylene urea (6,8)	Sheibley's reagent	$Cl_2C_6H_2\cdot NH\cdot CO\cdot$ $NH\cdot CO$	....	231.04
1968	1-bromoethane (1,1)	....	$CH_3\cdot CCl_2Br$	I-90	177.87
1969	1-bromoethane (2,2)	....	$Cl_2CH\cdot CH_2Br$	I-90	177.87
1970	bromomethane	....	Cl_2CHBr	I-67	163.85
1971	butane (1,1)(*n*)	butylidene dichloride	$C_2H_5CH_2CHCl_2$	I-119	127.02
1972	butane (1,2)(*n*)	butylene chloride	$C_2H_5\cdot CHCl\cdot CH_2Cl$	*I-38	127.02
1973	butane (1,4)(*n*)	tetramethylene diCl	$ClCH_2(CH_2)_2CH_2Cl$	I-119	127.02
1974	butane (*iso*)	1,1-dichloro-2-methyl-propane	$(CH_3)_2CH\cdot CHCl_2$	I-126	127.02
1975	butane (*iso*)	1,3-dichloro-2-methyl-propane	$(ClCH_2)_2CH\cdot CH_3$	**I-88	127.02
1976	butane (*iso*)	1,2-dichloro-2-methyl-propane	$(CH_3)_2CCl\cdot CH_2Cl$	I-126	127.02
1977	butyl alcohol (*tert*)	....	$(CH_2Cl)_2COH\cdot CH_3$	I-382	143.02
1978	butyric acid (α,β)	crotonic acid diCl	$CH_3(CHCl)_2CO_2H$	II-279	157.00
1979	butyric acid	*iso*-crotonic acid diCl	$CH_3(CHCl)_2CO_2H$	II-279	157.00
1980	1,2-dibromoethane	(1,1)	$BrCH_2\cdot CBrCl_2$	I-93	256.78
1981	1,2-dibromoethane	(1,2)	$ClBrCH\cdot CHBrCl$	I-93	256.78
1982	1,1-dibromoethane	(2,2)	$Br_2CH\cdot CHCl_2$	I-93	256.78
1983	dibromomethane	....	Cl_2CBr_2	I-68	242.76
1984	diethyl carbonate	(β,β')	$(ClCH_2CH_2O)_2CO$	....	187.03
1985	diethyl sulfide (β,β')	mustard gas	$(Cl\cdot CH_2CH_2)_2S$	I-349	159.08

Dichloro-*iso*-butane 1975-6

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1949	yel. nd.	....	expl. 155	....	i.	s.	sl. s.
1950	yel. nd./al.	....	155-6	subl.	i.	sl. s.	s.
1951	rhb. pr./aq.	....	219-20 d.	....	sl. s.; v. sl. s. bz.	v. s.; v. sl. s. chl.	v. s.; v. s. ac.
1952	col. lq.	$1.305^{20^\circ}_{4}$	–17.6	179	i.; ∞ bz.	∞	∞
1953	col. lq.	$1.288^{20^\circ}_{4}$	–24.8	$172^{766\text{mm}}$	i.	s.	s.
1954	col. mn.	1.458^{21°	53	$174^{764\text{mm}}$	i.; s. bz.	∞ h. abs.	v. s.
1955	nd./aq.	....	>100	....	v. s.	....	v. sl. s.
1956	mn./bz.	....	22.4	$170\text{-}4^{20\text{mm}}$	d.	d.	....
1957	nd./al.	....	132-3	....	i.	s.; s. bz.	s. ac.
1958	nd.	....	....	....	v. sl. s.	s.	....
1959	nd.	....	166	....	sl. s. h.	s.	s.
1960	nd./aq.	....	164	subl.	s. h.	s.	s.
1961	nd./aq.	....	154	301	0.09^{14°	s.	s. alk.
1962	nd./al.	....	140-3	subl.	s. h.	s. bz.	s. alk.
1963	nd./aq.	....	203-4	....	s. h.	v. s.	s. alk.
1964	nd./al.	....	182-3	subl.	....	v. s.	....
1965	col. mn./al.	1.393^{14°	66-7	$214\text{-}5^{22\text{mm}}$	i.; s. act.	190^{25° bz.	48^{25°
1966	col. lf./al.	....	145	$353^{757\text{mm}}$	i.; s. act.	12^{35° bz.	2^{25°
1967	col. nd./al.	....	296	....	i.; i. aq. NaOH	1 h.; s. aq. KOH	i.; v. sl. s. h. gly.
1968	lq.	1.752^{16°	....	$98\text{-}9^{758\text{mm}}$	....	....	....
1969	lq.	....	....	138	....	....	....
1970	col. lq.	$2.006^{15^\circ}_{4}$	-56	91-2	....	....	....
1971	oil	....	....	113-5	i.	s.	s.; s. chl.
1972	lq.	....	....	124	....	....	....
1973	lq.	....	–38.7	161-3	....	....	....
1974	lq.	1.011^{12°	....	103-5 d.	....	....	....
1975	col. lq.	1.138^{20°	....	135-9	....	....	....
1976	col. lq.	1.097^{20°	....	107-8	....	....	....
1977	col. lq.	$1.277^{20^\circ}_{4}$	....	174-5	8.2	s.	s.
1978	pr.	....	62.5-3.0	$124\text{-}5^{20\text{mm}}$	sl. s.	v. s.	$328^{10.5^\circ}$
1979	long pr.	....	78 (73)	$131.5^{20\text{mm}}$	sl. s.	v. s.	v. s.
1980	lq.	2.270^{16°	-66.9	176-8	i.	....	....
1981	lq.	....	-26	194-5	i.	....	....
1982	lq.	2.391^{19°	....	195-200	i.	....	....
1983	nd.	$2.42^{25^\circ}_{0}$	22	135±	i.	....	....
1984	pa. yel. lq.	....	....	$109\text{-}12^{12\text{mm}}$	....	....	....
1985	col. oil	$1.275^{20^\circ}_{4}$	13-4	217 sl. d.	0.07^{25°	s.; s. bz.; s. chl.	s.; s. ac.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Dichloro				
1986	diiodomethane	....	Cl_2CI_2	I-72	336.76
1987	2,2′-dinitrodiphenyl disulfide	(4,4′)	$(O_2N \cdot C_6H_3Cl \cdot S)_2$	VI-341	377.22
1988	dioxane (2,3)	....	$O \cdot (CHCl)_2O(CH_2)_2$	....	157.00
1989	diphenyl (3,3′)	....	$Cl \cdot C_6H_4 \cdot C_6H_4 \cdot Cl$	V-579	223.10
1990	diphenyl (4,4′)	....	$Cl \cdot C_6H_4 \cdot C_6H_4 \cdot Cl$	V-579	223.10
1991	dipropyl ether (*n*)	(γ,γ′)	$(ClCH_2CH_2CH_2)_2O$	**I-370	171.07
1992	dipropyl ether (*iso*)	(β,β′)	$[ClCH_2(CH_3)CH]_2O$	**I-370	171.07
1993	ethane (1,1)	ethylidene dichloride	$CH_3 \cdot CHCl_2$	I-83	98.97
1994	ethane (1,2)	ethylene chloride	$ClCH_2 \cdot CH_2Cl$	I-84	98.97
1995	ether (α,β)	....	$ClCH_2 \cdot CHCl \cdot O \cdot C_2H_5$	I-612	143.02
1996	ether (β,β′)(*sym*)	diCl-Et ether	$(ClCH_2 \cdot CH_2)_2O$	**I-335	143.02
1997	ethyl alcohol (β,β)	2,2-dichloro-ethanol-1	$Cl_2CH \cdot CH_2OH$	I-338	114.97
1998	ethylene (α,α)	1,1-dichloro-ethene	$CH_2{:}CCl_2$	I-186	96.95
1999	fluorescein (2,7)	....	$C_{20}H_{10}O_5Cl_2$	*XIX-722	401.19
2000	fluorescein (3′,6′)	....	$C_{20}H_{10}O_5Cl_2$	XIX-227	401.19
2001	hexane	2,3-dichloro-2,3-dimethyl-butane	$[(CH_3)_2CCl]_2$	I-152	155.07
2002	hexane	3,3-dichloro-2,2-dimethyl-butane	$(CH_3)_3C \cdot CCl_2 \cdot CH_3$	I-150	155.07
2003	hydroquinone (2,3)	....	$(HO)_2C_6H_2Cl_2$	VI-849	179.01
2004	hydroquinone (2,5)	....	$(HO)_2C_6H_2Cl_2$	VI-850	179.01
2005	1-iodoethane (2,2)	....	$ICH_2 \cdot CHCl_2$	I-98	224.88
2006	iodomethane	....	Cl_2CHI	I-71	210.85
2007	maleic acid	....	$({:}CCl \cdot CO_2H)_2$	II-753	184.97
2008	methyl ether (*sym*)	....	$ClCH_2 \cdot O \cdot CH_2Cl$	I-582	114.97
2009	naphthalene (1,2)	....	$C_{10}H_6Cl_2$	V-542	197.06
2010	naphthalene (1,3)	θ-dichloronaphthalene	$C_{10}H_6Cl_2$	V-542	197.06
2011	naphthalene (1,4)	β-dichloronaphthalene	$C_{10}H_6Cl_2$	V-542	197.06
2012	naphthalene (1,5)	γ-dichloronaphthalene	$C_{10}H_6Cl_2$	V-543	197.06
2013	naphthalene (1,6)	η-dichloronaphthalene	$C_{10}H_6Cl_2$	V-543	197.06
2014	naphthalene (1,7)	θ′-dichloronaphthalene	$C_{10}H_6Cl_2$	V-543	197.06
2015	naphthalene (1,8)	ζ-dichloronaphthalene	$C_{10}H_6Cl_2$	V-544	197.06
2016	naphthalene (2,3)	ι-dichloronaphthalene	$C_{10}H_6Cl_2$	V-544	197.06
2017	naphthalene (2,6)	ε-dichloronaphthalene	$C_{10}H_6Cl_2$	V-544	197.06
2018	naphthalene (2,7)	δ-dichloronaphthalene	$C_{10}H_6Cl_2$	V-544	197.06
2019	α-naphthol (2,4)	....	$Cl_2C_{10}H_5OH$	VI-612	213.06
2020	α-naphthoquinone	(2,3)	$O{:}C_{10}H_4Cl_2{:}O$	VII-729	227.05

Dichloro-ethanal 1926
Dichloro-ethane 1993-4
Dichloro-ethanol 1997

Dichloro-ethene 135-6, 1998
Dichloro-ethyl ether 1996
Dichloro-ethylene 135-6

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
1986	scales	....	85 d.	....	i.	s. d.	....
1987	yel. cr./ act.-al.	....	213-4	....	v. sl. s. CS_2	v. sl. s.	v. sl. s. lg.; sl. s. bz.
1988	col. lq.	....	....	88-9^{19mm}	....	....	....
1989	nd./al.	....	23	322-4	i.	v. s.	v. s.
1990	pr. or nd.	1.442$_{4}^{0°}$	148	315-9	i.; 14$^{25°}$bz.	v. sl. s.	4$^{25°}$
1991	oil	1.140$\frac{20°}{20}$	....	215^{745mm}	....	....	....
1992	col. lq.	1.112$\frac{20°}{20}$	....	187.3	0.17$^{20°}$	....	....
1993	col. lq.	1.175$\frac{20°}{4}$	–96.7	57.3	0.7$^{0°}$; 0.5$^{30°}$	∞	∞
1994	col. lq.	1.256$\frac{20°}{20}$	–35.3	83.7	0.9$^{0°}$; 0.9$^{30°}$	∞; ∞ chl.	∞
1995	lq.	1.174$^{23°}$	....	140-5	....	....	....
1996	lq.	1.222$\frac{20°}{20}$	....	178.5	1.07$^{20°}$	s.	s.
1997	lq.	1.145$^{15°}$	....	146	sl. s.	s.	s.
1998	lq.	1.250$^{15°}$	....	37	i.	....	....
1999	or. pd.	....	....	....	sl. s.	sl. s.	sl. s.
2000	or. pd.	....	....	....	v. s. alk.	....	....
2001	cr.	....	159-60	....	i.	....	....
2002	cr.	....	151	subl.	i.	....	....
2003	nd./aq.	....	144-5	subl.	i. c. lg.	s.	s.
2004	mn. nd./ act.	1.815$^{24°}$	166-70	subl.	s. h.; s. ac.	v. s.	v. s.
2005	lq.	2.219	....	171-2	i.	....	....
2006	lq.	2.403$^{21.5°}$	....	132	i.	....	....
2007	nd.	....	d. 119-20	....	v. s.; i. chl.	v. s.	v. s.
2008	col. lq.	1.328$\frac{15°}{4}$	....	104-5	d.	....	....
2009	nd./al.	1.315$\frac{48.5°}{4}$	37	282	....	....	....
2010	nd./al.	....	61.5	291^{775mm}	....	....	....
2011	nd./al.	1.300$\frac{76°}{4}$	67-8	286-7^{740mm}	v. s. act.	v. sl. s.	....
2012	lf./al.	....	107	....	i.	s.	s.
2013	nd./al.	....	48-9	....	....	....	....
2014	lf./aq. al.	1.261$\frac{100°}{4}$	63-4	285-6	....	s.	s.
2015	cr./al.	1.292$\frac{100°}{4}$	88	d.	....	....	....
2016	lf.	....	120	....	....	s. h.	s.
2017	nd./al.	....	135-6	285	....	sl. s.	v. s.
2018	pr.	....	114	....	....	v. s. h.	....
2019	nd./aq. al.	....	106-7	....	s. bz.	s.; s. ac.	s.
2020	yel. nd./al.	....	192-3	....	i.	s. h.	sl. s.

Dichloro-fluoran 3252
Dichloro-hydrin 3393-4
Dichloro-malonyl urea 1951
Dichloro-methane 4429

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Dichloro				
2021	4-nitroaniline	(2,6;4,1)	$Cl_2C_6H_2(NO_2)NH_2$	XII-735	207.02
2022	nitrobenzene (2,4)	NO_2-Cl-benzene	$Cl_2C_6H_3 \cdot NO_2$	V-245	192.01
2023	nitrobenzene (2,5)	....	$Cl_2C_6H_3 \cdot NO_2$	V-245	192.01
2024	nitrobenzene (2,6)	....	$Cl_2C_6H_3 \cdot NO_2$	V-246	192.01
2025	nitrobenzene (3,4)	....	$Cl_2C_6H_3 \cdot NO_2$	V-246	192.01
2026	nitrobenzene (3,5)	....	$Cl_2C_6H_3 \cdot NO_2$	V-246	192.01
2027	1-nitroethane (1,1)	....	$Cl_2C(NO_2) \cdot CH_3$	....	143.97
2028	nitrohydrin	diCl-Pr-nitrate	$ClCH_2 \cdot CHCl \cdot CH_2 \cdot NO_3$	I-356	173.99
2029	nitrophenol	(4,6;2,1)	$Cl_2C_6H_2(NO_2)OH$	VI-241	208.01
2030	nitrophenol	(2,6;4,1)	$Cl_2H_6H_2(NO_2)OH$	VI-241	208.01
2031	nitropropane	(1,1,1)	$C_2H_5 \cdot C(NO_2)Cl_2$	....	157.99
2032	1-nitrosoethane (1,1)	....	$CH_3 \cdot CCl_2 \cdot NO$	I-99	127.97
2033	pentane (1,4)	....	$CH_3CHCl(CH_2)_3Cl$	I-131	141.04
2034	pentane (1,5)	amylene chloride	$ClCH_2(CH_2)_3CH_2Cl$	I-131	141.04
2035	pentane (2,3)	....	$C_2H_5(CHCl)_2CH_3$	I-131	141.04
2036	pentane (2,4)	....	$(CH_3CHCl)_2{:}CH_2$	*I-43	141.04
2037	pentane	1,4-dichloro-2-methyl-butane	$ClCH_2 \cdot CH(CH_3) \cdot CH_2 \cdot CH_2Cl$	*I-47	141.04
2038	pentane	2,3-dichloro-2-methyl-butane	$(CH_3)_2CCl \cdot CHCl \cdot CH_3$	I-135	141.04
2039	pentane	2,4-dichloro-2-methyl-butane	$(CH_3)_2CCl \cdot CH_2 \cdot CH_2Cl$	I-135	141.04
2040	pentane	3,4-dichloro-2-methyl-butane	$(CH_3)_2CH \cdot CHCl \cdot CH_2Cl$	I-135	141.04
2041	pentane	4,4-dichloro-2-methyl-butane	$(CH_3)_2CH \cdot CH_2 \cdot CHCl_2$	I-135	141.04
2042	phenol (2,4)	....	$Cl_2C_6H_3 \cdot OH$	VI-189	163.01
2043	phenyl-3,4-dichlorobenzene sulfonate (2,4)	....	$Cl_2C_6H_3SO_3 \cdot C_6H_3Cl_2$	....	372.06
2044	phenylhydrazine	(2,5)	$Cl_2C_6H_3 \cdot NH \cdot NH_2$	XV-431	177.04
2045	phenylhydrazine-4-sulfonic acid	(2,5)	$Cl_2C_6H_2(SO_3H) \cdot NH \cdot NH_2$	XV-643	257.10
2046	phenyl-phenyl phosphate (*o*,*o*′)	phosphen 4	$C_6H_5 \cdot O \cdot PO{:}(ClC_6H_4 \cdot O)_2$	....	395.18
2047	phenyl-4-toluene sulfonate	....	$CH_3 \cdot C_6H_4 \cdot SO_3 \cdot C_6H_3Cl_2$	....	317.18
2048	*p*-phenylenediamine	(2,6)	$Cl_2C_6H_2(NH_2)_2$	XIII-118	177.04
2049	*p*-phenylenediamine HCl	(2,6)	$Cl_2C_6H_2(NH_2)_2 \cdot HCl$	....	213.50
2050	propane (1,1)	propylidene diCl	$C_2H_5 \cdot CHCl_2$	I-105	112.99
2051	propane (1,2)	propylene chloride	$CH_3 \cdot CHCl \cdot CH_2Cl$	I-105	112.99
2052	propane (1,3)	trimethylene diCl	$ClCH_2 \cdot CH_2 \cdot CH_2Cl$	I-105	112.99
2053	propane (2,2)	acetone chloride	$(CH_3)_2CCl_2$	I-105	112.99
2054	propionic acid (*α*,*α*)	....	$CH_3 \cdot CCl_2 \cdot CO_2H$	II-250	142.98
2055	propionic acid (*α*,*β*)	....	$ClCH_2 \cdot CHCl \cdot CO_2H$	II-252	142.98
2056	propionitrile (*α*,*α*)	....	$CH_3 \cdot CCl_2 \cdot CN$	II-251	123.98
2057	propyl carbonate	(*γ*,*γ*′)	$[Cl(CH_2)_3O]_2CO$	....	215.08
2058	propylene (*α*,*α*)	1,1-diCl-propene-1	$CH_3 \cdot CH{:}CCl_2$	I-199	110.98
2059	propylene (*α*,*β*)	allylene dichloride	$CH_3 \cdot CCl{:}CHCl$	I-199	110.98

Dichloro-propanol 3393-4
Dichloro-propene 2058-61
Dichloro-propyl acetate 45
Dichloro-propyl carbamate 171

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2021	yel. nd./ac.	....	194-5	....	i. h. HCl	s.	....
2022	nd./al.	$1.439^{80°}$	33	258.5	i.	v. s. h.	∞
2023	tri./al.	$1.669^{22°}$	54.6	266	i.	v. s. h.	v. s. bz.
2024	mn. pr.	$1.603^{17°}$	72.5	130^{8mm}	i.	s.	s. CS_2
2025	nd./al.	$1.456^{7.5°}_{4}$	42-3(α)*	255-6	....	....	....
2026	yel. mn.	$1.692^{14°}$	65.4	....	i.	s.	s. ac.
2027	lq.	$1.405^{20°}_{20}$	....	122-5	$<0.5^{20°}$	....	....
2028	lq.	$1.37^{°}$	....	180	....	....	....
2029	yel. mn./al.	$1.822^{20°}_{4}$	122-3	subl. <100	sl. s.	sl. s.; s. bz.	s; s. chl.
2030	yel. pl./et.	....	125 d.	....	i.; sl. s. bz.	s. h.	v. s.
2031	lq.	$1.314^{20°}_{20}$	....	141-4	$<0.5^{20°}$	....	....
2032	b. oil	$1.252^{19°}$	....	68	i.	....	....
2033	col. lq.	....	....	$58\text{-}60^{15mm}$	i.	∞	∞
2034	col. lq.	$1.094^{25°}_{4}$	....	180-1	i.; s. CS_2	s.; s. chl.	s.
2035	col. lq.	....	....	138-9	i.	∞	∞
2036	col. lq.	$1.063^{18°}$	....	147-50	i.	∞	∞
2037	col. lq.	$1.103^{21°}_{4}$	....	170-2	i.	∞	∞
2038	lq.	$1.068^{15°}_{4}$	....	130-5	i.	∞	∞
2039	col. lq.	$1.065^{20°}_{4}$	....	152-4 sl. d.	i.	∞	∞
2040	col. lq.	$1.092^{17.5°}$	....	143-5	i.	∞	∞
2041	col. lq.	$1.05^{24°}$	....	130	i.	∞	∞
2042	nd./bz.	$1.383^{60°}_{25}$	45	209-10	$0.45^{20°}$ v. s. chl.	v. s.; $160^{25°}$ CCl_4	v. s.; v. s. bz.
2043	col. cr.	....	81-2	....	i.	s. h.	s.
2044	nd./aq.	....	105	....	sl. s. h.	s.	s.; s. ac.
2045	nd./aq. HCl	....	....	....	....	....	....
2046	col. lq.	$1.34^{25°}_{25}$	<0	$255\text{-}7^{5mm}$	i.; ∞ bz.	v. s.	∞ CCl_4
2047	col. nd.	....	118-9	....	i.	s. h.	i.
2048	nd./aq. al.	....	123.5	....	....	s.	s.
2049	col. pd.	....	....	....	s.	sl. s.	i.
2050	lq.	$1.143^{10°}$	....	87	v. sl. s.	s.	....
2051	col. lq.	$1.159^{20°}_{20}$	<-70	96.8	$0.27^{20°}$	v. s.	v. s.
2052	lq.	$1.201^{15°}$	....	123-5	$0.27^{25°}$	s.	s.
2053	lq.	$1.093^{20°}_{20}$	-34.6	69.7	i.	s.	∞ CS_2
2054	col. lq.	$1.389^{22°}_{4}$	....	185-90	v. s.	v. s.	....
2055	nd.	....	50 (36)	210 d.	s.	s.	....
2056	col. lq.	$1.431^{15°}$	....	105	i.	∞	∞
2057	col. lq.	....	....	265-70	....	....	....
2058	lq.	$1.176^{19\text{-}5°}_{0}$	....	78	i.	....	....
2059	lq.	....	....	75	i.	....	....

* β modification, liquid, changes to α at 15°.
Dichloro-propyl nitrate 2028

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Dichloro				
2060	propylene (β,γ)	epidichlorohydrin (α)	$CH_2:CCl \cdot CH_2Cl$	I-199	110.98
2061	propylene (α,γ)	epidichlorohydrin (β)	$CH_2Cl \cdot CH:CHCl$	I-199	110.98
2062	quinazoline (2,4)	....	$C_6H_4 \cdot N:CCl \cdot N:CCl$	XXIII-176	199.04
2063	quinoline (2,3)	....	$C_9H_5NCl_2$	XX-361	198.05
2064	quinoline (2,4)	....	$C_9H_5NCl_2$	XX-361	198.05
2065	quinoline (2,7)	....	$C_9H_5NCl_2$	XX-361	198.05
2066	quinoline (5,6)	....	$C_9H_5NCl_2$	XX-361	198.05
2067	quinoline (5,8)	....	$C_9H_5NCl_2$	XX-362	198.05
2068	quinoline (6,8)	....	$C_9H_5NCl_2$	XX-362	198.05
2069	quinoline (7,8)	....	$C_9H_5NCl_2$	....	198.05
2070	quinone (2,5)	....	$Cl_2C_6H_2O_2$	VII-633	176.99
2071	quinone (2,6)	....	$Cl_2C_6H_2O_2$	VII-633	176.99
2072	quinone-chloroimide	....	$O:C_6H_2Cl_2:NCl$	VII-634	210.46
2073	tetrabromoethane	(2,2;1,1,1,2)	$Br_3C \cdot CCl_2Br$	I-95	414.60
2074	*p*-toluenesulfonamide (*N,N*)	dichloramine T	$CH_3 \cdot C_6H_4 \cdot SO_2NCl_2$	....	240.11
2075	tribromoethane	....	$Br_2CCl \cdot CHBrCl$	I-94	335.69
2076	tribromoethane	....	$Br_2CH \cdot CCl_2Br$	I-94	335.69
2077	tyrosine (3,5)(*dl*)	....	$Cl_2C_6H_2(OH) \cdot CH_2 \cdot CHNH_2CO_2H \cdot 2H_2O$	*XIV-670	286.12
2078	**Dicinnamalacetone**	....	$[C_6H_5(CH:CH)_2]_2CO$	VII-524	286.35
2079	**Dicresol** (*o*)	4,4′-diOH;3,3′-diMe	$(CH_3 \cdot C_6H_3OH)_2$	VI-1009	214.25
2080	**Dicyandiamide**	param	$H_2N \cdot C(:NH) \cdot NH \cdot CN$	III-91	84.08
2081	**Dicyano**-diamidine	guanyl urea; biuretamidine	$H_2N \cdot C(:NH) \cdot NH \cdot CONH_2$	III-89	102.10
2082	diamidine H_2SO_4	....	$C_2H_6ON_4 \cdot \frac{1}{2}H_2SO_4 \cdot H_2O$	III-90	338.31
2083	**Dicyclohexyl**	decahydro-diPh	$(CH_2(CH_2)_4CH\cdot)_2$	V-108	166.30
2084	adipate	....	$(CH_2CH_2CO_2C_6H_{11})_2$	....	310.42
2085	amine	....	$(C_6H_{11})_2NH$	XII-6	181.31
2086	maleate	....	$(:CHCO_2C_6H_{11})_2$	....	280.35
2087	oxalate	....	$(CO_2C_6H_{11})_2$	*VI-6	254.32
2088	phthalate	....	$C_6H_4(CO_2C_6H_{11})_2$	IX-799	330.41
2089	**Dicyclopentadiene**	....	$(\cdot CH:CH \cdot CH_2 \cdot CH:CH)_2$	V-495	132.20
2090	**Diethanolamine**	iminoethyl alcohol	$HN(CH_2 \cdot CH_2OH)_2$	IV-283	105.14
2091	**Diethoxy**-benzene (*o*)	....	$(C_2H_5O)_2C_6H_4$	VI-771	166.21
2092	benzene (*m*)	....	$(C_2H_5O)_2C_6H_4$	VI-814	166.21
2093	benzene (*p*)	....	$(C_2H_5O)_2C_6H_4$	VI-844	166.21
2094	ethyl carbonate	....	$(C_2H_5O \cdot C_2H_4)_2CO_3$	....	206.23
2095	ethyl maleate	....	$(:CHCO_2C_2H_4OC_2H_5)_2$	....	260.28
2096	ethyl phthalate	....	$C_6H_4(CO_2C_2H_4OC_2H_5)_2$	....	310.34
2097	ethyl sebacate	....	$[C_2H_5OC_2H_4CO_2 \cdot CH_2(CH_2)_2CH_2\cdot]_2$	....	346.45
2098	quinazoline (2,4)	....	$C_{12}H_{14}O_2N_2$	XXIII-486	218.25

Dichloro-sulfanilic acid 1938
Dichloro-xylene (ω) 6494-6

Dicresyl carbonate 2835
Dicresyl phthalate 2841

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2060	col. lq.	1.204^{25°	....	94	i.	∞	∞
2061	col. lq.	$1.233^{17.5^\circ}$	....	106-9	....	....	....
2062	nd.	....	120	....	i.	s.; i. lg.	s.; s. bz.
2063	cr./aq. al.	....	104-5	....	i.; i. alk.	s.; s. bz.	s.; sl. s. lg.
2064	nd./aq. al.	....	67	280-2	v. sl. s. h.	s.; s. chl.	s.; s. bz.
2065	nd./al.	....	98	....	sl. s.	s.	....
2066	nd.	....	85	....	sl. s.	s.	s. pet.
2067	nd./al.	....	92-3	....	....	s.	s.
2068	nd./al.	....	103-4	....	....	s.	....
2069	nd.	....	85.5	....	....	....	....
2070	lt. yel./bz.	....	155-60	....	sl. s. h.	v. s.	v. s.; sl. s. bz.
2071	rhb./al.	....	120-1	subl. <120	sl. s. h.	v. s. h.	s. chl.
2072	yel. nd./al.	....	67-8	d. 170	v. sl. s.	s. h.	v. s.; s. chl.
2073	cr.	....	180 d.	....	....	....	....
2074	pr./chl.-pet.	....	83	....	v. sl. s.	d. h.; s. chl.	120 bz.
2075	col. lq.	$2.626^{21.5^\circ}$	−5	133^{35mm}	....	....	....
2076	col. lq.	....	....	215-20	....	....	....
2077	pr./aq.	....	252±, d.	....	4; sl. s. bz.	v. sl. s.	v. sl. s.
2078	yel. nd. al.	....	146	....	i.; s. ac.	s. h.	sl. s.
2079	cr./PhMe	....	161	....	s. h.; s. ac.	s.; s. h. bz.	s.
2080	mn. pl.	1.40^{14°	207-8	d.	2.3^{13°	1.3^{13°	0.01^{13°
2081	cr./al.	....	105	d. 160	s. h.	sl. s. c.	i.
2082	col. nd.	....	193-5	$-H_2O$, 110	5 c.; 33 h.	sl. s.; s. dil. a.	i.
2083	lq.	$0.886^{21^\circ}_{4}$	3.6	236^{758mm}	i.; ∞ act.	7^{25° MeOH	∞; ∞ bz.
2084	col. nd.	....	33-5	....	i.	s.	s.
2085	col. lq.	0.925^{18°	20±	$254\text{-}6^{745mm}$	0.16^{28°	v. s.; s. bz.	∞
2086	col. pl.	....	82-3	....	i.	sl. s.	v. s.
2087	cr./MeOH	....	42-3	$190\text{-}1^{73mm}$	....	v. s.	v. s.
2088	pr./al.	....	66	....	i.	s.	....
2089	col. cr.	0.976^{35°	32.9 (19)	170 sl. d.	....	v. s.	v. s.
2090	pr.	$1.097^{20^\circ}_{4}$	28	270^{748mm}	∞; i. bz.	∞	v. sl. s.
2091	cr./pet.	....	43-5	....	....	....	....
2092	pr.	....	12.4	$234\text{-}5^{756mm}$	i.	s.	s.
2093	mn. lf.	....	71-2	246	i.	s.; s. bz.	s.; s. chl.
2094	col. lq.	....	....	$124\text{-}7^{15mm}$	....	....	....
2095	col. lq.	....	....	$174\text{-}7^{11mm}$	....	....	....
2096	col. lq.	....	31-3	....	i.	s.	s.
2097	col. lq.	....	−1±	$224\text{-}6^{8mm}$	....	....	....
2098	nd.	....	55	....	i.	s.	s.

Diethoxy-ethane 2139
Diethoxy-methane 2172

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2099	**Diethyl-**acetaldehyde	2-Et-butyraldehyde	$(C_2H_5)_2CH{\cdot}CHO$	I-693	100.16
2100	acetamide (*N,N*)	acetyl diEt-amine	$CH_3CO{\cdot}N(C_2H_5)_2$	IV-110	115.17
2101	acetic acid	....	$(C_2H_5)_2CH{\cdot}CO_2H$	II-333	116.16
2102	acetoacetic ester	....	$CH_3CO{\cdot}C(C_2H_5)_2{\cdot}CO_2C_2H_5$	III-710	186.24
2103	acetonedicarboxylate	....	$CO(CH_2CO_2C_2H_5)_2$	III-791	202.20
2104	acetonitrile	3-cyano-pentane	$(C_2H_5)_2CH{\cdot}CN$	II-334	97.16
2105	acetyl succinate	....	$CH_3CO{\cdot}C_2H_3{:}(CO_2C_2H_5)_2$	III-801	216.23
2106	adipate	....	$[{\cdot}(CH_2)_2CO_2C_2H_5]_2$	II-652	202.24
2107	allyl-acetamide	novonal	$(C_2H_5)_2C_3H_5{:}C{\cdot}CONH_2$	....	155.23
2108	allyl-malonate	....	$C_3H_5{\cdot}CH(CO_2C_2H_5)_2$	II-776	200.23
2109	amine	....	$(C_2H_5)_2NH$	IV-95	73.14
2110	amine hydrochloride	....	$(C_2H_5)_2NH{\cdot}HCl$	IV-97	109.60
2111	aminobenzaldehyde	(*p*)	$(C_2H_5)_2N{\cdot}C_6H_4{\cdot}CHO$	XIV-36	177.24
2112	aminoethanol (β)	....	$(C_2H_5)_2N{\cdot}CH_2CH_2{\cdot}OH$	IV-282	117.19
2113	aminoglycerol (α)	1-diethylamino-2,3-propandiol	$(C_2H_5)_2N{\cdot}CH_2{\cdot}CHOH{\cdot}CH_2OH$	IV-302	147.21
2114	aminophenetole (*m*)	diEt-*m*-phenetidine	$C_2H_5O{\cdot}C_6H_4{\cdot}N(C_2H_5)_2$	XIII-410	193.28
2115	aminophenol (*m*)	....	$(C_2H_5)_2N{\cdot}C_6H_4{\cdot}OH$	XIII-408	165.23
2116	aminophenol oxalate (*m*)	hydroxy-diEt-aniline oxalate	$(C_2H_5)_2N{\cdot}C_6H_4{\cdot}OH{\cdot}H_2C_2O_4$	XIII-410	255.26
2117	aminopropyl alcohol (β)	....	$(C_2H_5)_2N{\cdot}CH(CH_3){\cdot}CH_2OH$	....	131.21
2118	aminopropyl alcohol (γ)	....	$(C_2H_5)_2N{\cdot}CH_2{\cdot}CH_2{\cdot}CH_2OH$	IV-288	131.21
2119	aminopropyl cinnamate HCl	apothesine	$(C_2H_5)_2N(CH_2)_3O{\cdot}CO{\cdot}C_8H_7{\cdot}HCl$	....	297 82
2120	ammonium diethyldithiocarbamate	....	$(C_2H_5)_2N{\cdot}CS{\cdot}S{\cdot}NH_2(C_2H_5)_2$	....	222.40
2121	aniline (*N*)	....	$(C_2H_5)_2N{\cdot}C_6H_5$	XII-164	149.23
2122	aniline sulfonic acid (*m*)	diethylaminobenzene sulfonic	$(C_2H_5)_2N{\cdot}C_6H_4{\cdot}SO_3H$	XIV-690	229.29
2123	azelate	ethyl azelate	$(CH_2)_7(CO_2C_2H_5)_2$	II-709	244.32
2124	barbituric acid (5,5)	veronal; barbital	$C_8H_{12}O_3N_2$	XXIV-485	184.19
2125	barbituric Na	medinal	$C_8H_{11}O_3N_2Na$	XXIV-487	206.18
2126	benzene (*o*)	....	$(C_2H_5)_2C_6H_4$	V-426	134.21
2127	benzene (*m*)	....	$(C_2H_5)_2C_6H_4$	V-426	134.21
2128	benzene (*p*)	....	$(C_2H_5)_2C_6H_4$	V-426	134.21
2129	benzoylene urea (1,3)	....	$C_6H_4{\cdot}N(C_2H_5){\cdot}CO{\cdot}$ $N(C_2H_5){\cdot}CO$	XXIV-376	218.25
2130	benzylmalonate	....	$C_7H_7{\cdot}CH(CO_2C_2H_5)_2$	IX-869	250.28
2131	bromoacetamide (α)	neuronal	$(C_2H_5)_2CBr{\cdot}CO{\cdot}NH_2$	II-334	194.08
2132	bromomaleate	....	$CH{:}CBr(CO_2C_2H_5)_2$	II-755	251.08

Diethyl acetal 4
Diethyl-amino-propylene glycol 2113
Diethyl beryllium 845

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2099	lq.	$0.816_{20}^{20^\circ}$	....	117-8	0.3^{20°	∞	∞
2100	lq.	$0.925^{8.5^\circ}$	....	185-6	....	....	....
2101	col. lq.	$0.920_{0}^{18^\circ}$	<−15	195-7	sl. s.	s.	s.
2102	col. lq.	$0.965_{4}^{25^\circ}$	....	212	....	....	....
2103	oil	$1.113_{4}^{20^\circ}$	....	250	v. sl. s.	∞	∞
2104	oil	....	....	144-6	....	∞	∞
2105	lq.	$1.080_{5}^{25^\circ}$	....	254-6 d.	i.	s.	....
2106	col. lq.	$1.009_{4}^{20^\circ}$	−21	$239\text{-}41^{761mm}$	0.43^{30°	s.	s.
2107	wh. pd.	....	75-6	....	0.9	s.	s.
2108	col. lq.	$1.006_{25}^{25^\circ}$	....	222-3	i.	s.	s.
2109	col. lq.	$0.712_{15}^{15^\circ}$	−38.9	55.5^{759mm}	v. s.*	∞	∞
2110	lf./al. et.	$1.048_{4}^{21^\circ}$	228-9	320-30	232^{25°	sl. s. c.	i.
2111	yel. nd./ aq.	....	41	174^{7mm}	....	s.	s.
2112	lq.	$0.885_{20}^{20^\circ}$	....	162.1	∞	∞	s.
2113	syrup	....	....	233-5	s.	s.	s.; s. chl.
2114	oil	....	....	286	i.	s.	s. ac.
2115	rhb./CS_2-lg.	....	78	276-80	s.; s. chl.	s. CS_2	i. lg.
2116	cr.	....	....	155-6	....	....	....
2117	lq.	....	....	$61\text{-}3^{25mm}$	....	....	....
2118	lq.	....	....	189.5	v. s.	....	....
2119	col. cr.	....	136	....	s.	s.; sl. s. act.	sl. s.
2120	pa. yel. pl.	....	70-2	....	v. s.	v. s.	v. sl. s.
2121	oil	$0.934_{4}^{20^\circ}$	−34.4	216	1.4^{12°	s.	s.
2122	cr.	....	270 d.	....	s.	....	....
2123	lq.	$0.973_{4}^{20^\circ}$	−16	291-2	i.	s.	s.
2124	col. cr.	....	191	subl. vac.	0.7 c.; 8 h.	s. h.	s.; s. alk.
2125	col. cr.	....	....	....	20 c.; 40 h.	0.25	i.
2126	col. lq.	$0.881_{4}^{20^\circ}$	−31.4	183.5	i.	s.	s.
2127	col. lq.	$0.864_{4}^{20^\circ}$	−83.9	181.1	i.	s.	s.
2128	col. lq.	$0.862_{4}^{20^\circ}$	−43.2	183.8	i.	s.	s.
2129	nd.	....	110-11	....	i.	s.	....
2130	lq.	$1.077_{15}^{15^\circ}$	....	298-300	i.	....	....
2131	col. cr.	....	66-7	d. 160-70	0.8 c.; s. h.	v. s.; s. bz.	v. s.
2132	col. lq.	$1.410^{17.5^\circ}$	....	256	....	....	....

* Forms a hydrate $+1H_2O$, m. p. −19°.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Diethyl				
2133	bromomalonate	Et bromomalonate	$CHBr(CO_2C_2H_5)_2$	II-594	239.07
2134	*n*-butylmalonate	...	$C_4H_9\cdot CH(CO_2C_2H_5)_2$	*II-282	216.27
2135	butylmalonate	(*sec*)	$C_5H_{10}(CO_2C_2H_5)_2$	II-679	216.27
2136	butylmalonate	(*iso*)	$C_5H_{10}(CO_2C_2H_5)_2$	II-683	216.27
2137	carbanilide	...	$[(C_2H_5)(C_6H_5)N]_2CO$	XII-422	268.35
2138	carbonate	...	$CO(OC_2H_5)_2$	III-5	118.13
2139	cellosolve	diEtO-ethane	$(C_2H_5O\cdot CH_2)_2$	I-468	118.17
2140	chlorofumarate	...	$CH{:}CCl(CO_2C_2H_5)_2$	II-745	206.63
2141	chloromaleate	...	$CH{:}CCl(CO_2C_2H_5)_2$	II-753	206.63
2142	citraconate	...	$CH_3\cdot C_2H(CO_2C_2H_5)_2$	II-771	186.20
2143	cyanamide	cyano-diEt-amine	$(C_2H_5)\cdot N\cdot CN$	IV-121	98.15
2144	*iso*-cyanine iodide	ethyl red	$C_{23}H_{23}N_2\cdot I\cdot C_2H_5OH$	XXIII-298	500.42
2145	cyclohexylamine (*N,N*)	hexahydro-diethyl-aniline	$CH_2(CH_2)_4CH\cdot$ $N(C_2H_5)_2$	XII-6	155.28
2146	diacetosuccinate	...	$(CH_3CO)_2(CHCO_2\cdot C_2H_5)_2$	III-840	258.26
2147	diacetosuccinate	...	$(CH_3CO)_2(CHCO_2\cdot C_2H_5)_2$	III-840	258.26
2148	diacetosuccinate	...	$(CH_3CO)_2(CHCO_2\cdot C_2H_5)_2$	III-840	258.26
2149	diacetosuccinate	...	$(CH_3CO)_2(CHCO_2\cdot C_2H_5)_2$	III-840	258.26
2150	diacetosuccinate	...	$(CH_3CO)_2(CHCO_2\cdot C_2H_5)_2$	III-840	258.26
2151	diacetosuccinate	...	$(CH_3CO)_2(CHCO_2\cdot C_2H_5)_2$	III-840	258.26
2152	diacetyl tartrate	...	$(CH_3CO)_2(O\cdot CH\cdot CO_2C_2H_5)_2$	III-515	290.26
2153	dibenzyl malonate	...	$(C_7H_7)_2C(CO_2C_2H_5)_2$	IX-937	340.40
2154	dibromomaleate	...	$({:}CBr_2CO_2C_2H_5)_2$	II-757	329.99
2155	dibromomalonate	...	$Br_2C(CO_2C_2H_5)_2$	II-595	317.98
2156	dibromosuccinate	(α,α')	$(CHBr\cdot CO_2C_2H_5)_2$	II-624	332.01
2157	dibutylmalonate	(*n*)	$(C_4H_9)_2C(CO_2C_2H_5)_2$	*II-295	272.37
2158	diethylmalonate	...	$(C_2H_5)_2C(CO_2C_2H_5)_2$	II-686	216.27
2159	1,4-dihydrocollidine dicarboxylate	(3,5)	$(CH_3)_3C_5H_2N{:}(CO_2C_2H_5)_2$	XXII-147	267.32
2160	dihydroxymalonate	diEt-mesoxalate	$(HO)_2C(CO_2C_2H_5)_2$	III-769	192.17
2161	dimethylmalonate	...	$(CH_3)_2C(CO_2C_2H_5)_2$	II-648	188.22
2162	dithiocarbamate †	...	$(C_2H_5)_2N\cdot CS\cdot SH$	IV-121	149.27
2163	dithiocarbonate	carbonyl-disulfethyl	$CO(SC_2H_5)_2$	III-211	150.25
2164	dithiocarbonate	Et-xanthate	$C_2H_5O\cdot CS\cdot SC_2H_5$	III-210	150.25
2165	dithiooxalate	...	$(CO\cdot SC_2H_5)_2$	II-565	178.26
2166	disulfide	...	$C_2H_5S\cdot SC_2H_5$	I-347	122.24
2167	ethyl-*iso*-amyl-malonate	...	$C_5H_{11}\cdot C(C_2H_5){:}(CO_2C_2H_5)_2$	**II-611	258.35
2168	ethyl-*n*-butyl-malonate	...	$C_4H_9\cdot C(C_2H_5){:}(CO_2C_2H_5)_2$	II-712	244.32
2169	ethylmalonate	...	$C_2H_5\cdot CH(CO_2C_2H_5)_2$	II-644	188.22

† Free acid unstable; Na and K salts s. in aq.

Diethyl cadmium 1185

Diethyl *iso*-butyl carbinol 4924

Diethyl carbinol 408

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2133	lq.	$1.402^{25°}_{4}$	<-54	233-5 d.	i.	∞	∞
2134	col. lq.	$0.975^{20°}_{4}$	....	$235\text{-}40^{760mm}$	i.	v. s.	v. s.
2135	col. lq.	$0.988^{15°}$	....	$233\text{-}4^{774mm}$	v. sl. s.	v. s.	v. s.
2136	col. lq.	$0.983^{17°}$	....	225	v. sl. s.	v. s.	v. s.
2137	cr./al.	....	79	....	i.	....	....
2138	col. lq.	$0.975^{20°}_{4}$	-43	126^{759mm}	i.	∞	∞
2139	col. lq.	$0.842^{20°}_{20}$	....	124^{759mm}	$21^{20°}$	....	....
2140	col. lq.	$1.189^{30°}_{30}$	....	250 sl. d.	....	....	....
2141	col. lq.	$1.191^{25°}_{4}$	....	235 sl. d.	....	....	....
2142	col. lq.	$1.042^{20°}_{4}$	....	230.3	....	....	....
2143	lq.	$0.854^{20°}_{4}$	....	$188\text{-}9^{748mm}$	i.; d. HCl	s.	s.
2144	hyg. gn. met./al.	....	150-2 d.	....	v. sl. s; v. s. aq. a.	s.; s. act.; s. ac.	i.; i. CS_2
2145	lq.	$0.872^{0°}_{0}$	....	193	....	....	....
2146	α_1-oil	....	....	....	v. sl. s.	s.	s.; 10 lg.
2147	α_2-cr.	....	20-2	....	v. sl. s.	v. s.	v. s.
2148	α_3-pr./lg.	....	31-2	....	v. sl. s.	v. s.	v. s.; 35 lg.
2149	α_4-oil	....	....	....	....	....	....
2150	β-stable, mn./al.	$1.209^{20°}_{4}$	89-90	....	....	$6^{20°}$ abs.	2 abs.
2151	meta-stable	$1.176^{20°}_{4}$	....	....	....	....	....
2152	mn.	$1.081^{99°}_{4}$	67-8	288.5^{727mm}	s. h.	v. s. h.	v. s.
2153	oil	$1.093^{20°}_{4}$	13-14	$243\text{-}6^{18°}$	....	....	....
2154	col. lq.	$1.698^{25°}_{25}$	....	$170\text{-}5^{15mm}$	....	....	....
2155	lq.	....	....	250-6 sl. d.	....	....	....
2156	rhb. nd.	....	68	d. >130	....	....	....
2157	col. lq.	....	....	$153\text{-}4^{14mm}$	....	....	....
2158	col. lq.	$0.985^{20°}_{4}$	....	230	i.	∞	∞
2159	mn. pr./al.	....	131	>315 d.	v. sl. s.; s. chl.	s. h.; s. bz.	sl. s.; sl. s. CS_2
2160	col. pl./bz.	....	57	200	$130^{22°}$	v. s. abs.	v. s.
2161	col. lq.	$0.994^{25°}_{25}$	....	196.2-6.7	i.	∞	∞
2162	....	....	....	....	....	....	....
2163	yel. lq.	$1.085^{19°}$	....	198.6-200.1	i.	s.	s.
2164	yel. lq.	$1.085^{19°}$	....	200	i.	s.	s.
2165	yel. nd./et.	....	27-8	$238\text{-}40^{757mm}$	....	....	....
2166	oil	$0.993^{20°}_{4}$	....	152.8-3.4	v. sl. s.	....	....
2167	col. lq.	$0.954^{25°}_{25}$	....	150^{20mm}	....	....	....
2168	lq.	$0.965^{25°}_{4}$	....	$245\text{-}50^{747mm}$	....	....	....
2169	col. lq.	$1.004^{20°}_{20}$	....	211^{748mm}	....	....	....

Diethyl carbitol acetate 401
Diethyl carbitol 2233

Diethyl ether 2911

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2170	**Diethyl** ethyl-phenylmalonate	....	$C_6H_5 \cdot C(C_2H_5):(CO_2C_2H_5)_2$	*IX-384	264.31
2171	ethyl-*iso*-propylmalonate	....	$C_3H_7 \cdot C(C_2H_5):(CO_2C_2H_5)_2$	II-706	230.30
2172	formal	diEtO-methane	$CH_2(OC_2H_5)_2$†	I-574	104.15
2173	formamide	formyl-diethylamine	$HCO_2N(C_2H_5)_2$	IV-109	101.15
2174	fumarate	....	$(:CH \cdot CO_2C_2H_5)_2$	II-742	172.18
2175	glutaconate	....	$C_3H_4(CO_2C_2H_5)_2$	II-759	186.20
2176	glutarate	....	$(CH_2)_3(CO_2C_2H_5)_2$	II-633	188.22
2177	*n*-heptylmalonate	....	$C_7H_{15}CH(CO_2C_2H_5)_2$	**II-610	258.35
2178	hydrazine (*uns*)	....	$(C_2H_5)_2N \cdot NH_2$	IV-550	88.15
2179	itaconate	....	$C_3H_4(CO_2C_2H_5)_2$	II-762	186.20
2180	ketone	pentanone-3	$(C_2H_5)_2CO$	I-679	86.13
2181	ketone semicarbazone	....	$(C_2H_5)_2C:N \cdot NH \cdot CO \cdot NH_2$	III-103	143.19
2182	malate (*dl*)	....	$(CHOH \cdot CH_2):(CO_2C_2H_5)_2$	III-437	190.19
2183	maleate	....	$(:CH \cdot CO_2C_2H_5)_2$	II-751	172.18
2184	malonate	malonic ester	$CH_2(CO_2C_2H_5)_2$	II-573	160.17
2185	malonic acid	....	$(C_2H_5)_2C(CO_2H)_2$	II-686	160.17
2186	mesaconate	....	$CH_3 \cdot C_2H(CO_2C_2H_5)_2$	II-766	186.20
2187	methyl-ethyl-malonate	....	$C_2H_5 \cdot C(CH_3):(CO_2C_2H_5)_2$	II-664	202.24
2188	muconate	....	$(CH:CH \cdot CO_2C_2H_5)_2$	II-804	198.21
2189	*α*-naphthylamine (*N*)	....	$C_{10}H_7 \cdot N(C_2H_5)_2$	XII-1223	199.28
2190	4-nitrophthalate	....	$NO_2 \cdot C_6H_3(CO_2C_2H_5)_2$	IX-831	267.23
2191	nitrosamine	nitroso-diethylamine	$(C_2H_5)_2N \cdot NO$	IV-129	102.14
2192	oxalacetate	oxalacetic ester	$(CH_2CO)(CO_2C_2H_5)_2$	III-782	188.18
2193	oxalate	ethyl oxalate	$(CO_2C_2H_5)_2$	II-535	146.14
2194	oxamide (*sym*)	....	$(CO \cdot NHC_2H_5)_2$	IV-112	144.17
2195	oxomalonate	....	$CO(CO_2C_2H_5)_2$	III-769	174.15
2196	peroxide	....	$C_2H_5O \cdot OC_2H_5$	I-324	90.12
2197	phosphine	....	$(C_2H_5)_2PH$	IV-582	90.11
2198	phosphoric acid	....	$(C_2H_5O)_2PO \cdot OH$	I-332	154.11
2199	phthalate (*o*)	ethyl phthalate	$C_6H_4(CO_2C_2H_5)_2$	IX-798	222.23
2200	phthalate (*m*)	ethyl isophthalate	$C_6H_4(CO_2C_2H_5)_2$	IX-834	222.23
2201	phthalate (*p*)	ethyl terephthalate	$C_6H_4(CO_2C_2H_5)_2$	IX-844	222.23
2202	pimelate	....	$(CH_2)_5(CO_2C_2H_5)_2$	II-671	216.27
2203	propylmalonate	....	$C_3H_7 \cdot CH(CO_2C_2H_5)_2$	II-657	202.24
2204	*iso*-propylmalonate	....	$C_3H_7 \cdot CH(CO_2C_2H_5)_2$	II-669	202.24
2205	quinolinate (2,3)	....	$C_5H_3N(CO_2C_2H_5)_2$	XXII-151	223.22
2206	sebacate	ethyl sebacate	$(CH_2)_8(CO_2C_2H_5)_2$	II-719	258.35
2207	selenide, mono-	selenium ethyl	$(C_2H_5)_2Se$	I-349	137.08
2208	selenide, di-	ethyl diselenide	$(C_2H_5Se)_2$	I-349	216.04
2209	stilboestrol (*trans*)	stilboestrol	$[HOC_6H_4(C_2H_5)C:]_2 \cdot C_2H_5OH$	....	314.41
2210	suberate	....	$(CH_2)_6(CO_2C_2H_5)_2$	II-693	230.30
2211	succinate	ethyl succinate	$(CH_2 \cdot CO_2C_2H_5)_2$	II-609	174.19
2212	*iso*-succinate	....	$CH_3 \cdot CH(CO_2C_2H_5)_2$	II-629	174.19
2213	sulfate	ethyl sulfate	$(C_2H_5O)_2SO_2$	I-327	154.18
2214	sulfide	....	$(C_2H_5)_2S$	I-344	90.18
2215	sulfite	....	$(C_2H_5O)_2SO$	I-325	138.18

† Hydrate $+1H_2O$, s. aq., al., et., chl., bz.

Diethyl mercury 4043

Diethyl mesoxalate 2160, 3084

Diethyl phenetidine 2114

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2170	col. lq.	....	....	166^{12mm}	....	....	....
2171	lq.	....	....	232-3	....	....	....
2172	lq.	$0.824^{25°}_{4}$	−66.5	89	$9^{18°}$; $7^{30°}$	∞	∞
2173	col. lq.	$0.908^{19°}$	....	177-8	∞	v. s.	v. s.
2174	col. lq.	$1.054^{20°}_{20}$	0.6	218.5	....	....	....
2175	col. lq.	$1.050^{20°}_{4}$	....	236-8	i.	s.	s.
2176	syrup	$1.025^{21°}$	−24	237	$0.882^{20°}$	v. s.	s.
2177	pa. yel. lq.	$0.951^{20°}$	....	$144\text{-}6^{8mm}$	....	....	....
2178	hyg. lq.	....	....	96-9	v. s.	v. s.	v. s.
2179	col. lq.	$1.050^{15°}_{15}$	....	228-9	....	....	....
2180	col. lq.	$0.816^{19°}_{4}$	−42	101.7	$4.7^{20°}$	∞	∞
2181	nd./bz.	....	139	....	....	....	s. bz.
2182	col. lq.	$1.124^{21°}_{4}$	....	253-5	s.	∞	∞
2183	col. lq.	$1.070^{20°}_{20}$	−10.5	225	i.	s.	s.
2184	col. lq.	$1.055^{20°}_{4}$	−49.8	198.9	$2.08^{20°}$	∞	∞
2185	pr./aq.	....	125	d. 170-80	$65^{16°}$	v. s.	v. s.
2186	col. lq.	$1.047^{20°}_{4}$	....	229	....	....	....
2187	col. lq.	$0.994^{15°}_{15}$	....	207-8	....	....	....
2188	pr./al.	$0.983^{99°}_{4}$	63 (13)	200^{12mm}	....	v. s.	....
2189	col. oil	1.005	....	285-90	∞ bz.	∞	∞
2190	pl./al.	....	33-4	$208\text{-}10^{15mm}$	i.	s.	s.
2191	yel. oil	$0.943^{20°}_{4}$	....	176.9	s.	∞	∞
2192	col. oil	$1.131^{20°}_{4}$	....	$131\text{-}2^{24mm}$	i.	∞; ∞ bz.	∞
2193	col. lq.	$1.079^{20°}_{4}$	−40.6	186	v. sl. s.	∞	∞
2194	nd./al.	$1.169^{4°}$	....	179	....	....	....
2195	yel. gn. oil	$1.119^{40°}_{20}$	−30 ±	220 ±	....	s.	s.
2196	lq.	$0.827^{15°}_{4}$	....	65	v. sl. s.	∞	∞
2197	col. lq.	<1	....	85	....	....	....
2198	lq.	$1.175^{0°}$	....	203.3	....	....	....
2199	col. lq.	$1.121^{25°}_{25}$	....	298-9	i.	∞	∞
2200	col. lq.	$1.123^{25°}_{25}$	11.5	302	i.	∞	∞
2201	pr./al.	$1.110^{15°}_{15}$	43-4	302	i.	s.	s.
2202	col. oil	$0.999^{15°}_{15}$	−23.8	$252\text{-}5^{748mm}$	i.	s.	s.
2203	col. lq.	$0.993^{15°}_{15}$	....	$225\text{-}6^{771mm}$	i.	s.	s.
2204	col. lq.	$0.993^{15°}_{15}$	....	$215\text{-}7^{748mm}$	i.	s.	s.
2205	yel. oil	....	....	280-5 sl. d.	s.	s.	s.; s. bz.
2206	col. lq.	$0.965^{20°}_{4}$	1.3	306^{773mm}	0.008	s.	s.
2207	lq.	$1.230^{28°}_{4}$	....	110	i.	....	....
2208	red yel. lq.	$1.696^{13°}_{4}$	−95	137	....	....	....
2209	col. cr./al.	....	169-71	....	i.; s. alk.	s.	s.
2210	col. lq.	$0.982^{20°}_{4}$	5.9	282^{763mm}	i.	s.	s.
2211	col. lq.	$1.040^{20°}_{4}$	−20.8	217	i.	∞	∞
2212	col. lq.	$1.021^{15°}_{15}$	....	201.2-1.4	i.	∞	∞
2213	col. lq.	$1.172^{25°}_{4}$	−25	210.2 sl. d.	i.; sl. d.	s.; d. h.	∞
2214	col. lq.	$0.837^{20°}_{4}$	−99.5	$92\text{-}3^{754mm}$	$0.313^{20°}$	∞	∞
2215	col. lq.	$1.077^{25°}_{4}$	....	157.7	s. d.	s.	....

Diethyl phenylenediamine 303
Diethyl *n*-propyl carbinol 4966

Diethyl *iso*-propyl carbinol 4963
Diethyl pyridine 5040-1

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2216	**Diethyl** sulfone	....	$(C_2H_5)_2SO_2$	I-346	122.18
2217	sulfoxide	....	$(C_2H_5)_2SO$	I-346	106.18
2218	tartrate (*d*)	ethyl tartrate	$(CHOH\cdot CO_2C_2H_5)_2$	III-512	206.19
2219	telluride	tellurium ethyl	$(C_2H_5)_2Te$	I-350	185.73
2220	thiourea (*sym*)	....	$(C_2H_5NH)_2CS$	IV-118	132.22
2221	toluene (3,5)	....	$(C_2H_5)_2C_6H_3\cdot CH_3$	V-441	148.24
2222	urea (*sym*)	....	$(C_2H_5NH)_2CO$	IV-115	116.16
2223	urea (*uns*)	....	$(C_2H_5)_2N\cdot CO\cdot NH_2$	IV-120	116.16
2224	**Diethylene**-diacetate	....	$(CH_2CH_2O_2C\cdot CH_3)_2$	II-143	174.19
2225	diamine	piperazine	$NH\cdot C_2H_4\cdot NH\cdot C_2H_4$	XXIII-4	86.14
2226	diamine hydrate	piperazine hydrate	$C_4H_{10}N_2\cdot 6H_2O$	XXIII-4	194.23
2227	dilaurate	....	$(C_{11}H_{23}CO_2C_2H_4)_2$	....	454.71
2228	disulfide	dithian-1,4	$S\cdot C_2H_4\cdot S\cdot C_2H_4$	XIX-3	120.22
2229	glycol diacetate	....	$(CH_3CO_2C_2H_4)_2O$	II-141	190.19
2230	glycol dinitrate	....	$(O_2N\cdot O\cdot C_2H_4)_2O$	**I-521	196.12
2231	glycol monobenzyl ether	....	$HOCH_2CH_2\cdot O\cdot CH_2\cdot CH_2\cdot O\cdot CH_2C_6H_5$	....	196.24
2232	glycol *n*-butyl ether	butyl carbitol	$HOCH_2CH_2\cdot O\cdot CH_2\cdot CH_2\cdot O\cdot C_4H_9$	**I-521	162.22
2233	glycol diethyl ether	diethyl carbitol	$(C_2H_5O\cdot CH_2CH_2)_2O$	**I-520	162.22
2234	glycol monolaurate	glaurin	$C_{11}H_{23}CO_2C_2H_4\cdot O\cdot C_2H_4OH$	....	288.42
2235	imide oxide	morpholine	$NH\cdot (CH_2)_2\cdot O\cdot (CH_2)_2$	XXVII-5	87.12
2236	imide oxide ethanol	morpholine ethanol	$C_4H_8O:N\cdot C_2H_4OH$	....	131.17
2237	oxide	dioxan-1,4	$O:(CH_2)_4:O$	XIX-3	88.10
2238	triamine	....	$(NH_2\cdot C_2H_4)_2NH$	IV-255	103.17
2239	**Difluoro**-acetic acid	....	$F_2CH\cdot CO_2H$	II-193	96.04
2240	1-bromoethane (2,2)	....	$F_2CH\cdot CH_2Br$	I-89	144.96
2241	1-chloroethane (2,2)	....	$F_2CH\cdot CH_2Cl$	I-83	100.50
2242	1,2-dibromoethane	(2,2)	$F_2CBr\cdot CH_2Br$	I-92	223.87
2243	1,1-dibromoethane	(2,2)	$Br_2CH\cdot CHF_2$	I-92	223.87
2244	1,1-dichloroethane	(2,2)	$F_2CH\cdot CHCl_2$	I-85	134.95
2245	1,2-dichloroethylene (1,2)	....	$FClC:CClF$	....	132.93
2246	dichloromethane	Freon-12	F_2CCl_2	I-61	120.92
2247	diphenyl (2,2′)	....	$F\cdot C_6H_4\cdot C_6H_4\cdot F$	....	190.18
2248	diphenyl (4,4′)	....	$F\cdot C_6H_4\cdot C_6H_4\cdot F$	V-579	190.18
2249	ethane (1,2)	ethylene fluoride	$FCH_2\cdot CH_2F$	I-82	66.05
2250	ethylene (*α,α*)	1,1-difluoro-ethene	$CH_2:CF_2$	I-186	64.04
2251	1-iodoethane (2,2)	....	$F_2CH\cdot CH_2I$	I-98	191.96
2252	tetrabromoethane	(1,1,2,2;1,2)	$FBr_2C\cdot CFBr_2$	I-95	381.68
2253	tetrachloroethane	(1,1,1,2;2,2)	$Cl_3C\cdot CF_2Cl$	I-86	203.85
2254	tetrachloroethane	(1,1,2,2;1,2)	$FCl_2C\cdot CFCl_2$	....	203.85
2255	tribromoethane	(1,1,2;1,2)	$Br_2FC\cdot CHBrF$	I-94	302.78
2256	**Diformyl hydrazine**	(*sym*)	$(\cdot NH\cdot CHO)_2$	II-93	88.07
2257	**Difurfural**-cyclohexanone	....	$(C_4H_3O\cdot CH:)_2:C_6H_6O$	....	254.27

Diethyl tin 5949
Diethyl toluidine 4216-8

Diethyl zinc 6503
Diethylene glycol 3453

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2216	rhb. pl.	$1.357_{4}^{20^\circ}$	73-4	248	15.6^{16°	v. s. bz.	s. h.
2217	syrup	....	15	$88\text{-}90^{15mm}$	v. s.	s.	s.
2218	lq.	$1.204_{4}^{20^\circ}$	17	280	sl. s.	∞	∞
2219	red-yel. lq.	$1.599_{4}^{15^\circ}$	....	137-8	i.	s.	....
2220	cr.	....	77	....	s.	s.	....
2221	lq.	$0.879_{4}^{20^\circ}$	....	198-200	i.	∞	∞
2222	nd./al.	1.042	112.5	263	v. s.	v. s.	v. s.
2223	nd./et.	....	75	....	v. s.	v. s.	2.6^{22°
2224	lq.	1.048^{15°	12	230^{751mm}	....	....	....
2225	rhb./al.	....	105-6	145-6	15^{20°	v. s.	i.
2226	col. cr.	....	44	125-30	v. s.	s.	i.
2227	....	....	28-30	....	....	....	....
2228	mn./et.	....	111-2	199-200	i.; v. s. CS_2	s.	s.
2229	lq.	$1.116_{20}^{20^\circ}$	....	250	∞	....	....
2230	lq.	$1.377_{4}^{25^\circ}$	−11.3	161 ±	0.4^{24°	v. sl. s.	v. s.
2231	col. lq.	....	....	$176\text{-}9^{18mm}$	....	....	....
2232	col. lq.	$0.956_{20}^{20^\circ}$	....	231	∞; ∞ oils	v. s.	v. s.
2233	col. lq.	$0.909_{20}^{20^\circ}$	....	188	∞	v. s.	v. s.
2234	straw colrd. oil	0.960	17-8	>270	i.	s.	s.
2235	col. oil	$1.002_{20}^{20^\circ}$	....	128.9	∞	∞	s.
2236	col. lq.	$1.072_{20}^{20^\circ}$	....	226	∞	....	....
2237	col. lq.	$1.033_{4}^{20^\circ}$	9.5-10.5	101.1	∞	s.	s.
2238	lq.	....	....	208 sl. d.	∞	∞	i.
2239	col. lq.	1.536^{10°	−0.35	134.2^{766mm}	∞	∞	∞
2240	col. lq.	$1.824^{18.5^\circ}$	−74.5	57.3	v. sl. s.	∞	∞
2241	col. lq.	>1	....	36	....	....	....
2242	col. lq.	$2.242^{12.2^\circ}$	−56.5	93	i.	....	....
2243	col. lq.	2.312^{20°	....	107.5^{760mm}	....	....	....
2244	col. lq.	1.494^{17°	....	60	i.	∞	∞
2245	gas	....	−112	20.9	....	....	....
2246	gas	1.486^{-30°	−155	−29.2	5.7^{26° cc.	s.	s.
2247	cr.	....	117	....	....	....	....
2248	col. mn./al.	$1.336_{4}^{25^\circ}$	94-5	254-5	i.; s. oil	s.; s. chl.	s.
2249	gas	....	....	....	....	....	....
2250	col. gas	....	....	....	i.	150^{18° cc.	150^{18° cc., chl.
2251	col. lq.	$2.243^{12.2^\circ}$	....	89.5	i.	....	....
2252	col. cr.	....	62.5	186.5^{758mm}	i.	s.	s. ac.
2253	col. cr.	....	52	91	i.	sl. s. c.	v. s.
2254	col. cr.	1.64^{30°	26.5	91^{740mm}	i.; v. s. bz.	v. s.	v. s.
2255	col. lq.	2.603^{20°	....	146	i.	....	....
2256	pr.	....	159-60	....	v. s.	sl. s.	i.
2257	yel. nd.	....	144-5	....	i.	s. h.	sl. s.

Diethylene glycol ethyl ether 1232
Diethylene glycol methyl ether 4177

Difluoro-ethene 2250
Difluoro-methane 4433

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2258	**Difurfural** cyclopentanone (1,3;5)	pyroxanthin	$(C_4H_3O\cdot CH{:})_2{:}C_5H_4O$	XIX-140	240.25
2259	**Diglycerol**	....	$[(HO)_2C_3H_5]_2O$	I-513	166.17
2260	**Diglycol chlorohydrin**	Cl-OH-diEt ether	$Cl\cdot CH_2CH_2\cdot O\cdot CH_2CH_2OH$	I-467	124.57
2261	**Diglycolic acid**	....	$(HO_2C\cdot CH_2)_2O\cdot H_2O$	III-234	152.10
2262	**Diglycyl glycine**	....	$H_2N(CH_2CONH)_2\cdot CH_2CO_2H$	IV-374	189.17
2263	**Diheptyl**-acetic acid (*n*)	....	$(C_7H_{15})_2CH\cdot CO_2H$	II-376	256.42
2264	ether (*n*)	heptyl ether	$(C_7H_{15})_2O$	I-414	214.38
2265	ketone (*n*)	caprylone	$[CH_3(CH_2)_6]_2CO$	I-717	226.39
2266	sulfide (*n*)	heptyl sulfide	$(C_7H_{15})_2S$	I-415	230.44
2267	**Dihexyl ketone** (*n*)	oenanthone	$[CH_3(CH_2)_5]_2CO$	I-715	198.34
2268	**Dihydracrylic acid**	Na salt	$O(CH_2CH_2CO_2Na)_2$	III-297	206.12
2269	**Dihydrazino**-diphenyl	(2,2′)	$(H_2N\cdot NH\cdot C_6H_4)_2$	XV-584	214.26
2270	diphenyl	(4,4′)	$(H_2N\cdot NH\cdot C_6H_4)_2$	XV-585	214.26
2271	**Dihydro**-acridine (9,10)	....	$C_6H_4\cdot NH\cdot C_6H_4\cdot CH_2$	XX-443	181.23
2272	anthracene (9,10)	....	$C_6H_4{:}(CH_2)_2{:}C_6H_4$	V-641	180.24
2273	anthranol (9,10;9)	....	$C_6H_4\cdot CH_2\cdot C_6H_4\cdot CHOH$	VI-697	196.24
2274	carveol	....	$C_{10}H_{18}O$	VI-63	154.24
2275	carvone (*l*)	....	$C_{10}H_{16}O$	VII-83	152.23
2276	cholesterol	coprosterol	$C_{27}H_{47}OH$	....	388.65
2277	ethylanthracene (9,10;9)	....	$C_6H_4{:}C_2H_3(C_2H_5){:}C_6H_4$	V-649	208.29
2278	naphthalene (1,4)	....	$C_{10}H_{10}$	V-519	130.18
2279	phenazine (9,10)	hydrazophenylene	$NH\cdot C_6H_4\cdot NH\cdot C_6H_4$	XXIII-209	182.22
2280	*o*-phthalic acid (1,4)	....	$C_6H_6(CO_2H)_2$	IX-781	168.14
2281	*o*-phthalic acid (2,4)	....	$C_6H_6(CO_2H)_2$	IX-781	168.14
2282	*o*-phthalic acid (2,6)	....	$C_6H_6(CO_2H)_2$	IX-782	168.14
2283	*p*-phthalic acid (1,4)	dihydro-terephthalic	$C_6H_6(CO_2H)_2$	IX-785	168.14
2284	quinoline	....	C_9H_9N	....	131.17
2285	resorcinol (*m*)	hydroresorcin	$CO\cdot(CH_2)_3\cdot COCH_2$	VII-554	112.12
2286	toluene (1,2)	Me-cyclohexadiene	$CH_3\cdot C_6H_7$	V-115	94.15
2287	toluene (1,3)	....	$CH_3\cdot C_6H_7$	V-115	94.15
2288	toluene (2,4)	....	$CH_3\cdot C_6H_7$	V-115	94.15
2289	*o*-xylene (*x*,*x*)	diMe-cyclohexadiene	C_8H_{12}	V-118	108.18
2290	*m*-xylene (1,5)	....	C_8H_{12}	V-119	108.18
2291	*p*-xylene (1,3)	....	C_8H_{12}	V-120	108.18
2292	**Dihydroxy**-acetone	....	$(HO\cdot CH_2)_2CO$	I-846	90.08
2293	anthracene (β)(1,5)	rufol	$C_{14}H_8(OH)_2$	VI-1032	210.22
2294	anthracene (α)(1,8)	chrysazol	$C_{14}H_8(OH)_2$	VI-1033	210.22

Difurfuroyl 3328
Difuryl-diketone 3328
Digallic acid 5687
Digitalin, cf. glcde.
Digitin, cf. glcde.

Digitonin, cf. glcde.
Digitoxin, cf. glcde.
Dihexyl 2856
Dihydro-benzene 1599-1600

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2258	or. nd./al.; red yel./bz.	....	162-3	d.	i.	s. h.	v. sl. s.; v. sl. s. CS_2
2259	lq.	....	....	220-30^{10mm}	s. h.	....	i.
2260	lq.	$1.170_{20}^{20°}$	....	196.8	∞	....	....
2261	cr.	....	148	d.	v. s.	v. s.	sl. s.
2262	nd.	....	246 d.	....	v. s. h.	i.	i.
2263	cr.	$0.877_{4}^{25°}$	26-7	240-50^{85mm}	v. sl. s.	v. s.	v. s.; v. s. bz.
2264	lq.	$0.806^{20°}$	....	261.9	i.	s.	s.
2265	cr./al.	....	39-40	278	....	s.	....
2266	lq.	....	....	298	....	....	....
2267	lf./al.	$0.825^{30°}$	33	264	v. s. chl.	v. s.; s. lg.	v. s.
2268	cr.	....	....	....	i. c. 95% al.	s. h. 90% al.	....
2269	lf./bz.	....	110	....	s. h.; v. s. chl.	v. s.; v. s. h. bz.	i. pet.
2270	lf.	....	165-7 d.	....	sl. s. h.	v. sl. s.	v. sl. s.
2271	col. cr./al.	....	169	subl.; d. 300	i.	s. h.	s.
2272	mn. pr.	$0.897_{4}^{11°}$	108.5	305	i.; v. s. bz.	v. s.	v. s.
2273	nd./pet.	....	76	....	s. h.	s.	s.; s. bz.
2274	lq.	$0.927_{4}^{20°}$	....	224-5	....	....	....
2275	oil	$0.925_{4}^{20°}$	....	221-2	....	....	....
2276	nd.	....	104-5	210-20^{1mm}	s. chl., pet.	s. abs.	s.; s. bz.
2277	oil	$1.049_{18}^{18°}$	....	320-3 sl. d.	i.; ∞ bz.	∞	∞
2278	col. pl.	$0.997_{4}^{12°}$	25-8	211-2	i.	s.	s.
2279	rhb. lf.	....	212	....	i.	v. sl. s.	i. bz.
2280	mn.	....	153	....	$1.6^{6°}$	....	....
2281	mn. pr.	....	179-80	....	sl. s. h.	s.	....
2282	tri.	....	215	....	$0.3^{25°}$; 6 h.	s.	s. act.
2283	nd./aq.	....	subl. d.	....	0.01 c.	....	....
2284	lq.	....	....	220-6	....	....	....
2285	pr./bz.	....	105-6 sl. d.	....	v. s.; s. act.	v. s.; s. h. bz.	v. sl. s. abs
2286	lq.	....	....	108	....	....	....
2287	lq.	0.835	....	110	....	....	....
2288	lq.	$0.827_{4}^{20°}$	....	106	....	....	....
2289	col. lq.	....	....	134-5	....	....	s.
2290	col. lq.	$0.823_{4}^{20°}$	....	129-30^{745mm}	....	....	....
2291	col. lq.	$0.830_{4}^{20°}$	....	135-8	....	....	....
2292	cr.	....	68-75	....	v. s.; i. lg.	sl. s.	sl. s.
2293	yel./aq. al.	....	265 ±, d.	....	s. alk.	s.	s.; s. bz.
2294	yel./aq. al.	....	225 d.	....	s. alk.	s.	s.; s. bz.

Dihydro-estrone 2900
Dihydro-ketoacridine 145
Dihydro-morphinone hydrochloride, cf. alkd.
Dihydro-myrcene 2514
Dihydro-naringenin 5264
Dihydro-phytol 5295
Dihydro-pyrrole 5524
Dihydroxy-acetophenone 5550

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2295	**Dihydroxy** 9-anthranol (3,4)	anthrarobin	$C_{14}H_7(OH)_3$	VIII-330	226.22
2296	*x*-anthranol (1,8)	anthralin	$C_{14}H_7(OH)_3$	VIII-332	226.22
2297	anthraquinone (1,2)	alizarin	$C_6H_4(CO)_2C_6H_2{:}(OH)_2$	VIII-439	240.20
2298	anthraquinone (1,3)	purpuroxanthin	$C_6H_4(CO)_2C_6H_2{:}(OH)_2$	VIII-448	240.20
2299	anthraquinone (1,4)	quinizarin	$C_6H_4(CO)_2C_6H_2{:}(OH)_2$	VIII-450	240.20
2300	anthraquinone (1,5)	anthrarufin	$(HO{\cdot}C_6H_3)_2(CO)_2$	VIII-453	240.20
2301	anthraquinone (1,8)	chrysazin	$(HO{\cdot}C_6H_3)_2(CO)_2$	VIII-458	240.20
2302	anthraquinone (2,3)	hystazin; hystazarin	$C_6H_4(CO)_2C_6H_2{:}(OH)_2$	VIII-462	240.20
2303	anthraquinone (2,6)	anthraflavic acid	$(HO{\cdot}C_6H_3)_2(CO)_2$	VIII-463	240.20
2304	anthraquinone (2,7)	*iso*-anthraflavic acid	$C_{14}H_8O_4{\cdot}H_2O$	VIII-466	258.22
2305	anthraquinone carboxylic acid †	(2,4;1 or 1,3;2) munjistin	$C_6H_4(CO)_2C_6H{:}(OH)_2(CO_2H)$	X-1036	284.21
2306	anthraquinone carboxylic acid	(1;8,3) rheic acid; rhein	$HO{\cdot}C_6H_3(CO)_2C_6H_2{:}(OH)(CO_2H)$	X-1033	284.21
2307	azobenzene-4′-sulfonic acid (2,4)	....	$(HO)_2C_6H_3{\cdot}N{:}N{\cdot}C_6H_4{\cdot}SO_3H$	XVI-275	294.28
2308	azobenzene-4′-sulfonate Na (2,4)	tropeolin O; resorcin yellow	$C_{12}H_9O_5N_2SNa{\cdot}2\frac{1}{2}H_2O$	XVI-275	361.31
2309	behenic acid	....	$C_{22}H_{44}O_4$	III-410	372.57
2310	benzaldehyde (2,4)	β-resorcyl aldehyde	$(HO)_2C_6H_3{\cdot}CHO$	VIII-241	138.12
2311	benzaldehyde (3,4)	protocatechuic ald.	$(HO)_2C_6H_3{\cdot}CHO$	VIII-246	138.12
2312	benzene (*o*)	pyrocatechin	$C_6H_4(OH)_2$	VI-759	110.11
2313	benzene (*m*)	resorcinol	$C_6H_4(OH)_2$	VI-796	110.11
2314	benzene (*p*)	hydroquinone	$C_6H_4(OH)_2$	VI-836	110.11
2315	benzoic acid (2,3)	....	$(HO)_2C_6H_3CO_2H{\cdot}aq.$	X-375	154.12
2316	benzoic acid (2,4)	resorcylic acid (β)	$(HO)_2C_6H_3CO_2H{\cdot}aq.$	X-377	154.12
2317	benzoic acid (2,5)	gentisic acid	$(HO)_2C_6H_3{\cdot}CO_2H$	X-384	154.12
2318	benzoic acid (2,6)	resorcylic acid (γ)	$(HO)_2C_6H_3{\cdot}CO_2H{\cdot}H_2O$	X-388	172.13
2319	benzoic acid (3,4)	protocatechuic acid	$(HO)_2C_6H_3{\cdot}CO_2H{\cdot}H_2O$	X-389	172.13
2320	benzoic acid (3,5)	resorcylic acid (α)	$(HO)_2C_6H_3{\cdot}CO_2H{\cdot}1\frac{1}{2}H_2O$	X-404	181.14
2321	benzophenone (2,4)	benzoyl resorcin (4)	$(HO)_2C_6H_3{\cdot}CO{\cdot}C_6H_5$	VIII-312	214.21
2322	benzophenone (2,5)	benzoyl hydroquinone (2)	$(HO)_2C_6H_3{\cdot}CO{\cdot}C_6H_5$	VIII-312	214.21
2323	benzophenone (2,2′)	salicyl-phenol (2)	$(HO{\cdot}C_6H_4)_2CO$	VIII-313	214.21
2324	benzophenone (2,3′)	salicyl-phenol (3)	$(HO{\cdot}C_6H_4)_2CO$	VIII-315	214.21
2325	benzophenone (2,4′)	salicyl-phenol (4)	$(HO{\cdot}C_6H_4)_2CO$	VIII-315	214.21

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† See also No. 176.

Dihydroxy-anthraquinone carboxylic acid 176   Dihydroxy-anthraquinone quinoline 174

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2295	yel. nd./ aq. al.	....	208	....	sl. s.; s. ac.	s.; s. alk.	s.; s. act.
2296	yel. pd.	....	178-80	....	i.; s. fat	s. h.; s. bz.	s. dil. alk.
2297	red rhb.	....	289-90	430	$0.03^{100°}$	v. s.	v. s.; s. alk.
2298	yel. lf./bz.	....	263-4	....	i.; s. act.	sl. s.	s. h. ac.
2299	red nd./al.	....	200-2	subl. sl. d.	s. alk.	s. H_2SO_4	s.
2300	yel. lf.	....	280	subl.	i.	sl. s.	s.
2301	red-yel./ al.	....	191	....	s. H_2SO_4	s.; s. alk.	s.; s. ac.
2302	yel. brn. nd.	....	>280	....	s. H_2SO_4	v. sl. s. h.	v. sl. s.
2303	yel. nd./ al.	....	>330	....	s. H_2SO_4	$1.4^{17°}$	i.
2304	yel. nd./ aq. al.	....	>330; subl.	d. $-H_2O$, 100	s. H_2SO_4	sl. s.	v. sl. s.
2305	yel. lf./ac.	....	230-1	subl. d. > m. p.	s. h.; s. alk.	s. h.; s. H_2SO_4	s.; s. chl.
2306	yel. nd./ Me al.	....	321-2	subl.	i.; s. alk.; s. pyr.	sl. s.; sl. s. bz.	sl. s.; sl. s. chl.
2307	red lf.	....	....	....	$0.2^{19°}$; i. aq. HCl	v. sl. s.	i.
2308	brn. lf.	....	....	....	$0.4^{23°}$; $20^{100°}$	....	....
2309	cr./al.	....	132-3 (99)	....	....	$0.1^{18°}$ abs.	i.
2310	yel. nd./aq.	....	135-6	$220\text{-}8^{22mm}$	v. s.	v. s.	v. s.
2311	cr./aq.	....	153-4	....	5 c.; 33 h.	100 h.	v. s.
2312	nd./aq.	$1.344^{4°}$	104-5	240-5	$45.1^{20°}$	v. s.; s. chl.	v. s.; s. bz.
2313	col. rhb.	$1.272^{15°}$	110.7 (108)	276.5	$147.3^{12.5°}$	v. s.	v. s.
2314	cr.	$1.332^{15°}$	170.3	285^{730mm}	$6^{15°}$	v. s.	v. s.
2315	cr./aq.	....	204 (anh.)	−aq. 100	....	....	....
2316	cr.	....	194-200 (anh.) d.	....	$0.26^{17°}$; s. h.	s.	s.
2317	nd./aq.	....	199-200	....	s.; i. CS_2	s.; i. chl.	s.; i. bz.
2318	nd./aq.	....	148-67 (anh.) d.	....	v. s. h.	....	....
2319	nd./aq.	1.542	199 d.	....	$2^{14°}$	v. s.	s.
2320	pr. or nd.	....	237 (anh.)	....	v. s. h.	v. s.	v. s.
2321	nd./h. aq.	....	143-4	....	i. c.	s.	s.; sl. s. bz.
2322	yel. nd./ aq. al.	....	122-4	....	s. bz.	s.	s.
2323	yel. pr./lg.	....	59-60	330-40 sl. d.	i.; v. s. chl.	v. s.	v. s.
2324	yel. cr./et.	....	126	....	....	....	....
2325	lt. yel./aq.	....	147-8	....	sl. s. h.	s. h.; s. bz.	$44^{25°}$

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2326	**Dihydroxy** benzophenone (3,3′)	....	$(HO{\cdot}C_6H_4)_2CO$	VIII-316	214.21
2327	benzophenone (3,4′)	....	$(HO{\cdot}C_6H_4)_2CO$	VIII-316	214.21
2328	benzophenone (4,4′)	....	$(HO{\cdot}C_6H_4)_2CO$	VIII-316	214.21
2329	butane (1,2)	α-butylene glycol	$C_2H_5{\cdot}CHOH{\cdot}CH_2OH$	I-477	90.12
2330	butane (1,3)	β-butylene glycol	$CH_3{\cdot}CHOH{\cdot}CH_2{\cdot}CH_2OH$	I-477	90.12
2331	butane (1,4)	butandiol-1,4	$HO\,CH_2)_4OH$	I-478	90.12
2332	butane (2,3)	butylene glycol (pseudo) (meso)	$CH_3{\cdot}(CHOH)_2{\cdot}CH_3$	I-479	90.12
2333	cinnamic acid (2,4)	umbellic acid	$(HO)_2C_6H_3{\cdot}C_2H_2{\cdot}CO_2H$	X-434	180.15
2334	cinnamic acid (2,5)	....	$(HO)_2C_6H_3{\cdot}C_2H_2{\cdot}CO_2H$	X-435	180.15
2335	cinnamic acid (3,4)	caffeic acid	$C_9H_8O_4$	X-436	180.15
2336	dinaphthyl (α)	α-dinaphthol	$(HO{\cdot}C_{10}H_6{\cdot})_2$	VI-1053	286.31
2337	dinaphthyl (2,2′, 1,1′)	β-dinaphthol	$(HO{\cdot}C_{10}H_6{\cdot})_2$	VI-1051	286.31
2338	diphenyl (2,5)	Ph-hydroquinone	$(HO)_2C_6H_3{\cdot}C_6H_5$	VI-989	186.20
2339	diphenyl (3,4)	Ph-catechol (4)	$(HO)_2C_6H_3{\cdot}C_6H_5$	VI-990	186.20
2340	diphenyl (2,2′)	*o,o′*-diphenol	$(HO{\cdot}C_6H_4{\cdot})_2$	VI-989	186.20
2341	diphenyl (2,4′)	δ-diphenol	$(HO{\cdot}C_6H_4{\cdot})_2$	VI-990	186.20
2342	diphenyl (3,3′)	....	$(HO{\cdot}C_6H_4{\cdot})_2$	VI-991	186.20
2343	diphenyl (4,4′)	γ-diphenol	$(HO{\cdot}C_6H_4{\cdot})_2$	VI-991	186.20
2344	diphenylmethane	(4,4′)	$(HO{\cdot}C_6H_4)_2CH_2$	VI-995	200.23
2345	ethylamino-1-hydroxy-benzene	(4)	$HO{\cdot}C_6H_4{\cdot}N(CH_2{\cdot}CH_2OH)_2$	....	197.23
2346	hexane (2,3)	2,3-hexandiol	$CH_3(CH_2)_2(CHOH)_2{\cdot}CH_3$	I-484	118.17
2347	4-methoxy-benzophenone (2,6)	cotoin	$C_6H_5{\cdot}CO{\cdot}C_6H_2:(OH)_2(OCH_3)$	VIII-419	244.24
2348	naphthalene (1,2)	β-naphthohydroquinone	$C_{10}H_6(OH)_2$	VI-975	160.16
2349	naphthalene (1,3)	naphthoresorcinol	$C_{10}H_6(OH)_2$	VI-978	160.16
2350	naphthalene (1,4)	α-naphthohydroquinone	$C_{10}H_6(OH)_2$	VI-979	160.16
2351	naphthalene (1,5)	....	$C_{10}H_6(OH)_2$	VI-980	160.16
2352	naphthalene (1,6)	....	$C_{10}H_6(OH)_2$	VI-981	160.16
2353	naphthalene (1,7)	....	$C_{10}H_6(OH)_2$	VI-981	160.16
2354	naphthalene (1,8)	....	$C_{10}H_6(OH)_2$	VI-981	160.16
2355	naphthalene (2,3)	....	$C_{10}H_6(OH)_2$	VI-982	160.16
2356	naphthalene (2,6)	....	$C_{10}H_6(OH)_2$	VI-984	160.16
2357	naphthalene (2,7)	....	$C_{10}H_6(OH)_2$	VI-985	160.16
2358	naphthalene diacetate (1,5)	....	$(CH_3CO_2)_2C_{10}H_6$	VI-981	244.24
2359	naphthalene-3,6-disulfonic acid	(1,8); chromotropic acid	$(HO)_2C_{10}H_4:(SO_3H)_2{\cdot}2H_2O$	XI-307	356.32
2360	phenanthrene (3,4)	morphol	$C_{14}H_8(OH)_2$	VI-1034	210.22
2361	phenyl-α-alanine (3,4)(*l*-)	hydroxytyrosine; dopa	$(HO)_2C_6H_3{\cdot}CH_2{\cdot}CHNH_2{\cdot}CO_2H$	*XIV-681	197.19

Dihydroxy-chlorobenzene 1460
Dihydroxy-coumarin 1628, 2898
Dihydroxy-diethylsulfide 5900
Dihydroxy-ethylamine 2090
Dihydroxy-ethyl ether 3453
Dihydroxy-flavone 1494
Dihydroxy-fluoran 3253
Dihydroxy-fluorane 3720

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2326	nd./aq.	....	163-4	....	sl. s.	s. alk.	....
2327	nd./aq.	....	197-200	....	....	....	....
2328	cr./aq.	....	207-10	....	s. h.	s.; i. CS_2	s.; i. chl.
2329	lq.	$1.006^{\frac{17.5°}{0}}$	....	192-4	v. s.	v. s.	....
2330	oil	$1.006^{\frac{20}{20}°}$	....	206.5	∞	v. s.	i.
2331	oil	$1.020^{20°}$	19	230^{759mm}	∞	....	v. sl. s.
2332	lq.	$1.048^{0°}$	34	181.7^{742mm}	∞	∞	∞
2333	yel. pd.	....	d. 240-60	....	s. h.	s.; i. bz.	i.; i. lg.
2334	cr./aq.	....	207 d.	....	....	....	....
2335	yel. pr./aq.	....	195-213 d.	....	s. h.	s.	sl. s.
2336	pl./al.	....	300	....	i.; s. alk.	s.; sl. s. bz.	v. s.; sl. s. chl.
2337	nd./al.	....	218	subl.	i.; s. alk.	s.	v. s.
2338	nd./aq. al.	....	96-8	....	....	....	....
2339	cr./pet.	....	136-7	>360	s. h.	v. s.; s. CS_2	v. s.; s. chl.
2340	pr./toluene	....	103-9	$325\text{-}6^{755mm}$	s.	v. s.	v. s.
2341	mn. pr.	....	160-1	324	sl. s. h.	v. s.	v. s.
2342	nd./aq.	....	123	247^{18mm}	s. h.	v. s.	v. s.
2343	rhb./al.	1.25	270-2	....	sl. s.	v. s.	v. s.
2344	lf./aq.	....	158 (148)	....	i. CS_2	s.	v. s.
2345	col. fl.	....	140-1	....	i.	sl. s.	sl. s.
2346	cr.	$0.967^{0°}$	60	206-7	∞	s.	....
2347	yel. pr./al.	....	130-1	....	sl. s. h.; s. alk.	s.; s. bz.; s. CS_2	s.; s. chl.; s. act.
2348	lf.	....	60 ±	....	s. alk.	....	....
2349	lf.	....	124-5	....	v. s.	v. s.	v. s.
2350	long nd.	....	173-6	....	s. h.	v. s.	v. s.
2351	pr./aq.	....	258-60 d.	....	sl. s.	s.	v. s.
2352	pr./bz.	....	137-8	....	....	sl. s. c.	v. s.
2353	nd./aq.	....	178	....	v. s. h.	v. s.	v. s.
2354	nd. or lf.	....	140	....	sl. s. h.	v. s. bz.	v. s.
2355	mn.	....	159-60	....	sl. s. h.	v. s.	v. s.
2356	rhb./aq.	....	216-8	....	v. s. h.	v. s.	v. s.
2357	nd./aq.	....	190	subl. sl. d.	s. h.	v. s.	v. s.
2358	cr./bz.	....	159-60	....	....	....	....
2359	nd. or lf.	....	....	....	v. s.; i. aq. NaCl	i.	i.
2360	nd.	....	143	....	s.	s. alk.	....
2361	pr. or nd./aq.; lf./aq. al.	....	280 d.	....	$0.5^{20°}$; $2.5^{100°}$	i.; i. chl.; v. sl. s. bz.	i.; i. pet.; v. sl. s. CS_2

Dihydroxy-fuchsone 593
Dihydroxy-malonic acid 4055
Dihydroxy-methylanthranol 1492
Dihydroxy-methylanthraquinone 1495
Dihydroxy-methylfuchsone 5573
Dihydroxy-naphthoquinone 4477-8
Dihydroxy-phenylacetic acid 3673

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Dihydroxy				
2362	pyridine (2,4)	. . . .	$(HO)_2C_5H_3N$	XXI-160	111.10
2363	pyridine (2,6)	. . . .	$(HO)_2C_5H_3N{\cdot}\frac{1}{2}H_2O$	XXI-161	120.11
2364	quinone (2,5)	. . . .	$(HO)_2C_6H_2O_2$	VIII-377	140.09
2365	stearic acid (4,9) (*dl*)	. . . .	$C_{18}H_{36}O_4$	III-407	316.47
2366	stearic acid (*dl*)	(9,10)	$C_{18}H_{36}O_4$	III-408	316.47
2367	tartaric acid	. . . .	$[(HO)_2C{\cdot}CO_2H]_2$	III-830	182.09
2368	tartaric Na salt	. . . .	$[(HO)_2C{\cdot}CO_2Na]_2{\cdot}3H_2O$	III-832	280.11
2369	thiazole	mustard oil acetic acid	$\underbrace{HO{\cdot}C{:}CH{\cdot}S{\cdot}C(OH){:}N}$	XXVII-233	117.12
2370	toluene (2,3)	. . . .	$CH_3{\cdot}C_6H_3(OH)_2$	VI-872	124.13
2371	toluene (2,4)	4-Me-resorcinol	$CH_3{\cdot}C_6H_3(OH)_2$	VI-872	124.13
2372	toluene (2,5)	toluhydroquinone	$CH_3{\cdot}C_6H_3(OH)_2$	VI-874	124.13
2373	toluene (2,6)	2-Me-resorcinol	$CH_3{\cdot}C_6H_3(OH)_2$	VI-878	124.13
2374	toluene (3,4)	homocatechol	$CH_3{\cdot}C_6H_3(OH)_2$	VI-878	124.13
2375	*o*-xylene (3,5)	4,5-diMe-resorcinol	$(CH_3)_2C_6H_2(OH)_2$	VI-908	138.16
2376	*o*-xylene (3,6)	2,3-diMe-hydroquinone	$(CH_3)_2C_6H_2(OH)_2$	VI-908	138.16
2377	*m*-xylene (2,4)	2,4-diMe-resorcinol	$(CH_3)_2C_6H_2(OH)_2$	VI-911	138.16
2378	*m*-xylene (2,5)	2,6-diMe-hydroquinone	$(CH_3)_2C_6H_2(OH)_2$	VI-911	138.16
2379	*p*-xylene (2,5)	hydrophloron	$(CH_3)_2C_6H_2(OH)_2$	VI-915	138.16
2380	*p*-xylene (2,6)	β-orcin	$(CH_3)_2C_6H_2(OH)_2$	VI-918	138.16
2381	**Diiodo**-acetic acid	. . . .	$I_2CH{\cdot}CO_2H$	II-224	311.88
2382	acetylene	diiodo-ethyne	$IC{\vdots}CI$	I-246	277.86
2383	anthranilic acid	(3,5;2,1)	$I_2C_6H_2(NH_2)CO_2H$	*XIV-554	388.96
2384	atophan	*p*-iodophenyl-6-iodoquinoline-4-carboxylic acid	$C_{16}H_9O_2NI_2$	. . . .	501.08
2385	aniline (2,4)	. . . .	$I_2C_6H_3{\cdot}NH_2$	XII-675	344.95
2386	benzene (*o*)	*o*-phenylene iodide	$C_6H_4I_2$	V-225	329.93
2387	benzene (*m*)	. . . .	$C_6H_4I_2$	V-225	329.93
2388	benzene (*p*)	. . . .	$C_6H_4I_2$	V-227	329.93
2389	butane (1,4)	tetramethylene diiodide	$I(CH_2)_4I$	I-123	309.94
2390	ethane (1,1)	ethylidene diiodide	$CH_3{\cdot}CHI_2$	I-99	281.89
2391	ethane (1,2)	ethylene iodide	$ICH_2{\cdot}CH_2I$	I-99	281.89
2392	fluorescein	. . . .	$C_{20}H_{10}O_5I_2$	. . . .	584.12
2393	hexane (1,6)	hexamethylene diiodide	$I(CH_2)_6I$	I-147	338.00
2394	2-hydroxybenzoic acid (3,5)	3,5-diI-salicylic acid	$I_2C_6H_2(OH)CO_2H$	X-113	389.94
2395	4-hydroxybenzoic	(3,5;4,1)	$I_2C_6H_2(OH)CO_2H$	X-180	389.94
2396	pentane (1,5)	pentamethylene diiodide	$I(CH_2)_5I$	I-133	323.97
2397	propane (1,2)	propylene iodide	$CH_3{\cdot}CHI{\cdot}CH_2I$	I-115	295.92
2398	propane (2,2)	iodoacetol	$(CH_3)_2CI_2$	I-115	295.92
2399	propane (1,3)	trimethylene diiodide	$I(CH_2)_3I$	I-115	295.92
2400	thiophene (2,5)	. . . .	$I_2C_4H_2S$	XVII-35	335.96
2401	tyrosine (3,5)(*l*)	iodogorgonic acid	$C_9H_9O_3NI_2$	XIV-619	433.01

Dihydroxy-propane 5465, 6286
Dihydroxy-propionic acid 3379
Dihydroxy-purine, cf. alkd.

Dihydroxy-xanthone 3227
Diiodo-ethene 137-8
Diiodo-ethyne 2382

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2362	yel. nd./aq.	....	255-65 d.	....	s. h.	s.	v. sl. s.
2363	nd./aq.	....	195 d.	....	sl. s.	s. h.	i.
2364	yel. nd.	....	subl. 215-20 sl. d.	....	i. c.	s.	i. c.
2365	lf./al.	....	136.5	....	v. s. h. al.	0.6^{19°	0.2^{18°
2366	lf.	....	99-100	....	v. sl. s. c.	3.6^{18°	sl. s.
2367	wh. pd.	....	114-5 d.	....	v. s.; d. h.	....	....
2368	cr.	....	d., $-H_2O$, $-CO^2$	....	0.04^{0°	....	....
2369	rhb.	....	126-8	179^{19mm}; subl.	v. s. h.	s.	s.
2370	lf./bz.	....	68	238-40 sl. d.	s.; v. s. chl.	v. s.	s.; v. s. bz.
2371	cr./bz. pet.	....	104-5	267-70	s.; i. pet.	s.	s.; sl. s. bz.
2372	lf./bz.	....	124-5	....	s.	s.	s.; sl. s. bz.
2373	cr.	....	116	264	v. s.	v. s.	v. s.
2374	pr./bz.	$1.129^{7.4^\circ}_{4}$	65	252	v. s.	v. s.	v. s.
2375	nd./bz.*	....	136-7	subl.	s.; sl. s. lg.	s.	s.
2376	cr./aq.	....	221 sl. d.	....	....	....	....
2377	nd.	....	149-50	....	s.	v. s.	v. s.
2378	nd./xylene	....	150-1	....	....	....	....
2379	lf./aq.	....	213	subl.	s. h.	v. s.	v. s.; i. bz.
2380	cr./aq. al.	....	163	277-80	s. h.	s.	s.
2381	lt. yel. nd.	....	110 (95-6)	....	s.	s.	s.
2382	col. rhb.	....	78-82	d. 80-100	sl. s. c. lg.	....	....
2383	pr./al.	....	234-5	....	i. h.	sl. s. h. bz.	v. s.
2384	yel. pd.	....	291-2	....	i.	s. h.	v. sl. s.
2385	rhb.	2.75	95-6	....	s. h.	v. s. h.	v. s.
2386	cr./lg.	2.54^{20°	27	286.5	i.	sl. s. c.	....
2387	cr./al. et.	2.47^{25°	40.4	284.7^{757mm}	i.	sl. s.	....
2388	lf./al.	....	129.4	285	i.	sl. s.	....
2389	lq.	2.307^{18°	5.8	$120\text{-}5^{12mm}$	....	....	....
2390	lq.	2.84^{0°	....	177-9	i.	v. s.	v. s.
2391	yel. mn.	2.132^{10°	81-2	d.	sl. s.	s.	s.
2392	or.-red pd.	....	....	....	sl. s.	s.	s. alk.
2393	col. nd.	2.05^{18°	9.5	$163^{17.5mm}$	....	....	....
2394	yel.-wh. nd./al.	....	230 ±, d.	....	0.07 c.; 0.15 h.	s.	s.
2395	nd./aq. al.	....	278-9 d.	....	i. h.	v. s.	v. s.
2396	oil	2.194^{18°	9	149^{20mm}	....	....	....
2397	lq.	$2.490^{18.5^\circ}$	....	d.	....	....	....
2398	lq.	2.150^{0°	....	147-8 d.	....	....	....
2399	lq.	2.576^{15°	−13	224	v. sl. s.	s.	s.
2400	col. lf./al.	....	40-1	....	i.	s.	s.; s. chl.
2401	nd./aq. al.	....	213 d.	....	0.288^{15°	d. h. aq.	s. dil. alk.

* Cryst./aq. + $1H_2O$, m. p. 115-7°.

Diiodoform 5812
Diiodo-methane 4434
Diiodo-phenol sulfonic acid 5626
Diiodo-propanol 3401
Diiodo-salicylic acid 2394

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Diiodo				
2402	tyrosine (3,5)(*dl*)	....	$C_9H_9O_3NI_2$	XIV-622	433.01
2403	**Dimethallyl ether** (*β*)	....	$[CH_2{:}C(CH_3)\cdot CH_2]_2O$	....	126.19
2404	**Dimethoxy**-aniline	(2,5;1)	$(CH_3O)_2C_6H_3\cdot NH_2$	XIII-738	153.18
2405	benzaldehyde (2,4)	2-MeO-anisaldehyde	$(CH_3O)_2C_6H_3\cdot CHO$	VIII-242	166.17
2406	benzene (*o*)	veratrole	$(CH_3O)_2C_6H_4$	VI-771	138.16
2407	benzene (*m*)	resorcinol diMe ether	$(CH_3O)_2C_6H_4$	VI-813	138.16
2408	benzene (*p*)	hydroquinone diMe ether	$(CH_3O)_2C_6H_4$	VI-843	138.16
2409	benzophenone (4,4′)	*p*-anisoyl-anisole	$(CH_3O\cdot C_6H_4)_2CO$	VIII-317	242.26
2410	ethyl adipate	....	$[(CH_2)_2\cdot CO_2(CH_2)_2\cdot OCH_3]_2$	....	262.30
2411	ethyl carbonate	....	$[CH_3O(CH_2)_2O]_2CO$	....	178.18
2412	ethyl phthalate	....	$[CH_3O(CH_2)_2O_2C]_2\cdot C_6H_4$	....	282.28
2413	2-methyl-3,4-dihydroisoquinoline chloride (6,7)	Iodal	$C_{12}H_{16}O_2N\cdot Cl\cdot 3\frac{1}{2}H_2O$	XXI-170	304.77
2414	quinazoline (2,4)	....	$(CH_3O)_2C_8H_4N_2$	XXIII-486	190.20
2415	**Dimethyl**-acetal	dimethyl aldehyde	$CH_3\cdot CH(OCH_3)_2$	I-603	90.12
2416	acetamide (*N,N*)	acet-dimethylamide	$CH_3CO\cdot N(CH_3)_2$	IV-59	87.12
2417	acetanilide (2,3)	aceto-*o*-xylidide (*vic*)	$(CH_3)_2C_6H_3NH\cdot COCH_3$	XII-1101	163.21
2418	acetanilide (2,4)	aceto-*m*-xylidide (*uns*)	$(CH_3)_2C_6H_3NH\cdot COCH_3$	XII-1118	163.21
2419	acetanilide (2,5)	aceto-*p*-xylidide	$C_8H_9NH\cdot COCH_3$	XII-1137	163.21
2420	acetanilide (2,6)	aceto-*m*-xylidide (*vic*)	$C_8H_9NH\cdot COCH_3$	XII-1109	163.21
2421	acetanilide (3,4)	aceto-*o*-xylidide (*uns*)	$C_8H_9NH\cdot COCH_3$	XII-1104	163.21
2422	acetanilide (3,5)	aceto-*m*-xylidide (*sym*)	$C_8H_9NH\cdot COCH_3$	XII-1131	163.21
2423	acetoacetic ester	....	$CH_3CO\cdot C(CH_3)_2CO_2\cdot C_2H_5$	III-695	158.19
2424	acrylic acid (*β,β*)	....	$(CH_3)_2C{:}CH\cdot CO_2H$	II-432	100.11
2425	acrylic acid (*α,β*) (*cis*)	angelic acid	$CH_3\cdot CH{:}C(CH_3)\cdot CO_2H$	II-428	100.11
2426	acrylic acid (*α,β*) (*trans*)	tiglic acid	$CH_3\cdot CH{:}C(CH_3)\cdot CO_2H$	II-430	100.11
2427	acrylic aldehyde (*trans*)	tiglic aldehyde	$CH_3\cdot CH{:}C(CH_3)\cdot CHO$	I-733	84.11
2428	adipate	methyl adipate	$[(CH_2)_2CO_2CH_3]_2$	II-652	174.19
2429	amine	....	$(CH_3)_2NH$	IV-39	45.08
2430	amine hydrochloride	....	$(CH_3)_2NH\cdot HCl$	IV-41	81.55
2431	amino-azobenzene (*p*)	benzene-azo-diMe-aniline	$(CH_3)_2N\cdot C_6H_4\cdot N{:}N\cdot C_6H_5$	XVI-312	225.28
2432	amino-azobenzene (*p*) HCl	....	$C_{14}H_{15}N_3\cdot HCl$	XVI-312	261.75

Diketo-hydrindene 3854
Diketo-piperazine 3439
Diketo-tetrahydroquinazoline 779
Dilactide 3945
Dilactone 2872

Dilantin 2724
Dilaudid, cf. alkd.
Dilituric acid 4632
Dimercapto-thiodiazol 5898
Dimethoxy-azobenzene 598

Dimethoxy-benzaldehyde 6424
Dimethoxy-benzoic acid 6423
Dimethoxy-coumarin 3971
Dimethoxy-ethane 3459
Dimethoxy-methane 4424

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2402	pl./aq.	....	>200 d.	....	$0.56^{75°}$	....	....
2403	lq.	$0.816^{20°}_{4}$	....	134	<0.1	....	....
2404	sc./pet.	....	80-1	270 sl. d.	s.	v. s. h.	v. s. h. pet.
2405	nd./aq. al.	....	69-70	165^{10mm}	i.; s. bz.	s.; s. lg.	s.
2406	cr.	$1.091^{15°}_{15}$	22.5	207.1	v. sl. s.	s.	s.
2407	lq.	$1.062^{15°}_{15}$	-52	216.5-7.5	v. sl. s.	v. s.	v. s.
2408	lf.	$1.053^{55°}_{55}$	56	212.6	v. sl. s.	v. s.	v. s.
2409	nd./al.	....	144-5	....	s. bz.	s. h.	s. chl.
2410	col. lq.	....	....	$194\text{-}6^{20mm}$	....	....	....
2411	col. lq.	....	....	$115\text{-}7^{13mm}$	....	....	....
2412	col. lq.	....	....	$178\text{-}80^{1mm}$	....	....	....
2413	yel. nd./ aq. act.	....	61-2; 186 d. (anh.)	....	v. s.	v. s.	sl. s. chl.
2414	col. nd.	....	75	....	i.	s.	s.
2415	lq.	$0.850^{20°}_{4}$	-113.2	64^{748mm}	∞	∞	∞
2416	col. lq.	$0.943^{20°}_{4}$	....	165.5^{754mm}	....	....	....
2417	nd./al.	....	132-3	....	s. h.	s.	s.
2418	nd./aq. al.	....	128-9	....	v. sl. s. c.	s.	....
2419	nd./aq.	....	138-9	....	s. h.	s. h. toluene	....
2420	nd.	....	174-6	....	....	....	....
2421	pr./aq. al.	....	98-9	....	i.	v. s.	....
2422	nd./al.	....	144.5	....	i.	s.	....
2423	oil	$0.977^{20°}_{20}$	....	184-5	v. sl. s.	s.	s.
2424	mn./aq.	$1.006^{24°}$	69-70	194-5	s.	s.	s.
2425	mn. nd.	$0.983^{47°}$	45	185	s. h.	s.	s.
2426	tri. pl.	$0.964^{76°}_{4}$	64.5	198.5	s. h.	s.	s.
2427	lq.	$0.870^{18°}_{4}$	....	115.8^{739mm}	2.5	∞	∞
2428	col. lq.	$1.063^{20°}_{4}$	10-1	115^{13mm}	i.	....	....
2429	col. lq.	$0.680^{0°}_{4}$	-96	7.4	v. s.	s.	s.
2430	nd./al.	....	170-1	....	$369^{25°}$	v. s.	i.; $16.9^{25°}$ chl.
2431	yel. lf./al.	....	116-7	d.	i.; s. oil	s.; s. bz.	s.; s. chl.
2432	red-vl. cr.	....	168-74	....	....	....	....

Dimethoxy-methyl ether 4077
Dimethoxy-phenol 5515
Dimethoxy-phthalic acid 3502
Dimethoxy-phthalide 4017
Dimethoxy-strychnine, cf. alkd.
Dimethoxy-tetraglycol 5769
Dimethyl-aldehyde 2415
Dimethyl-aldine 2533
Dimethyl-allene 4155
Dimethyl-amino-antipyrine 363

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Dimethyl				
2433	amino-azobenzene-arsinic acid (*p*)	....	$(CH_3)_2N\cdot C_6H_4\cdot N{:}N\cdot C_6H_4\cdot As(OH)_2$	....	333.20
2434	amino-azo-benzene-arsonic acid (*p*)	....	$(CH_3)_2N\cdot C_6H_4\cdot N{:}N\cdot C_6H_4\cdot AsO(OH)_2$	XVI-885	349.20
2435	amino-benzaldehyde	(1,2)	$(CH_3)_2N\cdot C_6H_4\cdot CHO$	XIV-25	149.19
2436	amino-benzaldehyde (1,4)	Ehrlich's reagent	$(CH_3)_2N\cdot C_6H_4\cdot CHO$	XIV-31	149.19
2437	amino-benzal-rhodanine-5 (*p*)	....	$(CH_3)_2N\cdot C_6H_4\cdot CH{:}C_3HONS_2$	XXVII-433	264.35
2438	amino-benzene-1-azo-1-naphthalene (4)	butter yellow	$(CH_3)_2N\cdot C_6H_4\cdot N{:}N\cdot C_{10}H_7$	XVI-321	275.34
2439	amino-benzene-1-azo-2-naphthalene (4)	....	$(CH_3)_2N\cdot C_6H_4\cdot N{:}N\cdot C_{10}H_7$	XVI-321	275.34
2440	amino-benzoic acid (*o*)	*N,N*-di Me-anthranilic acid	$(CH_3)_2N\cdot C_6H_4\cdot CO_2H$	XIV-325	165.19
2441	amino-benzoic acid	(*p*)	$(CH_3)_2N\cdot C_6H_4\cdot CO_2H$	XIV-426	165.19
2442	amino-benzophenone (*p*)	....	$(CH_3)_2N\cdot C_6H_4\cdot CO\cdot C_6H_5$	XIV-82	225.28
2443	amino-ethanol	....	$(CH_3)_2N\cdot CH_2\cdot CH_2OH$	IV-276	89.14
2444	amino-glycerol (*α*)	γ-dimethylamino-propylene glycol	$(CH_3)_2N\cdot CH_2\cdot CHOH\cdot CH_2OH$	IV-302	119.16
2445	amino-phenol (*m*)	....	$(CH_3)_2N\cdot C_6H_4\cdot OH$	XIII-405	137.18
2446	amino-phenol (*p*)	....	$(CH_3)_2N\cdot C_6H_4\cdot OH$	XIII-442	137.18
2447	amino-phenol H_2SO_4	(*p*)	$C_8H_{11}ON\cdot \frac{1}{2}H_2SO_4$	XIII-442	186.21
2448	amino-phenyl acetate (*p*)	....	$CH_3CO_2\cdot C_6H_4\cdot N(CH_3)_2$	XIII-443	179.21
2449	ammonium-dimethyl-dithiocarbamate	....	$(CH_3)_2N\cdot CS\cdot S\cdot NH_2(CH_3)_2$	**IV-577	166.30
2450	aniline †	....	$(CH_3)_2N\cdot C_6H_5$	XII-141	121.18
2451	aniline sulfonic acid (*m*)	....	$(CH_3)_2N\cdot C_6H_4\cdot SO_3H$	XIV-690	201.24
2452	aniline sulfonic acid (*p*)	....	$(CH_3)_2N\cdot C_6H_4\cdot SO_3H\cdot H_2O$	XIV-699	219.25
2453	anthracene (1,3)	....	$(CH_3)_2C_{14}H_8$	V-678	206.27
2454	anthracene (2,3)	....	$(CH_3)_2C_{14}H_8$	V-678	206.27
2455	anthracene (2,6)	....	$(CH_3)_2C_{14}H_8$	V-678	206.27
2456	arsine	cacodyl hydride	$(CH_3)_2AsH$	IV-599	105.99
2457	benzamide (*N*)	....	$C_6H_5CO\cdot N(CH_3)_2$	IX-201	149.19
2458	benzoic acid (2,3)	hemellitic acid	$(CH_3)_2C_6H_3\cdot CO_2H$	IX-531	150.17
2459	benzoic acid (2,4)	xylic acid	$(CH_3)_2C_6H_3\cdot CO_2H$	IX-531	150.17
2460	benzoic acid (2,5)	....	$(CH_3)_2C_6H_3\cdot CO_2H$	IX-534	150.17
2461	benzoic acid (2,6)	....	$(CH_3)_2C_6H_3\cdot CO_2H$	IX-531	150.17
2462	benzoic acid (3,4)	....	$(CH_3)_2C_6H_3\cdot CO_2H$	IX-535	150.17

† See also xylidine.

Dimethyl-amino-azobenzene carboxylic acid 4376
Dimethyl-amino-benzophenonimide 592
Dimethyl-amino-propylene glycol 2444
Dimethyl-*n*-amyl carbinol 4967
Dimethyl-aniline 6471-5, 6477

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2433	vl. cr.	....	....	....	i.	sl. s.	i.
2434	red pd.	....	....	....	s. a.	s. alk.	....
2435	yel. oil	....	....	244	s. dil. ac.	s.	s.
2436	lf./aq.	....	74-5	176-7^{17mm}	i.; s. ac.	s.	s.
2437	red nd./ al.	....	240-70 d.	....	i.; s. conc. a.	sl. s. h.; v. sl. s. bz.	v. sl. s.; v. sl. s. chl.
2438	red-bl. pr./act.	....	....	....	s. conc. H_2SO_4	sl. s.; s. chl.	sl. s.; s. act.
2439	yel. brn. cr., bz.-lg.	....	174	....	....	....	....
2440	nd./et.	....	70	....	s.	s.	sl. s. h.
2441	nd./al.	....	238-9	....	s.	s.	sl. s.
2442	lf./al.	....	90-2	....	i.	v. s. h.	v. s.
2443	col. lq.	$0.887^{20°}_{4}$	....	135^{758mm}	∞	....	....
2444	syrup	....	....	220^{749mm}	s.	s.	s.; s. chl.
2445	nd./lg.	....	85	265-8	sl. s. h.	s.	s.
2446	cr./et.-lg.	....	78	....	v. sl. s. lg.	s.	s.
2447	cr.	....	209-10	....	v. s.	sl. s.	....
2448	nd. or pl./ aq. al.	....	78-9	....	v. sl. s.; v. sl. s. ac.	0.; v. s. bz.	s.; s. lg.; v. s. ch'.
2449	pa. yel. pl.	....	129-30 d.	....	v. s.	v. s.	v. sl. s.
2450	yel. lq.	$0.956^{20°}_{4}$	2.5	193	i.	s.; s. chl.	s.
2451	....	....	d. 266	....	s.	....	....
2452	pr. or lf.	....	270 (anh.) −H_2O, 135°	....	s. h.; s. ac.	v. sl. s.	v. sl. s.
2453	lf./et.	....	83	....	....	....	....
2454	lf.	....	252	....	v. s. bz.	....	....
2455	red-yel.; gn.-yel. or silvery	....	243-4	subl.	....	sl. s.	s. bz.
2456	col. lq.	$1.213^{29°}$	....	35.6^{747mm}	....	∞	∞
2457	col. cr.	....	41-2	272-3	v. s.	....	....
2458	pr./al.	....	144	....	v. sl. s. h.	s.	....
2459	mn. or tri.	....	126-7	267^{727mm}	sl. s. h.	s. h.	s. bz., chl.
2460	nd al.	$1.069^{20°}_{4}$	132	268	v. sl. s. h.	v. s. c.	....
2461	col. nd./lg.	....	116	....	....	sl. s. c. lg.	v. s.
2462	pr./al.	....	165-6	subl.	v. sl. s. h.	s.	....

Dimethyl-anthranilic acid 2440
Dimethyl-azobenzene 612-4
Dimethyl-benzene 6454, 6457, 6462
Dimethyl-benzene sulfonyl chloride 6461
Dimethyl-benzidine 5955, 5959
Dimethyl-benzophenone 2838

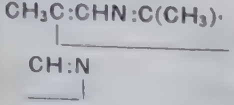
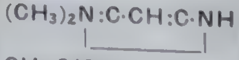
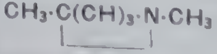
No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2463	**Dimethyl** benzoic acid (3,5)	mesitylenic acid	$(CH_3)_2C_6H_3\cdot CO_2H$	IX-536	150.17
2464	benzoylene urea	....	$C_6H_4\cdot N(CH_3)\cdot CO\cdot$ $N(CH_3)\cdot CO$	XXIV-375	190.20
2465	benzylamine (*N*)	....	$C_6H_5\cdot CH_2\cdot N(CH_3)_2$	XII-1019	135.20
2466	benzyl carbinol	....	$C_6H_5CH_2\cdot C(CH_3)_2OH$	VI-523	150.21
2467	carbanilide	*N,N'*-diMe-*N,N'*-diPh urea	$[C_6H_5(CH_3)N]_2CO$	XII-418	240.29
2468	carbonate	methyl carbonate	$CO(OCH_3)_2$	III-4	90.08
2469	citraconate	....	$CH_3\cdot C_2H(CO_2CH_3)_2$	II-770	158.15
2470	cyclohexan-3,5-diol (1,1)	....	$(CH_2\cdot CHOH)_2CH_2\cdot C:$ $(CH_3)_2$	*VI-371	144.21
2471	cyclohexane (*o*) *	hexahydro-*o*-xylene	$(CH_3)_2C_6H_{10}$	V-36	112.21
2472	cyclohexane (*m*) *	hexahydro-*m*-xylene	$(CH_3)_2C_6H_{10}$	V-36	112.21
2473	cyclohexane (*p*) *	hexahydro-*p*-xylene	$(CH_3)_2C_6H_{10}$	V-39	112.21
2474	2,4-dicarbethoxy-pyrrole (3,5)	....	$C_{12}H_{17}O_4N$	XXII-133	239.26
2475	dihydroresorcinol (5,5)	1,1-diMe-cyclohexan-3,5-dione	$(CH_3)_2C_6H_6O_2$	VII-559	140.18
2476	1,3-diphenylcyclobutane (1,3)	α-Me-styrene dimer	$[C_6H_5(CH_3)C\cdot CH_2]_2$	V-652	236.34
2477	dithiocarbamate Na	....	$(CH_3)_2N\cdot CS_2Na\cdot 2\frac{1}{2}H_2O$	IV-75	188.24
2478	ether	methyl ether	$CH_3\cdot O\cdot CH_3$	I-281	46.07
2479	6-ethoxyquinoline	(2,4)	$C_2H_5O\cdot C_9H_4N(CH_3)_2$	....	201.26
2480	6-ethoxyquinoline ethiodide (2,4)	....	$C_{13}H_{15}ON\cdot C_2H_5I$	....	357.24
2481	ethylacetic acid	....	$(CH_3)_2(C_2H_5):C\cdot CO_2H$	II-335	116.16
2482	ethylamine	....	$(CH_3)_2N\cdot C_2H_5$	IV-94	73.14
2483	ethylbenzene (3,4)	4-Et-*o*-xylene	$C_2H_5\cdot C_6H_3(CH_3)_2$	V-427	134.21
2484	ethylbenzene (3,5)	5-Et-*m*-xylene	$C_2H_5\cdot C_6H_3(CH_3)_2$	V-429	134.21
2485	ethylbenzene (2,4)	6-Et-*m*-xylene	$C_2H_5\cdot C_6H_3(CH_3)_2$	V-428	134.21
2486	ethylbenzene (2,5)	2-Et-*p*-xylene	$C_2H_5\cdot C_6H_3(CH_3)_2$	V-428	134.21
2487	fumarate	methyl fumarate	$(:CH\cdot CO_2\cdot CH_3)_2$	II-741	144.12
2488	furan (2,5)	α,α'-diMe-furan	$(CH_3)_2C_4H_2O$	XVII-41	96.12
2489	glutaric acid (α,α)	....	$(CH_3)_2C_3H_4(CO_2H)_2$	II-676	160.17
2490	glyoxime	diacetyl-dioxime	$(CH_3\cdot C:NOH)_2$	I-772	116.12
2491	guanidine H_2SO_4 (*uns*)	....	$(CH_3)_2N\cdot C(NH)\cdot NH_2\cdot \frac{1}{2}H_2SO_4$	**IV-574	136.16
2492	1,3-heptadiene-(2,6)	*iso*-geraniolene	C_9H_{16}	I-260	124.22
2493	1,5-hexadiene (2,5)	....	$[CH_2:C(CH_3)\cdot CH_2\cdot]_2$	I-259	110.19
2494	hydrazine (*sym*)	hydrazomethane	$CH_3NH\cdot NHCH_3$	IV-547	60.10
2495	hydrazine (*uns*)	....	$(CH_3)_2N\cdot NH_2$	IV-547	60.10
2496	hydrazine HCl	(*uns*)	$(CH_3)_2N\cdot NH_2\cdot HCl$	IV-547	96.57
2497	2-(2-hydroxyphenyl)-imidazole (4,5)	....	$CH_3\cdot C:C(CH_3)\cdot N:C\cdot$ $(C_6H_4OH)\cdot NH$	XXIII-391	188.22

Dimethyl-benzyl phenol 1573 * cis
imethyl-butadiene 2769
hyl-butandiol 5312
-butyl carbinol (*n*) 3535
vl carbinol (*iso*) 3530

Dimethyl-butyl carbinol (*tert*) 3528
Dimethyl cadmium 1186
Dimethyl-chloroarsine 1179
Dimethyl-cyclohexadiene 2289-91
Dimethyl-diazine 2533

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2463	mn./aq. al.	....	166	subl.	v. sl. s. h.	v. s. c.	....
2464	col. nd.	....	167-8	....	i.	s.	....
2465	lq.	0.915^{0°	....	$183\text{-}4^{765mm}$	sl. c.; v. sl. h.	∞	∞
2466	nd.	$0.979^{16^\circ}_{4}$	24	228	....	....	....
2467	mn. pr./al.	....	121	350	i.	s.	s.; s. bz.
2468	col. lq.	$1.070^{20^\circ}_{4}$	0.5	89-90	i.	∞	∞
2469	col. oil	$1.121^{15^\circ}_{15}$	....	210.5	3^{15°	....	....
2470	pl./act.	....	146-7	....	s.; s. bz.	s.; s. chl.	v. sl. s.
2471	lq.	$0.796^{20^\circ}_{4}$	−50.0	129.7	i.	∞	∞
2472	lq.	$0.766^{20^\circ}_{4}$	−75.6	120.1	i.	∞	∞
2473	lq.	$0.783^{20^\circ}_{4}$	−87.4	124.3	....	....	....
2474	cr./aq. al. or ac.	....	134-5	....	i.; s. chl.; s. H_2SO_4	s.; s. bz.; i. HCl	v. sl. s.; s. ac.
2475	yel. mn. nd./aq.	....	148-9	....	0.416^{25°; s. chl.	6.6 h. bz.; s. EtOAc	v. sl. s.
2476	cr./et.	....	52.6	307.5^{760mm}	i.; 125^{25° act.	5^{25°; 190^{25° bz.	1.7^{25°; 104^{25° CCl_4
2477	cr.	....	$-2H_2O$, 115	$-2\frac{1}{2}H_2O$, 130	....	....	....
2478	gas	1.617(A)	−138.5	−23.7	3700^{18° cc.	s.	s.
2479	col. nd.	....	86-8	....	i.	v. s.	v. s.
2480	yel. rhb.	....	163-4	....	i.	s.	i.
2481	lq.	....	−14	187	v. sl. s.	s.	s.
2482	col. lq.	....	....	37.5	....	....	....
2483	col. lq.	$0.875^{20^\circ}_{4}$	−67.0	189.8	i.	s.	s.
2484	col. lq.	$0.866^{20^\circ}_{4}$	−84.2	183.8	i.	s.	s.
2485	lq.	$0.876^{20^\circ}_{4}$	−63.0	188.4	i.	s.	s.
2486	lq.	$0.877^{20^\circ}_{4}$	−53.7	186.9	i.	s.	s.
2487	col. tri.	....	102	192	s. c. chl.	sl. s.	sl. s.
2488	col. lq.	$0.888^{20^\circ}_{4}$	....	93-4	i.; i. alk.	∞	∞
2489	nd./HCl	....	90	....	v. s.	v. s.	v. s.
2490	col. cr.	....	240-6	....	0.06^{20°	v. s.	v. s.
2491	col. cr./aq.	....	285-7 d.	....	v. s.	i.	i.
2492	lq.	$0.765^{10^\circ}_{4}$	....	$143\text{-}5^{755mm}$	i.	....	....
2493	lq.	$0.749^{21^\circ}_{21}$	<−80	$113\text{-}4^{755mm}$	i.	....	....
2494	hyg. lq.	$0.827^{20^\circ}_{4}$	....	81^{747mm}	∞	∞	∞
2495	hyg. lq.	0.791^{22°	....	62.5^{717mm}	v. s.	v. s.	v. s.
2496	col. cr.	....	82-3	....	s.	s.	i.
2497	nd./aq. al.	....	218	....	....	....	....

Dimethyl-diphenyl urea 2467
Dimethyl-disulfide 4222
Dimethyl-ethyl carbinol 409
Dimethyl-ethylene 1148-9
Dimethyl-ethylene glycol 1154
Dimethyl-ethylene oxide 1155
Dimethyl-furfurane carboxylic acid 6396
Dimethyl-hexyl carbinol (*n*) 4922
Dimethyl-hydantoin 66
Dimethyl-hydroquinone 2376, 2380

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2498	**Dimethyl** itaconate	. . . .	$C_3H_4(CO_2CH_3)_2$	II-762	158.15
2499	ketene	. . . .	$(CH_3)_2C{:}CO$	I-731	70.09
2500	malate (*l*)	methyl malate	$C_2H_4O(CO_2CH_3)_2$	III-429	162.14
2501	maleate	methyl maleate	$({:}CH{\cdot}CO_2{\cdot}CH_3)_2$	II-751	144.12
2502	malonate	methyl malonate	$CH_2(CO_2{\cdot}CH_3)_2$	II-572	132.11
2503	malonic acid	. . . .	$(CH_3)_2C(CO_2H)_2$	II-647	132.11
2504	mesaconate	. . . .	$CH_3{\cdot}C_2H(CO_2CH_3)_2$	II-765	158.15
2505	naphthylamine (α)	. . . .	$(CH_3)_2N{\cdot}C_{10}H_7$	XII-1221	171.23
2506	naphthylamine (β)	. . . .	$(CH_3)_2N{\cdot}C_{10}H_7$	XII-1273	171.23
2507	naphthalene (1,4)	. . . .	$(CH_3)_2C_{10}H_6$	V-570	156.22
2508	naphthalene (2,3)	guajen	$(CH_3)_2C_{10}H_6$	*V-268	156.22
2509	naphthalene (2,6)	. . . .	$(CH_3)_2C_{10}H_6$	V-570	156.22
2510	α-naphthoquinoline	(2,4)	$(CH_3)_2C_{13}H_7N$	XX-475	207.26
2511	β-naphthoquinoline	(2,4)	$(CH_3)_2C_{13}H_7N$	XX-476	207.26
2512	4-nitrophthalate	. . . .	$NO_2C_6H_3(CO_2CH_3)_2$	IX-830	239.18
2513	nitrosamine	nitroso-dimethyl-amine	$(CH_3)_2N{\cdot}NO$	IV-84	74.08
2514	2,6-octadiene (2,6)	dihydromyrcene	$C_{10}H_{18}$	I-260	138.24
2515	2,7-octadiene (2,6)	linaloolene	$C_{10}H_{18}$	I-261	138.24
2516	2,6-octadiene-8-ol (2,6)	nerol	$C_{10}H_{18}O$	I-459	154.24
2517	2,6-octadiene-8-ol (2,6)	geraniol	$C_{10}H_{18}O$	I-457	154.24
2518	2,7-octadiene-6-ol (2,6)	*l*-linalool	$C_{10}H_{18}O$	I-460	154.24
2519	octanol-6 (2,6)	linalool tetrahydride	$C_{10}H_{22}O$	I-426	158.28
2520	octanol-8 (2,6)	geraniol tetrahydride	$C_{10}H_{22}O$	I-426	158.28
2521	oxalate	methyl oxalate	$(CO_2{\cdot}CH_3)_2$	II-534	118.09
2522	oxamide (*sym*)	. . . .	$(CO{\cdot}NHCH_3)_2$	IV-61	116.12
2523	oxamide (*uns*)	. . . .	$(CH_3)_2N{\cdot}(CO)_2NH_2$	IV-61	116.12
2524	phenacyl chloride (2,4)	ω-Cl-2,4-diMe-acetophenone	$(CH_3)_2C_6H_3{\cdot}CO{\cdot}CH_2Cl$	VII-324	182.65
2525	phenanthrene (9,10)	. . . .	$(CH_3)_2C_{14}H_8$	V-680	206.27
2526	phenyl carbinol	. . . .	$C_6H_5{\cdot}C(CH_3)_2{\cdot}OH$	VI-506	136.19
2527	*p*-phenylenediamine	(*sym*)	$(CH_3NH)_2C_6H_4$	. . . .	136.19
2528	*p*-phenylenediamine oxalate	(*sym*)	$(CH_3NH)_2C_6H_4{\cdot}2H_2C_2O_4$	. . . .	316.26
2529	phosphine	. . . .	$(CH_3)_2PH$	IV-580	62.06
2530	*o*-phthalate	methyl phthalate	$C_6H_4(CO_2CH_3)_2$	IX-797	194.18
2531	*m*-phthalate	Me *iso*-phthalate	$C_6H_4(CO_2CH_3)_2$	IX-834	194.18
2532	*p*-phthalate	Me-terephthalate	$C_6H_4(CO_2CH_3)_2$	IX-843	194.18
2533	pyrazine (2,5)	ketine; glycoline	 $CH_3C{:}CHN{:}C(CH_3){\cdot}CH{:}N$	XXIII-96	108.14
2534	pyrazole (3,5)	. . . .	 $(CH_3)_2N{:}C{\cdot}CH{:}C{\cdot}NH$	XXIII-74	96.13
2535	pyrrol (1,2)	. . . .	 $CH_3{\cdot}C(CH)_3{\cdot}N{\cdot}CH_3$	. . . .	95.14
2536	pyrrol (2,3)	. . . .	$(CH_3)_2C_4H_2NH$	XX-172	95.14
2537	pyrrol (2,4)	. . . .	$(CH_3)_2C_4H_2NH$	XX-172	95.14

Dimethyl-itaconic acid 5700
Dimethyl-ketazine 3932
Dimethy-ketol 43
Dimethyl ketone 56
Dimethyl mercury 4044
Dimethyl-octane 1637-8
Dimethyl-octenol 1519
Dimethyl-pentanol 3529-31

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2498	mn./Me al.	$1.124_{4}^{18°}$	38	208	....	....	....
2499	yel. lq.	....	−97.5	34^{750mm}	d.	d.	s.
2500	lq.	$1.233_{4}^{20°}$	....	242	s.	∞	∞
2501	col. lq.	$1.151^{21°}$	7.6	205	....	....	....
2502	col. lq.	$1.154_{4}^{20°}$	−62	180-1	i.	∞	∞
2503	col. pr.	$1.357^{18°}$	192-3 d.	d. > 130	$10^{13°}$	v. s. abs.	v. s.
2504	col. lq.	$1.121_{20}^{20°}$	....	205.5-6.5	....	....	....
2505	col. oil	$1.042^{20°}$	....	274.5^{711mm}	i.	s.	s.
2506	col. cr.	$1.039_{70}^{70°}$	46-7	304-5	i.	s.	s.
2507	lq.	$1.016_{4}^{20°}$	<−18	264-6	i.	....	....
2508	lf./al.	....	104.0-4.5	$265\text{-}6^{767mm}$	i.	sl. s.	s. bz.
2509	lf./al.	$1.142_{4}^{0°}$	110-1	$261\text{-}2^{762mm}$	i.	sl. s.	....
2510	nd./pet.	....	43-4	....	v. s. h. pet.	i. 90% al.	v. s.
2511	nd./et.	....	126-7	>300 d.	v. sl. s. h.	s.; s. ac.	s.; s. act.
2512	cr./aq. al.	....	66-7.5	....	....	....	....
2513	yel. oil	$1.006_{4}^{20°}$	....	153^{774mm}	s.	s.	s.
2514	lq.	$0.775_{4}^{21°}$	....	171.5-3.5	....	....	....
2515	lq.	$0.788^{20°}$	....	165-8	....	....	....
2516	oil	$0.881^{15°}$	....	$224\text{-}5^{745mm}$	....	....	....
2517	col. lq.	$0.883^{15°}$	<−15	230	i.	∞	∞
2518	oil	$0.862^{20°}$	....	$197\text{-}200^{756mm}$	v. sl. s.	∞	∞
2519	lq.	$0.836_{4}^{15°}$	....	196-7	....	....	....
2520	lq.	$0.849_{4}^{0°}$	....	212-3	....	....	....
2521	col. mn.	$1.148^{54°}$	54	163.3	6	s.	s.
2522	nd./aq.	$1.3^{4°}$	212-7	subl.	$2.5^{9.4°}$; v. s. h.	s.; d. h. alk.	v. sl. s.; s. chl.
2523	pl./bz.	....	104	....	v. s.	v. s.	v. sl.s.
2524	lf.	....	62-3	....	....	s.	....
2525	pr./dil. ac.	....	139	subl.	s. ac.	sl. s.; s. bz.	s. chl.
2526	pr.	$0.972_{4}^{19°}$	23	215-20 sl. d.	....	....	....
2527	cr.	....	53	150^{17mm}	....	....	....
2528	col. cr.	....	194-6 d.	....	s.	sl. s.	i.
2529	col. lq.	<1	....	25	i.	....	....
2530	col. lq.	$1.189_{25}^{25°}$	....	280^{734mm}	0.43	....	....
2531	nd./aq. al.	....	67-8	....	i.	....	....
2532	rhb./al.	....	140	>300; subl.	0.3 h.	s. h.	s.
2533	pl.	$0.990_{4}^{18°}$	15	155	∞	∞	∞
2534	pl.	$0.884_{4}^{26°}$	106-7	218^{759mm}	s.; s. bz.	s.; s. chl.	s.
2535	lq.	....	....	65^{14mm}	....	....	....
2536	lq.	....	....	165	....	....	....
2537	lq.	$0.927_{4}^{14°}$	....	171	sl. s.	s.	s.; s. bz.

Dimethyl-phenol 6465-70
Dimethyl-phenyl hydrazine 6500-2
Dimethyl-phenylenediamine 305-7
Dimethyl-propyl carbinol (*n*) 3631
Dimethyl-propyl carbinol (*iso*) 3629
Dimethyl-pyridine 3981-4

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2538	**Dimethyl** pyrrol (2,5)		$(CH_3)_2C_4H_2NH$	XX-172	95.14
2539	quinolinate (2,3)		$C_5H_3N(CO_2CH_3)_2$	XXII-151	195.17
2540	quinoline (2,3)		$(CH_3)_2C_9H_5N$	XX-406	157.21
2541	quinoline (2,4)	4-Me-quinaldine	$(CH_3)_2C_9H_5N$	XX-407	157.21
2542	quinoline H_2SO_4	(2,4)	$C_{11}H_{11}N\cdot\frac{1}{2}H_2SO_4$	XX-408	206.24
2543	quinoline EtI	(2,4)	$C_{11}H_{11}N\cdot C_2H_5I$	XX-408	313.19
2544	quinoline (2,6)	6-Me-quinaldine	$(CH_3)_2C_9H_5N$	XX-408	157.21
2545	quinoline EtI	(2,6)	$C_{11}H_{11}N\cdot C_2H_5I$	XX-409	313.19
2546	quinoline (3,4)		$(CH_3)_2C_9H_5N$	XX-410	157.21
2547	quinoline (5,8)		$(CH_3)_2C_9H_5N$	XX-411	157.21
2548	quinoline (6,8)		$(CH_3)_2C_9H_5N$	XX-411	157.21
2549	quinone (2,3)	*o*-xyloquinone	$(CH_3)_2C_6H_2O_2$	VII-656	136.14
2550	quinone (2,5)	*p*-xyloquinone	$(CH_3)_2C_6H_2O_2$	VII-658	136.14
2551	quinone (2,6)	*m*-xylo-*p*-quinone	$(CH_3)_2C_6H_2O_2$	VII-657	136.14
2552	sebacate	methyl sebacate	$(CH_2)_8(CO_2CH_3)_2$	*II-293	230.30
2553	selenide	selenium methyl	$(CH_3)_2Se$	I-291	109.03
2554	succinate	methyl succinate	$(CH_2CO_2\cdot CH_3)_2$	II-609	146.14
2555	*iso*-succinate		$CH_3\cdot CH(CO_2\cdot CH_3)_2$	II-628	146.14
2556	succinic acid (*meso*)		$(CH_3CH)_2(CO_2H)_2$	II-665	146.14
2557	succinic acid (*α,α*)		$(CH_3)_2C\cdot CH_2(CO_2H)_2$	II-661	146.14
2558	succinic acid (*dl*)		$(CH_3CH)_2(CO_2H)_2$	II-667	146.14
2559	sulfate	methyl sulfate	$(CH_3O)_2SO_2$	I-283	126.13
2560	sulfide	methyl sulfide	$(CH_3)_2S$	I-288	62.13
2561	sulfite		$(CH_3O)_2SO$	I-282	110.13
2562	sulfone		$(CH_3)_2SO_2$	I-289	94.13
2563	sulfoxide		$(CH_3)_2SO$	I-289	78.13
2564	tartrate (*d*)		$(CHOH\cdot CO_2CH_3)_2$	III-510	178.14
2565	tartrate (racemic)	diMe-racemate	$(CH_3)_2C_4H_4O_6$	III-527	178.14
2566	telluride	tellurium methyl	$(CH_3)_2Te$	I-291	157.68
2567	thetin		$HO\cdot S(CH_3)_2\cdot CH_2\cdot CO_2H$	III-247	138.18
2568	thiourea (*sym*)		$(CH_3NH)_2C{:}S$	IV-70	104.17
2569	toluidine (*o*)(*N*)		$CH_3\cdot C_6H_4\cdot N(CH_3)_2$	XII-785	135.20
2570	toluidine (*m*)(*N*)		$CH_3\cdot C_6H_4\cdot N(CH_3)_2$	XII-857	135.20
2571	toluidine (*p*)(*N*)		$CH_3\cdot C_6H_4\cdot N(CH_3)_2$	XII-902	135.20
2572	urea (*sym*)		$(CH_3NH)_2C{:}O$	IV-65	88.11
2573	urea (*uns*)		$(CH_3)_2N\cdot CO\cdot NH_2$	IV-73	88.11
2574	**Dinaphthyl** (1,1′)	α,α′-binaphthyl	$C_{10}H_7\cdot C_{10}H_7$	V-726	254.31
2575	**Dinaphthyl** (2,2′)		$C_{10}H_7\cdot C_{10}H_7$	V-727	254.31
2576	amine (β,β′)		$C_{10}H_7\cdot NH\ C_{10}H_7$	XII-1278	269.33
2577	ketone (α,α′)		$(C_{10}H_7)_2CO$	VII-539	282.32
2578	ketone (α,β′)		$(C_{10}H_7)_2CO$	VII-539	282.32
2579	ketone (β,β′)		$(C_{10}H_7)_2CO$	VII-539	282.32
2580	methane (α,α′)		$(C_{10}H_7)_2CH_2$	V-728	268.34
2581	methane (α,β′)		$(C_{10}H_7)_2CH_2$	*V-360	268.34
2582	methane (β,β′)		$(C_{10}H_7)_2CH_2$	V-729	268.34
2583	sulfide (α,α′)		$(C_{10}H_7)_2S$	VI-623	286.37
2584	sulfide (β,β′)		$(C_{10}H_7)_2S$	VI-659	286.37
2585	urea (α)(*sym*)	α,α dinaphthyl carbamide	$(C_{10}H_7NH)_2CO$	XII-1238	312.35

Dimethyl-resorcinol 2375, 2377, 2380, 6479
Dimethyl-thiophene 5928-31
Dimethyl-xanthine, cf. alkd.

Dimethyl zinc 6504
Dinaphthol 2336-7
Dinaphthyl carbamide 2585

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2538	oil	$0.935^{20°}_{4}$	....	169	v. sl. s.	v. s.	v. s.; v. sl. s. alk.
2539	col. pl./bz.	....	53-4	....	s.; s. CS_2	s.; i. lg.	s.; s. bz.
2540	pl.	....	68-9	261^{729mm}	sl. s.	v. s.	s.; s. lg.
2541	lq.	$1.061^{15°}$	....	264-5	i.	s.	s.
2542	nd./al.	....	225-8 d.	....	v. s. h.	v. sl. s.	....
2543	yel. nd./al.	....	226-7	....	....	s. h.	....
2544	cr./et.	....	60	266-7	v. sl. s. h.	s.	s.
2545	cr.	....	225-7	....	....	....	....
2546	cr.	....	65	290^{737mm}	i.	....	....
2547	lq.	$1.070^{21°}$	4-5	265^{736mm}	i.	....	....
2548	lq.	$1.067^{4°}$	....	268-9	i.	....	....
2549	yel. nd.	....	55	subl.	sl. s.	s.	s.
2550	yel. tri.	....	124-5	subl.	sl. s. h.	v. s. h.	s.; s. bz.
2551	yel. nd.	....	72-3	subl.	....	....	....
2552	nd. or pl./et.	$0.988^{20°}_{4}$	38 (26)	293^{754mm}	....	....	....
2553	lq.	$1.408^{15°}_{4}$	....	58.2	i.	....	....
2554	col. cr.	$1.126^{15°}_{15}$	19.5	195.3	0.9	3	....
2555	lq.	$1.028^{25°}_{25}$	....	179	i.	∞	∞
2556	tri.	1.314	209	d.	$<3^{14°}$	v. s.	v. s.
2557	tri.	1.323	142	d. 165	$7.5^{14°}$	v. s.	v. sl. s.
2558	rhb. pr.	1.339	129	d. to anhyd.	$3^{14°}$	v. s.	v. s.
2559	poison. oil	$1.352^{0°}_{4}$	−26.8	188.3-8.6	v. sl. s.	∞	∞
2560	oil	$0.846^{21°}_{4}$	−83.2	37.3	i.	s.	s.
2561	lq.	$1.046^{16\cdot2°}_{4\cdot1}$	....	126.5^{756mm}	d.	s.	s.
2562	pr.	....	109	238	....	....	....
2563	oil	....	....	volt. 100 d.	v. s.	v. s.	v. s.
2564	cr.	$1.328^{20°}_{4}$	61.5 (48)	280	s.*	$200^{15°}$	v. s. bz.*
2565	mn./al.	$1.260^{99.6°}_{4}$	89	282	....	$21^{15°}$	....
2566	lt. yel. oil	<1	....	82	s.	s.	s.
2567	delq. cr.	....	d. $-H_2O$	....	s.	sl. s.	....
2568	hyg., delq.	....	61-2	....	v. s.	v. s.	sl. s. et.
2569	lq.	$0.929^{20°}_{4}$	−61	185-6	i.	s.	s.
2570	yel. oil	$0.941^{20°}_{4}$	....	213-5	i.	s.	s.
2571	lq.	$0.937^{20°}_{4}$	....	210-1	i.	s.	s.
2572	pr./chl. et.	1.142	106	268-70	v. s.	v. s.	v. sl. s.
2573	mn./al.	1.255	182-5	....	s.	sl. s. c.	v. sl. s.
2574	lf./al.	....	160	$240\text{-}4^{12mm}$	i.; s. bz.	s. h.	s.
2575	pl.	....	187.8	452^{753mm}	i.	v. sl. s. c.	v. sl. s. c.
2576	lf./bz.	....	171-2	471	i.	sl. s. h.	v. s. h. bz.
2577	nd./et.	....	104	....	s. H_2SO_4	s. h.	v. s. bz.
2578	nd./al.	....	135-6	....	s. bz.	$1.3^{14°}$	sl. s. h.
2579	lf. or nd.	....	α125.5 β164.5	....	....	$\alpha 0.4^{19°}$ $\beta 0.08^{19°}$	v. sl. s.; v. s. chl.
2580	pr. or nd./al.	....	109	>360	v. s. bz.	0.8 c.; 6.6 h.	v. s.
2581	pr./al.	....	95-6	....	s. bz.	s. EtOAc	....
2582	nd./al.	....	92	....	....	s.	s. bz.
2583	nd./al.	....	110	$289\text{-}90^{15mm}$	....	v. sl. s.	v. s. CS_2
2584	lf./al.	....	151	$295\text{-}6^{15mm}$	i.	v. sl. s.	v. s. CS_2
2585.	nd./ac.	....	297-8	subl.	....	sl. s. h.	....

* Modification m. p. 61.5° less soluble.

Dinaphthyl ether 4560-2
Dinaphthyl hydrazine 3690-1
Dinaphthyl mercury 4045
Dinicotinic acid 5502

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2586	**Dinitro**-acetanilide (2,4)	....	$(NO_2)_2C_6H_3\cdot NH\cdot COCH_3$	XII-754	225.16
2587	aniline (2,3)	....	$(NO_2)_2C_6H_3\cdot NH_2$	XII-747	183.12
2588	aniline (2,4)	....	$(NO_2)_2C_6H_3\cdot NH_2$	XII-747	183.12
2589	aniline (2,5)	....	$(NO_2)_2C_6H_3\cdot NH_2$	XII-757	183.12
2590	aniline (2,6)	....	$(NO_2)_2C_6H_3\cdot NH_2$	XII-758	183.12
2591	aniline (3,4)	....	$(NO_2)_2C_6H_3\cdot NH_2$	XII-758	183.12
2592	aniline (3,5)	....	$(NO_2)_2C_6H_3\cdot NH_2$	XII-759	183.12
2593	anisole (2,4)	α-dinitroanisole	$CH_3O\cdot C_6H_3(NO_2)_2$	VI-254	198.13
2594	anthranilic acid (3,5)	....	$C_6H_2(CO_2H)(NO_2)_2\cdot NH_2$	XIV-379	227.13
2595	anthraquinone (1,5)	....	$(NO_2C_6H_3)_2(CO)_2$	VII-793	298.20
2596	anthraquinone (1,8)	....	$(NO_2\cdot C_6H_3)_2(CO)_2$	VII-795	298.20
2597	anthraquinone (2,7)	β-diNO_2-anthraquinone	$(NO_2\cdot C_6H_3)_2(CO)_2$	VII-795	298.20
2598	azoxybenzene (4,4′)	....	$(NO_2\cdot C_6H_4)_2N_2O$	XVI-628	288.22
2599	benzalacetone (3,3′)	....	$(NO_2C_6H_4CH{:}CH)_2{:}CO$	VII-506	324.28
2600	benzaldehyde (2,4)	....	$(NO_2)_2C_6H_3\cdot CHO$	VII-264	196.12
2601	benzaldehyde (2,6)	....	$(NO_2)_2C_6H_3\cdot CHO$	*VII-144	196.12
2602	benzene (*o*)	....	$(NO_2)_2C_6H_4$	V-257	168.11
2603	benzene (*m*)	....	$(NO_2)_2C_6H_4$	V-258	168.11
2604	benzene (*p*)	....	$(NO_2)_2C_6H_4$	V-261	168.11
2605	benzene sulfonic acid	(2,4;1)	$(NO_2)_2C_6H_3\cdot SO_3H\cdot 3H_2O$	XI-78	302.22
2606	benzene sulfonic	Na salt (2,4;1)	$C_6H_3O_7N_2SNa\cdot H_2O$	XI-78	288.17
2607	benzoic acid (2,4)	....	$(NO_2)_2C_6H_3\cdot CO_2H$	IX-411	212.12
2608	benzoic acid (2,5)	....	$(NO_2)_2C_6H_3\cdot CO_2H$	IX-412	212.12
2609	benzoic acid (2,6)	....	$(NO_2)_2C_6H_3\cdot CO_2H$	IX-412	212.12
2610	benzoic acid (3,4)	....	$(NO_2)_2C_6H_3\cdot CO_2H$	IX-413	212.12
2611	benzoic acid (3,5)	....	$(NO_2)_2C_6H_3\cdot CO_2H$	IX-413	212.12
2612	benzophenone (4,4′)	....	$(NO_2\cdot C_6H_4)_2CO$	VII-428	272.21
2613	benzoyl chloride	(3,5)	$(NO_2)_2C_6H_3\cdot COCl$	IX-414	230.57
2614	benzoylene urea	(6,8)	$C_8H_4O_6N_4$	*XXIV-344	252.14
2615	benzyl chloride (2,4)	....	$(NO_2)_2C_6H_3\cdot CH_2Cl$	V-344	216.58
2616	*o*-cresol (4,6)	3,5-diNO_2-2-OH-toluene	$(NO_2)_2C_6H_2(CH_3)\cdot OH$	VI-368	198.13
2617	*m*-cresol (2,6)	2,4-diNO_2-3-OH-toluene	$(NO_2)_2C_6H_2(CH_3)\cdot OH$	VI-387	198.13
2618	diazo-aminobenzene (4,4′)	....	$NO_2C_6H_4\cdot N{:}N\cdot NH\cdot C_6H_4NO_2$	XVI-700	287.23
2619	diethylaniline	(2,4)	$(NO_2)_2C_6H_3N(C_2H_5)_2$	XII-750	239.23
2620	diphenyl (2,2′)	....	$(NO_2\cdot C_6H_4\cdot)_2$	V-583	244.20
2621	diphenyl (3,3′)	....	$(NO_2\cdot C_6H_4\cdot)_2$	V-583	244.20
2622	diphenyl (4,4′)	....	$(NO_2\cdot C_6H_4\cdot)_2$	V-584	244.20
2623	diphenyl (2,4′)	....	$(NO_2\cdot C_6H_4\cdot)_2$	V-584	244.20

Dinitro-aminophenol 5303
Dinitro-bromobenzene 930-1
Dinitro-bromobenzoic acid 932
Dinitro-chlorobenzene 1364-9

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2586	nd./al.	....	120	....	i. c.	v. s. h.	s.
2587	or. yel./al.	....	127	....	....	v. s.	s.
2588	yel. or gn. mn.	$1.615^{14\circ}$	187-8	....	v. sl. s. h.	$0.76^{21\circ}$	sl. s. h. HCl
2589	or. yel./al.	....	137	....	....	v. s.	....
2590	yel. nd./al.	....	138-40	....	i.	s. h. bz.	i. lg.
2591	yel. nd./aq.	....	154	....	....	v. s.	s.
2592	yel. nd./aq.	....	159-60	....	sl. s. bz.	s.	s.
2593	col. mn.	$1.341^{20\circ}$	94-5	....	sl. s. h.	$1.5^{20\circ}$	....
2594	yel. pl./al.	....	268	....	$0.02^{15\circ}$	sl. s.	....
2595	yel. nd.	....	>330	subl.	i.	v. sl. s.	v. sl. s.
2596	yel. pr.	....	312	....	s. Ac_2O	....	....
2597	nd./ac.	....	262	subl.	i.	sl. s.	sl. s.
2598	yel. nd./bz.	....	192-3	....	....	....	....
2599	cr./Ac_2O	....	237	....	i.	i.	i
2600	yel. pr.	....	69-70	$190\text{-}210^{10mm}$	i.	v. s.	v. s.
2601	lf./ac.	....	123	....	s. h.	s.; sl. s. CS_2	s.; v. sl. s. lg.
2602	col. mn.	$1.59^{18\circ}$	117-8	319^{774mm}	0.01 c.	$1.9^{21\circ}$	$5.7^{18\circ}$ bz.
2603	col. rhb.	$1.575^{20\circ}_{4}$	89.8	300-2	$0.3^{99\circ}$	$3.3^{20\circ}$ abs.	$39.5^{18\circ}$ bz.
2604	col. mn.	$1.625^{18\circ}$	173-4	299^{777mm}	$0.18^{100\circ}$	$0.18^{21\circ}$	$2.6^{18\circ}$ bz.
2605	pa. yel., hyg. pr.	....	106-8	$-3H_2O$, >130	s.; s. ac.	s.; i. bz.; i. lg.	v. sl. s.
2606	cr./aq.	....	....	....	v. s.	....	....
2607	cr./aq.	....	179-80	....	$1.85^{25\circ}$	s.	$0.71^{30\circ}$ bz.
2608	mn. pr.	....	177-9	....	s. h.	s.	s.
2609	nd./aq.	....	202	....	v. s. h.	....	....
2610	nd.	....	163-4	....	$0.67^{25\circ}$	s.	s.
2611	mn. pr.	....	204-5	subl.	2 h.	v. s.	sl. s.
2612	col. nd./ac.	....	189	....	i.	....	....
2613	nd./bz.	....	66-8	196^{12mm}	d.	d.	....
2614	gn. yel. pr.	....	274-5	....	$0.016^{23\circ}$	sl. s. h.; s. h. ac.	s. NaOH; sl. s. act.
2615	pl./et.	....	34	....	i.	s.	s.
2616	yel. pr./al.	....	86-7	....	v. sl. s.; v. sl. s. lg.	$10^{15\circ}$; s. alk.	s.; s. act.
2617	or. red nd.	....	99	....	....	....	....
2618	yel. nd./al.	....	224-6 d.	....	i.; v. sl. s. chl.	sl. s. h.; v. sl. s. bz.	s.
2619	yel. rhb./act.	$1.374^{15\circ}$	80	....	v. sl. s. lg.	v. s. h.	v. s. h.
2620	yel. nd.	1.45	124	....	i.	s. h.	s.
2621	cr.	....	198	....	i.	$0.6^{20\circ}$	....
2622	nd./al.	1.445	233	....	i.	$1.5^{20\circ}$	sl. s. bz.
2623	mn.	1.474	93.5	....	....	v. s. h.	....

Dinitro-chlorobenzoic acid 1370-1
Dinitro-chlorophenol 1372

Dinitro-dihydroxyquinone 4586

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2624	**Dinitro** diphenylamine (2,4)	....	$(NO_2)_2C_6H_3 \cdot NH \cdot C_6H_4$	....	259.22
2625	diphenylamine (2,4′)	....	$(NO_2 \cdot C_6H_4)_2NH$	XII-715	259.22
2626	diphenylamine (4,4′)	....	$(NO_2 \cdot C_6H_4)_2NH$	XII-716	259.22
2627	diphenyl ether (2,2′)	....	$(NO_2 \cdot C_6H_4)_2O$	VI-219	260.20
2628	diphenyl ether (4,4′)	....	$(NO_2 \cdot C_6H_4)_2O$	VI-232	260.20
2629	diphenylmethane	(4,4′)	$(NO_2 \cdot C_6H_4)_2CH_2$	V-595	258.23
2630	ethane (1,1)	....	$CH_3 \cdot CH(NO_2)_2$	I-102	120.07
2631	hexane (1,1)	....	$C_5H_{11} \cdot CH(NO_2)_2$	I-147	176.17
2632	hydroquinone acetate (2,6)	(2,6;1,4)	$(NO_2)_2C_6H_2(OH) \cdot O_2C \cdot CH_3$	VI-858 †	242.14
2633	hydroquinone diacetate (2,6)	....	$(NO_2)_2C_6H_2:(O_2C \cdot CH_3)_2$	*VI-419	284.18
2634	4′-hydroxydiphenylamine (2,4)	....	$(NO_2)_2C_6H_3 \cdot NH \cdot C_6H_4 \cdot OH$	XIII-444	275.22
2635	mesitylene (2,4)	*eso*-dinitromesitylene	$(NO_2)_2C_6H(CH_3)_3$	V-411	210.19
2636	methane	....	$(NO_2)_2CH_2$	I-77	106.04
2637	naphthalene (1,3)	γ-dinitronaphthalene	$(NO_2)_2C_{10}H_6$	V-557	218.16
2638	naphthalene (1,5)	α-dinitronaphthalene	$(NO_2)_2C_{10}H_6$	V-558	218.16
2639	naphthalene (1,6)	δ-dinitronaphthalene	$(NO_2)_2C_{10}H_6$	V-559	218.16
2640	naphthalene (1,8)	β-dinitronaphthalene	$(NO_2)_2C_{10}H_6$	V-559	218.16
2641	α-naphthol (2,4)	....	$(NO_2)_2C_{10}H_5 \cdot OH$	VI-617	234.16
2642	α-naphthol (2,4) Na	Martius yellow	$C_{10}H_5O_5N_2Na \cdot H_2O$	VI-618	274.17
2643	β-naphthol (1,6)	....	$(NO_2)_2C_{10}H_5 \cdot OH$	VI-655	234.16
2644	phenanthraquinone	(2,7)	$O:C_{14}H_6(NO_2)_2:O$	VII-807	298.20
2645	phenetole (2,4)	α-dinitrophenetole	$(NO_2)_2C_6H_3 \cdot OC_2H_5$	VI-254	212.16
2646	phenol (2,3)	ε-dinitrophenol	$(NO_2)_2C_6H_3 \cdot OH$	VI-251	184.11
2647	phenol (2,4)	α-dinitrophenol	$(NO_2)_2C_6H_3 \cdot OH$	VI-251	184.11
2648	phenol (2,4) Na	....	$C_6H_3O_5N_2Na \cdot H_2O$	*VI-126	224.11
2649	phenol (2,5)	γ-dinitrophenol	$(NO_2)_2C_6H_3 \cdot OH$	VI-256	184.11
2650	phenol (2,6)	β-dinitrophenol	$(NO_2)_2C_6H_3 \cdot OH$	VI-257	184.11
2651	phenol (3,4)	δ-dinitrophenol	$(NO_2)_2C_6H_3 \cdot OH$	VI-257	184.11
2652	phenol (3,5)	θ-dinitrophenol	$(NO_2)_2C_6H_3 \cdot OH$	VI-258	184.11
2653	phenylacetic acid (2,4)	....	$(NO_2)_2C_6H_3 \cdot CH_2 \cdot CO_2H$	IX-459	226.14
2654	phenylcarbazide (4,4′)	....	$(NO_2 \cdot C_6H_4 \cdot NH \cdot NH)_2:CO$	....	332.27
2655	phenyl disulfide	(2,2′)	$(NO_2 \cdot C_6H_4 \cdot S \cdot)_2$	VI-338	308.32
2656	phenyl disulfide	(4,4′)	$(NO_2 \cdot C_6H_4 \cdot S \cdot)_2$	VI-340	308.32
2657	phenylhydrazine	(2,4)	$(NO_2)_2C_6H_3 \cdot NHNH_2$	XV-489	198.14
2658	propane (1,1)	....	$C_2H_5 \cdot CH(NO_2)_2$	I-117	134.09
2659	propane (2,2)	....	$(CH_3)_2C(NO_2)_2$	I-117	134.09
2660	resorcinol (2,4)	....	$(NO_2)_2C_6H_2(OH)_2$	VI-827	200.11
2661	resorcinol (4,6)	....	$(NO_2)_2C_6H_2(OH)_2$	VI-828	200.11
2662	salicylic acid (3,5)	3,5-diNO₂-2-OH-benzoic acid	$(NO_2)_2C_6H_2(OH) \cdot CO_2H \cdot H_2O$	X-122	246.13

† See also correction in *VI-419

Dinitro-diphenyl disulfide 2655-6

Dinitro-glycol 3462

Dinitro-hydroxybenzoic acid 2662

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2624	red nd./bz.	....	157	....	s. act.	s. h.	s. chl.
2625	red nd.	....	220-2	....	i.	sl. s.	$0.4^{22°}$ act.
2626	yel. nd.	....	214-5	....	i.	sl. s.	$5.66^{20°}$ act.
2627	nd./al.	....	114.5	....	i.	$0.7^{20°}$	....
2628	nd./al.	....	142-3	....	i.	3 h.	sl. s.
2629	nd./bz.	....	183-5	....	s. h. ac.	i. c.	sl. s.
2630	lq.	$1.350^{23.5°}_{23.5}$	....	185-6	v. sl. s.	s.	s.
2631	yel. oil	>1	....	d.	v. sl. s.	v. s.	v. s.
2632	yel. nd./al.	....	95-6	....	s. chl.	s.	s.
2633	nd./al.	....	135-6	....	i.	s. h.	s. ac.
2634	red nd./aq. al.	....	195-6	....	s. alk.	s.	v. sl. s. bz.
2635	rhb./al.	....	86	....	i.	s. h.	....
2636	lq.	....	<-15	100 d.	s.	....	....
2637	lt. yel. nd.	....	144-5	subl.	i.	s.	....
2638	nd./ac.	....	216	subl.	i.	s. h. bz.	v. sl. s. CS_2
2639	cr./ac.	....	166	....	i.	....	....
2640	rhb. pl.	....	170-2	d.	i.	$0.19^{19°}$, 88% al.	$0.72^{19°}$ bz.
2641	yel. nd./al.	....	138	....	v. sl. s. h.	sl. s.	sl. s.; s. ac.
2642	yel. red nd.	....	....	....	v. s.	....	....
2643	yel. nd.	....	195	....	v. sl. s. h.	s.	v. s.
2644	yel. cr./ac.	....	303-5	....	....	sl. s.	sl. s. ac.
2645	col. nd./al.	....	86	d.	v. sl. s.	s.	....
2646	yel. mn./al.	$1.681^{20°}$	144-5	....	sl. s.	v. s. h.	v. s.
2647	yel. rhb.	$1.683^{24°}$	114-5	subl.	0.5 c.; 5 h.	$4^{20°}$; s. bz.	v. s. h.
2648	cr.	....	....	....	$4^{25°}$	$2.7^{25°}$ abs.	$1^{25°}$ act.
2649	yel. mn./aq.	....	104	....	sl. s.	v. s. h.	s.; s. alk.
2650	yel. rhb./aq.	....	63-4	....	s. h.	s. h.	s.; s. chl.
2651	col. tri./aq.	1.672	134	....	....	v. s.	v. s.
2652	mn./HCl	1.702	123	....	....	v. s.	v. s.
2653	col. nd./aq.	....	160	d. 179-80	....	....	....
2654	brn. pd.	....	261-3	....	i.	s.	i.
2655	yel. nd./bz.	....	195	d.	v. sl. s. ac.	v. sl. s.	v. sl. s. act.
2656	pl./al.	....	181	....		....	....
2657	vl. pr./al.	....	197-8 d.	....	i.	s. dil. a.	i.
2658	acidic oil	$1.258^{22°}$	....	189	s. alk.	....	....
2659	cr.	....	53	185.5	v. sl. s.	i. alk.	....
2660	yel. lf.	....	147-8	expl.	v. sl. s.	s.	s. alk.
2661	yel. pr.	....	215	subl.	s. h.	s.	s.
2662	pl./aq.	....	173 d.	....	s. c.	v. s.	v. s.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2663	**Dinitro** stilbene (4,4′)	low m.p. form	$(NO_2{\cdot}C_6H_4{\cdot}CH{:})_2$	V-637	270.24
2664	stilbene (4,4′)	high m.p. form	$(NO_2{\cdot}C_6H_4{\cdot}CH{:})_2$	V-637	270.24
2665	thymol (2,4)	(2,4;3,1,6)	$(NO_2)_2C_6H(CH_3){\cdot}(OH)(C_3H_7)$	VI-543	240.21
2666	toluene (2,3)	....	$(NO_2)_2C_6H_3{\cdot}CH_3$	V-339	182.13
2667	toluene (2,4)	....	$(NO_2)_2C_6H_3{\cdot}CH_3$	V-339	182.13
2668	toluene (2,5)	....	$(NO_2)_2C_6H_3{\cdot}CH_3$	V-341	182.13
2669	toluene (2,6)	....	$(NO_2)_2C_6H_3{\cdot}CH_3$	V-341	182.13
2670	toluene (3,4)	....	$(NO_2)_2C_6H_3{\cdot}CH_3$	V-341	182.13
2671	toluene (3,5)	....	$(NO_2)_2C_6H_3{\cdot}CH_3$	V-341	182.13
2672	tyrosine (3,5)(*l*)	....	$C_9H_9O_7N_3{\cdot}H_2O$	*XIV-668	289.20
2673	***o***-xylene (3,4)	....	$(NO_2)_2C_6H_2(CH_3)_2$	V-369	196.16
2674	***o***-xylene (3,6)	....	$(NO_2)_2C_6H_2(CH_3)_2$	V-369	196.16
2675	***o***-xylene (4,5)	....	$(NO_2)_2C_6H_2(CH_3)_2$	V-369	196.16
2676	***o***-xylene (3,5)	....	$(NO_2)_2C_6H_2(CH_3)_2$	V-369	196.16
2677	***m***-xylene (2,4)	....	$(NO_2)_2C_6H_2(CH_3)_2$	V-379	196.16
2678	***m***-xylene (4,6)	....	$(NO_2)_2C_6H_2(CH_3)_2$	V-380	196.16
2679	***p***-xylene (2,3)	β-dinitro-***p***-xylene	$(NO_2)_2C_6H_2(CH_3)_2$	V-387	196.16
2680	***p***-xylene (2,5)	γ-dinitro-***p***-xylene	$(NO_2)_2C_6H_2(CH_3)_2$	V-388	196.16
2681	***p***-xylene (2,6)	α-dinitro-***p***-xylene	$(NO_2)_2C_6H_2(CH_3)_2$	V-388	196.16
2682	**Dinonyl ketone** (***n***)	caprinone	$(C_9H_{19})_2CO$	I-718	282.49
2683	**Dioctyl** acetic acid (***n***)	....	$[CH_3(CH_2)_7]_2CH{\cdot}CO_2H$	II-388	284.47
2684	ether (***n***)	....	$[CH_3(CH_2)_7]_2O$	I-419	242.43
2685	ketone (***n***)	pelargone	$[CH_3(CH_2)_7]_2CO$	I-718	254.44
2686	**Dioxindole**	oxindole; hydrindic acid	$C_6H_4{\cdot}CHOH{\cdot}CO{\cdot}NH$	XXI-578	149.14
2687	**Diphenetyl urea** (4,4′)	di-(***p***-EtO-phenyl)-urea	$(C_2H_5O{\cdot}C_6H_4{\cdot}NH)_2{:}CO$	XIII-481	300.35
2688	**Diphenic** acid (2,2′)	diphenic acid (1,10)	$({\cdot}C_6H_4{\cdot}CO_2H)_2$	IX-922	242.22
2689	acid (3,3′)	diphenic acid (2,9)	$({\cdot}C_6H_4{\cdot}CO_2H)_2$	IX-927	242.22
2690	acid (2,3′)	diphenic acid (1,9)	$({\cdot}C_6H_4{\cdot}CO_2H)_2$	IX-926	242.22
2691	acid (2,4′)	diphenic acid (1,8)	$({\cdot}C_6H_4{\cdot}CO_2H)_2$	IX-926	242.22
2692	**Diphenoxy**-diethyl ether (β,β′)	....	$(C_6H_5OCH_2CH_2)_2O$	*VI-84	258.30
2693	ethane (1,2)	....	$(C_6H_5O{\cdot}CH_2{\cdot})_2$	VI-146	214.25
2694	propane (1,3)	....	$(C_6H_5O{\cdot}CH_2)_2CH_2$	VI-147	228.28
2695	**Diphenyl**	biphenyl; xenene	$C_6H_5{\cdot}C_6H_5$	V-576	154.20
2696	acetamidine (***N,N′***)	ethenyl-diPh-amidine	$CH_3C(NHC_6H_5){:}NC_6H_5$	XII-248	210.27
2697	acetic acid	....	$(C_6H_5)_2CH{\cdot}CO_2H$	IX-673	212.24
2698	amine	....	$(C_6H_5)_2NH$	XII-174	169.22
2699	amine HCl	....	$(C_6H_5)_2NH{\cdot}HCl$	XII-180	205.68
2700	amine sulfate	....	$(C_6H_5)_2NH{\cdot}H_2SO_4$	XII-180	267.29
2701	amine sulfonic acid	***N***-Ph-sulfanilic	$C_6H_5{\cdot}NH{\cdot}C_6H_4{\cdot}SO_3H$	XIV-699	249.28
2702	amine sulfonic	Ba salt	$(C_{12}H_{10}O_3NS)_2Ba$	XIV-699	633.90
2703	benzene (***o***)	diphenyl-phenylene	$C_6H_5{\cdot}C_6H_4{\cdot}C_6H_5$	**V-611	230.29
2704	benzene (***m***)	***iso***-diphenyl-benzene	$C_6H_5{\cdot}C_6H_4{\cdot}C_6H_5$	V-695	230.29
2705	benzene (***p***)	terphenyl	$C_6H_5{\cdot}C_6H_4{\cdot}C_6H_5$	V-695	230.29

Dioform 136
Diolene 5256
Dionin, cf. alkd.
Dioxane 2237, 6285

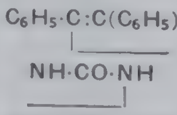
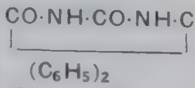
Dioxoallene 1240
Dioxolane 3454
Dioxy-purine 6449

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2663	red yel./chl.	....	210-6	....	s. bz., act.	v. sl. s.	v. sl. s.
2664	yel. lf./ac.	....	288-92	....	s. act.	sl. s.	sl. s.
2665	yel. pr./pet.	....	55	....	v. sl. s.	v. s.	v. s.
2666	nd./pet.	$1.263^{111°}$	61-3	....	....	....	....
2667	nd./CS_2	$1.321^{71°}$	70	300 sl. d.	$0.03^{22°}$	$1.2^{15°}$	$9^{15°}$
2668	nd./al.	$1.282^{111°}$	52.5	....	v. s. bz.	v. s.	v. s. CS_2
2669	rhb.	$1.283^{111°}$	60.5 *	....	....	s.	....
2670	nd./CS_2	$1.259^{111°}$	60-1	....	i.	$2.2^{17°}$ CS_2	....
2671	mn. pr.	$1.277^{111°}$	92-3	subl.	sl. s.	s. h.	s.
2672	yel. pl.	....	$-H_2O$, 140	d. >220	s. alk.	s. dil. a.	....
2673	nd./al.	....	82	expl. 413	sl. s. pet.	sl. s.	v. s.
2674	col. cr./al.	....	56	....	s. pet.	s.	s.
2675	col. nd./al.	....	115-6	....	sl. s. h.	sl. s. c.	sl. s. c. pet.
2676	yel. nd./al.	....	75-6	expl. 438	v. s. bz.	v. s. act.	v. s. chl.
2677	cr./al.	....	83-4	....	....	....	....
2678	col. pr./al.	....	93-4	....	i.	s. h.	....
2679	mn. pr./al.	....	90-3	....	i.	v. s. h.	....
2680	yel. nd./al.	....	147-8	....	i.	s. h.	s. h.
2681	nd./al.	....	123.5	....	....	....	....
2682	lf./al.	....	58	>350 sl. d.	....	s.	s.
2683	lf./al.	....	39	$270\text{-}5^{100mm}$	i.	s. abs.	....
2684	lq.	$0.805_{17}^{17°}$	....	291.7	sl. s.	s.	s.
2685	pl./Me al.	....	52-3	....	....	sl. s. c.	s. Me al.
2686	rhb./al.	....	180 (violet)	195 d.	8.3 c.; 16.6 h.	6.6 c.; 10 h.	s. alk.
2687	nd./ac.; pr./al.	....	225-6	....	....	....	....
2688	mn. pr.	....	228-9	subl.	sl. s.	s.	s.
2689	lf./al.	....	356-7	....	v. sl. s. h.	s. h.	s.
2690	nd./aq.	....	216	....	sl. s. h.	s.	....
2691	lf./al.	....	251-2	....	....	....	....
2692	col. nd./aq. al.	....	66-7	....	i.	s. h.	s.
2693	lf./abs. al.	....	97-8	....	i.; $27^{25°}$ bz.	s. h.; $23^{25°}$ act.	$9^{25°}$
2694	lf./al.	....	61	$338\text{-}40^{762mm}$	i.	s.	s.
2695	col. mn.	$0.992_{4}^{73°}$	69-70	254.9	i.	$9.98^{19.5°}$	$6.57^{19.5°}$ Me al.
2696	nd./al.	....	131-2	....	s. a.	s. h.	s.
2697	nd./aq.	....	148	....	s. h.	s.	s.
2698	col. mn.	$1.160_{20}^{20°}$	52.9	302	i.; $58^{19.5°}$ Me al.	$56^{19.5°}$; s. bz.	s.; s. CS_2; s. ac.
2699	col. nd./al.	....	....	....	s.	s.	....
2700	col. cr.	....	123-5	....	i.	s.	s. H_2SO_4 i.
2701	col. lf.	....	....	....	s.	s.	
2702	col. lf.	....	....	....	v. sl. s.	....	....
2703	pr./Me al.	....	56-7	332	i.	s.; s. chl.	s.; s. act.
2704	nd./aq. al.	....	86-7	363	i.; s. bz.	s. h.	s.; s. ac.
2705	lf. or nd.	$1.234_{4}^{0°}$	212-3	376	s. h. bz.	v. sl. s. h.	sl. s.

Dioxy-pyrimidine 6383
Diphenol 2340-3
Diphenyl-aceramide 84.1

*β, m. 65.5°
γ, m. 48°

Diphenyl-acetone 1787
Diphenyl-acetylene 5954
Diphenyl-amine orange 4996

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Diphenyl				
2706	benzidine (*N*)	. . . .	$(C_6H_5{\cdot}NH{\cdot}C_6H_4)_2$	XIII-223	336.42
2707	butyl-phenyl phosphate (***p-tert***)	phosphen I	$C_4H_9{\cdot}C_6H_4{\cdot}O{\cdot}PO{:}(O{\cdot}C_6H_5)_2$	. . . .	382.38
2708	carbamine chloride	diPh-carbamyl chloride	$(C_6H_5)_2N{\cdot}CO{\cdot}Cl$	XII-428	231.68
2709	carbazone (***sym***)	. . . .	$C_6H_5{\cdot}N{:}N{\cdot}CO{\cdot}NH{\cdot}NH{\cdot}C_6H_5$	XVI-24	240.26
2710	carbohydrazide (1,5)	diPh-carbazide	$(C_6H_5NH{\cdot}NH)_2CO$	XV-292	242.27
2711	carbonate	phenyl carbonate	$(C_6H_5O)_2CO$	VI-158	214.21
2712	chloroarsine	sneezing gas	$(C_6H_5)_2AsCl$	XVI-845	264.57
2713	*o*-chlorophenyl phosphate	phosphen 3	$(C_6H_5O)_2PO{\cdot}OC_6H_4Cl$	. . . .	360.73
2714	***iso***-cyanate	***p***-xenylcarbimide	$C_6H_5{\cdot}C_6H_4N{:}CO$	XII-1319	195.21
2715	disulfide	phenyl disulfide	$(C_6H_5S{\cdot})_2$	VI-323	218.32
2716	disulfoxide	phenyl oxydisulfide	$(C_6H_5{\cdot}SO)_2$	VI-324	250.32
2717	ethane (***sym***)	dibenzyl	$(C_6H_5{\cdot}CH_2{\cdot})_2$	V-598	182.25
2718	ethane (***uns***)	. . . .	$(C_6H_5)_2CH{\cdot}CH_3$	V-605	182.25
2719	ether	phenyl ether	$(C_6H_5)_2O$	VI-146	170.20
2720	ethylenediamine (***N***)(***sym***)	ethylene-diphenyl-diamine	$(C_6H_5{\cdot}NH{\cdot}CH_2{\cdot})_2$	XII-543	212.28
2721	formamidine (***N,N'***)	methenyl-diphenyl-amine	$HC({:}NC_6H_5)NHC_6H_5$	XII-236	196.24
2722	glyoxalone (4,5)	4,5-diPh-imidazolone	 $C_6H_5{\cdot}C{:}C(C_6H_5){\cdot}$ $NH{\cdot}CO{\cdot}NH$	XXIV-211	236.26
2723	guanidine	melaniline	$(C_6H_5NH)_2C{:}NH$	XII-369	211.26
2724	hydantoin (5,5)	dilantin	 $CO{\cdot}NH{\cdot}CO{\cdot}NH{\cdot}C{:}$ $(C_6H_5)_2$	XXIV-410	252.26
2725	hydrazine (*α,α*)†	. . . .	$(C_6H_5)_2N{\cdot}NH_2$	XV-122	184.23
2726	hydrazine HCl	(*α,α*), ***uns***, or ***N,N***	$(C_6H_5)_2N{\cdot}NH_2{\cdot}HCl$	XV-123	220.70
2727	hydrazine (***p***)	4-hydrazino-diPh	$C_6H_5{\cdot}C_6H_4{\cdot}NH{\cdot}NH_2$	XV-576	184.23
2728	iodonium hydroxide	known only in soln.	$(C_6H_5)_2I{\cdot}OH$	V-219	298.13
2729	iodonium iodide	. . . .	$(C_6H_5)_2I{\cdot}I$	V-219	408.04
2730	ketene	. . . .	$(C_6H_5)_2C{:}CO$	VII-471	194.22
2731	methane	ditane	$(C_6H_5)_2CH_2$	V-588	168.23
2732	*α*-naphthyl carbinol	. . . .	$(C_6H_5)_2C(OH){\cdot}C_{10}H_7$	VI-729	310.37
2733	nitrosamine	nitroso-diPh-amine	$(C_6H_5)_2N{\cdot}NO$	XII-580	198.22
2734	phenanthracene	(9,10)	$C_{14}H_8(C_6H_5)_2$	V-747	330.40
2735	phosphate	. . . .	$(C_6H_5O)_2PO{\cdot}OH$	VI-178	250.19
2736	phosphate	. . . .	$(C_6H_5)_2HPO_4{\cdot}2H_2O$	*VI-95	286.22
2737	phthalate	phenyl phthalate	$C_6H_4(CO_2C_6H_5)_2$	IX-801	318.31
2738	piperazine (***N,N'***)	. . . .	$(C_6H_5N)_2(CH_2)_4$	XXIII-8	238.32
2739	propionic acid (*β,β*)	*β*-Ph-hydrocinnamic acid	$(C_6H_5)_2CH{\cdot}CH_2{\cdot}CO_2H$	IX-680	226.26
2740	propiophenone	(*β,β*)	$(C_6H_5)_2CH{\cdot}CH_2{\cdot}CO{\cdot}C_6H_5$	VII-524	286.35

† See also No. 3685

Diphenyl-benzylamine 804
Diphenyl-black base-P 314
Diphenyl-carbamyl chloride 2708
Diphenyl-carbazide 2710
Diphenyl carbinol 691
Diphenyl-carbonimide 2714
Diphenyl-carboxylic acid 5160-2
Diphenyl-dichloromethane 726
Diphenyl-diimide 599
Diphenyl-ethyl carbamate 2761
Diphenyl-ethylene 5642-3

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2706	lf./PhMe	....	242	....	s. ac.	sl. s.	sl. s. bz.
2707	col. lq.	$1.16_{25}^{25°}$	<0	245-60^{5mm}	i.	v. s.; ∞ CCl$_4$	∞ bz.
2708	lf./al.	....	85-6	....	d. h.	d. alk.	....
2709	or. red nd.	....	157 ±, d.	....	i.	s.; s. bz.	s. chl.
2710	cr./al.	....	175	....	v. sl. s. h.	s. h.	i.; s. act.
2711	nd./al.	$1.272^{14°}$	80	302-6	i.	v. s.	s.; s. CCl$_4$
2712	rhb.	$1.583^{40°}$	43-4	333, in CO$_2$	0.2, d.	20	s.; s. bz.
2713	col. lq.	$1.30_{25}^{25°}$	<0	256-60^{15mm}	i.	v. s.	∞ bz.; ∞ CCl$_4$
2714	nd./et.	....	56	283 d.	....	....	v. s.
2715	nd./al.	....	61	310	i.	s.	v. s.
2716	mn./al.	....	45	d.	i.; i. alk.	s. h.	s.
2717	col. pr.	$0.978_{50}^{50°}$	52-3	284	i.; i. NH$_3$	s.; s. SO$_2$	v. s.
2718	col. oil	$1.004^{20°}$	-21.5	272	i.	∞	∞
2719	col. rhb.	$1.073^{20°}$	27	259	v. sl. s.; s. ac.	$5^{-10°}$, 87% al.	∞ ; s. bz.
2720	lf./aq. al.	....	64-5	....	....	v. s.	v. s.
2721	nd./bz.	....	139-43	sl. d.	v. s. chl.	$0.05^{9°}$ pet.	s.
2722	nd./al.	....	324-5	....	i.; s. h. ac.	s.; v. sl. s. bz.	v. sl. s.; v. sl. s. lg.
2723	mn./al.	....	147-8	d. >170	v. sl. s. c.; s. dil. a.	$9.1^{20°}$ 90% al.	sl. s.; s. h. bz.
2724	cr./al.	....	295-8	....	i.; s. alk.; sl. s. bz.	2; s. ac.; sl. s. chl.	sl. s.; 3 act.
2725	tri.	$1.190^{16°}$	44 (36)	220^{50mm}	sl. s.	s.	s.
2726	nd./al.-HCl	....	....	....	i.	v. s.	i. HCl
2727	lf./al.	....	135-6 d.	....	v. sl. s.	v. sl. s. lg.	....
2728	....	....	....	....	....	....	....
2729	yel. nd./al.	....	182	....	....	v. sl. s. h.	....
2730	red-yel. lq.	$1.104_{4}^{20°}$	....	265-70	....	....	....
2731	col. pr.	$1.001_{4}^{26°}$	26-7	265	i.	v. s.	v. s.
2732	cr./lg.	....	137-8	d.	i.; s. bz.	s. h.	v. s.
2733	yel. mn.	....	66-7	....	v. s. h. bz.	s. h.	....
2734	col. nd./al.	....	249-50	subl.	s. bz.	sl. s.	s.
2735	nd./chl. lg.	....	70	....	3	s.; s. bz.	s.; s. chl.
2736	col. cr./aq.	$1.242_{25}^{60°}$	51	$-2H_2O$, 100	$3^{25°}$	$4^{25°}$ CCl$_4$	$100^{25°}$
2737	col. pr./al.	$1.572^{74°}$	73	* 405^{759mm}	i.; s. act.	sl. s.	sl. s.
2738	nd./Me al.	....	164	230-5^{12mm}	i.; $7^{25°}$ bz.	$4^{25°}$ act.	$2^{25°}$
2739	nd./aq. al.	....	154-5	....	v. sl. s.	s.	....
2740	nd./al.	....	96	....	v. sl. s. lg.; s. bz.	s. h.; s. act.	sl. s.; s. chl.

* Heated rapidly; decomposed when heated slowly.

Diphenyl-glycolic acid 699
Diphenyl-imidazolone 2722
Diphenyl-ketone 724
Diphenyl-ketoxime 728
Diphenyl mercury 4047
Diphenyl-methylenediamine 4431
Diphenyl-oxide 2719
Diphenyl-phenoxy ethane 2853
Diphenyl-phenylene 2703-5
Diphenyl-phthalide 5292

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2741	**Diphenyl** quinomethane	fuchsone	$(C_6H_5)_2C{:}C_6H_4{:}O$	VII-520	258.30
2742	selenium	selenium diphenyl	$(C_6H_5)_2Se$	VI-345	233.16
2743	selenium dichloride	....	$(C_6H_5)_2SeCl_2$	VI-346	304.07
2744	semicarbazide (1,1)		$(C_6H_5)_2N{\cdot}NH{\cdot}CONH_2$	XV-304	227.26
2745	semicarbazide (1,4)		$(C_6H_5NH{\cdot})\ NH{\cdot}CO{\cdot}$	XV-288	227.26
2746	semicarbazide (2,4)		$C_6H_5N(NH_2){\cdot}CO{\cdot}NH{\cdot}C_6H_5$	XV-277	227.26
2747	semicarbazide (4,4)	....	$(C_6H_5)_2N{\cdot}CONHNH_2$	*XII-257	227.26
2748	succinate	phenyl succinate	$(CH_2{\cdot}CO_2{\cdot}C_6H_5)_2$	VI-155	270.27
2749	sulfide	phenyl sulfide	$(C_6H_5)_2S$	VI-299	186.26
2750	sulfone	sulfobenzide	$(C_6H_5)_2SO_2$	VI-300	218.26
2751	4-sulfonic acid	Na salt	$C_6H_5{\cdot}C_6H_4{\cdot}SO_3Na$		256.25
2752	sulfoxide	....	$(C_6H_5)_2SO$	VI-300	202.26
2753	thiocarbazone	dithizone	$C_6H_5N{:}N{\cdot}CS{\cdot}NH{\cdot}NH{\cdot}C_6H_5$	XVI-26	256.32
2754	thiocarbohydrazide (1,5)	s-Ph₂-thiocarbazide	$(C_6H_5NH{\cdot}NH)_2CS$	XV-299	258.33
2755	iso-thiocyanate	p-xenyl mustard oil	$C_{12}H_9N{:}CS$	XII-1319	211.27
2756	tolyl methane (m)	3-methyl tritane	$CH_3{\cdot}C_6H_4{\cdot}CH(C_6H_5)_2$	V-712	258.34
2757	tolyl methane (p)	4-methyl tritane	$CH_3{\cdot}C_6H_4{\cdot}CH(C_6H_5)_2$	V-712	258.34
2758	triketone	....	$(C_6H_5{\cdot}CO)_2CO$	VII-871	238.23
2759	urea (sym)	carbanilide	$(C_6H_5{\cdot}NH)_2CO$	XII-352	212.24
2760	urea (uns)	....	$(C_6H_5)_2N{\cdot}CO{\cdot}NH_2$	XII-429	212.24
2761	urethane	N-diPh-ethyl carbamate	$(C_6H_5)_2N{\cdot}CO_2C_2H_5$	XII-427	241.28
2762	o-xenyl phosphate	phosphlex 5	$C_6H_5{\cdot}C_6H_4{\cdot}O{\cdot}PO{:}(O{\cdot}C_6H_5)_2$		402.37
2763	**Diphenylene** oxide	dibenzofurane	$(C_6H_4)_2O$	XVII-70	168.18
2764	**Dipicryl**-amine (2,4,6,2′,4′,6′)	hexaN O₂-diPh-amine	$[(NO_2)_3C_6H_2]_2NH$	XII-766	439.22
2765	sulfide	(2,4,6,2′,4′,6′)	$[(NO_2)_3C_6H_2]_2S$	VI-344	456.26
2766	**Dipiperonalacetone**	dipiperonylideneacetone	$(CH_2O_2{:}C_6H_3{\cdot}CH{:}CH)_2CO$	XIX-446	322.30
2767	**Di-iso-propanolamine**	....	$(C_3H_6{\cdot}OH)_2NH$	**IV-737	133.19
2768	**Dipropargyl**	hexadiyne-1,5	$[CH{:}C{\cdot}CH_2-]_2$	I-256	78.11
2769	**Di-iso-propenyl**	2,3-dimethyl-butadiene-1,3	$[CH_2{:}C(CH_3)-]_2$	I-256	82.14
2770	**Dipropyl** acetic acid (n)		$(C_3H_7)_2CH{\cdot}CO_2H$	II-350	144.21
2771	adipate (n)	n-propyl adipate	$[(CH_2)_2CO_2C_3H_7]_2$	**II-574	230.30
2772	amine (n)		$(C_2H_5{\cdot}CH_2)_2NH$	IV-138	101.19
2773	amine (iso)	[illegible]	$(C_3H_7)_2NH$	IV-154	101.19
2774	aminobenzaldehyde		$(C_3H_7)_2N{\cdot}C_6H_4{\cdot}CHO$		205.29
2775	aniline (n)(N)	....	$C_6H_5N(C_3H_7)_2$	XII-167	177.28
2776	barbituric acid (5,5)	proponal	$CO{\cdot}NH{\cdot}CO{\cdot}NH$ $CO{\cdot}C{:}(C_3H_7)_2$	XXIV-492	212.24
2777	benzene (iso)(o)		$[(CH_3)_2CH]_2C_6H_4$	V-447	162.26
2778	benzene (iso)(m)	[illegible]	$[(CH_3)_2CH]_2C_6H_4$	V-447	162.26

Diphenyl selenide 2742
Diphenyl-thiocarbazide 2754
Diphenyl-thiourea 5892
Diphenylene carbinol 3247

Diphenylene [illegible] 5877
Diphenylene [illegible] 1131
Diphenylene ketone 3046
Diphenylene ketone oxide 6451

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2741	brn yel. nd.	....	168-9	....	i.	v. s. act.	sl. s. h.
2742	oil	$1.338^{18°}_{4}$	2.5	301-2	....	∞	∞
2743	pa. yel. pr.	....	182-5	....	i.	i.	i.
2744	nd./al.	....	195	....	....	s.	s. bz.
2745	nd./al.	....	179-80	....	v. sl. s. h.	s.; s. bz.	i.
2746	col. lf./al.	....	165.5*	....	v. s. ac.	s.; s. bz.	s.; s. chl.
2747	pr./al.	....	154	....	s. h.; s. bz.	s.; s. chl.	v. sl. s.
2748	lf./al.	....	122-3	330	i.; s. bz.	s. CS_2	s.
2749	col. lq.	$1.119^{15°}_{15}$	<-40	296-7	i.; ∞ bz.	s. h.	∞; ∞ CS_2
2750	nd./aq.	$1.248^{25°}_{4}$	128-9	379	sl. s. h.	s. h.	s. bz.
2751	col. cr.	....	....	....	$1.5^{25°}$	$0.03^{25°}$ CCl_4	$0.03^{25°}$
2752	pr./lg.	....	70.5	340 sl. d.	sl. s. pet.	s.	s.; s. bz.
2753	b.-bl. cr.	....	....	....	i.; s. alk.	v. sl. s.; s. H_2SO_4	v. sl. s.; sl. s. chl.
2754	pr., al.	....	150±	d.	v. sl. s. bz.	v. sl. s.	v. sl. s. ac.
2755	nd./et.	....	58	....	....	....	v. s.
2756	pr./al.	$1.07^{16°}$	60.5-1.5	$353\text{-}4^{774mm}$	v. s. bz.	sl. s.	v. s.
2757	pr./Me al.	....	72	>360	sl. s. pet.	v. s. h.	v. s. bz.
2758	yel. nd./lg.	....	69-70	289^{175mm}	i.	sl. s.	s.
2759	rhb.	1.239	240	260-2	v. sl. s.	sl. s. h.	s.
2760	rhb.	1.276	189	....	v. sl. s.	s.	s.; s. chl.
2761	pr./lg.	....	72	>360	s.; s. pet.	v. s.; s. bz.	v. s.
2762	col. lq.	$1.20^{50°}_{4}$	<0	$250\text{-}85^{5mm}$	i.; ∞ bz.	v. s.	∞ CCl_4
2763	lf./al.	....	86-7	287-8	i.; s. bz.	s. h.	v. s.
2764	yel. pr./ac.	....	244-6 d.	....	i.; s. 93% HNO_3	v. sl. s. act.	i.
2765	yel. lf./ac.	....	226-30	expl. 290	i.	v. sl. s.	v. sl. s.
2766	yel. nd./bz.	....	185	....	i.; i. lg.	sl. s.	s. chl.; s. act.
2767	....	....	33-4	....	....	....	....
2768	lq.	$0.805^{20°}_{4}$	-6	85.4	i.	s.	v. s.
2769	lq.	$0.727^{25°}_{25}$	-76	88.5	....	....	....
2770	col. lq.	$0.922^{20°}_{4}$	....	221-2	v. sl. s.	....	....
2771	col. lq.	$0.979^{20°}_{4}$	-20.3	$143\text{-}5^{10mm}$	i.	s.	s.
2772	col. lq.	$0.739^{20°}_{4}$	-39.6	110-1	s.	∞	∞
2773	col. lq.	$0.722^{22°}$	-61	83.5^{743mm}	s.	s.	....
2774	lt. yel. lq.	....	....	$204\text{-}6^{20mm}$	....	....	....
2775	yel. oil	$0.910^{20.4°}$	....	245.4	i.	s.	s.
2776	cr.	....	145	....	v. sl. s. c.; $1.4^{100°}$	v. s.	v. s.
2777	col. lq.	$0.858^{25°}_{25}$	....	210^{760mm}	i.	∞	∞
2778	col. lq.	$0.860^{25°}_{25}$	-105	202^{760mm}	i.	∞	∞

* Decomposes to form 1,4-derivative

Diphenyline 1711
Diphosgene 6159
Diphthalimido-ethane 3205
Dipicolinic acid 5500
Diplosal 5585
Dipropasin 2779
Dipropenyl 3573

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2779	**Dipropyl** carbanilid-4,4′-dicarboxylate (*n*)	dipropasin	$CO(NH\cdot C_6H_4\cdot CO_2\cdot CH_2\cdot C_2H_5)_2$	XIV-434	384.42
2780	carbonate (*n*)	*n*-propyl carbonate	$(C_2H_5\cdot CH_2\cdot O)_2CO$	III-6	146.18
2781	*α,α′*-dibromo-succinate (*n*)	....	$(CHBr\cdot CO_2C_3H_7)_2$	....	360.06
2782	disulfide (*n*)	....	$(C_2H_5\cdot CH_2\cdot S\cdot)_2$	I-360	150.29
2783	ether (*n*)	*n*-propyl ether	$(C_2H_5\cdot CH_2)_2O$	I-354	102.17
2784	ether (*iso*)	*iso*-propyl ether	$[(CH_3)_2CH]_2O$	I-362	102.17
2785	ether (*n-iso*)	....	$C_2H_5CH_2\cdot O\cdot CH(CH_3)_2$	I-362	102.17
2786	ketone (*n*)	heptanone-4	$(C_2H_5\cdot CH_2)_2CO$	I-699	114.18
2787	ketone (*iso*)	2,4-di Me-pentanone-3	$[(CH_3)_2CH]_2CO$	I-703	114.18
2788	maleate (*n*)	propyl maleate	$(CH\cdot CO_2C_3H_7)_2$	II-752	200.23
2789	malonate (*n*)	....	$CH_2(CO_2C_3H_7)_2$	II-581	188.22
2790	nitrosamine (*n*)	nitroso-diPr-amine	$(C_3H_7)_2N\cdot NO$	IV-146	130.19
2791	nitrosamine (*iso*)	....	$[(CH_3)_2CH]_2N\cdot NO$	IV-156	130.19
2792	oxalate (*n*)	propyl oxalate	$(CO_2CH_2\cdot C_2H_5)_2$	II-539	174.19
2793	oxalate (*iso*)	....	$(CO_2\cdot C_3H_7)_2$	II-539	174.19
2794	phthalate (*n*)	propyl phthalate	$(C_6H_4(CO_2\cdot C_3H_7)_2$	....	250.28
2795	phthalate (*iso*)	....	$C_6H_4(CO_2\cdot C_3H_7)_2$	IX-798	250.28
2796	succinate (*n*)	propyl succinate	$(CH_2\cdot CO_2\cdot CH_2\cdot C_2H_5)_2$	II-611	202.24
2797	succinate (*iso*)	....	$(CH_2\cdot CO_2\cdot C_3H_7)_2$	II-611	202.24
2798	sulfate (*n*)	*n*-propyl sulfate	$(C_2H_5\cdot CH_2O)_2SO_2$	I-354	182.23
2799	sulfide (*n*)	*n*-propyl sulfide	$(C_2H_5\cdot CH_2)_2S$	I-359	118.23
2800	sulfide (*iso*)	....	$[(CH_3)_2CH]_2S$	I-367	118.23
2801	sulfite (*n*)	....	$(C_2H_5\cdot CH_2\cdot O)_2SO$	I-354	166.23
2802	sulfone (*n*)	....	$(C_2H_5\cdot CH_2)_2SO_2$	I-359	150.23
2803	sulfone (*iso*)	....	$[(CH_3)_2CH]_2SO_2$	I-367	150.23
2804	tartrate (*n*)(*d*)	propyl tartrate	$(CHOH\cdot CO_2\cdot C_3H_7)_2$	III-516	234.24
2805	tartrate (*iso*)(*d*)	....	$(CHOH\cdot CO_2\cdot C_3H_7)_2$	III-517	234.24
2806	urea (*n*)(*sym*)	....	$(C_2H_5\cdot CH_2\cdot NH)_2CO$	IV-142	144.21
2807	urea (*n*)(*uns*)	....	$(C_3H_7)_2N\cdot CO\cdot NH_2$	IV-143	144.21
2808	**Dipropylene glycol**	....	$(CH_3CHOHCH_2)_2O$	**I-537	134.17
2809	**Dipyridine**	nicotyrine	$C_{10}H_{10}N_2$	XXIII-185	158.20
2810	**Dipyridyl** (2,2′)	(*α,α′*)	$(C_5H_4N)_2$	XXIII-199	156.18
2811	**Dipyridyl** (4,4′)	....	$(C_5H_4N)_2$	XXIII-200	156.18
2812	**Dipyridyl** (2,3′)	....	$C_{10}H_8N_2$	XXIII-200	156.18
2813	**Dipyridyl** (3,3′)	....	$C_{10}H_8N_2$	XXIII-200	156.18
2814	**Diquinoyl** (2,3′)	....	$(C_9H_6N)_2$	XXIII-293	256.29
2815	**Diquinoyl** (3,7′)(*β*)	....	$(C_9H_6N)_2$	XXIII-295	256.29
2816	**Diquinoyl** (6,6′)(*γ*)	....	$(C_9H_6N)_2$	XXIII-295	256.29
2817	**Diresorcinol** (5,5′)	....	$[C_6H_3(OH)_2]_2\cdot 2H_2O$	VI-1164	254.23
2818	**Dithio**-acetic acid	....	$CH_3\cdot CS\cdot SH$	II-233	92.17
2819	carbamic acid	....	$NH_2\cdot CS\cdot SH$	III-216	93.16
2820	hydroquinone (*p*)	....	$HS\cdot C_6H_4\cdot SH$	VI-867	142.23
2821	oxamide	rubeanic acid	$(\cdot C{:}S\cdot NH_2)_2$	II-565	120.19
2822	resorcinol (*m*)	....	$HS\cdot C_6H_4\cdot SH$	VI-834	142.23
2823	salicylic acid	(1,2)	$HO\cdot C_6H_4\cdot CS\cdot SH$	X-134	170.24
2824	**Ditolualacetone** (*p*)	dixylidene acetone	$(CH_3\cdot C_6H_4\cdot CH{:}CH)_2CO$	VII-508	262.33
2825	**Ditolyl** (2,2′)	....	$(CH_3\cdot C_6H_4\cdot)_2$	V-608	182.25
2826	**Ditolyl** (2,3′)	....	$(CH_3\cdot C_6H_4\cdot)_2$	V-609	182.25

Dipropyl carbinol (*n*) 3543
Dipropyl carbinol (*iso*) 3531
Dipropyl mercury 4046
Dipropyl zinc 6505-6

Di-*iso*-propylidene acetone 5268
Disalicylic acid 5585
Disalicylide 3747
Dispermin 2226

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2779	wh. pd.	....	171-2	....	i.	s.	....
2780	col. lq.	0.968^{22°	....	168.2	....	....	....
2781	lt. yel. lq.	....	....	$147\text{-}50^{7mm}$	i.	s.	s.
2782	col. lq.	0.814^{17°	−102 ±	192-3	i.	s.	s.
2783	col. lq.	$0.744^{21.2^\circ}_{0}$	−122	91	sl. s.	∞	∞
2784	col. lq.	$0.725^{20.8^\circ}_{0}$	−60	68.5-9.0	0.2	∞	∞
2785	col. lq.	$0.747^{12.5^\circ}_{4}$	....	82-3	0.5^{20°	....	....
2786	col. lq.	$0.822^{20^\circ}_{4}$	−32.6	144.2	0.43	∞	∞
2787	col. lq.	$0.806^{20^\circ}_{4}$	....	123.7	v. sl. s.	∞	∞ ; s. bz.
2788	col. lq.	$1.030^{18.4^\circ}_{4}$	....	$114\text{-}7^{6mm}$	....	....	....
2789	col lq.	$1.009^{20^\circ}_{4}$	....	228.3	....	....	....
2790	yel. oil	$0.916^{20^\circ}_{4}$	....	205.9	v. sl. s.	....	....
2791	cr./et.	....	46	194.5	v. sl. s.	s.	s.; s. bz.
2792	col. lq.	$1.038^{0^\circ}_{0}$	−51.7	213.5	d. h.	....	....
2793	col. lq.	....	....	190 ±	....	....	....
2794	col. lq.	....	....	$129\text{-}32^{1mm}$	i.	s.	s.
2795	col. lq.	....	....	$160\text{-}1^{9mm}$	i.	s.	s.
2796	col. lq.	$1.001^{20^\circ}_{4}$	−10.4	250.8	....	....	....
2797	col. lq.	$1.019^{0^\circ}_{0}$	....	247.1	....	....	....
2798	oil	$1.106^{20^\circ}_{4}$	d. 140-70	120^{20mm}	....	....	v. s. pet.
2799	lq.	$0.839^{20^\circ}_{4}$	....	$142\text{-}3^{772mm}$	i.	s.	s.
2800	lq.	....	....	120.5^{763mm}	....	....	....
2801	col. lq.	$1.030^{20^\circ}_{4}$	....	194	i.	s.	s.
2802	scales	$1.028^{30^\circ}_{4}$	29-30	....	....	....	....
2803	cr.	....	36	....	v. s.	....	....
2804	lq.	$1.139^{20^\circ}_{4}$	....	303	sl. s.	s.	s.
2805	col. lq.	1.130^{20°	....	275	....	....	....
2806	nd./aq.	....	105	255	sl. s. c.	v. s.	v. s.
2807	nd./pet.	....	76	....	v. s.	....	....
2808	col. lq.	$1.025^{20^\circ}_{20}$	....	231.8	∞	....	....
2809	lq.	1.124^{13°	....	280-1	v. sl. s. h.	s.	s.
2810	pr./pet.	....	69.5	272.5	0.5	s.; s. bz.	s.; s. chl.
2811	pl.	....	111-2	304.8	s. h.	v. s.	v. s.
2812	lq.	....	....	296	v. sl. s.	....	s.
2813	hyg. nd.	1.164^{20°	68	295.5-6.5	∞	∞	sl. s.
2814	yel. nd.	....	175.5-6.0	>400 sl. d.	i. h.	s. h.	s.
2815	pl./al.	....	192.5	subl.	i.	s. h.	sl. s.
2816	mn./al.	....	178	....	v. sl. s. h.	sl. s.	sl. s.; s. bz.
2817	pl. or nd.	....	310 (anh.)	$-2H_2O$, 100	s. h.	sl. s.	i. ac.
2818	red-yel. oil	1.24^{20°	....	37^{15mm}	i. c.	v. s.	v. s.; s. bz.
2819	col. nd.	....	....	....	v. s. d.	v. s.; d. h.	v. s.
2820	lf./aq. al.	....	98	....	s. bz.	s.; s. lg.	s. ac.
2821	or. red cr.	....	41	subl.	v. sl. s. c.	s.; s. alk.	i.
2822	cr.	....	27	243	....	....	....
2823	yel. nd./ pet.	....	48-50	....	sl. s.	s.	s.; s. bz.
2824	yel. nd./al.	....	175	....	....	....	....
2825	cr./al.	0.955^{10°	17.8	258^{738mm}	v. s. bz.	v. s.	v. s.
2826	lq.	0.998^{22°	....	273-4	....	v. s.	v. s.

Distyryl ketone 1775
Disulfo acid-C 4534
Disulfo acid-S 4533

Ditane 2731
Dithizone 2753
Dithymol-diiodide 5940

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2827	**Ditolyl** (3,3′)	. . . .	$(CH_3 \cdot C_6H_4 \cdot)_2$	V-609	182.25
2828	**Ditolyl** (4,4′)	. . . .	$(CH_3 \cdot C_6H_4 \cdot)_2$	V-610	182.25
2829	**Ditolyl** (2,4′)	. . . .	$(CH_3 \cdot C_6H_4 \cdot)_2$	V-609	182.25
2830	amine (2,2′)	. . . .	$(CH_3 \cdot C_6H_4)_2NH$	XII-787	197.27
2831	amine (3,3′)	. . . .	$(CH_3 \cdot C_6H_4)_2NH$	XII-858	197.27
2832	amine (4,4′)	. . . .	$(CH_3 \cdot C_6H_4)_2NH$	XII-907	197.27
2833	carbonate (*o*)	dicresyl carbonate	$(CH_3 \cdot C_6H_4 \cdot O)_2CO$	VI-356	242.26
2834	carbonate (*m*)	. . . .	$(CH_3 \cdot C_6H_4 \cdot O)_2CO$	VI-379	242.26
2835	carbonate (*p*)	. . . .	$(CH_3 \cdot C_6H_4 \cdot O)_2CO$	VI-398	242.26
2836	disulfide (*p*)	. . . .	$(CH_3 \cdot C_6H_4 \cdot S)_2$	VI-425	246.37
2837	guanidine (*o*)	. . . .	$(C_7H_7 \cdot NH)_2C{:}NH$	XII-803	239.31
2838	ketone (*p*)	diMe-benzophenone	$(CH_3 \cdot C_6H_4)_2CO$	VII-451	210.26
2839	*m*-phenylene-diamine (*p*)	. . . .	$(CH_3 \cdot C_6H_4NH)_2C_6H_4$	XIII-42	288.38
2840	*p*-phenylene-diamine (*p*)	. . . .	$(CH_3 \cdot C_6H_4NH)_2C_6H_4$	XIII-81	288.38
2841	phthalate (*o*)	*o*-cresyl phthalate	$C_6H_4(CO_2 \cdot C_7H_7)_2$	. . . .	346.36
2842	sulfide (*p*)	diMe-diPh sulfide	$(CH_3 \cdot C_6H_4)_2S$	VI-419	214.31
2843	sulfone (*p*)	. . . .	$(CH_3 \cdot C_6H_4)_2SO_2$	VI-419	246.31
2844	thiourea (*o*)(*sym*)	. . . .	$(CH_3 \cdot C_6H_4 \cdot NH)_2CS$	XII-807	256.35
2845	thiourea (*m*)(*sym*)	. . . .	$(CH_3 \cdot C_6H_4 \cdot NH)_2CS$	XII-864	256.35
2846	thiourea (*p*)(*sym*)	. . . .	$(CH_3 \cdot C_6H_4 \cdot NH)_2CS$	XII-948	256.35
2847	urea (*o*)(*sym*)	. . . .	$(CH_3 \cdot C_6H_4 \cdot NH)_2CO$	XII-801	240.29
2848	urea (*m*)(*sym*)	. . . .	$(CH_3 \cdot C_6H_4 \cdot NH)_2CO$	XII-863	240.29
2849	urea (*p*)(*sym*)	. . . .	$(CH_3 \cdot C_6H_4 \cdot NH)_2CO$	XII-941	240.29
2850	**Diundecyl ketone**	laurone	$(C_{11}H_{23})_2CO$	I-719	338.60
2851	**Diurea**	*p*-urazine	$CO{:}(NH \cdot NH)_2{:}CO$	XXVI-204	116.08
2852	**Divinyl sulfide**	. . . .	$(CH_2{:}CH)_2S$	I-434	86.15
2853	**Dixenoxy ethane** (*o*)	diPh-phenoxy ethane	$(C_6H_5 \cdot C_6H_4 \cdot O \cdot CH_2)_2$	. . . .	366.44
2854	**Djenkolic acid** (*l*)(−)	cysteine thioform-acetal	$[HO_2C \cdot CH(NH_2) \cdot CH_2S]_2CH_2$	. . . .	254.32
2855	**Docosane** (*n*)	. . . .	$CH_3(CH_2)_{20}CH_3$	I-174	310.59
2856	**Dodecane** (*n*)	dihexyl	$CH_3(CH_2)_{10}CH_3$	I-171	170.33
2857	**Dodecane**	2,4,5,7-tetra-methyl-octane	$C_{12}H_{26}$	I-171	170.33
2858	**Dodecyl** acetate (*n*)	. . . .	$CH_3 \cdot CO_2 \cdot C_{12}H_{25}$	II-136	228.36
2859	alcohol (*n*)	dodecanol-1	$CH_3(CH_2)_{10}CH_2OH$	I-428	186.33
2860	bromide (*n*)	lauryl bromide	$CH_3(CH_2)_{10}CH_2Br$	**I-133	249.24
2861	chloride (*n*)	lauryl chloride	$CH_3(CH_2)_{10}CH_2Cl$	**I-133	204.78
2862	cyanide (*n*)	. . . .	$CH_3(CH_2)_{10}CH_2CN$	II-364	195.34
2863	**Dodecylene** (*α*)	dodecene-1	$CH_3(CH_2)_9CH{:}CH_2$	I-225	168.31
2864	**Dodecyne-2**	. . . .	$CH_3(CH_2)_8C{\vdots}C \cdot CH_3$	I-261	166.30
2865	**Doryl**	carbamylcholine chloride	$NH_2 \cdot CO_2 \cdot CH_2 \cdot CH_2 \cdot N(CH_3)_3Cl$	. . . .	182.65
2866	**Dotriacontane** (*n*)	dicetyl	$CH_3(CH_2)_{30}CH_3$	I-177	450.85
2867	**Echitin**	. . . .	$C_{32}H_{52}O_2$	. . . .	468.74
2868	**Eicosane** (*n*)	. . . .	$CH_3(CH_2)_{18}CH_3$	I-174	282.54
2869	**Eicosyl alcohol**	eicosanol-1	$CH_3(CH_2)_{18}CH_2OH$	I-431	298.54
2870	**Elaidic acid**	. . . .	$C_{17}H_{33} \cdot CO_2H$	II-469	282.45
2871	**Eleostearic acid**	. . . .	$C_{18}H_{32}O_2$	II-497	280.44

Ditolyl-hydrazine 3692-4
Ditolyl mercury 4048-50
Divinyl ether 6436
Dixylylidene acetone 2824
D. M. gas 2712
Docosanoic acid 623
Docosenoic acid 2892
Docosenol 2893
Docosinoic acid 624
Dodecahydro-diphenyl 2083
Dodecanal 3952
Dodecanoic acid 3950
Dodecanol 2859
Dodecene 2863
Dopa 2361
Double green 3594
Dulcin 5112
Dulcite (*iso*) 5558
Dulcitol 3608
Duotol 3484

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2827	oil	$0.999^{16°}_{4}$	5-7	287^{713mm}	i.; s. bz.	s.	s.
2828	mn./et.	....	121-2	295	i.; s. bz.	v. sl. s. c.	s.
2829	lq.	....	....	273-6	i.; s. bz.	s.	s.
2830	lq.	....	....	$312^{727.5mm}$	v. sl. s.	....	....
2831	lq.	....	<-12	320-4	v. sl. s.	s.	s.
2832	nd.	....	79	330.5	v. sl. s.	....	....
2833	nd./al.	....	60	....	s. ac.	....	....
2834	col. cr.	....	47-9	....	i.	s. h.	s.
2835	nd. al.	....	111-3	....	v. sl. s.	sl. s. c.	....
2836	nd./al.	....	46	$210-5^{20mm}$	....	s.	v. s.
2837	cr. aq. al.	$1.10^{20°}_{4}$	178-9	....	v. sl. s.	s. h.	s.
2838	rhb. al.	....	95	333^{725mm}	i.; s. CS_2	v. s. abs.	v. s.
2839	nd. al.	....	138-9	d.	sl. s. bz.; sl. s. ac.	sl. s. c.	sl. s.
2840	lf.	....	182	....	sl. s. bz.; sl. s. ac.	v. sl. s. c.	v. sl. s. pet.
2841	col. cr.	....	110-2	....	i.	s. h.	i.
2842	nd. al.	....	56-7	>300	i.; s. bz.	v. s. h.	v. s.
2843	pr. bz.	....	158-9	405^{714mm}	s. CS_2	s. h.	s. chl.
2844	nd. al.	....	158	216-8	i.	v. s. h.	i.
2845	nd.	....	122	....	v. sl. s. h.	s.	s. bz.
2846	rhb.	....	178	....	i.	v. sl. s. h.	i.
2847	nd. ac.	....	255-6	....	i.	sl. s. h.	s. h. ac.
2848	nd./al.	....	217	....	i.	s. h.	....
2849	cr. al.	....	266-8	....	i.	sl. s. c.	sl. s.
2850	pl.	$0.809^{69°}_{4}$	69-70	....	....	i. c.	....
2851	mn. aq.	....	267-70	....	sl. s. c.	sl. s.	sl. s. h. ac.
2852	oil	$0.917^{15°}_{4}$	....	85-6	v. sl. s.	∞	∞
2853	col. cr.	....	101-2	....	$0.02^{25°}$	$19^{25°}$ act.	$55^{25°}$ bz.
2854	nd.	....	300-50	....	....	....	....
2855	cr.	$0.778^{41°}_{4}$	44.5	224.5^{15mm}	i.	4 h.	v. s.
2856	lq.	$0.751^{20°}_{4}$	-9.6	214.5	i.	v. s.	v. s.
2857	oily lq.	....	....	208-10	s. lg.	....	....
2858	col. lq.	....	....	$151-2^{15mm}$	....	....	....
2859	lf.	$0.831^{24°}_{4}$	24	255-9	i.	s.	s.
2860	col. lq.	....	....	$175-80^{45mm}$	i.	s.	s.
2861	col. lq.	....	....	$128-30^{11mm}$	i.	....	s.
2862	col. lq.	....	....	275	....	v. s.	v. s.
2863	col. lq.	$0.762^{15°}_{4}$	-31.5	96^{15mm}	i.	v. s.	v. s.
2864	lq.	$0.792^{15°}_{4}$	-9	105^{15mm}	....	....	....
2865	col. cr.	....	203-4 d.	....	100	2	i.
2866	cr. chl.	$0.780^{70.1°}$	70-1	310^{15mm}	s. h. ac.	v. sl. s. c.	s. h.
2867	lf.	....	170	....	v. s. chl.	$0.07^{15°}$, 80% al.	sl. s.
2868	cr.	$0.778^{56.5°}_{4}$	36.5	205^{15mm}	i.	....	∞
2869	col. wax		65-6	220^{3mm}	s. h. pet.	v. s. c.	s. h. bz.
2870	lf. al.	$0.851^{72.1°}_{4}$	51-2	288^{100mm}	i.	v. s.	v. s.
2871	α lf. al. β nd./al.	....	α48-9 β72	235^{12mm} ±, sl. d.	αv. s. et. βv. s. CS_2	β s. h. ac.	....

Duratol 784
Durene 5828-9
Duridine 5819-20
Duroquinone 5831
Durylic acid 6256, 6259-61
Dutch liquid 1994
Ebert and Merz α acid 4464
Ebert and Merz β acid 4463
Ecgonine, cf. alkd.
Echtrot-D 3732
Eclipse red 733
Ehrlich's reagent 2436
Eicosanoic acid 574
Eicosanol 2869
Eikonogen 341
Elbon 1509

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2872	**Ellagic acid**	dilactone	$C_{14}H_2O_4(OH)_4\cdot 2H_2O$	XIX-261	338.22
2873	**Embelin**	embelic acid	$C_{18}H_{26}O_2(OH)_2$	....	308.40
2874	**Emodin**	4,5,7-triOH-2-Me-anthraquinone	$C_{15}H_7O_2(OH)_3$	VIII-520	270.23
2875	**Eosine**	tetraBr-fluorescein	$C_{20}H_8O_5Br_4$	XIX-228	647.93
2876	salt	soluble eosine	$C_{20}H_6O_5Br_4Na_2$	XIX-230	691.91
2877	**Ephedrine** (*l*) †	....	$C_6H_5\cdot CHOH\cdot CH\cdot (CH_3)\cdot NHCH_3$	XIII-636	165.23
2878	*pseudo*-**Ephedrine** (*d*) †	*d*-isoephedrine	$C_6H_5\cdot CHOH\cdot CH\cdot (CH_3)\cdot NHCH_3$	XIII-637	165.23
2879	**Epichlorohydrin** (α)	chloropropylene oxide	$O\cdot CH_2\cdot CH\cdot CH_2\cdot Cl$	XVII-6	92.53
2880	**Epicyanohydrin**	cyanopropylene oxide	$O\cdot CH_2\cdot CH\cdot CH_2CN$	XVIII-261	83.09
2881	**Epiiodohydrin** (α)	iodopropylene oxide	$O\cdot CH_2\cdot CH\cdot CH_2I$	XVII-10	183.99
2882	**Epinine**	3,4-diOH-Ph-EtMe-amine	$(HO)_2C_6H_3\cdot CH_2\cdot CH_2\cdot NHCH_3$	....	167.20
2883	**Equilenin** (*dl*)	(synthetic)	$C_{18}H_{18}O_2$	....	266.32
2884	**Equilenin** (*d*)	(from mares)	$C_{18}H_{18}O_2$	....	266.32
2885	benzoate	....	$C_{18}H_{17}O\cdot O_2C\cdot C_6H_5$	....	370.43
2886	**Equilenin** (*l*)	(synthetic)	$C_{18}H_{18}O_2$	....	266.32
2887	*iso*-**Equilenin** (*dl*)	....	$C_{18}H_{18}O_2$	....	266.32
2888	*iso*-**Equilenin** (*d*)	14-epi-equilenin	$C_{18}H_{18}O_2$	....	266.32
2889	**Ergosterol**	ergosterin	$C_{28}H_{44}O$	....	396.63
2890	**Ergothioneine** (*d*)	thiohistidine betaine	$C_9H_{15}O_2N_3S\cdot 2H_2O$	XXV-521	265.33
2891	**Eriodictyol** §	5,7,3′,4′-tetraOH-flavanone	$(HO)_2C_7H_2O_2\cdot C_6H_3(OH)$	VIII-543	244.19
2892	**Erucic acid**	docosenoic acid	$CH_3(CH_2)_7CH{:}CH\cdot (CH_2)_{11}CO_2H$	II-472	338.56
2893	**Erucyl alcohol**	docosene-9-ol-22	$C_{22}H_{44}O$	I-453	324.57
2894	**Erythritol** (*dl*)	butantetrol-1,2,3,4	$(CHOH\cdot CH_2OH)_2$	I-525	122.12
2895	tetranitrate	nitro-erythrite	$C_4H_6(ONO_2)_4$	I-527	302.12
2896	**Erythrosin**	tetraiodo-fluorescein	$C_{20}H_8O_5I_4$	XIX-231	835.94
2897	salt	....	$C_{20}H_6O_5I_4Na_2$	....	879.92
2898	**Esculetin**	6,7-diOH-coumarin	$C_9H_6O_4\cdot H_2O$	XVIII-98	196.15
2899	**Esculin**	....	$C_{15}H_{16}O_9\cdot 1\frac{1}{2}H_2O$	....	367.30
2900	**Estradiol** (β)	dihydroestrone	$CH_3\cdot C_{17}H_{19}(OH)_2$	....	272.37
2901	**Estragole**	*p*-methoxy-allyl-phenol	$CH_2{:}CH\cdot CH_2\cdot C_6H_4\cdot OCH_3$	VI-571	148.20
2902	**Estriol**	estrone hydrate	$C_{18}H_{24}O_3$	....	288.37
2903	**Estrone**	ketohydroxy-estrin	$CH_3\cdot C_{17}H_{18}O(OH)$	....	270.36
2904	**Ethane**	....	$CH_3\cdot CH_3$	I-80	30.07
2905	sulfinic acid	ethyl sulfinic acid	$C_2H_5\cdot SO\cdot OH$	IV-1	94.13
2906	sulfonic acid	ethyl sulfonic acid	$C_2H_5\cdot SO_2\cdot OH$	IV-5	110.13
2907	**Ethanolamine**	amino-ethyl alcohol	$NH_2\cdot CH_2\cdot CH_2OH$	IV-274	61.08

† See also Alkaloid Table.

§ Beilstein shows structure as a chalcone.

Elon 4117
Embelic acid 2873
Embutal 4583
Emerald green base 5762
Emetine, cf. alkd.
Empirin 115
Enanthaldehyde 3521
Enanthaldoxime 3522
Enanthic acid 3520
Endoiodin 3591
Ephedrine (iso) 2878
Epiallocholesterol 1481
Epicarin 3790

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts: Water	Alcohol	Ether
2872	yel. pd.	1.667^{18°	d.	$-2H_2O >$ 120	v. sl. s. h.	sl. s.	i.
2873	or. lf.	....	143	subl.	i.; s. alk.	s.	sl. s. pet.
2874	red nd./ac.	....	255-7	....	i.; s. alk.	s.; s. bz.; s. chl.	s.; s. ac.
2875	col. cr./ac.	....	....	....	i.	s.	sl. s. h. ac.
2876	red brn. pd.	....	....	....	s.	s.	....
2877	cr./et.	....	40	255	5	500	s.; s. chl.
2878	rhb. pl.	....	117	....	sl. s. c.	s.	s.
2879	lq.	$1.183^{25^\circ}_{25}$	−25.6	117^{756mm}	<5	∞	∞
2880	pr.	....	162	....	s. h.	s.	d. a.
2881	lq.	2.03^{13°	....	160-80	i.	....	....
2882	col. cr.	....	188-9	....	sl. s.	sl. s.	....
2883	lf./act. al.	....	288 (278)	....	v. sl. s.	....	....
2884	nd./aq. al.	....	251 (vac.)	....	v. sl. s.	s.	s.
2885	cr.	....	223 (vac.)	....	....	....	....
2886	col. cr.	....	251 (vac.)	....	v. sl. s.	s.	s.
2887	col. cr.	....	223 (206)	....	v. sl. s.	s.	s.
2888	col. cr.	....	273 (258)	....	v. sl. s.	s.	s.
2889	cr.	1.04	160-3	....	i.; s. chl.	s.; s. bz.	s.
2890	col. mn./aq.	....	290 ±, d.	....	11.6^{20°	v. sl. s.	i.; i. chl.
2891	col. pl./al.	....	267	....	sl. s. h.	sl. s. h.	s. alk.
2892	nd./al.	$0.860^{55^\circ}_{4}$	33-4	281^{30mm}	i.	v. s.	v. s.
2893	cr.	....	34.5	$241\text{-}2^{10mm}$	v. s. ac.	v. s.	v. s. bz.
2894	tet. pr.	$1.451^{20^\circ}_{4}$	126	329-31	60	sl. s. c.	i.
2895	lf./al.	....	61	expl.	i. c.	s.; s. glyc.	s.
2896	or. cr./et.	....	....	....	i.; i. bz.	sl. s.; i. chl.	i. abs.
2897	brn. pd.	....	....	....	s.	s.	....
2898	nd.	....	>270 d. (anh.)	....	s. h.	s.	v. sl. s.
2899	pr.	....	160 d. (anh.)	$-H_2O$, 120-30	0.15^{11°	4 h.; s. ac.	i. abs.
2900	nd./bz. act.	....	223 (175)	d.	s. dioxane	s.	s.
2901	lq.	0.965^{21°	....	$214\text{-}6^{764mm}$	....	....	....
2902	cr./al. EtOAc	....	283 (275)	....	0.003	s.	sl. s.
2903	col. cr./al.	....	259-61 *	....	i.; s. alk.	s.; s. bz.	s.; s. chl.
2904	col. gas	0.546^{-88° 1.049(A)	−183.2	−88.6	4.7^{20° cc.; 1.8^{80°cc.	150 cc., abs.	....
2905	syrup	....	....	....	s. alk.	....	....
2906	hyg. cr.	1.334^{25°	−17	....	s.	s.	s. alk.
2907	col. oil	1.022^{20°	10.5	171^{757mm}	∞; sl. s. bz.	∞; s. chl.	1

* Two other forms, m. p. 254° and 256°.

Epidibromohydrin 1869-70
Epidichlorohydrin 2060-1
Epihydrin alcohol 3436
Epinephrine 157
Equisetic acid 141
Ergosterin 2889
Ergotinine, cf. alkd.
Ergotoxine, cf. alkd.
Ericin 4078
Eriodictyol (homo) 3672
Eriodictyonone 3672
Erythrene 1019
Esculetin methyl ether 5604
Esculin, cf. glcde.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2908	**Ethenyl-** aminophenol	2-methyl-benzoxazole	$C_6H_4N{:}C(CH_3)O$	XXVII-46	133.14
2909	aminothiophenol	2-methyl-benzothiazole	$C_6H_4N{:}C(CH_3)S$	XXVII-46	149.20
2910	*p,p'*-diethoxy-diphenylamidine HCl	holocaine-HCl; phenacaine-HCl	$C_2H_5O\cdot C_6H_4\cdot NH\cdot C{:}(CH_3)N\cdot C_6H_4\cdot OC_2H_5\cdot HCl\cdot H_2O$	....	352.85
2911	**Ether**	(di)ethyl ether	$(C_2H_5)_2O$	I-314	74.12
2912	**Ethoxy-**acetic acid	glycolic ethyl ether	$C_2H_5O\cdot CH_2\cdot CO_2H$	III-233	104.10
2913	acetoanil (*p*)	*N*-ethylidene-*p*-phenetidine	$C_2H_5O\cdot C_6H_4\cdot N{:}CH\cdot CH_3$	....	163.21
2914	benzaldehyde (*o*)	....	$C_2H_5O\cdot C_6H_4\cdot CHO$	VIII-43	150.17
2915	benzoic acid (*o*)	....	$C_2H_5O\cdot C_6H_4\cdot CO_2H$	X-64	166.17
2916	benzoic acid (*m*)	....	$C_2H_5O\cdot C_6H_4\cdot CO_2H$	X-138	166.17
2917	benzoic acid (*p*)	....	$C_2H_5O\cdot C_6H_4\cdot CO_2H$	X-156	166.17
2918	diphenyl (*p*)	....	$C_2H_5O\cdot C_6H_4\cdot C_6H_5$	....	198.25
2919	diphenyl sulfide	(*p*)	$C_2H_5O\cdot C_6H_4\cdot S\cdot C_6H_5$	....	230.31
2920	ethyl adipate (β)	....	$(CH_2)_4(CO_2\cdot CH_2\cdot CH_2\cdot O\cdot C_2H_5)_2$	....	290.35
2921	ethyl *o*-benzoyl-benzoate (β)	....	$C_6H_5\cdot CO\cdot C_6H_4\cdot CO_2\cdot CH_2CH_2\cdot OC_2H_5$	....	298.32
2922	ethyl carbamate	(β)	$NH_2\cdot CO_2CH_2CH_2\cdot OC_2H_5$	....	133.15
2923	ethyl chloroformate (β)	β-EtO-ethyl chlorocarbonate	$Cl\cdot CO_2CH_2\cdot CH_2\cdot OC_2H_5$	....	152.58
2924	ethyl glycolate	(β)	$HOCH_2CO_2\cdot(CH_2)_2OC_2H_5$	....	148.16
2925	ethyl α-hydroxy-*iso*-butyrate	....	$(CH_3)_2C(OH)CO_2\cdot CH_2CH_2\cdot OC_2H_5$	....	176.21
2926	ethyl lactate (β)	....	$CH_3\cdot CHOH\cdot CO_2CH_2\cdot CH_2\cdot OC_2H_5$	....	162.18
2927	phenol (*o*)	guaethol	$C_2H_5O\cdot C_6H_4\cdot OH$	VI-771	138.16
2928	phenol (*m*)	resorcinol ethyl ether	$C_2H_5O\cdot C_6H_4\cdot OH$	VI-814	138.16
2929	phenol (*p*)	hydroquinone ethyl ether	$C_2H_5O\cdot C_6H_4\cdot OH$	VI-843	138.16
2930	**Ethoxyl-**aniline	β-anilino-ethanol	$C_6H_5\cdot NH(C_2H_4OH)$	XII-182	137.18
2931	piperidine	γ-pipecolyl carbinol	$C_5H_{10}N\cdot C_2H_4OH$	XXI-4	129.20
2932	**Ethyl** abietate	....	$C_{19}H_{29}CO_2\cdot C_2H_5$	....	330.49
2933	acetamide (*N*)	....	$CH_3CO\cdot NH\cdot C_2H_5$	IV-109	87.12
2934	acetanilide	acetethylanilide	$CH_3CO\cdot N(C_2H_5)C_6H_5$	XII-246	163.21
2935	acetate	acetic ether	$CH_3CO_2\cdot C_2H_5$	II-125	88.10
2936	acetate, ortho	ethenyl triEt-ether	$CH_3C(OC_2H_5)_3$	II-129	162.22
2937	acetoacetate	acetoacetic ester	$CH_3CO\cdot CH_2\cdot CO_2\cdot C_2H_5$	III-632	130.14
2938	acetoacetic ester	....	$CH_3CO\cdot CH(C_2H_5)\cdot CO_2\cdot C_2H_5$	III-691	158.19
2939	acetopyruvate	oxalacetone	$CH_3CO\cdot CH_2\cdot CO\cdot CO_2\cdot C_2H_5$	III-747	158.15
2940	acetylglycolate	....	$CH_3CO_2\cdot CH_2\cdot CO_2\cdot C_2H_5$	III-237	146.14
2941	acetylsalicylate	....	$CH_3CO_2\cdot C_6H_4\cdot CO_2\cdot C_2H_5$	X-75	208.21

Esculinic acid, cf. glcde.
Eserine, cf. alkd.
Esmodil 6264
Essence of bitter almonds 642
Essence of mirbane 4646
Estrone hydrate 2902
Ethanal 5

Ethanamide 14
Ethandial 3478
Ethandioic acid 5006-7
Ethandiol 3444
Ethandithiol 3209
Ethanoic acid 36
Ethanol 2946

Ethanolic acid 3468
Ethanolthiol 5904
Ethanoyl, cf. acetyl.
Ethanselenol 3071
Ethanthiol 3083
Ethene 3192
Ethenol 6429

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2908	col. lq.	$1.137^{0°}$	....	200-1	i.	s.	∞
2909	lq.	....	12-4	238	i.	s.	s. HCl
2910	col. cr./aq.	....	189 (anh.)	....	2	s.	i.; s. chl.
2911	col. lq.	$0.708^{25°}_{4}$	α −116.3 β −123.3	34.6	$7.5^{20°}$	∞	∞ chl.
2912	col. lq.	$1.102^{20°}_{4}$	....	206-7 sl. d.	s.	s.	s.
2913	yel. lq.	....	....	160-2^{7mm}	....	....	....
2914	col.	....	20-2(6)	247-9	....	∞	∞
2915	oil	....	19-20	d. 300 ±	v. sl. s.	....	....
2916	nd./aq.	....	135-7	subl.	v. sl. s. h.	s.	s.
2917	nd.	....	195-6	....	v. sl. s. h.	....	....
2918	col. fl.	....	71-2	....	i.	s. h.	s.
2919	yel. lq.	....	....	186-9^{10mm}	....	....	....
2920	col. lq.	....	....	164-6^{4mm}	....	....	....
2921	col. pl.	....	51-3	....	i.	s.	v. s.
2922	col. cr.	....	61-2	....	s.	s.	sl. s.
2923	lt. yel. lq.	....	....	55-65^{15mm}	....	....	....
2924	col. lq.	....	....	98-100^{7mm}	....	....	....
2925	col. lq.	....	....	204-6	....	....	....
2926	col. lq.	....	....	99-101^{10mm}	....	....	....
2927	oil	....	28	216-7	sl. s.	∞	∞
2928	yel. lq.	....	....	246-7	v. sl. s.	s.	s.; s. bz.
2929	lf./aq.	....	66-7	246-7	v. s. h.	v. s.	v. s.
2930	lq.	$1.097^{20°}_{20}$	35 ±	286	$4.6^{20°}$	s.	s.; s. chl.
2931	lq.	$1.006^{15°}_{4}$	....	227-8	∞	∞	....
2932	lq.	$1.020^{20°}_{20}$	d. >280	200^{4mm}	i.	....	....
2933	oily lq.	$0.942^{4.5°}$	....	205	∞	∞	i. aq. alk.
2934	rhb./aq.	$0.994^{60°}_{4}$	53-4	258	i.	s.	v. s.
2935	col. lq.	$0.901^{20°}_{4}$	−82.4	77.1	$8.5^{15°}$	∞	∞
2936	col. lq.	$0.885^{25°}_{4}$	....	144-6	i.c.	∞; ∞ chl.	∞ act.
2937	col. lq.	$1.025^{20°}_{4}$	−45	180^{755mm}	$13^{17°}$; ∞	∞; ∞ chl.	∞
2938	oil	$0.986^{20°}_{4}$	....	198	sl. s.	∞	∞
2939	cr.	$1.125^{20°}_{4}$	18	213-5	....	....	....
2940	lq.	$1.099^{17°}$	....	180	v. sl. s.	....	....
2941	col. lq.	$1.157^{15°}$	....	272 sl. d.	i.	s.	s.

Ethenyl-diphenylamidine 2696
Ethenyl-triethyl ether 2936
Ethine 130
Ethobrom 6104
Ethocaine 4934
Ethovan 3188
Ethoxy-acetanilide 23-5
Ethoxy-benzoylamino-quinoline 508
Ethoxy-ethyl acetate 1266
Ethoxy-ethyl alcohol 1265
Ethoxy-methoxybenzaldehyde 6419
Ethoxy-phenylsuccinimide 5476
Ethoxyl-amine 2907
Ethyl, cf. also diethyl.
Ethyl acetone 4355
Ethyl-acetylene 1156

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
2942	**Ethyl** acrylate	(polymerizes readily)	$CH_2:CH\cdot CO_2\cdot C_2H_5$	II-399	100.11
2943	acrylic acid (β)	butenoic acid	$C_2H_5\cdot CH:CH\cdot CO_2H$	II-426	100.11
2944	adipate (mono)	Et hydrogen adipate	$C_2H_5O_2C\cdot(CH_2)_4\cdot CO_2H$	* II-277	174.19
2945	alaninate HCl (*dl*)	alanine ethyl ester HCl	$CH_3CH(NH_2)CO_2\cdot C_2H_5\cdot HCl$	IV-390	153.61
2946	alcohol	ethanol; alcohol	$CH_3\cdot CH_2OH$	I-292	46.07
2947	allophanate	....	$NH_2CO\cdot NHCO_2C_2H_5$	III-69	132.12
2948	allylacetoacetate	....	$CH_3CO\cdot CH(C_3H_5)\cdot CO_2C_2H_5$	III-738	170.20
2949	allyl ether	....	$CH_2:CH\cdot CH_2\cdot O\cdot C_2H_5$	I-438	86.13
2950	amine	amino-ethane	$C_2H_5\cdot NH_2$	IV-87	45.08
2951	amine hydrobromide	....	$C_2H_5NH_2\cdot HBr$	IV-91	126.01
2952	amine hydrochloride	....	$C_2H_5NH_2\cdot HCl$	IV-91	81.55
2953	aminobenzoate (*o*)	ethyl anthranilate	$NH_2\cdot C_6H_4\cdot CO_2C_2H_5$	XIV-319	165.19
2954	aminobenzoate (*m*)	....	$NH_2\cdot C_6H_4\cdot CO_2C_2H_5$	XIV-389	165.19
2955	aminobenzoate (*p*)	anesthesine	$NH_2\cdot C_6H_4\cdot CO_2C_2H_5$	XIV-422	165.19
2956	aminocrotonate (β)	....	$CH_3C(NH_2):CH\cdot CO_2C_2H_5$	III-654	129.16
2957	amino ethanol (β)	....	$C_2H_5NH\cdot CH_2\cdot CH_2OH$	IV-282	89.14
2958	amino phenol (*o*)	....	$C_2H_5NH\cdot C_6H_4\cdot OH$	XIII-364	137.18
2959	amino phenol (*m*)	....	$C_2H_5NH\cdot C_6H_4\cdot OH$	XIII-408	137.18
2960	amino phenol (*p*)	....	$C_2H_5NH\cdot C_6H_4\cdot OH$	XIII-443	137.18
2961	amyl ether (*act.*)	....	$C_2H_5\cdot O\cdot C_5H_{11}$	I-387	116.20
2962	amyl ether (*iso*)	....	$C_2H_5\cdot O\cdot C_5H_{11}$	I-401	116.20
2963	*n*-amyl ketone	octanone-3	$C_2H_5\cdot CO\cdot C_5H_{11}$	I-706	128.21
2964	*iso*-amyl ketone	....	$C_2H_5\cdot CO\cdot C_5H_{11}$	I-706	128.21
2965	aniline †	Et-Ph-amine	$C_6H_5\cdot NH\cdot C_2H_5$	XII-159	121.18
2966	aniline sulfonic acid (*m*)	*N*-ethyl-metanilic acid	$C_2H_5NH\cdot C_6H_4\cdot SO_3H$	XIV-690	201.24
2967	aniline sulfonate	Na salt	$C_8H_{10}O_3NSNa\cdot 2H_2O$	XIV-690	259.26
2968	anisate (*p*)	....	$CH_3O\cdot C_6H_4\cdot CO_2\cdot C_2H_5$	X-159	180.20
2969	anthracene (*9*)	....	$(C_6H_4)_2C_2H\cdot C_2H_5$	V-678	206.27
2970	arsine	....	$C_2H_5\cdot AsH_2$	IV-601	105.99
2971	arsonic acid	....	$C_2H_5\cdot AsO(OH)_2$	IV-614	153.99
2972	benzamide (*N*)	....	$C_6H_5CO\cdot NH\cdot C_2H_5$	IX-202	149.19
2973	benzene	phenylethane	$C_6H_5\cdot C_2H_5$	V-351	106.16
2974	benzene sulfonate	....	$C_6H_5\cdot SO_3\cdot C_2H_5$	XI-30	186.22
2975	benzoate	....	$C_6H_5\cdot CO_2\cdot C_2H_5$	IX-110	150.17
2976	benzoic acid (*o*)	....	$C_2H_5\cdot C_6H_4\cdot CO_2H$	IX-526	150.17
2977	benzoic acid (*m*)	....	$C_2H_5\cdot C_6H_4\cdot CO_2H$	IX-528	150.17
2978	benzoic acid (*p*)	....	$C_2H_5\cdot C_6H_4\cdot CO_2H$	IX-529	150.17
2979	*o*-benzoylbenzoate	....	$C_6H_5CO\cdot C_6H_4\cdot CO_2\cdot C_2H_5$	X-749	254.27
2980	benzoylformate	....	$C_6H_5CO\cdot CO_2C_2H_5$	X-657	178.18
2981	benzoylene urea (1)	....	$C_{10}H_{10}O_2N_2$	....	190.20
2982	benzoylene urea (3)	....	$C_{10}H_{10}O_2N_2$	XXIV-375	190.20
2983	benzylacetoacetate	....	$CH_3CO\cdot CH(C_7H_7)\cdot CO_2C_2H_5$	X-710	220.26
2984	benzylaniline	benzyl-Et-aniline	$C_6H_5N(C_2H_5)C_7H_7$	XII-1026	211.29

† See also Nos. 319-21.

Ethyl adipate 2944
Ethyl aminobenzene sulfonic acid 2966
Ethyl anilinocrotonate 39
Ethyl anthranilate 2953

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2942	col. lq.	0.925^{15°	....	100-1	sl. s.	....	....
2943	col. lq.	0.992^{15°	9-10	197–200	6.3^{20°	....	....
2944	hyg. cr./ et.-pet.	....	29	$180^{19\text{mm}}$	....	....	....
2945	col. hyg. cr.	....	85-7	....	v. s.	s.	i.
2946	col. lq.	*$0.789^{20^\circ}_{4}$	–112	78.4	∞	∞ chl.	∞
2947	cr./bz.	....	197-8	d.	s. h.	0.5^{21°	0.1^{20°
2948	lq.	$0.992^{17.6^\circ}_{4}$	....	206 sl. d.	....	....	....
2949	lq.	$0.765^{20^\circ}_{4}$	....	$66\text{-}7^{742.9\text{mm}}$	i.	∞	∞
2950	col. lq.	$0.689^{15^\circ}_{15}$	–80.6	16.6	∞	∞	∞
2951	mn. nd./al.	1.741	....	....	s. act.	v. s.	i. chl.
2952	mn.	1.216	108-9	....	240^{17°	v. s.	i.
2953	cr.	$1.117^{20^\circ}_{4}$	13	266-8	....	s.	s.
2954	oil	....	....	294	sl. s. h.	∞	∞
2955	cr./al.	....	91-2	....	i.	s.	s.
2956	mn. pr.	$1.021^{20^\circ}_{4}$	33.9(20)	210-5 d.	i.	s.	s.; s. bz.
2957	oil	$0.914^{20^\circ}_{4}$	....	$167\text{-}9^{751\text{mm}}$	v. s.	v. s.	v. s.
2958	pl.	....	108-9	....	i.; sl. s. CS_2	v. s.; s. h. bz.	sl. s.
2959	cr./bz. lg.	....	62	$176^{12\text{mm}}$	s. h.	s.; sl. s. lg.	s.; v. s. chl.
2960	nd./aq.	....	100	....	s. h.	s.	s.
2961	lq.	$0.759^{18^\circ}_{4}$	....	$108\text{-}9^{736\text{mm}}$	i.	∞	∞
2962	lq.	0.764^{18°	....	112	i.	∞	∞
2963	lq.	0.850^{0°	....	$169\text{-}70^{738\text{mm}}$	i.	∞	∞
2964	lq.	0.830^{20°	....	163.5	i.	∞	∞
2965	lq.	$0.963^{20^\circ}_{4}$	–63.5	204	i.	∞	∞
2966	nd./aq.	....	d. 294	....	2.15^{15°	....	....
2967	lf./aq. al.	....	....	....	....	....	....
2968	lq.	$1.103^{25^\circ}_{25}$	7-8	269-70	i.	s.	s.
2969	lf./al.	1.041^{99°	59-60	....	i.	s.	....
2970	col. lq.	1.217^{22°	....	36	0.01^{19°	....	....
2971	cr./al.	....	99.5	....	70^{27°	39.4^{25°	....
2972	nd./aq.	....	70-1	298-300	sl. s. h.	....	....
2973	col. lq.	$0.867^{20^\circ}_{4}$	–95.0	136 2	0.01^{15°	∞; i. NH_3	∞; s. SO_2
2974	col. lq.	$1.219^{17^\circ}_{4}$	....	$156^{15\text{mm}}$	d. h.	∞; ∞ bz.	∞; ∞ chl.
2975	col. lq.	$1.052^{15^\circ}_{15}$	–34.6	211-2	i.; ∞ pet.	∞; ∞ chl.	∞
2976	nd./h. aq.	....	68	259	v. sl. s.	s.	s.
2977	nd./aq. al.	$1.042^{100^\circ}_{4}$	47	....	i. c.	s.	....
2978	pr./al.	....	112-3	....	s. h.	s.	s.
2979	col. rhb. pr.	$1.122^{64.4^\circ}_{4}$	58	....	....	v. s.	v. s.
2980	lq.	$1.122^{25.1^\circ}_{4}$	....	$265^{766\text{mm}}$	....	....	....
2981	cr.	....	215-7	....	i.; s. NaOH	sl. s.	s. H_2SO_4
2982	nd.	....	197.5-8.5	....	i.	s.	s. NaOH
2983	col. lq.	$1.036^{15.5^\circ}_{16.5}$	....	283-4	i.	∞	∞
2984	lt. yel. oil	$1.034^{18.5^\circ}$	....	285^{710} sl. d.	i.; ∞ chl.	18	∞

* See also special table of specific gravities.
Ethyl azelate 2123

"Ethyl" base 5762
Ethyl benzoylacetate 739

No.	Name	Synonym	Formula	Beil. Ref	Formula Weight
	Ethyl				
2985	benzylbenzene (p)		$C_2H_5{\cdot}C_6H_4{\cdot}CH_2{\cdot}C_6H_5$	V-614	196.28
2986	benzyl ether		$C_2H_5O{\cdot}CH_2{\cdot}C_6H_5$	VI-431	136.19
2987	benzyl ketone		$C_2H_5{\cdot}CO{\cdot}CH_2{\cdot}C_6H_5$	VII-314	148.20
2988	benzyl-o-toluidine	Et o-tolyl-benzylamine	$CH_3{\cdot}C_6H_4{\cdot}N(C_2H_5){\cdot}CH_2{\cdot}C_6H_5$	XII-1033	225.32
2989	bromide	bromoethane	C_2H_5Br	I-88	108.98
2990	bromoacetate		$Br{\cdot}CH_2{\cdot}CO_2{\cdot}C_2H_5$	II-214	167.01
2991	α-bromoacetoacetate		$CH_3CO{\cdot}CHBr{\cdot}CO_2{\cdot}C_2H_5$	III-664	209.05
2992	bromobutyrate	(α) (n)	$C_2H_5{\cdot}CHBr{\cdot}CO_2C_2H_5$	II-282	195.06
2993	bromo-iso-butyrate	(α)	$(CH_3)_2CBr{\cdot}CO_2C_2H_5$	II-296	195.06
2994	α-bromo-n-caproate		$CH_3(CH_2)_3CHBr{\cdot}CO_2C_2H_5$	II-325	223.12
2995	α-bromopropionate		$CH_3{\cdot}CHBr{\cdot}CO_2C_2H_5$	II-255	181.04
2996	β-bromopropionate		$Br(CH_2)_2CO_2{\cdot}C_2H_5$	II-256	181.04
2997	α-bromovalerate (n)		$CH_3(CH_2)_2CHBr{\cdot}CO_2C_2H_5$	II-302	209.09
2998	α-bromo-iso-valerate		$(CH_3)_2CH{\cdot}CHBr{\cdot}CO_2C_2H_5$	II-317	209.09
2999	n-butyl-barbituric acid (5,5)	sonneryl, neonal	$(CONH)_2CO{\cdot}C{:}(C_2H_5)(C_4H_9)$		212.24
3000	n-butyl ether		$C_2H_5{\cdot}O{\cdot}C_2H_4{\cdot}C_2H_5$	I-369	102.17
3001	iso-butyl ether		$C_2H_5{\cdot}O{\cdot}CH_2{\cdot}CH(CH_3)_2$	I-376	102.17
3002	tert-butyl ether		$C_2H_5{\cdot}O{\cdot}C(CH_3)_3$	I-381	102.17
3003	n-butyl ketone	heptanone-3	$C_2H_5{\cdot}CO{\cdot}C_4H_9$	I-699	114.18
3004	iso-butyl ketone		$C_2H_5{\cdot}CO{\cdot}C_4H_9$	I-700	114.18
3005	n-butyl sulfide		$C_2H_5{\cdot}S{\cdot}C_4H_9$	**I-399	118.23
3006	n-butyrate		$C_2H_5{\cdot}CH_2{\cdot}CO_2{\cdot}C_2H_5$	II-270	116.16
3007	iso-butyrate		$(CH_3)_2CH{\cdot}CO_2{\cdot}C_2H_5$	II-291	116.16
3008	n-caprate		$CH_3(CH_2)_8CO_2C_2H_5$	II-356	200.31
3009	n-caproate		$CH_3(CH_2)_4{\cdot}CO_2C_2H_5$	II-323	144.21
3010	n-caprylate		$CH_3(CH_2)_6{\cdot}CO_2C_2H_5$	II-348	172.26
3011	carbazole (N)		$C_{12}H_8N{\cdot}C_2H_5$	XX-436	195.25
3012	carbonate, ortho †		$C(OC_2H_5)_4$	III-5	192.25
3013	carbostyril		$C_6H_4{\cdot}CH{:}C(C_2H_5)$ $NH{\cdot}CO$	XXI-115	173.21
3014	chaulmoograte	chaulmestrol, moogrol	$C_5H_7(CH_2)_{12}CO_2C_2H_5$	IX-80	308.49
3015	chloride	chloroethane	$C_2H_5{\cdot}Cl$	I-82	64.52
3016	chloroacetate		$Cl{\cdot}CH_2{\cdot}CO_2{\cdot}C_2H_5$	II-197	122.55
3017	chloroacetoacetate		$Cl{\cdot}CH_2{\cdot}CO{\cdot}CH_2{\cdot}CO_2{\cdot}C_2H_5$	III-663	164.59
3018	α-chloroacetoacetate		$CH_3CO{\cdot}CHCl{\cdot}CO_2{\cdot}C_2H_5$	III-662	164.59
3019	chloroformate	ethyl chlorocarbonate	$Cl{\cdot}CO_2{\cdot}C_2H_5$	III-10	108.53
3020	α-chloropropionate		$CH_3{\cdot}CHCl{\cdot}CO_2C_2H_5$	II-249	136.58

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† See also No. 2138.

Ethyl borate 6186
Ethyl bromomalonate 2133
Ethyl-butyl-acetaldehyde 3662
Ethyl-butyl alcohol 3638

Ethyl-butylamine 3640
Ethyl-butyl [illegible]mate 1140-1
Ethyl-butyl carbinol iso 3637
Ethyl-butyl carbinol sec 3641
Ethyl butylma[illegible]e 2134-6

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
2985	lq.	$0.985^{19°}$	....	294-5	s. chl.	s.	s.
2986	oil	$0.949^{20°}_{4}$	....	$187\text{-}9^{732mm}$	i.	∞	∞
2987	lq.	$0.998^{17°}$	....	230^{755mm}	i.	s.	∞
2988	yel. oil	....	....	$153\text{-}7^{10mm}$	....	....	....
2989	col. lq.	$1.460^{20°}_{4}$	−117.8	38.4	$1.06^{0°}$; $0.9^{30°}$	∞	∞
2990	lq.	$1.506^{20°}_{20}$	....	168	i.	∞	∞
2991	lq.	$1.429^{15°}_{4}$	....	210-5 d.	....	....	....
2992	col. lq.	$1.330^{20°}_{20}$	....	177.5^{765mm} sl. d.	i.	∞	∞
2993	col. lq.	$1.329^{20°}_{20}$	....	163.5^{762mm}	i.	∞	∞
2994	lq.	....	....	295-10	....	....	....
2995	col. lq.	$1.394^{20°}_{4}$	....	160-5 sl. d.	i.	∞	∞
2996	lq.	$1.412^{15°}_{4}$	....	$72\text{-}5^{15mm}$	....	....	....
2997	lq.	$1.226^{12°}_{4}$	....	190-2	i.	∞	∞
2998	lq.	$1.278^{12°}_{12}$	....	186	....	....	....
2999	col. cr. / aq. al.	....	127-8	....	sl. s.; s. dil. alk.	20	11
3000	col. lq.	$0.752^{20°}_{20}$	....	91.4	i.	∞	∞
3001	col. lq.	0.751	....	78-80	i.	∞	∞
3002	col. lq.	$0.752^{20°}$	....	70^{758mm}	i.	∞	∞
3003	lq.	....	−39	149-50	i.	∞	∞
3004	lq.	$0.815^{15°}_{4}$	....	135^{735mm}	i.	∞	∞
3005	yel. lq.	$0.857^{25°}_{25}$	....	143-5	....	....	....
3006	col. lq.	$0.879^{20°}_{4}$	−93.3	120-1	$0.68^{25°}$	∞	∞
3007	col. lq.	$0.871^{20°}_{4}$	−88.2	110-1	sl. s.	∞	∞
3008	lq.	$0.859^{28°}$	−20	244.6^{758mm}	i.; ∞ chl.	∞	∞
3009	col. lq.	$0.873^{20°}_{20}$	−67.5	$165\text{-}6^{736mm}$	i.	∞	∞
3010	col. lq.	$0.878^{17°}$	−45	$207\text{-}8^{753mm}$	i.	∞	∞
3011	lf./et.	....	67-8	....	i.	v. s. h.	v. s.
3012	col. lq.	$0.919^{12°}_{4}$	....	158-9	....	....	
3013	cr./aq. HCl	....	168	....	....	....	....
3014	pa. yel. lq.	$0.906^{15°}_{4}$	....	230^{20mm}	i.	∞	∞ chl.
3015	col. lq.	$0.917^{0°}_{4}$	−139	13	$0.45^{0°}$	∞	∞
3016	col. lq.	$1.159^{20°}_{4}$	−26	144	i.	∞	∞
3017	lq.	$1.218^{15°}_{4}$	−8 ±	220^{756mm}	v. sl. s.	∞	∞
3018	lq.	$1.19^{13°}_{13}$	....	193 d.	v. sl. s.	s.	s.
3019	col. lq.	$1.138^{20°}_{4}$	−80.6	94-5	d.	∞; ∞ bz.	∞; ∞ chl.
3020	col. lq.	$1.087^{20°}_{4}$	....	147-8	i.	∞	∞

Ethyl-butyraldehyde 2099
Ethyl-butyric acid 2101
Ethyl-cacodyl 579
Ethyl-caproic acid 1221
Ethyl carbamate 6392
Ethyl carbonate 2138
Ethyl-carbylamine 3029
Ethyl chlorocarbonate 3019

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Ethyl				
3021	β-chloropropionate	....	$Cl\cdot CH_2\cdot CH_2\cdot CO_2C_2H_5$	II-250	136.58
3022	chlorosulfate	ethyl chlorosulfonate	$C_2H_5O\cdot SO_2Cl$	I-327	144.58
3023	cinnamate (*trans*)	....	$C_6H_5\cdot C_2H_2\cdot CO_2C_2H_5$	IX-581	176.21
3024	crotonate (α)	....	$C_3H_5\cdot CO_2\cdot C_2H_5$	II-411	114.14
3025	crotonic acid (α)	....	$CH_3\cdot CH{:}C(C_2H_5)\cdot CO_2H$	II-442	114.14
3026	crotonic acid (α)	....	$CH_3\cdot CH{:}C(C_2H_5)\cdot CO_2H$	II-442 *II-408	114.14 114.14
3027	cyanate	....	$NCO(C_2H_5)$	....	71.08
3028	*iso*-cyanate	....	$C_2H_5\cdot N{:}CO$	IV-122	71.08
3029	*iso*-cyanide	ethyl carbylamine	$C_2H_5\cdot NC$	IV-127	55.08
3030	cyanoacetate	cyanacetic ester	$NC\cdot CH_2\cdot CO_2\cdot C_2H_5$	II-585	113.11
3031	α-cyanocinnamate	Et β-Ph-α-cyanoacrylate	$C_6H_5\cdot CH{:}C(CN)\cdot CO_2\cdot C_2H_5$	IX-894	201.22
3032	cyanoformate	cyanethyl carbonate	$NC\cdot CO_2\cdot C_2H_5$	II-547	99.09
3033	cyclopentan-1-one-2-carboxylate	....	$CO\cdot(CH_2)_3CH\cdot CO_2\cdot C_2H_5$	X-597	156.18
3034	diacetoacetate	diacetoethyl acetate	$(C_2H_3O)_2CH\cdot CO_2C_2H_5$	III-751	172.18
3035	diazoacetate	diazoethyl acetate	$N_2CH\cdot CO_2\cdot C_2H_5$	*III-211	114.10
3036	dibromoacetate	....	$Br_2CH\cdot CO_2\cdot C_2H_5$	II-219	245.92
3037	α,β-dibromobutyrate	....	$CH_3(CHBr)_2CO_2C_2H_5$	II-284	273.97
3038	di-*n*-butylcarbamate	*N,N*	$(C_4H_9)_2N\cdot CO_2C_2H_5$	....	201.30
3039	dichloroacetate	....	$Cl_2CH\cdot CO_2\cdot C_2H_5$	II-203	157.00
3040	dichloroarsine	....	$C_2H_5\cdot AsCl_2$	IV-603	174.88
3041	3,5-diiodosalicylate	(3,5,2,1)	$I_2C_6H_2(OH)CO_2C_2H_5$	X-114	417.99
3042	β,β-dimethylacrylate	....	$(CH_3)_2C{:}CHCO_2C_2H_5$	II-433	128.17
3043	3.5-dinitrobenzoate	....	$(NO_2)_2C_6H_3\cdot CO_2C_2H_5$	IX-414	240.17
3044	diphenylamine	....	$C_2H_5\cdot N{:}(C_6H_5)_2$	XII-181	197.27
3045	diphenylphosphine	....	$C_2H_5\cdot P{:}(C_6H_5)_2$	XVI-759	214.24
3046	fluoride	fluoroethane	$CH_3\cdot CH_2F$	I-82	48.06
3047	formamide (*N*)	....	$H\cdot CO\cdot NHC_2H_5$	IV-108	73.09
3048	formate	....	$H\cdot CO_2\cdot C_2H_5$	II-19	74.08
3049	formate, ortho	aethon	$H\cdot C(OC_2H_5)_3$	II-20	148.20
3050	furoate (α)	ethyl pyromucate	$C_4H_3O\cdot CO_2\cdot C_2H_5$	XVIII-275	140.13
3051	furoate (β)	....	$C_4H_3O\cdot CO_2\cdot C_2H_5$		140.13
3052	furoylacetate (α)	....	$C_4H_3O\cdot CO\cdot CH_2\cdot CO_2\cdot C_2H_5$	XVIII-408	182.17
3053	β-furylacrylate	....	$C_4H_3O\cdot CH{:}CH\cdot CO_2\cdot C_2H_5$	XVIII-300	166.17
3054	glutaric acid (α)	....	$C_2H_5\cdot C_3H_5(CO_2H)_2$	II-678	160.17
3055	glutaric acid (β)	....	$C_2H_5\cdot CH(CH_2CO_2H)_2$	II-678	160.17
3056	glycerate	....	$(HO)_2C_2H_3\cdot CO_2C_2H_5$	III-397	134.13
3057	glycinate	....	$H_2N\cdot CH_2\cdot CO_2\cdot C_2H_5$	IV-340	103.12
3058	glycinate HCl	....	$C_4H_9O_2N\cdot HCl$	IV-342	139.59
3059	glycine (*N*)	....	$C_2H_5NH\cdot CH_2\cdot CO_2H$	IV-349	103.12
3060	glycolate	....	$HO\cdot CH_2\cdot CO_2\cdot C_2H_5$	III-236	104.10

Ethyl-cinnamic acid 5151
Ethyl citrate 6187
Ethyl cresyl ether 3173-5
Ethyl cresyl sulfide 3176
Ethyl cyanide 5363
Ethyl-cyclohexenyl-barbituric acid 5091
Ethyl decanoate (*n*) 3008
Ethyl dibenzyl-malonate 2153
Ethyl dibromo-malonate 2155
Ethyl dibromo-succinate 2156
Ethyl dibutyl-malonate 2157
Ethyl diethyl-malonate 2158
Ethyl diphenyl-carbamate 2761
Ethyl-dipropyl carbinol 4923
Ethyl diselenide 2208

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3021	col. lq.	$1.109^{20°}_{4}$	....	$162\text{-}3^{765mm}$	....	....	....
3022	lq.	$1.263^{18°}$	....	58^{20mm}	s. chl.	s. bz.	s.
3023	col. lq.	$1.049^{20°}_{4}$	12	271	i.	∞	∞
3024	col. lq.	$0.924^{15°}_{4}$	....	138^{748mm}	i.	s.	s.
3025	col. pr.	....	41.5	209	v. sl. s.	v. s.	v. s.
3026	oily lq.*;	....	-35	199.5^{750mm}	i.	∞	∞
	nd./aq.	$0.958^{50°}_{4}$	41-2	$204\text{-}7^{755mm}$			
3027	lq.	$1.127^{15°}$	....	d.	i.	∞	∞
3028	lq.	$0.907^{16°}_{4}$	....	60	d.	....	....
3029	col. lq.	$0.744^{25°}$	<-66	78-9	sl. s.	....	s.
3030	col. lq.	$1.062^{20°}_{4}$	-22.5	208^{753mm}	$2^{25°}$; $9^{80°}$	∞	∞
3031	nd./al.**	....	50-1	360 sl. d.	s. chl.; s. ac.	12 c.	s.; s. bz.
3032	lq.	$1.003^{20°}_{4}$	....	115-6	....	....	....
3033	col. lq.	$1.098^{0°}$	....	218 sl. d.	....	....	....
3034	col. lq.	$1.089^{25°}_{25}$	....	209-11 sl. d.	sl. s.	v. s.	v. s.
3035	yel. oil	$1.085^{18°}_{4}$	-22	$140\text{-}1^{720mm}$	sl. s.	∞	∞
3036	oil	$1.903^{20°}_{20}$	....	192-4	i.	∞	∞
3037	lq.	....	....	$123\text{-}4^{30mm}$	....	....	....
3038	col. lq.	....	....	$101\text{-}3^{6mm}$	....	....	....
3039	col. lq.	$1.282^{20°}_{4}$	....	158	i.	∞	∞
3040	col. lq.	$1.742^{15°}_{4}$	....	156	sl. s.	∞	∞
3041	col. lf./al.	....	133	d. >200°	i. c.	s. h.	sl. s.
3042	lq.	$0.922^{21°}_{21}$	....	154-5	v. s. CS_2; v. s. lg.	v. s.; v. s. chl.	v. s.; v. s. bz.
3043	nd./al.	$1.295^{111°}$	91-2	....	....	$0.6^{13°}$	s. h. al.
3044	lq.	....	....	295-7	i.	s.	....
3045	oil	....	....	293	....	s.	s. bz.
3046	gas	1.7(A)	....	-32	$198^{14°}$cc.	v. s.	....
3047	lq.	$0.952^{21°}$	<-30	197-9	∞	∞	∞
3048	col. lq.	$0.923^{20°}_{4}$	-79	54^{760mm}	$11^{18°}$	∞	∞
3049	lq.	$0.939^{25°}_{25}$	-76	145-6	v. sl. s.	∞	∞
3050	lf.	$1.117^{20.8°}_{4}$	34	195^{766mm}	i.	∞	∞
3051	lq.	$1.038^{20°}_{20}$	....	$65\text{-}7^{14mm}$	....	....	....
3052	lt. yel. oil	$1.165^{17°}$	....	$143\text{-}5^{10mm}$	i.; v. s. NH_4OH	s.	s.
3053	yel. cr.	$1.09^{20°}_{4}$	24.5	232-3	i.	∞	∞
3054	col. cr.	....	60.5	250-60 sl. d.	v. s.	v. s.	v. s.
3055	pr./chl.	....	73	....	v. s.	v. s.	v. s.
3056	lq.	$1.191^{15°}_{15}$	....	121^{14mm}	s.	s.	....
3057	col. oil	$1.028^{20°}_{4}$	<-20	148^{748mm} sl. d.	∞	∞	∞
3058	nd.	....	144	subl.	v. s.	v. s.	d. alk.
3059	lf./al.	....	>160 d.	....	s.	s.	....
3060	col. lq.	$1.087^{15°}_{4}$	....	160	....	v. s.	v. s.

* Easily converted to solid modification.

** Also a liquid form, d. on boiling & forms some solid modification.

Ethyl dithiooxalate 2165
Ethyl ether 2911
Ethyl ethyl-acetoacetate 2938
Ethyl ethyl-amyl-malonate 2167
Ethyl ethyl-butyl-malonate 2168
Ethyl *N*-ethyl-carbamate 3184
Ethyl-ethylene 1147

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3061	**Ethyl** glycol ether	...	$HO\cdot CH_2\cdot CH_2\cdot O\cdot C_2H_5$	I-467	90.12
3062	hexaldehyde (2)	Et-Bu-acetaldehyde	$C_4H_9\cdot CH(C_2H_5)\cdot CHO$	I-707	128.21
3063	hydracrylate	...	$HOCH{:}CHCO_2C_2H_5$	III-297	118.13
3064	hydrazine	...	$C_2H_5\cdot NH\cdot NH_2$	IV-550	60.10
3065	hydrocinnamate	...	$C_6H_5(CH_2)_2CO_2C_2H_5$	IX-511	178.22
3066	hydrogen oxalate	ethyl oxalic acid	$HO_2C\cdot CO_2\cdot C_2H_5$	II-535	118.09
3067	hydrogen phthalate (*o*)	...	$C_6H_4(CO_2C_2H_5)\cdot CO_2H$	IX-797	194.18
3068	hydrogen tetrachlorophthalate	...	$HO_2C\cdot C_6Cl_4\cdot CO_2\cdot C_2H_5$	IX-820	331.98
3069	hydrogen sulfate	ethyl sulfuric acid	$C_2H_5O\cdot SO_2\cdot OH$	I-325	126.13
3070	hydrogen tartrate (*d*)	...	$HO_2C\cdot (CHOH)_2\cdot CO_2C_2H_5$	III-512	178.14
3071	hydroselenide	...	$C_2H_5\cdot SeH$	I-349	109.03
3072	*p*-hydroxybenzoate †	...	$HO\cdot C_6H_4\cdot CO_2C_2H_5$	X-159	166.17
3073	*α*-hydroxy-*iso*-butyrate	...	$(CH_3)_2C(OH)CO_2\cdot C_2H_5$	III-315	132.16
3074	hydroxylamine (*α*)	...	$C_2H_5O\cdot NH_2$	I-336	61.08
3075	hydroxylamine (*β*)	...	$C_2H_5\cdot NH\cdot OH$	IV-535	61.08
3076	hypochlorite	...	$C_2H_5\cdot O\cdot Cl$	I-324	80.52
3077	iodide	iodoethane	$CH_3\cdot CH_2I$	I-96	155.98
3078	iodoacetate	...	$ICH_2\cdot CO_2\cdot C_2H_5$	II-222	214.02
3079	lactate	...	$CH_3\cdot CHOH\cdot CO_2C_2H_5$	III-280	118.13
3080	laurate	...	$CH_3(CH_2)_{10}CO_2C_2H_5$	II-361	228.36
3081	levulinate	...	$CH_3\cdot CO(CH_2)_2\cdot CO_2\cdot C_2H_5$	III-675	144.17
3082	malonic acid	...	$C_2H_5\cdot CH(CO_2H)_2$	II-643	132.11
3083	mercaptan	ethanthiol	$C_2H_5\cdot SH$	I-340	62.13
3084	mesoxalate	...	$CO(CO_2C_2H_5)_2$	III-769	174.15
3085	methylacetoacetate	Me-acetoacetic ester	$CH_3CO\cdot CH(CH_3)\cdot CO_2\cdot C_2H_5$	III-679	144.17
3086	methyl acrylate	...	$C_3H_5\cdot CO_2\cdot C_2H_5$	II-423	114.14
3087	*S*-methylxanthate	...	$C_2H_5O\cdot CS\cdot SCH_3$	III-210	136.22
3088	myristate	...	$C_{13}H_{27}CO_2\cdot C_2H_5$	II-365	256.42
3089	naphthalene (*α*)	...	$C_2H_5\cdot C_{10}H_7$	V-569	156.22
3090	naphthalene (*β*)	...	$C_2H_5\cdot C_{10}H_7$	V-569	156.22
3091	*α*-naphthylamine	...	$C_2H_5\cdot NH\cdot C_{10}H_7$	XII-1222	171.23
3092	*β*-naphthylamine	...	$C_2H_5\cdot NH\cdot C_{10}H_7$	XII-1274	171.23
3093	*α*-naphthyl ether	...	$C_{10}H_7\cdot O\cdot C_2H_5$	VI-606	172.22
3094	*β*-naphthyl ether	neroline; bromelia	$C_{10}H_7\cdot O\cdot C_2H_5$	VI-641	172.22
3095	nicotinate	...	$C_5H_4N\cdot CO_2C_2H_5$	XXII-39	151.16
3096	nitrate	nitric ether	$C_2H_5\cdot O\cdot NO_2$	I-329	91.07
3097	nitrite	nitrous ether	$C_2H_5\cdot O\cdot NO$	I-329	75.07
3098	nitroacetate	...	$NO_2\cdot CH_2\cdot CO_2\cdot C_2H_5$	II-225	133.10
3099	nitrobenzoate (*o*)	...	$NO_2\cdot C_6H_4\cdot CO_2C_2H_5$	IX-372	195.17
3100	nitrobenzoate (*m*)	...	$NO_2\cdot C_6H_4\cdot CO_2C_2H_5$	IX-378	195.17
3101	nitrobenzoate (*p*)	...	$NO_2\cdot C_6H_4\cdot CO_2C_2H_5$	IX-390	195.17
3102	nitrocinnamate (*o*)	...	$NO_2\cdot C_6H_4\cdot CH{:}CH\cdot CO_2\cdot C_2H_5$	IX-605	221.21
3103	nitrocinnamate (*m*) (*trans*)	...	$NO_2\cdot C_6H_4\cdot CH{:}CH\cdot CO_2\cdot C_2H_5$	IX-606	221.21
3104	nitrocinnamate (*p*)	...	$NO_2\cdot C_6H_4\cdot CH{:}CH\cdot CO_2\cdot C_2H_5$	IX-607	221.21

† See also ethyl salicylate.

Ethyl ethyl-malonate 2169
Ethyl ethyl-phenyl-malonate 2170
Ethyl ethyl-propyl-malonate 2171
Ethyl *S*-ethylxanthate 2164
Ethyl fumarate 2174
Ethyl glutaconate 2175
Ethyl glutarate 2176
Ethyl glycolic acid 2912
Ethyl *n*-heptylate 3108
Ethyl heptyl-malonate 2177
Ethyl hexenal 3141
Ethyl-hexyl carbinol 4920
Ethyl itaconate 2179
Ethyl malate 2182

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3061	lq.	$0.935^{15^\circ}_{15}$	....	$134\text{-}5^{748mm}$	....	....	s. lq. NH_3
3062	col. lq.	$0.820^{20^\circ}_{20}$	<−100	163-4	0.07^{20°	....	....
3063	col. lq.	1.064^{25°	....	185-90	∞	∞	∞
3064	hyg. lq.	....	....	99.5^{709mm}	v. s.	v. s.	v. s.
3065	lq.	$1.015^{20^\circ}_{4}$	....	249	i.	s.	s.
3066	col. lq.	$1.218^{20^\circ}_{4}$	....	117^{15mm}	....	....	....
3067	oil	....	2	d.	sl. s.	s.	s.
3068	cr.	....	94-5	d. 150	i.; s. aq. alk. carb.	s.	s.
3069	syrup	1.316^{17°	....	d.	∞; d. h.	∞; d. h.	∞
3070	col. hyg. pr.	....	90 ±	....	s.; d. h.	s.	i.
3071	lq.	$1.395^{24^\circ}_{4}$	....	53.5	i.	....	....
3072	col. cr.	....	115-6	297-8	1^{80°	72^{25° act.	45^{25°
3073	col. lq.	....	....	149-50	d. h.	....	....
3074	col. lq.	$0.883^{7.5^\circ}$	....	68	∞	∞	∞
3075	nd./lg.	$0.908^{20^\circ}_{4}$	59 d.	....	v. s.	v. s.	sl. s.
3076	yel. lq.	$1.013^{-6^\circ}_{4}$	expl.	36^{752mm}	∞ bz.	∞ chl.	∞
3077	col. lq.	$1.933^{20^\circ}_{4}$	−105	72.4	0.4^{20°	∞	∞
3078	col. oil	$1.817^{18.7^\circ}_{4}$	....	178-80	....	....	....
3079	oil	$1.030^{25^\circ}_{4}$	....	155	∞	∞	∞
3080	oil	$0.868^{13^\circ}_{4}$	−10.7	269	i.	s.	∞
3081	col. lq.	$1.016^{20^\circ}_{20}$	....	205.2^{756mm}	v. s.	∞	....
3082	col. pr.	....	111.5	d. 160	v. s.	v. s.	v. s.
3083	lq.	$0.839^{20^\circ}_{4}$	−121	36-7	1.5; s. alk.	s.	s.
3084	yel. gn. lq.	$1.119^{20^\circ}_{20}$	−30 ±	220 ±	....	s.	s.
3085	col. lq.	$1.019^{20^\circ}_{4}$	....	186.8	i.	s.	s.
3086	col. lq.	$0.913^{15.6}$	....	118	i.	s.	s.
3087	lq.	$1.119^{25^\circ}_{4}$	....	183-4	i.	s.	s.
3088	col. cr.	$0.856^{20^\circ}_{4}$	10.5-1.5	295	i.	sl. s.	sl. s.
3089	lq.	$0.990^{25^\circ}_{25}$	−27	258^{758mm} sl. d.	i.	∞	∞
3090	lq.	$1.002^{25^\circ}_{0}$	−19	251	i.	∞	∞
3091	oil	$1.060^{20^\circ}_{4}$	....	303^{723mm}	i.	s.	s.
3092	oil	$1.057^{20^\circ}_{4}$	....	316-7	i.	s.	s.
3093	cr.	$1.061^{20^\circ}_{20}$	5.5	276.4	i.	s.	s.
3094	pl.	$1.064^{20^\circ}_{20}$	37.5	282	i.; s. chl.	s.; s. bz.	s.; s. pet.
3095	col. oil	....	8-9	225	sl. s.	s.	s.; s. bz.
3096	col. lq.	$1.100^{25^\circ}_{4}$	−102	87-8	1.3^{55°	∞	∞
3097	lq.	$0.900^{15.5^\circ}$	....	17	v. sl. s.	∞	∞
3098	col. lq.	$1.199^{20^\circ}_{4}$	....	$105\text{-}7^{25mm}$	v. sl. s.	∞	....
3099	tri.	....	30	149^{10mm}	i.	s.	s.
3100	mn. pr.	....	47	298 ±	i.	s.	s.
3101	tri./al.	....	57	....	i.	s.	s.
3102	yel. rhb.	....	44	....	v. s. bz.	v. s. h.	v. s.
3103	col. mn./al.	....	78-9	....	i.	sl. s.	sl. s.
3104	wh. tri.	....	141-2	....	i.	v. sl. s. c.	s. ac.

Ethyl maleate 2183
Ethyl malonate 2184
Ethyl mesaconate 2186
Ethyl-metanilic acid 2966
Ethyl *N*-methylcarbamate 4416
Ethyl-morphine HCl, cf. alkd.
Ethyl muconate 2188
Ethyl mustard oil 3159

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3105	**Ethyl** nitrolic acid	. . . .	$CH_3\cdot C(NOH)\cdot NO_2$	II-189	104.07
3106	octyl ether (*n*)	. . . .	$C_2H_5\cdot O\cdot C_8H_{17}$	I-419	158.28
3107	octyl ketone (*n*)	undecanone-3	$C_2H_5\cdot CO\cdot C_8H_{17}$	I-713	170.29
3108	oenanthylate	ethyl *n*-heptylate	$C_6H_{13}CO_2\cdot C_2H_5$	II-340	158.23
3109	oleate	. . . .	$C_{17}H_{33}CO_2\cdot C_2H_5$	II-467	310.50
3110	oxanilate	. . . .	$C_6H_5\cdot NH\cdot CO\cdot CO_2\cdot C_2H_5$	XII-282	193.20
3111	oxindole (1)	*N*-Et-oxindole	$C_8H_6ON\cdot C_2H_5$	XXI-283	161.20
3112	palmitate	. . . .	$C_{15}H_{31}CO_2\cdot C_2H_5$	II-372	284.47
3113	pelargonate	. . . .	$C_8H_{17}CO_2\cdot C_2H_5$	II-353	186.29
3114	phenol (*o*)	phlorol	$C_2H_5\cdot C_6H_4\cdot OH$	VI-470	122.16
3115	phenol (*m*)	. . . .	$C_2H_5\cdot C_6H_4\cdot OH$	VI-471	122.16
3116	phenol (*p*)	. . . .	$C_2H_5\cdot C_6H_4\cdot OH$	VI-472	122.16
3117	γ-phenoxybutyrate	. . . .	$C_6H_5O\cdot CH_2(CH_2)_2\cdot CO_2\cdot C_2H_5$	. . . .	208.25
3118	phenylacetate	. . . .	$C_6H_5\cdot CH_2\cdot CO_2\cdot C_2H_5$	IX-434	164.20
3119	phenylacetic acid	. . . .	$C_6H_5\cdot CH(C_2H_5)CO_2H$	IX-541	164.20
3120	phenylacetylene	1-phenyl-butyne-1	$C_6H_5\cdot C\vdots C\cdot C_2H_5$	V-517	130.18
3121	phenylbromo-acetate	(*dl*)	$C_6H_5\cdot CHBrCO_2C_2H_5$	IX-452	243.10
3122	phenyl carbinol (*dl*)	sec-Ph-Pr-alcohol	$C_6H_5\cdot CHOH\cdot C_2H_5$	VI-502	136.19
3123	phenyl carbinol (*l*)	. . . .	$C_6H_5\cdot CHOH\cdot C_2H_5$	VI-502	136.19
3124	phenyl-ethanol-amine	β-ethylanilino-ethyl alcohol	$C_6H_5N(C_2H_5)CH_2\cdot CH_2OH$	XII-183	165.23
3125	phenylglycinate	*N*-Ph-glycine Et ester	$C_6H_5NH\cdot CH_2CO_2\cdot C_2H_5$	XII-470	179.21
3126	phenylhydantoin (*dl*) (5,5)	nirvanol	$\underline{CO\cdot NH\cdot CO\cdot NH\cdot C}:(C_2H_5)(C_6H_5)$	*XXIV-348	204.22
3127	phenylhydrazine	(α,α)	$C_6H_5N(C_2H_5)\cdot NH_2$	XV-119	136.19
3128	phenylhydrazine	(α,β)	$C_6H_5\cdot NH\cdot NH\cdot C_2H_5$	XV-120	136.19
3129	phenyl ketone	propiophenone	$C_2H_5\cdot CO\cdot C_6H_5$	VII-300	134.17
3130	2-phenyl-6-methyl-cinchoninate	neocincophen; neo-quinophan; novatophan	$CH_3\cdot C_9H_4N(C_6H_5)\cdot CO_2\cdot C_2H_5$	*XXII-520	291.33
3131	phenylpropiolate	. . . .	$C_6H_5\cdot C\vdots C\ CO_2\cdot C_2H_5$	IX-634	174.19
3132	phenyl sulfide	thiophenetole	$C_6H_5\cdot S\cdot C_2H_5$	VI-297	138.22
3133	phenylsulfone	. . . .	$C_6H_5\cdot SO_2\cdot C_2H_5$	VI-297	170.22
3134	phenyl urea (*N,N′*)	. . . .	$C_2H_5NH\cdot CO\cdot NHC_6H_5$	XII-348	164.20
3135	phosphine	. . . .	$C_2H_5\cdot PH_2$	IV-581	62.06
3136	propargyl ether	. . . .	$CH\vdots C\cdot CH_2\cdot O\cdot C_2H_5$	I-454	84.11
3137	propiolate	. . . .	$CH\vdots C\cdot CO_2\cdot C_2H_5$	II-477	98.10
3138	propionate	. . . .	$C_2H_5\cdot CO_2\cdot C_2H_5$	II-240	102.13
3139	*n*-propylaceto-acetate	. . . .	$CH_3CO\cdot CH(C_3H_7)\cdot CO_2\cdot C_2H_5$	III-700	172.22
3140	*iso*-propylaceto-acetate	. . . .	$CH_3CO\cdot CH(C_3H_7)\cdot CO_2\cdot C_2H_5$	III-702	172.22
3141	β-*n*-propyl-acrolein (α)	2-Et-hexenal	$C_3H_7\cdot CH:C(C_2H_5)\cdot CHO$	I-744	126.19
3142	*n*-propyl ether	. . . .	$C_2H_5\cdot O\cdot CH_2\cdot C_2H_5$	I-354	88.15
3143	*iso*-propyl ether	. . . .	$C_2H_5\cdot O\cdot CH(CH_3)_2$	I-362	88.15
3144	*n*-propyl ketone	hexanone-3	$C_2H_5\cdot CO\cdot CH_2\cdot C_2H_5$	I-690	100.16
3145	*iso*-propyl ketone	2-Me-pentanone-3	$C_2H_5\cdot CO\cdot CH(CH_3)_2$	I-691	100.16
3146	pyridine (2)	. . . .	$C_2H_5\cdot C_5H_4N$	XX-241	107.15

Ethyl nitrophthalate 2190
Ethyl nitroso-ethylcarbamate 4886
Ethyl nitroso-methylcarbamate 4891
Ethyl orthoformate 3049
Ethyl orthopropionate 6193

Ethyl oxalate 2193
Ethyl oxalic acid 3066
Ethyl oxamate 5015
Ethyl-phenylamine 2965
Ethyl-phenyl-barbituric acid 5113

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3105	rhb.	....	88 d.	....	s.	s.	s.
3106	lq.	0.801^{0°	....	189	i.	s.	s.
3107	lq.	$0.827^{20^\circ}_{4}$	12.5	227	i.	s.	s.
3108	col. lq.	$0.872^{20^\circ}_{20}$	−66.1	187-8	0.029^{20°	∞	∞; ∞ chl.
3109	oil	0.867^{25°	<−15	$216\text{-}8^{15mm}$	i.	∞	∞
3110	pl. or pr./al.	....	66-7	260-300 (sl. d.)	sl. s. h.	s.	s.
3111	nd./act.	....	97	....	sl. s. h.	....	....
3112	col. nd.	$0.858^{25^\circ}_{4}$	24-5	191^{10mm}	i.	s.	s.
3113	col. lq.	$0.866^{17.5^\circ}$	−44.5	$227\text{-}8^{757mm}$	i.	∞	∞
3114	col. lq.	$1.018^{25^\circ}_{25}$	−45	$207\text{-}8^{756mm}$	v. sl. s.	∞; s. bz.	∞
3115	col. lq.	$1.001^{25^\circ}_{25}$	−4	214^{752mm}	v. sl. s.	∞	∞
3116	nd.	....	46-7	218.5-9.5	v. sl. s.	1200^{25°	710^{25°
3117	lq.	$1.048^{23^\circ}_{25}$	....	$156\text{-}62^{20mm}$	....	....	....
3118	col. lq.	$1.033^{20^\circ}_{4}$	....	227	i.	∞	∞
3119	pl./et.	....	42	270	....	....	....
3120	lq.	0.923^{21°	....	201-3	i.	s.	s.
3121	oil	$1.415^{20^\circ}_{4}$	....	145^{15mm}	....	....	....
3122	col. lq.	$0.994^{23^\circ}_{0}$	....	219-20 sl. d.	i.	s.	s.
3123	col. lq.	$0.998^{13.8^\circ}_{4}$	....	....	i.	s.	s.
3124	lq.	$1.04^{20^\circ}_{20}$	....	268^{740mm}	0.5^{20°	....	....
3125	lf.	....	57-8	273 sl. d.	v. sl. s. h.	v. s. h.	v. s.
3126	col. nd./al.	....	199-200	....	0.06 c.; 0.9 h.	6; i. bz.; s. alk.	0.6; s. ac.
3127	oil	1.018^{15°	....	237	....	....	....
3128	oil	$1.004^{15^\circ}_{15}$	....	*237-40	sl. s.	v. s.	v. s.
3129	pl.	$1.012^{20^\circ}_{20}$	21	218	i.	s.	s.
3130	yel. cr./al.	....	75-6	....	i.; s. a.	s. h.	s.; s. chl.
3131	oil	$1.063^{13^\circ}_{4}$	....	260-70 sl. d.	....	....	....
3132	lq.	$1.024^{15^\circ}_{4}$	....	205-6	....	....	....
3133	mn.	1.010^{22°	42	>300	s. h.	s.	s.; s. a
3134	nd./aq. al.	....	99	....	....	s.	..
3135	col. lq.	<1	....	25	....	....	....
3136	lq.	$0.833^{20^\circ}_{4}$	....	80-2	sl. s.	∞	....
3137	col. lq.	$0.968^{15^\circ}_{15}$	....	119^{745mm}	i.; v. s. chl.	v. s.	v. s.
3138	col. lq.	$0.891^{20^\circ}_{4}$	−72.6	99.1	2.4^{20°	∞	∞
3139	lq.	$0.948^{25^\circ}_{4}$	....	223.6	....	....	....
3140	lq.	$0.960^{25^\circ}_{25}$	....	205 d.	v. sl. s.	∞	∞
3141	col. lq.	$0.848^{20^\circ}_{4}$	....	174.5^{746mm}	0.07^{20°	s.	∞; ∞ bz.
3142	col. lq.	$0.739^{20^\circ}_{4}$	<−79	62-3	sl. s.	∞	∞
3143	col. lq.	0.745^{0°	....	54	sl. s.	∞	∞
3144	col. lq.	$0.813^{21.8^\circ}_{4}$	....	123-4	v. sl. s.	∞	∞
3145	col. lq.	$0.814^{18^\circ}_{0}$	....	114^{745mm}	v. sl. s.	v. s.	∞
3146	lq.	0.950^{0°	....	148.5^{753mm}	sl. s.	∞	v. s.

* In nitrogen.

Ethyl phenyl-benzyl-carbamate 5165
Ethyl phenyl-carbamate 5254
Ethyl phenyl-cyanoacrylate 3031
Ethyl-phenyl ether 5111
Ethyl-phenylnitrosoamine 4885
Ethyl phosphate 6188
Ethyl phosphite 6192
Ethyl phthalate 2199, 3067
Ethyl pimelate 2202
Ethyl-propyl carbinol (*n*) 3626
Ethyl-propyl carbinol (*iso*) 3632
Ethyl propyl-malonate 2203-4

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3147	**Ethyl** pyridine (3)	β-lutidine	$C_2H_5 \cdot C_5H_4N$	XX-242	107.15
3148	pyridine (4)		$C_2H_5 \cdot C_5H_4N$	XX-243	107.15
3149	pyrrole (*N*)	Et-pyrrolylamine	$C_4H_4N \cdot C_2H_5$	XX-163	95.14
3150	pyruvate		$CH_3CO \cdot CO_2 \cdot C_2H_5$	III-616	116.11
3151	salicylate (*o*)	Et hydroxybenzoic †	$HO \cdot C_6H_4 \cdot CO_2 \cdot C_2H_5$	X-73	166.17
3152	silicate, ortho		$Si(OC_2H_5)_4$	I-334	208.30
3153	stearate		$C_{17}H_{35}CO_2 \cdot C_2H_5$	II-379	312.52
3154	succinic acid		$HO_2C \cdot CH(C_2H_5) \cdot CH_2 \cdot CO_2H$	II-660	146.14
3155	sulfone chloride	Et-sulfonyl chloride	$C_2H_5 \cdot SO_2 \cdot Cl$	IV-6	128.58
3156	thioacetate (*S*)		$CH_3CO \cdot S \cdot C_2H_5$	II-232	104.16
3157	thiocarbamate	dithiourethane	$NH_2 \cdot CS \cdot S \cdot C_2H_5$	III-218	121.21
3158	thiocyanate		$C_2H_5 \cdot S \cdot CN$	III-175	87.14
3159	*iso*-thiocyanate	ethyl mustard oil	$C_2H_5 \cdot N:C:S$	IV-123	87.14
3160	thioglycolate		$HS \cdot CH_2CO_2 \cdot C_2H_5$	III-255	120.16
3161	thioglycolic acid	(*S*)	$C_2H_5S \cdot CH_2 \cdot CO_2H$	III-248	120.16
3162	thiourea		$C_2H_5 \cdot NH \cdot CS \cdot NH_2$	IV-117	104.17
3163	toluate (*o*)		$CH_3 \cdot C_6H_4 \cdot CO_2 \cdot C_2H_5$	IX-463	164.20
3164	toluate (*m*)		$CH_3 \cdot C_6H_4 \cdot CO_2 \cdot C_2H_5$	IX-476	164.20
3165	toluate (*p*)		$CH_3 \cdot C_6H_4 \cdot CO_2 \cdot C_2H_5$	IX-484	164.20
3166	toluene (*o*)	methyl-ethyl-benzene	$C_2H_5 \cdot C_6H_4 \cdot CH_3$	V-396	120.19
3167	toluene (*m*)		$C_2H_5 \cdot C_6H_4 \cdot CH_3$	V-396	120.19
3168	toluene (*p*)		$C_2H_5 \cdot C_6H_4 \cdot CH_3$	V-397	120.19
3169	*p*-toluene sulfonate		$CH_3 \cdot C_6H_4 \cdot SO_3 \cdot C_2H_5$	XI-99	200.25
3170	*o*-toluidine		$CH_3 \cdot C_6H_4 \cdot NHC_2H_5$	XII-786	135.20
3171	*m*-toluidine		$CH_3 \cdot C_6H_4 \cdot NHC_2H_5$	XII-857	135.20
3172	*p*-toluidine		$CH_3 \cdot C_6H_4 \cdot NHC_2H_5$	XII-904	135.20
3173	*o*-tolyl ether	Et *o*-cresyl ether	$CH_3 \cdot C_6H_4 \cdot O \cdot C_2H_5$	VI-352	136.19
3174	*m*-tolyl ether		$CH_3 \cdot C_6H_4 \cdot O \cdot C_2H_5$	VI-376	136.19
3175	*p*-tolyl ether		$CH_3 \cdot C_6H_4 \cdot O \cdot C_2H_5$	VI-393	136.19
3176	*p*-tolyl sulfide	Et *p*-cresyl sulfide	$CH_3 \cdot C_6H_4 \cdot S \cdot C_2H_5$	VI-417	152.25
3177	triazoacetate		$N_3CH_2 \cdot CO_2 \cdot C_2H_5$	II-229	129.12
3178	tribromoacetate		$Br_3C \cdot CO_2 \cdot C_2H_5$	II-221	324.83
3179	trichloroacetate		$Cl_3C \cdot CO_2 \cdot C_2H_5$	II-209	191.45
3180	tripropylbenzene	(*iso*)	$C_2H_5 \cdot C_6H_2(C_3H_7)_3$		232.39
3181	undecylate (*n*)		$C_{10}H_{21}CO_2 \cdot C_2H_5$	II-358	214.34
3182	*n*-undecyl ketone	tetradecanone-3	$C_2H_5 \cdot CO \cdot C_{11}H_{23}$	I-716	212.36
3183	urea		$C_2H_5 \cdot NH \cdot CO \cdot NH_2$	IV-115	88.11
3184	urethane	Et *N*-Et carbamate	$C_2H_5 \cdot NHCO_2C_2H_5$	IV-114	117.15
3185	valerate (*n*)		$CH_3(CH_2)_3CO_2C_2H_5$	II-301	130.18
3186	*iso*-valerate		$(CH_3)_2CH \cdot CH_2 \cdot CO_2 \cdot C_2H_5$	II-312	130.18
3187	vanillate (4,3;1)		$HO(CH_3O)C_6H_3 \cdot CO_2 \cdot C_2H_5$	X-397	196.20
3188	vanillin	3-EtO-4-OH-benzaldehyde; ethovan	$HO(C_2H_5O)C_6H_3 \cdot CHO$	VIII-256	166.17
3189	vinyl carbinol	pentene-1-ol-3	$CH_2:CH \cdot CHOH \cdot C_2H_5$	I-443	86.13
3190	vinyl sulfide		$CH_2:CH \cdot S \cdot C_2H_5$	I-434	86.16
3191	violet base	hexaEt-4,4′,4″-tri-NH₂-triPh-carbinol	$[(C_2H_5)_2N \cdot C_6H_4]_3C \cdot OH$	XIII-759	473.68

† See also No. 3072.

Ethyl pyromucate 3050
Ethyl-pyrrolylamine 3149
Ethyl red 2144
Ethyl sebacate 2206
Ethyl selenomercaptan 3071
Ethyl suberate 2210
Ethyl succinate 2211-2
Ethyl sulfate 2213
Ethyl sulfinic acid 2905
Ethyl sulfonic acid 2906
Ethyl sulfonyl chloride 3155
Ethyl sulfuric acid 3069
Ethyl tartrate 2218, 3070
Ethyl thioncarbamate 6450

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3147	lq.	$0.959^{0°}_{4}$	....	165.3	sl. s. c.; v. sl. s. h.	s.	s.
3148	lq.	$0.936^{20°}$	....	166	s. aq. a.	....	....
3149	lq.	$0.888^{16°}$	....	130-1	i. c.; s. a.	∞	∞
3150	col. lq.	$1.060^{16°}_{4}$	....	155	i.	∞	∞
3151	col. lq.	$1.136^{15°}_{4}$	1.3	233-4	i.	∞	∞
3152	lq.	$0.936^{20°}_{20}$	....	168.1	sl. d.	∞	....
3153	col. cr.	$0.848^{36.3°}$	33.4(30.9)	$199\text{-}201^{10mm}$	i.	s.	s.
3154	col. pr.	....	98	....	v. s.	v. s.	v. s.
3155	lq.	$1.357^{22.5°}$	....	177.5	sl. d.	sl. d.	v. s.
3156	lq.	$0.976^{28°}_{4}$	....	116-7	i.	v. s.	v. s.
3157	lf./et.	....	41-2	d.	i.	v. s.	v. s.
3158	lq.	$0.996^{25°}_{4}$	−85.5	145^{765mm}	i.	∞	∞
3159	col. lq.	$1.004^{15°}_{4}$	−5.9	131-2	i.	∞	∞
3160	lq.	$1.096^{15°}$	....	156-8	....	....	....
3161	oil	$1.150^{20°}_{4}$	−8.7	$123\text{-}4^{15mm}$	∞	s.	s.
3162	nd.	....	114 (113)	....	v. s.	v. s.	....
3163	lq.	$1.032^{25°}_{25}$	<−10	227	i.	∞	∞
3164	lq.	$1.030^{20°}_{20}$	....	231^{750mm}	i.	∞	∞
3165	lq.	$1.024^{25°}_{25}$	....	235.5	i.	∞	∞
3166	lq.	$0.881^{20°}_{4}$	−80.8	165.2	i.	∞	∞
3167	lq.	$0.865^{20°}_{4}$	−95.6	161.3	i.	∞	∞
3168	lq.	$0.861^{20°}_{4}$	−62.4	162.0	i.	∞	∞
3169	mn. pr./al.	$1.166^{48°}_{4}$	33-4	221.3	i.	s.	s.
3170	lq.	$0.948^{25°}_{4}$	<−15	215-6	i.	....	....
3171	lq.	....	....	221-2	....	....	....
3172	lq.	$0.942^{25°}_{4}$	....	217	i.	....	....
3173	lq.	$0.959^{13.3°}_{4}$	....	184	....	....	....
3174	lq.	$0.956^{0°}_{0}$	....	192	....	....	....
3175	lq.	$0.966^{0°}_{0}$	....	188-9	....	....	....
3176	lq.	$1.002^{17.5°}$	....	220-1	....	....	....
3177	col. oil	$1.127^{20°}_{20}$	....	70^{20mm}	....	....	....
3178	col. lq.	$2.230^{20°}_{20}$	....	225	i.	∞	∞
3179	col. lq.	$1.383^{20°}_{4}$	....	167-8	i.	∞	∞
3180	col. cr.	....	106.9	260	i.	$1.5^{25°}$	$105^{25°}$
3181	lq.	....	....	140^{20mm}	i.	....	....
3182	cr./Me al.	....	34	152^{16mm}	....	....	....
3183	nd.	$1.213^{18°}$	92	....	v. s.	80	i.
3184	col. lq.	$0.981^{20°}_{4}$	....	174-6	$63^{15°}$	d. h. alk.	....
3185	col. lq.	$0.877^{20°}$	−91.2	145.5	$0.24^{25°}$	∞	∞
3186	col. lq.	$0.867^{20°}_{4}$	−99.3	135	$0.17^{20°}$	∞; ∞ bz.	∞
3187	nd.	....	44	291-3	i.; s. alk.	v. s.	v. s.
3188	col. pl./aq.	....	77-8	....	v. sl. s.	s.	s.
3189	lq.	$0.840^{19.5°}_{0}$	....	114.5-4.7	....	....	....
3190	col. lq.	$0.887^{14°}$	....	90.5-1.5	....	....	....
3191	cr./lg.	....	....	....	....	sl. d.	....

Ethyl thionurethane 6450
Ethyl thiourethane 5921
Ethyl-tolyl-benzylamine 2988
Ethyl vinyl ether 6438
Ethyl xylene 2483-6
Ethylal 2172
Ethylene acetate 3445
Ethylene benzoate 3447
Ethylene bromide 1837
Ethylene chloride 1994
Ethylene chlorobromide 1343
Ethylene diacetate 3445
Ethylene dibenzoate 3447
Ethylene dibutyrate 3450
Ethylene dicaprate 3451

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3192	**Ethylene**	ethene	$CH_2:CH_2$	I-180	28.05
3193	bromohydrin	glycol bromohydrin	$Br \cdot CH_2 \cdot CH_2OH$	I-338	124.98
3194	chlorohydrin	2-chloro-ethanol-1	$ClCH_2 \cdot CH_2OH$	I-337	80.52
3195	cyanohydrin	β-OH-propionitrile	$HO \cdot CH_2 \cdot CH_2 \cdot CN$	III-298	71.08
3196	diamine	....	$NH_2 \cdot CH_2 \cdot CH_2 \cdot NH_2$	IV-230	60.10
3197	diamine HBr	....	$(CH_2NH_2)_2 \cdot 2HBr$	IV-232	221.95
3198	diamine HCl	....	$(CH_2NH_2)_2 \cdot 2HCl$	IV-232	133.03
3199	diamine hydrate	....	$(CH_2NH_2)_2 \cdot H_2O$	IV-230	78.12
3200	diamine *iso*-valerate	*iso*-valeryl-ethyl-ene-diamine	$C_{12}H_{28}O_4N_2$	....	264.36
3201	dicaprate	....	$(C_9H_{19}CO_2)_2C_2H_4$	....	370.56
3202	diphenyl ether	....	$(C_6H_5 \cdot O \cdot CH_2)_2$	VI-146	214.25
3203	diphenylsulfone	....	$(C_6H_5 \cdot SO_2 \cdot CH_2)_2$	VI-302	310.37
3204	diphenylthioether	....	$(C_6H_5 \cdot S \cdot CH_2)_2$	VI-301	246.37
3205	diphthalimide (*N,N′*)	....	$[C_6H_4(CO)_2:N \cdot CH_2]_2$	XXI-492	320.29
3206	disulfonic acid	....	$(HO_3S \cdot CH_2)_2$	IV-11	190.19
3207	ethylidene oxide	glycol-ethylidene-diacetal	$CH_3 \cdot CH:(OCH_2 \cdot)_2$	XIX-8	88.10
3208	iodohydrin	2-iodo-ethanol-1	$ICH_2 \cdot CH_2OH$	I-339	171.98
3209	mercaptan	ethandithiol-1,2	$HS \cdot CH_2 \cdot CH_2 \cdot SH$	I-471	94.19
3210	oxide	....	$\underbrace{CH_2 \cdot CH_2 \cdot O}$	XVII-4	44.05
3211	thiocyanate	....	$(CH_2 \cdot SCN)_2$	III-178	144.21
3212	urea	....	$(CH_2NH)_2CO$	XXIV-2	86.09
3213	**Ethylidene** acetone	Me-propenyl ketone	$CH_3 \cdot CH:CH \cdot CO \cdot CH_3$	I-732	84.11
3214	diacetate	diacetoxyethane (1,1)	$CH_3 \cdot CH(O_2C \cdot CH_3)_2$	II-152	146.14
3215	diurethane	....	$CH_3 \cdot CH:(NH \cdot CO_2 \cdot C_2H_5)_2$	III-24	204.22
3216	urea	....	$CH_3 \cdot CH:(NHCONH)$	III-60	86.09
3217	**Eucalyptole**	cineole	$C_{10}H_{18}O$	XVII-24	154.24
3218	**Eugenol** (1,3,4)	allyl guaiacol	$C_6H_3(C_3H_5)(OCH_3) \cdot OH$	VI-961	164.20
3219	acetate	....	$CH_3 \cdot CO_2 \cdot C_{10}H_{11}O$	VI-965	206.23
3220	benzoate	benzoyl eugenol	$C_6H_5CO_2C_{10}H_{11}O$	....	268.30
3221	cinnamate	....	$C_8H_7CO_2C_{10}H_{11}O$	IX-586	294.33
3222	methyl ether	....	$C_3H_5 \cdot C_6H_3:(OCH_3)_2$	VI-963	178.22
3223	***iso*-Eugenol** (1,3,4)	propenyl guaiacol	$C_6H_3(C_3H_5)(OCH_3) \cdot OH$	VI-955	164.20
3224	methyl ether	Me isoeugenol	$C_3H_5 \cdot C_6H_3:(OCH_3)_2$	VI-956	178.22
3225	**Eugetinic acid**	(5;6,3,1)	$CH_3O \cdot C_6H_2(OH) \cdot (C_3H_5)CO_2H$	X-441	208.21
3226	**Eupittonic acid**	....	$C_{19}H_8(OCH_3)_6O_3$	VIII-574	470.46
3227	**Euxanthone**	1,7-diOH-xanthone	$CO:(C_6H_3OH)_2O$	XVIII-113	228.19
3228	**Evans blue**	....	$C_{34}H_{26}O_{14}N_6S_4Na_4$	....	962.82
3229	**Evernic acid**	....	$C_{16}H_{13}O_6 \cdot OCH_3$	X-416	332.30
3230	**Everninic acid**	(6,4;2,1)	$HO(CH_3O)C_6H_2 \cdot (CH_3)CO_2H$	X-413	182.17
3231	**Evipan** (1,5;5)	*N*-Me-cyclohexenyl-methylbarbituric	$C_4HO_3N_2(CH_3)_2 \cdot C_6H_9$	....	236.26
3232	**Fenchene** (*dl*)	....	$C_{10}H_{16}$	V-163	136.23
3233	**Fenchone** (*d*)	....	$C_{10}H_{16}O$	VII-96	152.23

Ethylene dicaprylate 3452
Ethylene dicyanide 5661
Ethylene dilaurate 3458
Ethylene dimyristate 3461
Ethylene dipalmitate 3464
Ethylene diphenyldiamine 2720
Ethylene dipropionate 3465
Ethylene distearate 3467
Ethylene fluoride 2249
Ethylene formate 3455
Ethylene glycol-, cf. glycol.
Ethylene glycol 3444
Ethylene glycol diethyl ether 2139
Ethylene imine 6430
Ethylene iodide 2391
Ethylene lactic acid 3682
Ethylene malonic acid 6425
Ethylene nitrate 3462
Ethylene nitrite 3463
Ethylene periodide 5812
Ethylene phenyl sulfide 3204
Ethylene tetrabromide 5721
Ethylene tetrachloride 5741
Ethylene tetraiodide 5812

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3192	col. gas	0.975(A) $0.566^{-102°}_{4}$	−169.2	−103.7	$25.6^{0°}$ cc.	360 cc.	s.
3193	col. lq.	$1.772^{20°}_{4}$	....	150 sl. d.	s.	s.	i. pet.
3194	col. lq.	$1.213^{20°}_{4}$	−69	128.8*	∞	∞	∞
3195	lq.	$1.059^{0°}$	....	$220\text{-}2^{754mm}$	∞	∞	$2.3^{15°}$
3196	col. lq.	$0.900^{20°}_{20}$	8.5	117.2	∞	∞; i. bz.	0.3
3197	col. pr.	....	....	....	s.	i.	i.
3198	mn. pr.	....	subl.	....	s.	i.	i.
3199	col. lq.	$0.963^{21°}_{4}$	10	118	∞	....	....
3200	wh. pd.	....	129	....	s.	s.	....
3201	col. pl.	....	37-8	....	i.	s.	v. s.
3202	lf./abs. al.	....	97-8	....	i.	s. h.	s.; s. chl.
3203	nd./al.	....	179-80	....	v. sl. s. h.	s. h.; s. bz.	v. s. h. ac.
3204	nd.	....	70.0-0.5	....	i.	....	....
3205	nd./ac.	....	233-4	....	i.	s. h.	i.; s. bz.
3206	nd.	....	104	....	v. s.	v. s.	....
3207	lq.	$0.987^{15°}_{4}$	....	82.5^{766mm}	66.6; i. aq. $CaCl_2$	∞	∞
3208	col. lq.	$2.197^{20°}_{4}$	....	85^{25mm}	s.	s.	....
3209	lq.	$1.123^{23.5°}$	....	146	v. s. alk.	v. s.	s. NH_4OH
3210	lq.	$0.887^{7°}_{4}$	−111.3	13.5^{747mm}	∞	∞	v. s.
3211	pl. or nd.	....	90	d.	sl. s.	s.	s.
3212	nd.	....	131	....	s.	s. h.	v. sl. s.
3213	col. lq.	$0.856^{20°}$	....	$122\text{-}4^{745mm}$	s.	....	....
3214	col. lq.	$1.061^{12°}$	18.85	168^{740mm}	sl. s.	∞	d. alk.
3215	nd.	....	125-6	$170\text{-}80^{20mm}$	s. h.	s.	s.
3216	nd.	....	154	d. 160	i.	sl. s.	i.
3217	col. oil	$0.927^{20°}$	1.5	176-7	$1.9^{15°}$	∞; s. oils	∞; s. ac.
3218	oil	$1.070^{15°}_{15}$	10.3	253.5	v. sl. s.	∞; ∞ chl.	∞
3219	pl./al.	$1.087^{15°}_{15}$	29-30	$281\text{-}2^{752mm}$	i.	s.	s.
3220	col. cr.	....	70.5	360	i.; s. act.	s. h.	s.; s. chl.
3221	col. nd.	....	90-1	....	i.; s. act.	s. h.	s.; s. chl.
3222	lq.	$1.055^{15°}$	....	248-9	i.	25, 60% al.	∞
3223	oil	$1.091^{15°}_{15}$	−10	267.5	v. sl. s.	∞	∞
3224	col. lq.	$1.055^{22°}$	....	263-4	i.	s.	s.
3225	pr./aq.	....	124	d.	v. sl. s. c.	s.; s. $(NH_4)_2CO_3$	s.
3226	or. nd./al.	....	200 d.	....	s. alk.	sl. s. h. abs.	s. ac.
3227	yel. nd.	....	240	subl. sl. d.	i.; s. alk.	s. h.	sl. s.
3228	b. pd.	....	....	....	s.	i.	i.
3229	pr./al.	....	168-9 d.	....	v. sl. s. h.	s. h.	v. sl. s.
3230	cr./aq.	....	170-1 d.	....	v. sl. s. h.; s. EtOAc	s. h.; s. dil. NaOH	v. sl. s.
3231	col. cr. pd.	....	143-5	....	sl. s.	s. h.	sl. s.
3232	lq.	$0.868^{19°}$	....	155-6	....	....	....
3233	oil	$0.948^{18°}$	5-6	193-5	i.	v. s.	v. s.

* Constant b. p. mixt., 42.5% aq. 95.8°.

Ethylene tribromide 6105
Ethylene trichloride 6155
Ethylidene chlorobromide 1342
Ethylidene dibromide 1836
Ethylidene dichloride 1993
Ethylidene diiodide 2390
Ethylidene dimethyl ether 2415
Ethylidene phenetidine 2913
Ethyne 130
Eubornyl 863
Eudermol, cf. alkd.
Eupyrin 6420
Euresol 114
Eurisol 114
Euxanthic acid, cf. glcdo.
Evipal 3231
Evodiamine, cf. alkd.
Ewer and Pick's acid 4462
Exalgin 4086
F acid 4510
Fantan 5171
Fast green-J base 5672
Fast red-D 3732

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3234	**Fenchyl** alcohol (*dl*)	....	$C_{10}H_{17}OH$	VI-71	154.24
3235	alcohol (*d*)(α)	fenchol	$C_{10}H_{17}OH$	VI-70	154.24
3236	**Ferulic acid** (3;4,1)	MeO-OH-cinnamic acid	$CH_3O\cdot C_6H_3(OH)\cdot CH{:}CHCO_2H$	X-436	194.18
3237	*iso*-**Ferulic acid** (4;3,1)	hesperetinic acid	$CH_3O\cdot C_6H_3(OH)\cdot CH{:}CHCO_2H$	X-437	194.18
3238	**Filicic acid**	filicin (1,1;2,4,6)	$(CH_3)_2C_6H_4({:}O)_3$	VII-856	154.16
3239	**Filixic acid**	....	$C_{35}H_{40}O_{12}$	VIII-576	652.67
3240	**Flavianic** acid	2,4-diNO_2-1-naphthol-7-sulfonic	$(NO_2)_2C_{10}H_4(OH)\cdot SO_3H\cdot 3H_2O$	XI-275	368.27
3241	sodium salt	naphthol yellow S	$C_{10}H_4O_8N_2SNa_2\cdot 3H_2O$	XI-275	412.25
3242	**Flavaniline** (α)	*p*-aminophenyllepidine	$NH_2\cdot C_6H_4\cdot C_9H_5N\cdot CH_3$	XXII-469	234.29
3243	**Flavone**	3-phenyl-benzo-4-pyrone	$C_6H_4\cdot OC(C_6H_5){:}$ $CH\cdot CO$	XVII-373	222.23
3244	**Fluoran**	....	$C_{20}H_{12}O_3$	XIX-146	300.30
3245	**Fluoranthene**	idryl	$C_{16}H_{10}$	V-685	202.24
3246	**Fluorene**	....	$C_6H_4\cdot CH_2\cdot C_6H_4$	V-625	166.21
3247	**Fluorenol**	diphenylene carbinol	$C_6H_4\cdot C_6H_4\cdot CHOH$	VI-691	182.21
3248	**Fluorenone**	diphenylene ketone	$C_6H_4\cdot CO\cdot C_6H_4$	VII-465	180.19
3249	oxime	....	$C_{12}H_8{:}C{:}NOH$	VII-467	195.21
3250	**Fluorescein**	resorcinol phthalein	$C_{20}H_{12}O_5$	XIX-222	332.30
3251	sodium salt	uranin	$C_{20}H_{10}O_5Na_2$	XIX-225	376.27
3252	chloride	3,6-diCl-fluoran	$C_{20}H_{10}O_3Cl_2$	XIX-147	369.19
3253	diacetate	3,6-diAcO-fluoran	$C_{24}H_{16}O_7$	XIX-227	416.37
3254	**Fluorescin**	resorcinol phthalin	$C_{20}H_{14}O_5$	XVIII-358	334.31
3255	**Fluoro**-acetic acid	....	$FCH_2\cdot CO_2H$	II-193	78.04
3256	aniline (*p*)	....	$F\cdot C_6H_4\cdot NH_2$	XII-597	111.12
3257	anisole (*p*)	....	$F\cdot C_6H_4\cdot OCH_3$	*VI-98	126.13
3258	benzene	phenyl fluoride	$C_6H_5\cdot F$	V-198	96.10
3259	benzoic acid (*o*)	....	$F\cdot C_6H_4\cdot CO_2H$	IX-333	140.11
3260	benzoic acid (*m*)	....	$F\cdot C_6H_4\cdot CO_2H$	IX-333	140.11
3261	benzoic acid (*p*)	....	$F\cdot C_6H_4\cdot CO_2H$	IX-333	140.11
3262	bromobenzene (*p*)	....	$F\cdot C_6H_4\cdot Br$	V-209	175.01
3263	chlorobenzene (*o*)	....	$F\cdot C_6H_4\cdot Cl$	*V-110	130.55
3264	chlorobenzene (*m*)	....	$F\cdot C_6H_4\cdot Cl$	....	130.55
3265	chlorobenzene (*p*)	....	$F\ C_6H_4\cdot Cl$	V-201	130.55
3266	chlorobromomethane	....	$CHClBrF$	I-67	147.39
3267	chloromethane	....	CH_2ClF	I-60	68.48
3268	dibromomethane	(2;1,1)	$FCH_2\ CHBr_2$	I-92	205.88
3269	dibromoethane	(2;1,2)	$FCHBr\cdot CH_2Br$	I-92	205.88
3270	1,1-dichloro-1,2-dibromoethane (2)	....	$Cl_2CBr\cdot CHFBr$	I-93	274.77
3271	dichloromethane	Freon-21	$FCHCl_2$	I-61	102.93
3272	iodobenzene (*p*)	....	$F\cdot C_6H_4\cdot I$	V-220	222.01
3273	naphthalene (α)	naphthyl fluoride	$C_{10}HX_7F$	V-540	146.16
3274	nitrobenzene (*p*)	....	$NO_2\cdot C_6H_4\cdot F$	V-241	141.10

Fast scarlet 733
Fast yellow 4996
Fenchol 3235
Feraconitine, cf. alkd.

Ferron 3888
Ferulic methyl ketone 6416
Filicin 3238
Filicinic acid 3238

Fire damp 4061
Fisetin 5805
Flavin 5807
Flavopurpurin 6214

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3234	col. cr.	$0.935^{40°}$	33-5*	201	sl. s.	....	....
3235	col. pr.	$0.964^{20°}_{4}$	45-7	201-2	sl. s.	s.	s.; s. pet.
3236	pr./aq.	....	169-70	d.	s. h.	s.; sl. s. bz.	sl. s.
3237	nd. or pr.	....	225-8	....	sl. s. h.	s.	s.; i. lg.
3238	col. cr./al.	....	213-5 d.	subl. sl. d.	1.4 h.	10 h.	sl. s.
3239	cr.	....	184 d.	....	i.; s. chl.	i. abs.	sl. s.; s. bz.
3240	pa. yel. nd./HCl	....	100; 140-50(anh.)	d. >175	v. s.	v. s.	....
3241	yel. pd.	....	....	....	s.	....	....
3242	yel. nd./al.	....	83-4	....	i.	s.	s.; s. bz.
3243	col./lg.	....	97	....	i.	s.	s.
3244	nd.	....	184	....	s. H_2SO_4	s. HNO_3	....
3245	nd./al.	$1.252^{0°}_{4}$	109-10	$250\text{-}1^{60mm}$	i.	v. s. h.	v. s.
3246	col. cr./al.	$1.203^{0°}_{4}$	115-6	293-5	i.; i. NH_3; s. SO_2	s. h.	s.
3247	nd./aq.	....	153	....	....	s.	s.
3248	yel. rhb.	....	83-4	341.5	i.	v. s.	v. s.
3249	nd.	....	192-3	....	s. chl.	i. pet.	....
3250	yel. red pd.	....	d. >290	....	v. sl. s. h.	s. h.; s. alk.	s. h. ac.
3251	or. red pd.	....	....	....	s.	sl. s.	....
3252	col. cr.	....	252	....	i.; s. chl.	v. sl. s.	s. h. bz.
3253	col. cr./et. bz.	....	201-5	....	i. c. alk.	v. sl. s.	s. ac.
3254	col. nd./ac.	....	125-7**	....	i.; s. alk.	s.	s.
3255	cr.	....	33	165	....	....	....
3256	oil	$1.173^{20°}_{4}$	−0.8	187^{753mm}	v. sl. s.	....	....
3257	col. lq.	....	−43.5	156-7	....	....	....
3258	col. lq.	$1.024^{20°}_{4}$	−41.2	85-6	i.	∞	∞
3259	nd./aq.	....	120-2	....	s. h.	s.	s.
3260	lf./aq.	....	124	....	sl. s. h.	....	....
3261	mn./aq.	....	182-4	....	sl. s. h.	s.	s.
3262	col. lq.	$1.597^{20°}_{4}$	−8	152^{755mm}	i.	v. s.	v. s.
3263	lq.	....	−42.5	138^{774mm}	....	....	....
3264	col. lq.	....	....	123-5	....	....	....
3265	col. lq.	$1.226^{20.5°}_{4}$	−26.9	130^{756mm}	....	....	....
3266	col. lq.	$1.906^{16°}$	<−65	38	....	....	....
3267	gas	....	....	....	d.	....	....
3268	lq.	....	....	117.5	....	....	....
3269	col. lq.	$2.257^{17°}$	−54	122.5^{761mm}	....	....	....
3270	col. lq.	$2.130^{23°}$	....	163.5	....	....	....
3271	gas	$1.426^{0°}$	−127	14.5	i.	s.	s.
3272	col. lq.	$1.925^{15°}$	−18 (−27)	183.2^{760mm}	i.	s.	s.
3273	lq.	$1.133^{19.5°}_{4}$	−8	212-6	s. bz.	s.; s. ac.	s. chl.
3274	pa. yel. cr.	$1.320^{20°}_{4}$	27(21.6)	205	....	....	....

* Rapid heating, m. p. 37-8°.
** Solvent free crysts. m. p. 253-4°.

Fluoro-ethane 3046
Fluoro-ethylene 6439
Fluoro-methane 4240
Fluoro-octane 4978

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Fluoro				
3275	pentabromoethane	....	$Br_3C{\cdot}CBr_2F$	I-95	442.60
3276	pentachloroethane	....	$Cl_3C{\cdot}CCl_2F$	....	220.31
3277	tetrabromoethane	....	$Br_3C{\cdot}CHBrF$	I-95	363.69
3278	tetrachloroethane	....	$Cl_3C{\cdot}CHClF$	I-86	185.86
3279	toluene (*o*)	....	$CH_3{\cdot}C_6H_4{\cdot}F$	V-290	110.13
3280	toluene (*m*)	....	$CH_3{\cdot}C_6H_4{\cdot}F$	V-290	110.13
3281	toluene (*p*)	....	$CH_3{\cdot}C_6H_4{\cdot}F$	V-290	110.13
3282	tribromoethane	....	$BrCH_2{\cdot}CFBr_2$	I-93	284.78
3283	tribromoethane	....	$Br_2CH{\cdot}CHBrF$	I-93	284.78
3284	trichloroethane	....	$Cl_2CH{\cdot}CHClF$	I-85	151.41
3285	trichloroethylene	....	$FClC{:}CCl_2$	....	149.39
3286	trichloromethane	Freon-11	Cl_3CF	I-64	137.38
3287	**Fluoroform**	trifluoromethane	CHF_3	I-59	70.02
3288	**Formaldehyde**	methanal	$H{\cdot}CH{:}O$	I-558	30.03
3289	**Formaldehyde** (meta)	α-trioxymethylene	$(CH_2O)_3$	XIX-381	90.08
3290	**Formaldehyde** (para)	....	$(CH_2O)_x{\cdot}xH_2O$	I-566	(30.03)
3291	acetamide	formicin †	$CH_3CONH{\cdot}CH_2OH$	II-178	89.09
3292	bisulfite Na	....	$CH_2OH{\cdot}SO_3Na{\cdot}H_2O$	I-578	152.11
3293	hydrosulfite	hydrosulfite N. F.	$CH_2O{\cdot}Na_2S_2O_4{\cdot}H_2O$	I-578	222.16
3294	oxime	formaldoxime	$H_2C{:}NOH$	I-590	45.04
3295	sulfoxalate Na	formosul	$CH_2OH{\cdot}SO_2Na{\cdot}2H_2O$	I-577	154.12
3296	**Formamide**	....	$H{\cdot}CO{\cdot}NH_2$	II-26	45.04
3297	**Formamidine**	salts only known	$HN{:}CH{\cdot}NH_2$	II-90	44.06
3298	**Formamidoxime**	isuretin	$H_2N{\cdot}CH{:}NOH$	II-91	60.06
3299	**Formanilide**	formylaniline	$C_6H_5{\cdot}NH{\cdot}CHO$	XII-230	121.13
3300	sodium salt	....	$C_6H_5{\cdot}N(Na){\cdot}CHO$	XII-233	143.12
3301	**Formic acid**	methanoic acid	$H{\cdot}CO_2H$	II-8	46.03
3302	sodium salt	sodium formate	$H{\cdot}CO_2Na$	II-14	68.02
3303	thallium salt	thallous formate	$H{\cdot}CO_2Tl$	II-16	249.41
3304	**Formyl** acetone	....	$HO{\cdot}CH{:}CH{\cdot}CO{\cdot}CH_3$	I-767	86.09
3305	amino-1,3-dimethylbenzene (2)	form-*m*-xylidide (*vis*)	$(CH_3)_2C_6H_3NH{\cdot}OCH$	XII-1109	149.19
3306	diphenylamine	*N*-Ph-formanilide	$H{\cdot}CO{\cdot}N(C_6H_5)_2$	XII-235	197.23
3307	hydrazine	formhydrazide	$H_2N{\cdot}NH{\cdot}CHO$	II-93	60.06
3308	phenylhydrazine (β)	....	$C_6H_5NH{\cdot}NH{\cdot}CHO$	XV-233	136.15
3309	thioaldehyde	....	$\underbrace{CH_2{\cdot}(S{\cdot}CH_2)_2{\cdot}S}$	XIX-382	138.26
3310	**Fraxin** ‡	....	$C_{16}H_{18}O_{10}$ + aq.	....	370.30
3311	**Fructosamine** (*d*)	*iso*-glucosamine	$C_6H_{11}O_5(NH_2)$	IV-332	179.17
3312	**Fucose**	....	$C_5H_{11}O_4{\cdot}CHO$	I-876	164.16
3313	**Fulminuric acid**	*iso*-cyanuric acid	$NC{\cdot}CH(NO_2){\cdot}CONH_2$	II-598	129.08
3314	**Fumaric** acid (*trans*)	butendioic acid	$({:}CH{\cdot}CO_2H)_2$	II-737	116.07
3315	amide	....	$({:}CH{\cdot}CO{\cdot}NH_2)_2$	II-743	114.10
3316	chloride	fumaryl chloride	$({:}CH{\cdot}CO{\cdot}Cl)_2$	II-743	152.97
3317	**Furfural** (3)	....	$C_4H_3O{\cdot}CHO$	....	96.08
3318	**Furfural** (2)	furfurol	$C_4H_3O{\cdot}CHO$	XVII-272	96.08

† Formicin is a commercial syrupy product. ‡ See also Glucoside table.

Fluoro-propane 5406-7
Folliculin 2903
Formaldehyde diacetate 4430
Formaldehyde diethylacetal 2172
Formaldehyde dimethylacetal 4424
Formaldehyde dipropylacetal 5458
Formaldehyde trimethyleneacetal 6285
Formaldoxime 3294
Formamine 3599
Formhydrazide 3307
Formicin 3291
Formin 3599
Formonitrile 3714
Formopan 3298
Formosul 3295
Formyl-aniline 3299
Formyl-diethylamine 2173
Formyl-salicylic acid 168
Formyl-xylidine 3305
Form-xylidide 3305
Forsling's acid-I 4551

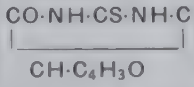
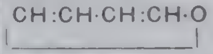
No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3275	col. cr.	....	176 d.	subl. 120	s. bz., chl.	sl. s. c.	s.
3276	col. cr.	$1.74^{25°}$	100	136.8	i.	....	....
3277	lq.	$1.939^{16°}$	....	103.5^{23mm}	....	....	....
3278	col. lq.	$1.631^{16.7°}$	....	116.5	....	....	....
3279	col. lq.	$1.004^{13.2°}$	−80 ±	115-6	i.	s.	s.
3280	col. lq.	$0.997^{13.4°}$	−110.8	115-6	i.	s.	s.
3281	col. lq.	$1.001^{16°}_{4}$	....	116-7	i.	s.	s.
3282	col. lq.	$2.605^{17.5°}$	....	162.7^{757mm}	....	....	....
3283	col. lq.	$2.674^{18°}$	....	178	....	....	....
3284	col. lq.	$1.550^{17°}$	....	103	i.	∞	∞
3285	col. lq.	$1.530^{25°}$	−82	71.0	d.	....	....
3286	col. lq.	$1.494^{17.2°}$	....	24.9	i.	∞	∞
3287	gas	....	....	$20^{40atm.}$	75 cc.	500 cc.	sl. s. chl.
3288	gas	$0.815^{-20°}$	−92 ±	−21	v. s.	v. s.	v. s.
3289	wh. solid	$1.17^{65°}$	64; subl. 46	114.5^{759mm}	$21^{25°}$; ∞ h.	s.	s.; sl. s. pet.
3290	wh. amor.	....	150-60	subl. 120 ±	$20\text{-}30^{18°}$	i.	i.
3291	hyg. cr.	1.2	50-2 ±	d.	v. s.	v. s.	i.
3292	nd./aq.	....	....	....	s.; d. alk.	sl. s.; d. a.	s. Me al.
3293	nd.	....	....	....	s.	....	....
3294	col. lq.	....	....	84	10–20	....	....
3295	hyg. nd./aq.	....	63-4	d. >125	50–60	i. abs.	i.; i. bz.
3296	lq.	$1.139^{20°}_{4}$	2	193	∞	∞	v. sl. s.
3297	....	....	....	....	....	....	....
3298	rhb.	....	104-5	....	v. s.; i. bz.	v. sl. s.	v. sl. s.
3299	mn.	$1.147^{15°}_{15}$	47	216^{120mm}	sl. s.	v. s.	s.
3300	....	....	....	....	d.	v. sl. s.	....
3301	col. lq.	$1.220^{20°}_{4}$	8.6	100.8	∞	∞	....
3302	mn.	1.919	124	d.	70	sl. s.	i.; s. gly.
3303	nd./al.	$4.967^{10.4°}_{4}$	104(101)	....	$500^{10°}$	sl. s.	v.sl.s.chl.
3304	exists only as salts	....	....	....	....	....	....
3305	nd./al.	....	164-5*	....	....	s.	....
3306	rhb./al.	$1.230^{20°}_{4}$	73-4	$189\text{-}90^{13mm}$	i.	s.	s.; s. bz.
3307	pl. or nd.	....	54	....	v. s. chl.	v. s.; s. bz.	v. s.
3308	lf., al.	....	145-6	....	s. h.	s.	sl. s. bz.
3309	pr./chl.	....	247(218)	subl. 150	sl. s. h.	sl. s.	sl. s.; s. bz.
3310	nd./al.	....	$-H_2O$, 110	....	s. h.	s. h.	i.
3311	syrup	....	....	....	....	s.	i.
3312	nd.	....	145	....	v. s.	v. sl. s.	....
3313	pr./al.	....	145 d.	....	v. s.; i. bz.	v. s.	v. sl. s.
3314	col. pr.	$1.635^{20°}_{4}$	286-7** subl. 7^{200}	290	$0.7^{17°}$; $9.8^{100°}$	$5.75^{29.7°}$	$0.7^{25°}$
3315	pr. aq.	....	d. 265-70	....	s. h.	sl. s. h.	i. ac.; i. chl.
3316	col. lq.	$1.415^{20°}_{20}$	....	161-4	d.	d.	....
3317	lq.	$1.111^{20°}_{20}$	....	144^{732mm}	....	....	....
3318	lq.	$1.159^{20°}_{4}$	38.7	161.7^{760mm}	$9.1^{13°}$	∞	∞

* When heated rapidly, m. p. 176-7°. ** In sealed tube.

Forsling's acid-II 4550
Frangulin, cf. glcde.
Frangulinic acid 2874
Franguloside, cf. glcde.
Fraxin, cf. glcde.
Fraxinin, cf. glcde.
Freon 2246, 3271, 3286, 6206

Fructose 3616
Fructosone 3368
Fruit sugar 3616
Fuchsine 5571
Fuchsine (para) 5039
Fuchsine carbinol base 5570
Fuchsone 2741

Fumarine, cf. alkd.
Fumaryl chloride 3316
Furacrolein 3347
Furan 3327
Furan carboxylic acid 3339-40
Furan tetrahydride 5773
Furfuracrolein 3347
Furfuraldehyde 3318

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3319	**Furfural** acetone	....	$C_4H_3O\cdot CH:CH\cdot CO\cdot CH_3$	XVII-306	136.14
3320	acetophenone (ω)	....	$C_4H_3O\cdot CH:CH\cdot CO\cdot C_6H_5$	XVII-353	198.21
3321	diacetate	....	$C_4H_3O\cdot CH(O_2C\cdot CH_3)_2$	XVII-278	198.17
3322	oxime (α)(*syn*)	furfuraldoxime	$C_4H_3O\cdot CH:NOH$	XVII-281	111.10
3323	oxime (β)(*anti*)	....	$C_4H_3O\cdot CH:NOH$	XVII-281	111.10
3324	phenylhydrazone	....	$C_4H_3O\cdot CH:N\cdot NH\cdot C_6H_5$	XVII-282	186.21
3325	2-thiohydantoin (5)	....	 $CO\cdot NH\cdot CS\cdot NH\cdot C: \; CH\cdot C_4H_3O$	....	194.20
3326	**Furfuramide**	....	$(C_5H_4O)_3N_2$	XVII-281	268.26
3327	**Furfuran**	furan	 $CH:CH\cdot CH:CH\cdot O$	XVII-27	68.07
3328	**Furil** (α,α)	difurfuroyl	$(C_4H_3O\cdot CO)_2$	XIX-166	190.15
3329	dioxime (*syn*)(α)	....	$(C_4H_3O\cdot C:NOH)_2\cdot H_2O$	XIX-166	238.20
3330	dioxime (β)	....	$(C_4H_3O\cdot C:NOH)_2$	XIX-166	220.18
3331	**Furfuryl** acetate	....	$C_4H_3O\cdot CH_2\cdot O_2C\cdot CH_3$	XVII-112	140.13
3332	alcohol	α-furyl carbinol	$C_4H_3O\cdot CH_2OH$	XVII-112	98.10
3333	amine	....	$C_4H_3O\cdot CH_2NH_2$	XVIII-584	97.11
3334	butyrate (α)	....	$C_3H_7CO_2\cdot CH_2\cdot C_4H_3O$	....	168.19
3335	chloride (α)	....	$C_4H_3O\cdot CH_2Cl$	....	116.55
3336	furoate (α)	furfuryl pyromucate	$C_4H_3O\cdot CO_2\cdot CH_2\cdot C_4H_3O$	....	192.16
3337	mercaptan (α)	....	$C_4H_3O\cdot CH_2\cdot SH$	....	114.16
3338	propionate (α)	....	$C_2H_5CO_2\cdot CH_2\cdot C_4H_3O$	....	154.16
3339	**Furoic** acid (β)(3)	....	$C_4H_3O\cdot CO_2H$	*XVIII-439	112.08
3340	acid (α)(2)	pyromucic acid	$C_4H_3O\cdot CO_2H$	XVIII-272	112.08
3341	amide (α)	pyromucamide	$C_4H_3O\cdot CO\cdot NH_2$	XVIII-276	111.10
3342	amide (β)	....	$C_4H_3O\cdot CO\cdot NH_2$	....	111.10
3343	anhydride (α)	pyromucic anhydride	$(C_4H_3O\cdot CO)_2O$	XVIII-276	206.15
3344	chloride (α)	furoyl chloride	$C_4H_3O\cdot COCl$	XVIII-276	130.53
3345	nitrile (α)	2-cyanofuran	$C_4H_3O\cdot CN$	XVIII-278	93.08
3346	**Furoin** (α,α)	....	$C_4H_3O\cdot CHOH\cdot CO\cdot C_4H_3O$	XIX-204	192.16
3347	**Furyl**-acrolein	fur (fur)acrolein	$C_4H_3O\cdot CH:CH\cdot CHO$	XVII-305	122.12
3348	acrolein oxime	....	$C_4H_3O\cdot (CH)_3NOH$	....	137.13
3349	acrylamide	....	$C_4H_3O\cdot CH:CH\cdot CO\cdot NH_2$	XVIII-300	137.13
3350	acrylic acid	(stable form)	$C_4H_3O\cdot CH:CH\cdot CO_2H$	XVIII-300	138.12
3351	acrylic acid	(labile form)	$C_6H_5O\cdot CO_2H$	XVIII-301	138.12
3352	**Gallamide** (3,4,5;1)	gallamic acid	$(HO)_3C_6H_2\cdot CONH_2\cdot 1\frac{1}{2}H_2O$	X-487	196.16
3353	**Gallocyanine**	solid violet	$C_{15}H_{12}O_5N_2$	XXVII-438	300.26
3354	**Geranyl** acetate	geraniol acetate	$CH_3CO_2\cdot C_{10}H_{17}$	II-140	196.28
3355	*n*-butyrate	....	$C_3H_7\cdot CO_2\cdot C_{10}H_{17}$	II-272	224.33
3356	formate	....	$H\cdot CO_2\cdot C_{10}H_{17}$	II-23	182.25
3357	**Germanium tetraethyl**	tetraEt germanium	$(C_2H_5)_4Ge$	IV-631	188.84

Furfuraldoxime 3322-3
Furfurol 3318
Furfuryl pyromucate 3336
Furfurylidene, cf. furfural.
Furoyl chloride 3344
Furyl, cf. also furfuryl.
Furyl carbinol 3332
Furyl cyanide 3345

Furylidene acetic acid 3350-1
Fustic 5806
Fustin, cf. glcde.
G acid 4495-6
Galactonic acid 3946
Galactose 3617
Gallacetophenone 6211
Gallamic acid 3352

Gallic acid 6223
Gallic acid dimethyl ether 5686
Gallic acid trimethyl ether 6242
Gallicin 4249
Gallobromol 1841
Gamma acid 338
Garantose 5579
Gardenal 5113

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3319	col. nd.	....	39-40	$135\text{-}7^{33mm}$	i.	s.	s.; s. chl.
3320	oil	$1.114^{20°}$	....	317	....	....	....
3321	col. cr./pet.	....	52-3	220	i.; s. bz.	s.	v. s.
3322	nd./lg.	....	90-1	201-8 sl. d.	v. sl. s. c.	s.; s. bz.	s.; s. ac.
3323	nd./lg.	....	74-5	....	sl. s.	v. s.; s. bz.	v. s.
3324	yel. lf./al.	....	97-8	....	i.; i. lg.	s.	s.
3325	gn. cr.	....	250-2	....	i.	sl. s.	i.
3326	nd./al.	....	117-21	250 d.	i.; d. a.	s.	s.
3327	col. lq.	$0.937_{4}^{20°}$	....	$31\text{-}2^{756mm}$	i.	s.	s.
3328	yel. nd./bz.	....	165-6	....	i.; s. chl.	sl. s.	sl. s.
3329	col. nd./aq.	....	166-8	....	v. sl. s. bz.	v. s.	v. s.
3330	cr./lg.-et.	....	188-90 d.	....	....	....	v. sl. s.
3331	col. oil	$1.118_{4}^{20°}$	....	175-7	i.	s.	s.
3332	oil	$1.129_{4}^{25°}$	....	169.5^{752mm}	∞; slow d.	s.	s.
3333	lq.	<1	....	145^{754mm}	[illegible]	s.	s.
3334	col. lq.	$1.053_{4}^{20°}$	....	212-3	v. sl. s.	s.	∞
3335	col. lq.	$1.178_{4}^{20°}$	....	49^{26mm}	i.	s.	s.
3336	col. lq.	$\alpha 1.33$ $\beta 1.40$	$\alpha 19.5$ $\beta 27.5$	$>350^{760}$ d.	i.; i. pet.	∞; ∞ bz.	∞; ∞ chl.
3337	col. oil	$1.132_{4}^{20°}$	....	84^{65mm}	i.	....	....
3338	col. lq.	$1.109_{4}^{20°}$	....	195-6	v. sl. s.	s.	∞
3339	col. nd./aq.	....	121-2	$105\text{-}10^{12mm}$	s. h.	s.	v. s.
3340	mn. pr.	....	133-4 subl.>100	230-2 d. >250	$3.6^{15°}$; 25 h.	s.	s.
3341	cr.	....	142-3	subl. >100	....	....	....
3342	cr.	....	169	....	....	....	....
3343	nd./al.	....	73	325 d.	....	s.	s.
3344	col. lq.	....	−2 to 0	173-6	sl. d. h.	sl. d. h.	s.
3345	col. lq.	....	....	146-8	v. sl. s.	∞	∞
3346	pa. brn. nd./Me al.	....	138-9	d.	v. sl. s. h.	sl. s. h.; s. h. toluene	sl. s.
3347	yel. nd./lg.	....	54	>200 d.	i.	s.	s.
3348	yel. nd.	....	103-5	....	i.	s.	s.
3349	sc./aq.	....	168-9	....	v. sl. s. c.	....	....
3350	nd./aq.	....	141	286 d.; in vac. subl.	0.2 c.; s. h.	s.; v. s. ac.; $1.5^{19°}$ bz.	v. s.; i. lg.; i. CS_2
3351	pr. or pl.	....	103-4	....	s. h.	$7.5^{19°}$ bz.	....
3352	lf./aq.	....	....	244 d. (anh.)	s. h.	s.	....
3353	gn. cr.	....	....	....	v. sl. s. h.	s.; s. act.	s. alk.
3354	col. lq.	$0.917^{15°}$	....	$242\text{-}5^{764}$ d.	v. sl. s.	s.	∞
3355	col. lq.	$0.901_{4}^{17°}$	....	$151\text{-}3^{18mm}$	i.	s.	s.
3356	col. lq.	$0.927_{4}^{20°}$	....	$113\text{-}4^{15mm}$	i.	s.	s.
3357	col. lq.	$0.991_{24.5}^{24.5°}$	−90	163.5	i.	s.	s.

Gardenidin 1555
Gardenin 1555
Garlic oil 1684
Gas (for war) 1247; 1303; 1473; 1985; 4697
Gaultherin, cf. glcde.
GC solvent 3446
Gelsemine, cf. alkd.
Gelseminic acid 5604
Gelseminine, cf. alkd.
Genol 4117
Gentian violet base 3592
Gentian violet dye salt 3593
Gentisic acid 2317
Geoffroyine 4405
Geranial 1512
Geraniol 2517
Geraniol acetate 3354
Geraniol butyrate 3355
Geraniol formate 3356
Geraniol tetrahydride 2520
Geraniolene 2492
Glaucine, cf. alkd.
Glaurin 2234

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3358	**Gluco-α-heptose** (*d*)	....	$C_7H_{14}O_7$	I-934	210.18
3359	**Gluconic** acid	....	$CH_2OH(CHOH)_4\cdot CO_2H$	III-542	196.16
3360	Ca salt	Ca gluconate	$C_{12}H_{22}O_{14}Ca\cdot H_2O$	III-544	448.39
3361	δ-lactone	glucono-δ-lactone	$C_6H_{10}O_6$	*XVIII-405	178.14
3362	**Glucose** (α) penta-acetate (*d*)	penta-acetyl glucose	$C_6H_7O_6(COCH_3)_5$	II-159	390.34
3363	(β)pentacetate (*d*)	....	$C_6H_7O_6(COCH_3)_5$	II-159	390.34
3364	pentabutyrate	....	$C_6H_7O_6(COC_3H_7)_5$	....	530.60
3365	pentapropionate	....	$C_6H_7O_6(COC_2H_5)_5$	....	460.47
3366	phenylhydrazone	(*d*)(α)	$C_6H_5NH\cdot N:C_6H_{12}O_5$	XV-221	270.28
3367	phenylhydrazone (β)	....	$C_6H_5NH\cdot N:C_6H_{12}O_5$	XV-221	270.28
3368	**Glucosone** (*d*)	fructosone	$C_4H_9O_4\cdot CO\cdot CHO$	I-932	178.14
3369	**Glucosoxime** (*d*)	....	$C_6H_{12}O_5:NOH$	I-902	195.17
3370	**Glutaconic acid** (trans)	pentendioic acid	$HO_2C\cdot CH_2\cdot CH:CH\cdot CO_2H$	II-758	130.10
3371	**Glutamic** acid (*dl*)	glutaminic acid	$HO_2C\cdot CHNH_2\cdot (CH_2)_2\cdot CO_2H$	IV-493	147.13
3372	acid (*l*)(+)	α-NH$_2$-glutaric	$C_5H_9O_4N$	IV-488	147.13
3373	acid HCl (*d*)	acidulin	$C_5H_9O_4N\cdot HCl$	IV-491	183.60
3374	amide (*dl*)	glutamine	$HO_2C\cdot C_3H_5NH_2\cdot CO\cdot NH_2$	IV-491	146.15
3375	amide (*l*)(+)	*l*-glutamine	$C_5H_{10}O_3N_2$	IV-491	146.15
3376	**Glutaric** acid	pentandioic acid	$CH_2(CH_2\cdot CO_2H)_2$	II-631	132.11
3377	nitrile	....	$CH_2(CH_2\cdot CN)_2$	II-635	94.11
3378	**Glutathione**	....	$C_{10}H_{17}O_6N_3S$	**IV-931	307.32
3379	**Glyceric** acid (*dl*)	dihydroxy-propionic	$HOCH_2CHOH\cdot CO_2H$	III-392	106.08
3380	aldehyde (*dl*)	....	$HOCH_2CHOH\cdot CHO$	I-845	90.08
3381	**Glycerol**	glycerin	$CHOH(CH_2OH)_2$	I-502	92.09
3382	acetate, mono	monacetin †	$C_5H_{10}O_4$	II-146	134.13
3383	acetate, di	diacetin	$HO\cdot C_3H_5(O_2C\cdot CH_3)_2$	II-147	176.17
3384	amine, di (αγ)	1,3-diNH$_2$-2-propanol	$CHOH(CH_2NH_2)_2$	IV-290	90.13
3385	amine, mono (α)	1-NH$_2$-2,3-propandiol	$CH_2OH\cdot CHOH\cdot CH_2\cdot NH_2$	IV-301	91.11
3386	*iso*-amyl ether	(di)(αγ)	$(C_5H_{11}OCH_2)_2:CHOH$	I-513	232.35
3387	*iso*-amyl ether	(mono)(α)	$CH_2OH\cdot CHOH\cdot CH_2\cdot O\cdot C_5H_{11}$	I-513	162.22
3388	bromohydrin, di (α)	1,3-dibromo-2-propanol	$(CH_2Br)_2:CHOH$	I-365	217.91
3389	bromohydrin, di (β)	2,3-dibromo-1-propanol	$Br\cdot CH_2\cdot CHBr\cdot CH_2OH$	I-357	217.91
3390	*n*-butyl ether	(di)(αγ)	$(C_4H_9OCH_2)_2:CHOH$	....	204.30
3391	*n*-butyl ether	(mono)(α)	$CH_2OH\cdot CHOH\cdot CH_2\cdot O\cdot C_4H_9$	....	148.20
3392	*n*-butyrate, mono	α-monobutyrin	$C_3H_7CO_2\cdot CH_2\cdot CHOH\cdot CH_2OH$	II-273	162.18
3393	chlorohydrin, di (α)	1,3-dichloro-2-propanol	$(CH_2Cl)_2:CHOH$	I-364	128.99
3394	chlorohydrin, di (β)	2,3-dichloro-1-propanol	$Cl\cdot CH_2\cdot CHCl\cdot CH_2OH$	I-356	128.99

† Mixture of both isomers.

Gluco-chloral 1289
Gluco-gallin, cf. glcde.
Glucosamine (*iso*) 3311
Glucose 3618
Glucose dimethyl-ketal 60
Glucosido-methyl salicylate, cf. glcde.
Glucosido-salicylaldehyde, cf. glcde.
Gluside 5579
Glutamine 3374-5

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3358	rhb.	....	180-90 d.	....	$10^{14°}$; v. s. h.	v. sl. s. abs. al.	....
3359	nd./al. et.	....	softens 110; 131	....	s.	i. abs. al.	i.
3360	col. nd./aq.	....	....	....	$3.8^{16.5°}$	i.	20 h. aq.
3361	nd./al.	....	153	....	d.	....	....
3362	mn. nd./al.	....	112-3	....	$0.15^{18.5°}$; i. pet.	$1.3^{19°}$ abs. al.	$2.8^{15°}$
3363	mn. nd./al.	....	131-2	subl. vac.	$0.1^{18°}$; i. pet.	$0.8^{19°}$ abs. al.	$2.1^{15°}$
3364	pa. yel. lq.	$1.094^{25°}$	....	$228^{1.5mm}$	i.	s.	s.; s. chl.
3365	pa. yel. lq.	$1.151^{25°}$	....	....	i.	s.	s.; s. chl.
3366	col. cr.	....	159-60	....	s.	sl. s. c.	sl. s. c.
3367	col. cr.	....	140-1	....	sl. s.	sl. s. c.	v. sl. s. c.
3368	amor.	....	....	....	s.	s. h.	i.
3369	nd./Me al.	....	137-8	....	v. s.	v. sl. s.	i.
3370	pr./et.	....	137-8	....	v. s.	v. s.	v. s.
3371	cr./aq.	1.460	199 d.	....	$1.5^{20°}$	v. sl. s.	v. sl. s.
3372	rhb.	$1.538^{20°}_{4}$	224-5 d.	....	$0.7^{20°}$	i. abs.	i.
3373	rhb.	....	202-4*	....	33.3 c.*	i. HCl	....
3374	nd./aq.	....	256	....	$3.6^{18°}$	v. sl. s.	....
3375	nd./aq. al.	....	186	....	$3.6^{18°}$	$0.0005^{25°}$	v. sl. s.
3376	col. cr.	$1.429^{15°}$	97.5	200^{20mm}	$63.9^{20°}$	v. s. abs.	v. s.; s. bz.
3377	col. lq.	$0.989^{25°}$	−29	285-7	s.	s.	i.
3378	col. pr./al.	....	190-2 d.	....	$10^{0°}$; d.h.	i. abs.	i.; i. ac.
3379	syrup	....	....	....	∞	∞	i.
3380	nd. or pr.	$1.455^{18°}_{18}$	142	$140\text{-}50^{0.8mm}$	$3^{18°}$	sl. s.	sl. s.; i. bz.
3381	col. lq.	$1.260^{20°}_{4}$	17.9**	290	∞; i. bz.	∞; i. pet.	i.; i. chl.
3382	col. oil	$1.20^{20°}_{4}$	....	158^{165mm}	v. s.	v. s.	sl. s.; i. bz.
3383	col. lq.	$1.178^{15°}_{15}$	40	$175\text{-}6^{40mm}$	s.	s.	sl. s.
3384	col. hyg.	$1.096^{25°}_{25}$	42	130^{10mm} ±	∞; d. act	∞; i. bz.	i.; i. CCl_4
3385	oil	$1.185^{25°}_{25}$	....	264 sl. d.	s.	s.	i.; i. bz.
3386	col. lq.	$0.903^{25°}_{25}$	....	270-2	i.	∞	∞
3387	col. lq.	$0.987^{25°}_{25}$	....	260-2	s.	∞	∞
3388	col. lq.	$2.135^{21°}_{21}$	....	214.8	i.	....	....
3389	col. lq.	$2.120^{20°}_{4}$	....	219 sl. d.	i.	∞; ∞ act.	∞; ∞ bz.
3390	col. lq.	....	....	$121\text{-}5^{13mm}$	i.	∞	∞
3391	col. lq.	$0.945^{25°}_{25}$	....	$133\text{-}7^{18mm}$	s.	∞	∞
3392	col. lq.	$1.129^{18°}$	....	269-71	∞	....	....
3393	col. lq.	$1.367^{20°}_{4}$	<−20	174.3^{760mm}	$12^{20°}$, $19^{70°}$	∞	∞
3394	col. lq.	$1.362^{20°}_{4}$	....	182-3	14.5	∞	∞

* Heated rapidly, m. p. 213°; d. − HCl, in aq.

** Solidifies at much lower temp.

Glutaminic acid 3371

Glycerin(e) 3381

Glycerol, cf. also glyceryl.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Glycerol				
3395	chlorohydrin, mono	α-chlorohydrin	$CH_2Cl\cdot CHOH\cdot CH_2OH$	I-473	110.54
3396	chlorohydrin, mono	β-chlorohydrin	$CHCl(CH_2OH)_2$	I-476	110.54
3397	formal *	....	$H_2C:C_3H_6O_3$	....	104.10
3398	formate, di *	....	$(HCO_2)_2C_3H_6O$	II-24	148.11
3399	furfural *	....	$C_5H_4O:C_3H_6O_3$	....	170.16
3400	guaiacol ether, mono	guaiamar; aresol; oreson	$CH_3O\cdot C_6H_4\cdot O\cdot C_3H_5(OH)_2$	....	198.21
3401	iodohydrin, di (α)	1,3-diiodo-2-propanol; iotone	$(CH_2I)_2:CHOH$	I-366	311.92
3402	iodohydrin, mono (α)	3-iodo-1,2-propandiol; alival	$CH_2I\cdot CHOH\cdot CH_2OH$	I-475	202.01
3403	methyl ether, di	(αγ)	$(CH_3OCH_2)_2CHOH$	I-512	120.15
3404	methyl ether, mono	(α)	$CH_3O\cdot C_3H_5(OH)_2$	I-512	106.12
3405	nitrate, di (1,2)	....	$C_3H_3(OH)(O\cdot NO_2)_2$	I-515	182.09
3406	nitrate, di (1,3)	....	$CHOH(CH_2NO_3)_2$	I-515	182.09
3407	nitrate, mono (α)	....	$(HO)_2C_3H_5\cdot O\cdot NO_2$	I-514	137.09
3408	nitrate, mono (β)	....	$(CH_2OH)_2CH_2O\cdot NO_2$	I-515	137.09
3409	phenyl ether, di	(αγ)	$(C_6H_5OCH_2)_2CHOH$	VI-149	244.28
3410	phenyl ether, mono (α)	antodyne	$C_6H_5\cdot O\cdot CH_2\cdot CHOH\cdot CH_2OH$	VI-149	168.19
3411	phosphoric acid	....	$(HO)_2C_3H_5\cdot OPO_3H_2$	I-517	172.08
3412	phosphate, sodium	(β)	$(HOCH_2)_2CH\cdot O\cdot PO(ONa)_2\cdot 5H_2O$	*I-517	306.14
3413	propionate, mono	α-monopropionin	$C_2H_5CO_2\cdot CH_2\cdot CHOH\cdot CH_2OH$	*II-107	148.16
3414	salicylate, mono (α or β)	monosalicylin	$HO\cdot C_6H_4CO_2\cdot C_3H_5(OH)_2$	X-82	212.20
3415	stearate, mono	α-monostearin	$C_{17}H_{35}CO_2\cdot CH_2\cdot CHOH\cdot CH_2OH$	II-380	358.55
3416	stearate, mono	β-monostearin	$C_{17}H_{35}CO_2\cdot CH:(CH_2OH)_2$	II-380	358.55
3417	**Glyceryl** ether	....	$C_3H_5O_3:C_3H_5$	XIX-393	130.14
3418	triacetate	triacetin	$(CH_3CO_2)_3C_3H_5$	II-147	218.20
3419	triarachidate	triarachin	$(C_{19}H_{39}CO_2)_3C_3H_5$	II-390	975.61
3420	tribenzoate	tribenzoin	$(C_6H_5CO_2)_3C_3H_5$	IX-140	404.40
3421	tributyrate	tributyrin	$(C_3H_7CO_2)_3C_3H_5$	II-273	302.36
3422	tricaprate	tricaprin	$(C_9H_{19}CO_2)_3C_3H_5$	II-356	554.83
3423	tricaproate	tricaproin	$(C_5H_{11}CO_2)_3C_3H_5$	II-324	386.51
3424	tricaprylate	tricaprylin	$(C_7H_{15}CO_2)_3C_3H_5$	II-348	470.67
3425	triheptylate	triheptylin	$(C_6H_{13}CO_2)_3C_3H_5$	**II-295	428.59
3426	trilaurate	trilaurin	$(C_{11}H_{23}CO_2)_3C_3H_5$	II-362	638.98
3427	trimyristate	trimyristin	$(C_{13}H_{27}CO_2)_3C_3H_5$	II-367	723.14
3428	trinitrate	nitroglycerin	$(O_2N\cdot O)_3C_3H_5$	I-516	227.09
3429	trinitrite	....	$(ON\cdot O)_3C_3H_5$	I-514	179.09
3430	trioleate	triolein	$(C_{17}H_{33}CO_2)_3C_3H_5$	II-468	885.40
3431	tripalmitate	tripalmitin	$(C_{15}H_{31}CO_2)_3C_3H_5$	II-373	807.29
3432	tripropionate	tripropionin	$(C_2H_5CO_2)_3C_3H_5$	*II-107	260.28
3433	tristearate	tristearin	$(C_{17}H_{35}CO_2)_3C_3H_5$	II-383	891.45
3434	trivalerate	trivalerin	$(C_4H_9CO_2)_3C_3H_5$	....	344.41

* Mixture of both isomers.
Glyceryl, cf. also glycerol.

Glyceryl-amine 3384-5
Glyceryl diacetate 3383

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3395	col. lq.	$1.318^{25°}_{25}$	....	213	∞	∞	s.
3396	col. lq.	$1.321^{20°}_{4}$	....	146^{18mm}	s.	∞; s. bz.	∞; ∞ act
3397	col. lq.	$1.220^{25°}_{25}$	....	192-5	∞	∞	∞
3398	col. lq.	$1.304^{15°}$	....	$163\text{-}6^{30mm}$	i. CS_2	....	....
3399	yel. lq.	$1.267^{25°}_{25}$	....	$163\text{-}7^{22mm}$	s.	∞	sl. s.
3400	col. cr. pd.	....	78-9	....	5	s.	s.; s. chl.
3401	yel. oil	$2.4^{15°}$	freezes −16 to −20	d.	1.3; d. alk.	∞; ∞ bz.	∞; ∞ chl.
3402	col. cr.	$2.03^{13°}$	49 ±	....	v. s.	v. s.	....
3403	col. lq.	$1.004^{25°}_{4}$	....	169	∞	∞	∞
3404	col. lq.	$1.111^{25°}_{4}$	....	220	∞	∞	s.
3405	oil	....	expl.	....	d. by a.	d. by alk.	....
3406	oil	$1.47^{15°}$	<−30; expl.	$146\text{-}8^{15mm}$ sl. d.	d. by a., alk.	v. s.	v. s.
3407	col. pr.	1.40	58-9	155-60*	$70^{15°}$	v. s.	v. sl. s.
3408	lf.	1.40	54	155-60	....	v. s.	sl. s.
3409	col. hex.	$1.179^{24°}_{4}$	80-1	$200\text{-}10^{10mm}$	i.; s. bz.	s. h.	s.; s. chl.
3410	col. nd./abs. et.	$1.225^{30°}_{4}$	69-70 (53-4)	200^{22mm}	∞; v. sl. s. lg.	∞; v. s. bz.	∞
3411	syrup	$1.59^{14°}$	−20	....	∞	∞ abs.	....
3412	pl./aq.	....	98-100	d. >130	66 c.	....	....
3413	col. lq.	$1.154^{20°}_{4}$	....	$141\text{-}4^{6mm}$	....	....	....
3414	col. nd./et.	....	76	....	1 c.; v. s. h.	s.; ∞ gly.	sl. s.; s. h. bz.
3415	col. nd./Me al.	$0.984^{20°}_{4}$	82(57)	....	i.	s. h.	s.
3416	nd. or wax	....	....	....	i.	s. h.	s.
3417	lq.	$1.091^{18°}$	....	171-2	∞	∞	∞
3418	col. lq.	$1.161^{17°}_{4}$	−78	258-9	$7.17^{15°}$	∞; ∞ chl.	∞; ∞ bz.
3419	col. cr.	....	72.2	....	i.	s. h.	s. h.
3420	nd./Me al.	$1.228^{12°}$	75-6	d.	i.; s. bz.	s. h.	s.; s. chl.
3421	col. lq.	$1.032^{20°}_{4}$	<−75	305-9	i.	s.	s.
3422	col. cr.	$0.921^{40°}_{4}$	31(25)	....	i.; s. bz.	s. h.	v. s.
3423	col. lq.	$0.987^{20°}_{4}$	−25	....	i.	s. 85% al.	s.
3424	col. lq.	$0.954^{20°}_{4}$	8.3(−21)	....	i.	s. 85% al.	s.
3425	col. lq.	$0.969^{20°}$	....	$223\text{-}5^{3mm}$	i.	s.	s.
3426	col. nd.	$0.894^{60°}_{4}$	45-6(36)**	....	v. s. bz.	sl. s. c.	v. s.
3427	lf.	$0.885^{60°}_{4}$	56.5(49)**	....	i.; v. s. bz.	v. s.	v. s. chl.
3428	col. or yel. oil	$1.601^{15°}$	13.3(2.0)	160^{15mm}; expl. 270	$0.18^{20°}$	$54^{20°}$ abs.	∞
3429	yel. lq.	$1.291^{10°}_{18}$	....	150 sl. d.	d.; i. CS_2	d.; s. chl.	s.; s. bz.
3430	col. oil	$0.915^{150°}$	−4	240^{18mm} sl. d.	i.	sl. s.	v. s.
3431	col. nd.	$0.866^{80°}_{4}$	65.1 (55; 45)	$310\text{-}20^{0.1mm}$	i.	$0.004^{21°}$ abs. al.	v. s.
3432	lq.	$1.100^{20°}_{18}$	....	$177\text{-}82^{20mm}$	....	....	....
3433	col. pr.	$0.862^{80°}_{4}$	70.8(54.5; 64.5)	....	i.; s. bz.	s. h.	s. h.; sl. s. pet.
3434	pa. yel. lq.	$1.030^{20°}$	....	$152\text{-}5^{1mm}$	i.	s.	s.

* Not explosive.

** Probably several other modifications.

Glyceryl tribromohydrin 6112
Glyceryl trichlorohydrin 6166

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Glyceryl				
3435	trivalerate (*iso*)	tri-*iso*-valerin	$(C_4H_9CO_2)_3C_3H_5$	II-314	344.44
3436	**Glycide**	glycidol; epihydrin alcohol	$CH_2 \cdot O \cdot CH \cdot CH_2OH$	XVII-104	74.08
3437	**Glycine**	amino-acetic acid	$NH_2 \cdot CH_2 \cdot CO_2H$	IV-333	75.07
3438	amide	. . . .	$NH_2 \cdot CH_2 \cdot CO \cdot NH_2$	IV-343	74.08
3439	anhydride	diketopiperazine	$C_4H_6O_2N_2$	XXIV-264	114.10
3440	**Glycocholic** acid	cholylglycine; "cholic acid"	$C_{24}H_{39}O_4 \cdot NH \cdot CH_2 \cdot CO_2H$	. . . .	465.61
3441	sodium salt	Na glycocholate	$C_{26}H_{42}O_6NNa$	. . . .	487.60
3442	**Glycocyamine**	guanyl glycine	$HN{:}C(NH_2) \cdot NH \cdot CH_2CO_2H$	IV-359	117.11
3443	**Glycogen**	animal starch	$(C_6H_{10}O_5)_x$	. . . .	(162.14)
3444	**Glycol**	ethandiol-1,2	$HOCH_2 \cdot CH_2OH$	I-465	62.07
3445	acetate, di	ethylene acetate	$(CH_3CO_2 \cdot CH_2 \cdot)_2$	II-142	146.14
3446	acetate, mono	. . . .	$CH_3CO_2 \cdot CH_2CH_2OH$	II-141	104.10
3447	benzoate, di	ethylene benzoate	$(C_6H_5CO_2 \cdot CH_2)_2$	IX-129	270.27
3448	benzyl ether, di	. . . .	$(C_6H_5CH_2 \cdot O \cdot CH_2)_2$	. . . .	242.30
3449	benzyl ether, mono	benzyl cellosolve	$C_7H_7O \cdot C_2H_4OH$	. . . .	152.19
3450	butyrate, di	ethylene dibutyrate	$(C_3H_7CO_2 \cdot CH_2)_2$	II-272	202.24
3451	capr(o)ate, di	ethylene dicaprate	$(C_5H_{11}CO_2 \cdot CH_2)_2$	. . . .	258.35
3452	caprylate, di	ethylene dicaprylate	$(C_7H_{15}CO_2 \cdot CH_2)_2$	**II-303	314.45
3453	ether	diethylene glycol	$(HO \cdot CH_2 \cdot CH_2)_2O$	I-468	106.12
3454	formal	dioxolane; glycol-methylene ether	$O \cdot CH_2 \cdot CH_2 \cdot O \cdot CH_2$	XIX-2	74.08
3455	formate, di	ethylene formate	$(HCO_2 \cdot CH_2)_2$	II-23	118.09
3456	formate, mono	. . . .	$HCO_2 \cdot CH_2 \cdot CH_2OH$	II-23	90.08
3457	guaiacyl ether, di	. . . .	$(CH_3OC_6H_4O \cdot CH_2)_2$	. . . .	274.30
3458	laurate, di	ethylene dilaurate	$(C_{11}H_{23}CO_2 \cdot CH_2)_2$	II-361	426.66
3459	methyl ether, di	di MeO-ethane	$(CH_3 \cdot O \cdot CH_2)_2$	I-467	90.12
3460	methyl ether, mono	methyl cellosolve	$CH_3O(CH_2)_2OH$	I-467	76.09
3461	myristate, di	ethylene dimyristate	$(C_{13}H_{27}CO_2 \cdot CH_2)_2$	II-366	482.76
3462	nitrate, di	dinitroglycol	$(O_2N \cdot O \cdot CH_2)_2$	I-469	152.07
3463	nitrite, di	ethylene nitrite	$(ON \cdot O \cdot CH_2)_2$	I-469	120.07
3464	palmitate, di	ethylene dipalmitate	$(C_{15}H_{31}CO_2 \cdot CH_2)_2$	II-373	538.87
3465	propionate, di	ethylene dipropionate	$(C_2H_5CO_2 \cdot CH_2)_2$	II-242	174.19
3466	salicylate, mono	glysal; spirosal	$C_7H_5O_3 \cdot C_2H_4OH$	X-81	182.17
3467	stearate, di	ethylene distearate	$(C_{17}H_{35}CO_2 \cdot CH_2)_2$	II-380	594.97
3468	**Glycolic** acid	hydroxy-acetic acid	$HO \cdot CH_2 \cdot CO_2H$	III-228	76.05
3469	Ca salt	calcium glycolate	$C_4H_6O_6Ca \cdot 4H_2O$	III-232	262.23
3470	aldehyde	hydroxy-acetaldehyde	$HO \cdot CH_2 \cdot CHO$	I-817	60.05
3471	aldehyde-diethyl-acetal	. . . .	$HO \cdot CH_2 \cdot CH{:}(OC_2H_5)_2$	I-818	134.17
3472	amide	hydroxy-acetamide	$HO \cdot CH_2 \cdot CO \cdot NH_2$	III-240	75.07
3473	anhydride	. . . .	$(HO \cdot CH_2 \cdot CO)_2O$	III-239	134.09
3474	nitrile	. . . .	$HO \cdot CH_2 \cdot CN$	III-242	57.05
3475	**Glycolide**	glycolid	$CH_2 \cdot CO_2 \cdot CH_2 \cdot CO \cdot O$	XIX-153	116.07
3476	**Glycyl** glycine	. . . .	$H_2N \cdot CH_2 \cdot CO \cdot NH \cdot CH_2 \cdot CO_2H$	IV-371	132.12
3477	glycine ester	. . . .	$C_3H_7ON_2 \cdot CO_2C_2H_5$	IV-373	160.17
3478	**Glyoxal**	ethandial	$O{:}CH \cdot CH{:}O$	I-759	58.04

Glycidol 3436
Glycin (photo) 3800
Glycine ethyl ester 3057
Glycine phenetidide 5115
Glycocol 3437
Glycol acetal 3207
Glycol amide 3472
Glycol bromohydrin 3193
Glycol chlorohydrin 3194
Glycol cyanohydrin 3195
Glycol dibromide 1837
Glycol dichloride 1994
Glycol diiodide 2391
Glycol ethyl ether 1265
Glycol ethylidene-diacetal 3207

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3435	oil	0.998^{20°	....	$153\text{-}6^{2mm}$	....	....	....
3436	col. lq.	$1.114\frac{16^\circ}{16}$	....	166-7 sl. d.	∞; sl. s. pet.	∞; sl. s. xylene	∞; s. bz.
3437	mn.	1.161	232-6 d.	....	23 c.	0.1 c.	i.
3438	hyg. nd.	....	65-7	....	v. s.	v. s.	v. sl. s.
3439	pl./aq.	....	275 d.	subl. 260	s. h.	s.; d. a.	d. alk.
3440	nd.	....	154-5 d.	....	3.3^{20°; 8.5^{100°	v. s.; v. sl. s. bz.	0.09^{20°; v. sl. s. chl.
3441	hyg. pd.	....	....	....	s.	s.	....
3442	nd./aq.	....	270-80	....	0.45^{15°	v. sl. s.	v. sl. s.
3443	wh. pd.	....	240	....	s.	i.	i.
3444	col. lq.	$1.113\frac{19^\circ}{4}$	−15.6	197.4	∞	∞	1.0
3445	col. lq.	$1.109\frac{11^\circ}{4}$	−31	190.5	14.3^{22°	∞	∞
3446	col. lq.	1.108	....	182	∞	∞	....
3447	rhb./et.	....	73-4	>360	i.	....	s.
3448	col. lq.	....	....	$131\text{-}6^{2mm}$	....	....	....
3449	col. lq.	1.07	<−75	256	0.4	....	....
3450	col. lq.	1.024^{0°	....	240	i.	v. s.	v. s.
3451	....	....	37-8	....	....	....	....
3452	pa. yel. lq.	....	22	....	i.	....	....
3453	lq.	$1.118\frac{20^\circ}{20}$	−10.5	244.8	∞; i. bz.	∞; i. chl.	i.
3454	lq.	$1.060\frac{20^\circ}{4}$	....	75-6	∞	....	....
3455	lq.	....	....	174	....	s.	s.
3456	lq.	$1.199\frac{15^\circ}{4}$	....	180	∞	....	....
3457	col. nd.	....	138-9	....	v. sl. s.	s. h.	....
3458	col. amor.	....	52-4	188^{20mm}	i.	v. s.	v. s.
3459	lq.	$0.863\frac{20^\circ}{4}$	−58	84-5	∞	....	....
3460	col. lq.	$0.965\frac{20^\circ}{4}$	....	124-5	∞	∞	∞; ∞ bz.
3461	....	....	63-4	$208^{0.1mm}$	....	....	....
3462	yel. lq.	$1.482\frac{21^\circ}{2}$	−20	expl. 114	i.; d. alk.	s.; ∞ bz.	∞; ∞ act.
3463	lq.	1.216^{0°	<−15	96-8	i.; d. alk.	s. d.	s.
3464	nd./al. chl.	....	71-2	$226^{0.1mm}$	i.	s.	s.
3465	lq.	1.045^{25°	....	211-2	sl. s.	∞	∞
3466	col. cr.	....	37	$169\text{-}70^{12mm}$	0.97^{22°	v. s.; s. bz	v. s.
3467	lf.	....	76-7	$241^{0.1mm}$	i.	0.12^{40°	v. s.
3468	nd./aq.	....	79(63)	d.	v. s.	90^{25°	v. s.
3469	nd.	....	$-4H_2O$,110°	....	1.3^{15°	5^{100° aq.	....
3470	col. pl.	1.366^{100°	95-7	....	v. s.	v. s. h.	v. sl. s.
3471	lq.	0.888^{24°	....	107	d. h.	....	....
3472	rhb.	....	120	....	v. s.	sl. s.	....
3473	cr. pd.	....	128-30	....	i. c.; d. h.	i.	i.
3474	col. oil	1.104^{19°	< 72	183 sl. d.	v. s.	v. s.	v. s.; i. bz.
3475	lf./al.	....	86-7	....	s. h.; s. ac.	s. h.	sl. s. c.; s. h. chl.
3476	lf./aq.	....	d. 215-20	....	v. s. h.	sl. s.	i.
3477	nd.	....	88-9	....	v. s.	v. s.	sl. s.
3478	yel. cr.	1.14^{20°	15	51^{776mm}	....	v. s. abs.	v. s. abs.

Glycol iodohydrin 3208
Glycol methylene ether 3454
Glycol phenyl ether 5136
Glycolic ethyl ether 2912
Glycolic methyl ether 4063
Glycoline 2533
Glycoluril 139
Glycolyl thiourea 5907
Glycolyl urea 3679
Glycovanillin, cf. glcde.
Glycophillin, cf. glcde.
Glyoxalic acid 3480
Glyoxalin 3851

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3479	**Glyoxime**	....	$HON:CH\cdot CH:NOH$	I-761	88.07
3480	**Glyoxylic acid**	glyoxalic acid	$HO_2C\cdot CH:O\cdot H_2O$	III-594	92.05
3481	**Guaiacol** acetate	....	$CH_3OC_6H_4\cdot O_2CCH_3$	VI-774	166.17
3482	benzoate	benzosol	$CH_3OC_6H_4O_2C_7H_5$	IX-130	228.24
3483	*n*-caproate	....	$CH_3OC_6H_4O_2C_6H_{11}$	....	222.27
3484	carbonate	duotal	$(CH_3O\cdot C_6H_4O)_2CO$	VI-776	274.26
3485	cinnamate	styracol	$CH_3OC_6H_4O_2C_9H_7$	IX-585	254.27
3486	salicylate	guaiacol salol	$C_{14}H_{12}O_4$	X-81	244.24
3487	valerate	....	$CH_3OC_6H_4O_2C_5H_9$	....	208.25
3488	**Guanidine**	imino-urea	$(H_2N)_2C:NH$	III-82	59.07
3489	acetate	....	$CH_5N_3\cdot HC_2H_3O_2$	III-86	119.13
3490	carbonate	....	$(CH_5N_3)_2\cdot H_2CO_3$	III-86	180.17
3491	hydrochloride	....	$CH_5N_3\cdot HCl$	III-86	95.54
3492	nitrate	....	$CH_5N_3\cdot HNO_3$	III-86	122.09
3493	sulfate	....	$(CH_5N_3)_2\cdot H_2SO_4\cdot \frac{1}{2}H_2O$	III-86	225.23
3494	thiocyanate	....	$CH_5N_3\cdot HCNS$	III-169	118.16
3495	**Gynocardic acid**	....	$C_{17}H_{33}CO_2H$	....	282.45
3496	**Hedonal**	Me-*n*-Pr-carbinol-urethane	$H_2N\cdot CO_2\cdot CH(CH_3)\cdot (CH_2CH_2CH_3)$	III-29	131.17
3497	**Helenin**	alantolactone	$C_{15}H_{20}O_2$	XVII-327	232.31
3498	**Hematein**	....	$C_{16}H_{12}O_6$	XVIII-227	300.26
3499	**Hematin**	phenodin	$C_{34}H_{33}O_5N_4Fe$	....	633.49
3500	**Hematoxylin**	hydroxybrasilin	$C_{16}H_{14}O_6\cdot 3H_2O$	XVII-219	356.32
3501	**Hemin**	....	$C_{34}H_{32}O_4N_4ClFe$	....	651.94
3502	**Hemipinic acid** (3,4;1,2)	3,4-di MeO-phthalic acid	$(CH_3O)_2C_6H_2:(CO_2H)_2 + aq.$	X-543	226.18
3503	**Heneicosane** (*n*)	....	$CH_3(CH_2)_{19}CH_3$	I-174	296.56
3504	**Heneicosene-9**	....	$CH_3(CH_2)_7CH:CH(CH_2)_{10}CH_3$	I-227	294.55
3505	**Hentriacontane** (*n*)	....	$CH_3(CH_2)_{29}CH_3$	I-177	436.82
3506	**Hepta-**chloropropane	(1,1,1,2,2,3,3)	$Cl_3C\cdot CCl_2\cdot CHCl_2$	I-108	285.24
3507	cosane (*n*)	....	$CH_3(CH_2)_{25}CH_3$	I-176	380.72
3508	decane (*n*)	....	$CH_3(CH_2)_{15}CH_3$	I-173	240.46
3509	decyl alcohol	heptadecanol-9	$[CH_3(CH_2)_7]_2CHOH$	I-430	256.46
3510	diene-2,4	....	$CH_3\cdot (CH:CH)_2\cdot C_2H_5$	I-257	96.17
3511	**Heptandiol-**1,7	....	$HO\cdot (CH_2)_7\cdot OH$	I-489	132.20
3512	**Heptane** (*n*)	....	$CH_3\cdot (CH_2)_5\cdot CH_3$	I-154	100.20
3513	**Heptane** (*iso*)	2-methyl-hexane	$(CH_3)_2CH\cdot C_4H_9$	I-156	100.20
3514	**Heptane**	3-methyl-hexane	$C_3H_7\cdot CH(CH_3)\cdot C_2H_5$	I-157	100.20
3515	**Heptane**	2,2-dimethyl-pentane	$(CH_3)_3C\cdot CH_2\cdot C_2H_5$	I-157	100.20
3516	**Heptane**	2,4-dimethyl-pentane	$[(CH_3)_2CH]_2CH_2$	I-158	100.20
3517	**Heptane**	3,3-dimethyl-pentane	$(CH_3)_2C(C_2H_5)_2$	I-158	100.20
3518	**Heptane**	3-ethyl-pentane	$(C_2H_5)_3CH$	I-157	100.20
3519	**Heptane**	2,2,3-tri Me-butane	$(CH_3)_3C\cdot CH(CH_3)_2$	**I-121	100.20
3520	**Heptanoic** acid	oenanthylic acid	$CH_3(CH_2)_5CO_2H$	II-338	130.18
3521	aldehyde	oenanthole	$CH_3(CH_2)_5\cdot CHO$	I-695	114.18
3522	aldehyde oxime	enanthaldoxime	$CH_3(CH_2)_5\cdot CH:NOH$	I-698	129.20
3523	amide	*n*-heptamide	$CH_3(CH_2)_5CO\cdot NH_2$	II-340	129.20

Glyoxyl diureide 181
Glyoxylic nitrile 756
Glysal 3466
Gnoscopine, cf. alkd.
Gold orange 4328
Grain alcohol 2946
Grape sugar 3618
Gratiolin, cf. glcde.
Gratus strophanthin, cf. glcde.
Guaethol 2927
Guaiacol 4079
Guaiacol ethylene ether 3457
Guaiacol glyceryl ether 3400
Guaiacol salol 3486
Guaiamar 3400
Guajen 2508
Guanicaine 1760
Guanidine aminovaleric acid 575
Guanine, cf. alkd.
Guanyl glycine 3442
Guanyl hydrazine 322
Guanyl urea 2081
Guaranine, cf. alkd.
Guojol 2427

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3479	pr./aq.	....	178	....	v. s. h.	v. s.	v. s.
3480	mn./aq.	....	98	....	v. s.	v. sl. s.	v. sl. s.
3481	col. lq.	$1.156^{0°}$	....	240-1	....	∞	∞
3482	col. cr. pd.	....	57-8	....	v. sl. s.	s. h.	s.; s. chl.
3483	col. lq.	....	....	$168\text{-}70^{15°}$	i.	s.	s.
3484	cr.	....	85-6	....	i.	2; s. h.	7; s. bz.
3485	nd./al.	....	130	....	i.	s.; s. bz.	s.; s. chl.
3486	col. cr./al.	....	65	....	i.	s.	s.; s. chl.
3487	yel. lq.	1.05	....	265	i.	s.; s. bz.	s.; s. chl.
3488	hyg. col. cr.	....	50 ±	....	v. s.	s.	....
3489	nd.	....	229-30	....	v. s.	v. s.	i.
3490	col. cr.	1.25	197 d.	....	$50^{24°}$	$0.2^{24°}$	i. NH_3
3491	col. cr.	....	....	....	v. s.	s.	....
3492	col. cr.	....	214	....	$14^{25°}$	$1.6^{25°}$	$0.6^{25°}$ act.
3493	col. cr.	....	....	....	v. s.	i.	....
3494	col. lf.	....	118	....	$73^{0°}$	$135^{15°}$ aq.	....
3495	col. lf./al.	....	67.5	....	i.	s.	s.
3496	col. nd.	....	74-6	215 ±	$0.8^{35°}$	s.	s.; s. chl.
3497	nd./aq. al.	....	76	275	v. sl. s. h.	s.; s. bz.	s.; s. chl.
3498	silv. nd.	....	250 d.	....	$0.06^{20°}$; s. NH_4OH	sl. s.; i. chl.	$0.013^{20°}$; i. bz.
3499	brn. pd.	....	>200	....	i.; s. alk.	i.; i. chl.	i.
3500	cr./aq. $(NH_4)_2SO_3$	....	140(anh.)	$-H_2O$, 100-20	s. h.	s.; s. aq. borax	s.
3501	b. bl. rhb.	....	....	....	i.; s. ac.	i.	i.; i. chl.
3502	mn.	....	182-6 d.	....	sl. s. c.	s.	0.09
3503	col. cr.	$0.778_{4}^{40.4°}$	40.4	215^{5mm}	i.	....	....
3504	col. lq.	$0.802^{20°}$	3	$201\text{-}2^{11mm}$	i.	....	....
3505	col. cr.	$0.781_{4}^{68.1°}$	68.1	302^{15mm}	i.	$0.7^{15°}$ chl.	sl. s.
3506	col. cr.	$1.805_{4}^{34°}$	30	247-8	....	....	....
3507	col. cr.	$0.780_{4}^{59.5°}$	59.5	270^{15mm}	i.	....	....
3508	col. cr.	$0.775_{4}^{20°}$	22.5	303	i.	sl. s.	s.
3509	col. pl.	....	61	....	....	sl. s. aq. al.	....
3510	col. lq.	$0.733_{4}^{21.5°}$	....	107	....	....	....
3511	col. cr.	....	22.5	262	v. s.	v. s.	i.
3512	col. lq.	$0.684_{4}^{20°}$	−90.6	98.4^{760mm}	$0.0052^{18°}$	sl. s.	∞; ∞ chl.
3513	col. lq.	$0.679_{4}^{20°}$	−118.3	90.1	i.	s.	∞
3514	col. lq.	$0.687_{4}^{20°}$	−119.4	92.0	i.	s.	∞
3515	col. lq.	$0.674_{4}^{20°}$	−123.8	79.2	i.	s.	∞
3516	col. lq.	$0.673_{4}^{20°}$	−119.2	80.5	i.	s.	∞
3517	col. lq.	$0.693_{4}^{20°}$	−134.5	86.1	i.	s.	∞
3518	col. lq.	$0.698_{4}^{20°}$	−118.6	93.5	i.	s.	∞
3519	col. lq.	$0.690_{4}^{20°}$	−25.0	80.9	i.	s.	∞
3520	col. lq.	$0.918^{20°}$	−10	221-2	$0.25^{15°}$	s.	s.
3521	col. lq.	0.[illegible]$50_{4}^{20°}$	−42	155	$0.02^{20°}$	∞	∞
3522	pl./al.	$0.858^{54.7°}$	56	195	sl. s. c.	s.	s.
3523	nd./al.	$0.849_{4}^{112°}$	95-6	250-8	v. s.	v. s.	v. s.

Guvacine, cf. alkd.
Gynesin, cf. alkd.
Gynoval 869
H acid 342
Harmaline, cf. alkd.
Harmine, cf. alkd.
Hasting's naphtha 4100
Hederin (α), cf. glcde.
Helianthin-B 4328
Helicin, cf. glcde.
Helicon 115
Heliotropine 5323
Helixin, cf. glcde.
Helleborein, cf. glcde.
Helleborin, cf. glcde.
Hemellitic acid 2458
Hemimellitic acid 683
Hemimellitene 6253
Hemisine 157
Hendecenoic acid 6376
Hepta-decanal 4015
Hepta-decanoic acid 4014
Hepta-decanol 3509
Hepta-decyl cyanide 5638
Hepta-methylene 1596
Hepta-methylene dicyanide 597
Heptamide 3523
Heptandioic acid 5309

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Heptanoic				
3524	anhydride (*n*)	heptylic anhydride	$(C_6H_{13}CO)_2O$	II-340	242.35
3525	**Heptanthiol**-2	heptyl mercaptan	$CH_3\cdot CH(SH)\cdot C_5H_{11}$	I-415	132.26
3526	**Heptyl** acetate (*n*)	...	$CH_3CO_2\cdot C_7H_{15}$	II-134	158.23
3527	alcohol (*n*)	heptanol-1	$CH_3(CH_2)_5CH_2OH$	I-414	116.20
3528	alcohol	2,2,3-trimethyl-butanol-3	$(CH_3)_3C\cdot C(CH_3)_2\cdot OH$	I-418	116.20
3529	alcohol	2,3-dimethyl-pentanol-3	$(CH_3)_2CH\cdot C(OH)\cdot (CH_3)\cdot C_2H_5$	I-417	116.20
3530	alcohol	2,4-dimethyl-pentanol-2	$(CH_3)_2C(OH)\cdot CH_2\cdot CH(CH_3)_2$	I-417	116.20
3531	alcohol	2,4-diMe-pentanol-3	$[(CH_3)_2CH]_2CHOH$	I-417	116.20
3532	alcohol	3-ethyl-pentanol-2	$(C_2H_5)_2CH\cdot CHOH\cdot CH_3$	I-416	116.20
3533	alcohol	3-ethyl-pentanol-3	$(C_2H_5)_3COH$	I-417	116.20
3534	alcohol	2-methyl-hexanol-1	$CH_3(CH_2)_3CH(CH_3)\cdot CH_2OH$	I-415	116.20
3535	alcohol	2-methyl-hexanol-2	$(CH_3)_2C(OH)(CH_2)_3\cdot CH_3$	I-415	116.20
3536	alcohol	2-methyl-hexanol-3	$(CH_3)_2CH\cdot CHOH\cdot (CH_2)_2CH_3$	I-416	116.20
3537	alcohol	2-methyl-hexanol-4	$(CH_3)_2CH\cdot CH_2\cdot CHOH\cdot C_2H_5$	I-416	116.20
3538	alcohol	2-methyl-hexanol-5	$(CH_3)_2CH(CH_2)_2\cdot CHOH\cdot CH_3$	I-416	116.20
3539	alcohol (*iso*)	2-methyl-hexanol-6	$(CH_3)_2CH(CH_2)_3\cdot CH_2OH$	I-416	116.20
3540	alcohol	3-methyl-hexanol-3	$C_2H_5\cdot CH_2\cdot C(CH_3)\cdot (OH)\cdot C_2H_5$	I-416	116.20
3541	alcohol	3-methyl-hexanol-4	$C_2H_5\cdot CH(CH_3)\cdot CHOH\cdot C_2H_5$	I-416	116.20
3542	alcohol	heptanol-2	$CH_3(CH_2)_4\cdot CHOH\cdot CH_3$	I-415	116.20
3543	alcohol	heptanol-4	$(CH_3\cdot CH_2\cdot CH_2)_2:CHOH$	I-415	116.20
3544	amine (*n*)	...	$C_7H_{15}\cdot NH_2$	IV-193	115.21
3545	bromide (*n*)	1-bromoheptane	$CH_3(CH_2)_5\cdot CH_2Br$	I-155	179.11
3546	chloride (*n*)	1-chloroheptane	$CH_3(CH_2)_5\cdot CH_2Cl$	I-154	134.65
3547	chloride	3-chloro-2,3-di-methyl-petane	$(CH_3)_2CH\cdot CCl(CH_3)\cdot C_2H_5$	I-157	134.65
3548	formate (*n*)	...	$HCO_2\cdot C_7H_{15}$	II-22	144.21
3549	iodide	1-iodo-2-methyl-hexane	$ICH_2\cdot CH(CH_3)\cdot (CH_2)_3\cdot CH_3$	I-157	226.11
3550	malonic acid (*n*)	...	$C_7H_{15}CH(CO_2H)_2$	II-721	202.24
3551	nitrite (*n*)	...	$CH_3(CH_2)_6\cdot O\cdot NO$	I-415	145.20
3552	oenanthylate	*n*-heptyl *n*-heptylate	$C_6H_{13}CO_2\cdot C_7H_{15}$	II-340	228 36
3553	propionate (*n*)	...	$C_2H_5CO_2\cdot C_7H_{15}$	II-241	172.26
3554	**Heptylene** (α)	heptene-1	$CH_3(CH_2)_4\cdot CH:CH_2$	I-219	98.18
3555	**Heptylene**	2,4-dimethyl-pentene-2	$(CH_3)_2C:CH\cdot CH:(CH_3)_2$	I-220	98.18
3556	**Heptylene**	2,3,3-triMe-butene-1	$(CH_3)_3C\cdot C(CH_3):CH_2$	**I-199 ..	98.18
3557	alcohol	2-Me-penten-4-ol-2	$C_2H_3\cdot CH_2\cdot C(CH_3)_2\cdot OH$	I-445	114.18
3558	**Heptyne-1**	oenanthylidene	$CH_3(CH_2)_4\cdot C\vdots CH$	I-256	96.17

Heptanol 3527-43
Heptanone 2786, 3003, 4122
Heptene 3554-6
Heptyl, cf. also diheptyl.
Heptyl aldehyde 3521

Heptyl carbinol 4961
Heptyl cyanide 1226
Heptyl ether 2264
Heptyl heptylate 3552
Heptyl mercaptan 3525

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3524	lq.	0.932^{21°	17	258-68	....	....	....
3525	lq.	0.835^{20°	....	$174\text{-}5^{765mm}$	i.	....	....
3526	col. lq.	$0.874^{16^\circ}_{16}$	....	191.5^{759mm}	i.	s.	s.
3527	col. lq.	$0.824^{20^\circ}_{4}$	34.6	175^{756mm}	0.18^{25°	∞	∞
3528	col. lq.	....	15-7	131-2	hydrate $+1H_2O$	∞	∞
3529	lq.	$0.840^{20^\circ}_{4}$	<-30	$138\text{-}40^{750mm}$	....	∞	∞
3530	lq.	$0.816^{20^\circ}_{4}$	<-20	$132\text{-}3^{760mm}$	i.	∞	∞
3531	col. lq.	$0.829^{20^\circ}_{4}$	....	140	v. sl. s.	∞	∞
3532	lq.	0.853^{0°	....	151^{743mm}	....	∞	∞
3533	col. oil	$0.839^{20^\circ}_{4}$	....	142^{764mm}	sl. s.	∞	∞
3534	lq.	$0.831^{13^\circ}_{4}$	....	$162\text{-}4^{750mm}$	....	∞	∞
3535	col. lq.	$0.815^{20^\circ}_{20}$	....	$141\text{-}2^{755mm}$	i.	∞	∞
3536	col. oil	$0.827^{16.7^\circ}_{4}$	....	145-6	i.	∞	∞
3537	lq.	....	....	$147\text{-}8^{756mm}$	....	∞	∞
3538	lq.	$0.819^{17.5^\circ}$	....	148-50	....	∞	∞
3539	lq.	$0.825^{11.5^\circ}_{4}$	....	170.5^{755mm}	v. sl. s.	∞	∞
3540	lq.	$0.828^{18^\circ}_{4}$	....	140.3^{745mm}	....	∞	∞
3541	lq.	0.852^{0°	....	149-50	i.	s.	s.
3542	lq.	$0.819^{20^\circ}_{4}$	....	160.4	0.4^{20°	s.	s.
3543	lq.	$0.820^{20^\circ}_{4}$	-37	156	i.	s.	s.
3544	col. lq.	0.777^{20°	-23	155	v. sl. s.	∞	∞
3545	lq.	1.133^{16°	....	178.5^{751mm}	i.	∞	∞
3546	lq.	0.881^{16°	....	159.2^{750mm}	i.	∞	∞
3547	lq.	0.884^{22°	<-15	$135\text{-}8^{757mm}$	i.	∞	∞
3548	lq.	0.894^{0°	....	176.7	i.	s.	s.
3549	lq.	$1.366^{21^\circ}_{4}$	....	$78\text{-}9^{19mm}$	i.	s.	s.
3550	cr./bz.	....	95 d.	....	i.	s.	s.; v. s. act.
3551	lq.	0.894^{0°	....	155	i.	....	s.
3552	col. lq.	$0.865^{19^\circ}_{4}$	....	$273\text{-}4^{754mm}$	i.	s.	s.
3553	lq.	0.885^{0°	....	208	i.	s.	s.
3554	col. lq.	$0.697^{20^\circ}_{4}$	-119.2	93.3	i.	s.	s.
3555	col. lq.	$0.696^{20^\circ}_{4}$	....	82.4	i.	s.	s.
3556	lq.	0.705^{20°	-111.4	77.9	....	....	....
3557	lq.	$0.831^{18^\circ}_{0}$	-73	119.5	....	....	....
3558	lq.	$0.732^{20^\circ}_{4}$	-81	99	....	....	....

Heptyl sulfide 2266
Heptylic acid 3520
Heptylic anhydride 3524
Herapathite, cf. alkd.
Heroin, cf. alkd.
Hesperetinic acid 3237
Hesperetole 6441
Hesperidin, cf. glcde.
Heteroauxin 3865
Hexabromo-cyclohexane 666
Hexachloro-cyclohexane 668-9
Hexadecanoic acid 5022
Hexadecanol 1275
Hexadecene 3570
Hexadecyl, cf. cetyl.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3559	**Hesperetin** †	5,7,3′-triOH-4′-MeO-flavanone	$C_{16}H_{14}O_6$	VIII-544	302.27
3560	**Hesperidin**	....	$C_{28}H_{34}O_{15}$	....	610.55
3561	**Hexabromo**-benzene	perbromobenzene	C_6Br_6	V-215	551.56
3562	ethane	perbromoethane	$Br_3C{\cdot}CBr_3$	I-96	503.52
3563	**Hexachloro**-benzene	perchlorobenzene	C_6Cl_6	V-205	284.80
3564	ethane	carbon hexachloride	$Cl_3C{\cdot}CCl_3$	I-87	236.76
3565	chlorophenol	(low melting)	C_6OCl_6	VI-194	300.80
3566	chlorophenol	(high melting)	C_6OCl_6	VII-144	300.80
3567	**Hexacosane** (*n*)	....	$CH_3(CH_2)_{24}{\cdot}CH_3$	I-175	366.69
3568	**Hexacosane** (*iso*) (impure?)	cerane	$(CH_3)_2CH{\cdot}(CH_2)_{22}{\cdot}CH_3$	*I-70	366.69
3569	**Hexadecane** (*n*)	cetane	$CH_3(CH_2)_{14}{\cdot}CH_3$	I-172	226.43
3570	**Hexadecylene** (*α*)	hexadecene-1	$CH_3(CH_2)_{13}{\cdot}CH{:}CH_2$	I-226	224.42
3571	**Hexadecyne**-1	....	$CH_3(CH_2)_{13}{\cdot}C\vdots CH$	I-262	222.40
3572	**Hexadecyne**-2	cetylene	$CH_3(CH_2)_{12}{\cdot}C\vdots C{\cdot}CH_3$	I-262	222.40
3573	**Hexadiene**-2,4	dipropenyl	$(CH_3{\cdot}CH{:}CH{\cdot})_2$	I-254	82.14
3574	**Hexadiene**-1,5	diallyl	$(CH_2{:}CH{\cdot}CH_2{\cdot})_2$	I-253	82.14
3575	**Hexaethylbenzene**	"alkazene 6"	$(C_2H_5)_6C_6$	V-471	246.42
3576	**Hexahydro**-anthracene	anthracene hexahydride	$C_{14}H_{16}$	V-573	184.27
3577	benzoic acid	cyclohexane-carboxylic acid	$\underline{CH_2(CH_2)_4{\cdot}CH}{\cdot}CO_2H$	IX-7	128.17
3578	cumene	....	$C_3H_7{\cdot}C_6H_{11}$	V-41	126.23
3579	cymene (*p*)	menthane; terpane	$CH_3{\cdot}C_6H_{10}{\cdot}C_3H_7$	V-47	140.26
3580	mellitic acid	....	$C_6H_6(CO_2H)_6$	IX-1007	348.22
3581	mesitylene	(1,3,5)	$C_6H_9(CH_3)_3$	V-45	126.23
3582	naphthalene	....	$C_{10}H_{14}$	V-433	134.21
3583	*o*-phthalic acid (*cis*)	....	$C_6H_{10}(CO_2H)_2$	IX-730	172.18
3584	*o*-phthalic acid (*dl*)	(*trans*)	$C_6H_{10}(CO_2H)_2$	IX-730	172.18
3585	*p*-phthalic acid	(*cis*)	$C_6H_{10}(CO_2H)_2$	IX-733	172.18
3586	*p*-phthalic acid	(*trans*)	$C_6H_{10}(CO_2H)_2$	IX-733	172.18
3587	salicylic acid (*o*)	....	$HO{\cdot}C_6H_{10}{\cdot}CO_2H$	X-5	144.17
3588	**Hexahydroxybenzene**	....	$C_6(OH)_6$	VI-1198	174.11
3589	**Hexaiodobenzene**	periodobenzene	C_6I_6	V-230	833.58
3590	**Hexamethyl**-benzene	....	$C_6(CH_3)_6$	V-450	162.26
3591	diamino-*iso*-propanol-diiodide	endoiodin	$[I(CH_3)_3N{\cdot}CH_2]_2{:}CHOH$	....	430.14
3592	pararosaniline base	4,4′,4″-tris-diMe-amino-triPh-carbinol	$[(CH_3)_2N{\cdot}C_6H_4]_3C{\cdot}OH$	XIII-755	389.52
3593	pararosaniline chloride	(dye salt) ‡	$C_{25}H_{30}N_3Cl{\cdot}9H_2O$	XIII-756	570.12
3594	pararosaniline-hydroxymethylate	(dye salt) §	$C_{26}H_{33}N_3Cl_2$	XIII-758	458.46
3595	4,4′,4″-triamino-triphenyl-methane	(leuco base)	$[(CH_3)_2N{\cdot}C_6H_4]_3CH$	XIII-315	373.52

† Beilstein lists this compound as a chalkone.
‡ Commercial product usually mixed with pentamethyl deriv.
§ Base not isolated; comes into commerce as $ZnCl_2$ double salt.

Hexadecyl acetylene 4942
Hexadecyl bromide 1276
Hexadienoic acid 5625
Hexadiyne 2768
Hexaethyl-pararosaniline 3191
Hexahydro-aniline 326
Hexahydro-benzene 1601
Hexahydro-cresol 4200–1
Hexahydro-diethylaniline 2145

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3559	yel. wh. cr./ EtOAc	....	226-7 d.	....	i.; v. sl. s. alk.	s.; sl. s. bz.	s.; sl. s. chl.
3560	hyg. nd.	....	251 ±, d.	....	0.02 h.	sl. s.	i.; i. bz.
3561	nd., bz.	....	316	....	i. h.	$0.01^{20°}$	v. sl. s.
3562	rhb.	3.823	170 d.	....	v. s. CS_2	v. sl. s. h.	v. sl. s.
3563	mn.	$2.044^{24°}$	228-31	309^{742mm}	i.; s. bz.	v. sl. s. h.	s. h.
3564	rhb.	$2.091^{20°}_{4}$	186.9-7.4*	185.5^{777mm}	$0.005^{22°}$	v. s.	v. s.
3565	yel. cr.	....	46	....	....	....	....
3566	yel. cr.	....	106	d. 210	i.	s.; s. chl.	s. pet.
3567	cr.	$0.779^{57°}_{4}$	56.6	262^{15mm}	s. bz.	v. sl. s.	$3.5^{15°}$chl:
3568	pl./et.	....	61	$207^{0.7mm}$	i.	s.	s.
3569	lf.	$0.774^{20°}_{4}$	18.5(16.2)	287.5	i.	∞	∞
3570	lq.	$0.784^{15°}_{4}$	4	274	i.	....	....
3571	cr.	$0.797^{20°}$	15	155^{15mm}	i.	....	....
3572	pl.	$0.804^{20°}_{4}$	20	160^{15mm}	i.	....	....
3573	oil	$0.720^{20°}$	....	80	i.	....	....
3574	lq.	$0.691^{20°}$	−141	59.6	i.	....	....
3575	pr./al.	$0.831^{130°}_{4}$	130	298.3	i.; v. s. bz.	$0.75^{25°}$	$8^{25°}$
3576	lf.	....	63	290	i.; v. s. bz.	v. s.	v. s.
3577	pr.	$1.034^{22°}_{4}$	30-1	232-4	sl. s.	v. s.; s. chl.	v. s.; s. pet.
3578	lq.	$0.790^{20°}_{4}$	−90.6	154.7	i.	v. s.	v. s.
3579	lq.	$0.793^{20°}_{0}$	....	169-70	i.	v. s.	v. s.
3580	syrup	....	d., $-H_2O$	....	v. s.	v. s.	sl. s.
3581	lq.	$0.787^{4°}$	....	135-8	....	....	....
3582	lq.	$0.934^{23°}_{0}$	....	200	....	....	....
3583	tri., aq.	....	192	d., $-H_2O$ >192	$>0.2^{20°}$	s.	....
3584	mn./aq.	....	215-21	....	$0.2^{20°}$	s. act.	....
3585	lf./aq.	....	....	....	$>0.08^{17°}$	s.	s.; s. chl.
3586	mn./aq.	....	300 ±	subl.	$0.08^{17°}$; 1.3 h.	s.; s. act.	sl. s.; i. chl.
3587	cr./aq.	....	111	....	s.	s.	s.; sl. s. bz.
3588	nd./aq. HCl	....	d. 200	....	sl. s. c.	sl. s.	sl. s.; sl. s. bz.
3589	red nd./bz.	....	340-50 d.	....	i.	i.	i.
3590	pl./al.	....	166	265	i.	$0.2^{0°}$; 4.6 h.	v. s.; v. s. bz.
3591	col. cr. pd.	....	275 d.	....	s.	sl. s.	i.; i. act.
3592	col. cr./bz.	....	219	....	i.; s. bz.; s. pet.	sl. s.; s. CS_2	s.; s. chl.
3593	gn. brn. met. cr./aq.	....	$-8H_2O$, 70-80°	....	s.	s.	v. s. chl.
3594	gn. pd.	....	....	....	s.	sl. s.	....
3595	lf./al.	....	178-9	....	i. c.; s. bz.	s. h.; s. ac.	s.; s. chl.

* Sealed tube.

Hexahydro-phenol 1605
Hexahydro-pyridine 5322
Hexahydro-toluene 4199
Hexahydro-triphenyltriazine 512
Hexahydro-xylene 2471-3
Hexahydroxy-anthraquinone 5575
Hexahydroxy-hexahydrobenzene 1602-3
Hexalin 1601
Hexamethyl-ethane 4945

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3596	**Hexamethylene-** diamine	....	$NH_2\cdot(CH_2)_6\cdot NH_2$	IV-269	116.20
3597	dicyanide	....	$NC\cdot(CH_2)_6\cdot CN$	II-694	136.19
3598	glycol	hexandiol-1,6	$HO\cdot(CH_2)_6\cdot OH$	I-484	118.17
3599	tetramine	urotropine; formin; methenamine	$(CH_2)_6N_4$	I-583	140.19
3600	tetramine-alliodide	allyliodourotropine	$C_6H_{12}N_4\cdot C_3H_5I$	I-588	308.18
3601	camphorate	amphotropin	$C_{12}H_{24}N_8\cdot C_{10}H_{16}O_4$	....	480.60
3602	salicylate	saliformin	$C_6H_{12}N_4\cdot C_7H_6O_3$	....	278.31
3603	**Hexane** (*n*)	....	$CH_3\cdot(CH_2)_4\cdot CH_3$	I-142	86.17
3604	**Hexane** (*iso*)	2-methyl-pentane	$(CH_3)_2CH\cdot(CH_2)_2\cdot CH_3$	I-148	86.17
3605	**Hexane**	2,2-dimethyl-butane	$(CH_3)_3C\cdot C_2H_5$	I-150	86.17
3606	**Hexane**	2,3-dimethyl-butane	$[(CH_3)_2CH]_2$	I-151	86.17
3607	**Hexane**	3-methyl-pentane	$(C_2H_5)_2CH\cdot CH_3$	I-149	86.17
3608	**Hexanhexol**	dulcitol	$HOCH_2(CHOH)_4\cdot CH_2OH$	I-544	182.17
3609	**Hexanhexol**	*d*-mannitol; mannite	$HOCH_2(CHOH)_4\cdot CH_2OH$	I-534	182.17
3610	hexaacetate	mannitol hexa-acetate	$C_6H_8O_6(COCH_3)_6$	II-150	434.39
3611	**Hexanhexol**	*d*-sorbitol; sorbite	$HOCH_2(CHOH)_4\cdot CH_2OH$	I-533	182.17
3612	hexaacetate	sorbitol hexaacetate	$C_6H_8O_6(COCH_3)_6$	II-150	434.39
3613	**Hexatriacontane**	....	$C_{36}H_{74}$	I-178	506.95
3614	**Hexenyl** alcohol	....	$C_6H_{11}OH$	I-446	100.16
3615	alcohol	1-hexen-5-ol	$CH_2{:}CH(CH_2)_2\cdot CHOH\cdot CH_3$	I-444	100.16
3616	**Hexose**	*d*-fructose; levulose	$C_5H_{12}O_5{:}CO$	I-918	180.16
3617	**Hexose**	*d*-galactose	$C_5H_{11}O_5\cdot CHO$	I-911	180.16
3618	**Hexose**	*d*-glucose; dextrose	$C_5H_{11}O_5\cdot CHO$	I-879	180.16
3619	**Hexose**	*d*-mannose; seminose	$C_5H_{11}O_5\cdot CHO$	I-905	180.16
3620	**Hexose**	*d*-sorbose; sorbinose	$C_6H_{12}O_6$	I-927	180.16
3621	**Hexyl** acetate (*n*)	....	$CH_3CO_2\cdot C_6H_{13}$	II-132	144.21
3622	acetate	Me-*iso*-Bu carbinol acetate	$CH_3CO_2\cdot CH(CH_3)\cdot CH_2CH(CH_3)_2$	II-133	144.21
3623	acetate (*iso*)	....	$CH_3CO_2\cdot C_4H_7(CH_3)_2$	II-133	144.21
3624	alcohol (*n*)	hexanol-1	$CH_3(CH_2)_4CH_2OH$	I-407	102.17
3625	alcohol (*n*)	hexanol-2	$CH_3\cdot CHOH\cdot C_4H_9$	I-408	102.17
3626	alcohol (*n*)	hexanol-3	$C_2H_5\cdot CHOH\cdot C_3H_7$	I-408	102.17
3627	alcohol	2,2-diMe-butanol-3	$(CH_3)_3C\cdot CHOH\cdot CH_3$	I-412	102.17
3628	alcohol	2,2-diMe-butanol-4	$(CH_3)_3CCH_2CH_2OH$	I-412	102.17
3629	alcohol	2,3-diMe-butanol-2	$(CH_3)_2CH\cdot C(CH_3)_2\cdot OH$	I-413	102.17
3630	alcohol	2-Me-pentanol-1	$C_2H_5\cdot CH_2\cdot CH(CH_3)\cdot CH_2OH$	I-409	102.17
3631	alcohol	2-Me-pentanol-2	$(CH_3)_2COH\cdot CH_2\cdot C_2H_5$	I-409	102.17
3632	alcohol	2-Me-pentanol-3	$(CH_3)_2CH\cdot CHOH\cdot C_2H_5$	I-410	102.17
3633	alcohol	2-Me-pentanol-4	$CH_3\cdot CHOH\cdot CH_2\cdot CH(CH_3)_2$	I-410	102.17

Hexamethylene-dibromide 1844
Hexamethylene-diiodide 2393
Hexamin 2764
Hexamine 3599
Hexanal 1212
Hexandecanal 5023
Hexandioic acid 153
Hexandiol 2346, 3598, 3662
Hexanoic acid 1208
Hexanol 3624-38
Hexanone 3144, 4163
Hexanthiol 3652
Hexanitro-diphenylamine 2764
Hexanitro-diphenyl sulfide 2765
Hexazane 5322

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3596	lf.	....	42	204-5	v. s.	s.	....
3597	col. lq.	0.954^{18°	-3.5	185^{15mm}	....	....	....
3598	nd./aq.	....	42	250	s.	s.	sl. s. h.
3599	col. rhb.	....	....	subl. vac. 230-70	81^{12°	3^{12° abs.	v. sl. s.
3600	col. cr.	....	148 ±, d.	....	v. s.	i. chl.	i.
3601	col. cr.	....	....	....	10	s.; s. chl.	i.; i. bz.
3602	col. cr.	....	....	....	s.	s.	....
3603	col. lq.	$0.659_{4}^{20^\circ}$	-95.3	68.7	i.; ∞ chl.	50^{33°	∞
3604	lq.	$0.654_{4}^{20^\circ}$	-153.7	60.3	i.	....	s.
3605	lq.	$0.649_{20}^{20^\circ}$	-99.7	49.7	i.	....	s.
3606	lq.	$0.662_{4}^{20^\circ}$	-128.4	58.0	i.	....	s.
3607	lq.	$0.664_{4}^{20^\circ}$	-118	63.3	i.	....	s.
3608	mn.	1.466^{15°	189	$290\text{-}5^{3mm}$	3.2^{15°; v. s. h.	v. sl. s.	i.
3609	col. rhb.	$1.489_{4}^{20^\circ}$	166	$290\text{-}5^{3mm}$	13^{14°	0.01^{14° abs. al.	i.
3610	col. cr.	....	119-20	....	i.	sl. s. h.	i.; s. ac.
3611	cr. + ½ or 1 H_2O	....	110-2 (anh.)*	....	v. s.	v. s. h.	....
3612	col. cr./al.	....	99-100	....	sl. s.	sl. s.	i.
3613	cr.	0.782^{76°	75.8	$265^{1.0mm}$	sl. s. chl.	v. sl. s.	sl. s.
3614	lq.	0.891^{10°	....	137^{765mm}	10^{10°	∞	∞
3615	lq.	$0.842_{17.8}^{16.2^\circ}$	....	140^{759mm}	v. sl. s.	....	....
3616	nd./aq.	$1.669^{17.5^\circ}$	95-105	....	v. s.	8.5^{18° abs. al.	s. act.
3617	pr.	....	165.5 (anh.)**	....	10.3^{0° 68.3^{25°	$0.6^{38.5^\circ}$ 85% al.	s. pyr.
3618	rhb.***	1.544^{25°	146(anh.)	....	$82^{17.5^\circ}$	sl. s.	i.
3619	rhb.	$1.539_{4}^{20^\circ}$	132	....	248^{17°	v. sl. s. abs.	i.
3620	rhb.	1.654^{15°	165	....	55^{17°	v. sl. s. abs.	sl. s. Me al.
3621	col. lq.	$0.890_{0}^{0^\circ}$	....	169.2	i.	v. s.	v. s.
3622	col. lq.	$0.860_{20}^{20^\circ}$	....	146-7	0.13^{20°	....	....
3623	col. lq.	....	....	159^{755mm}	i.	v. s.	v. s.
3624	col. lq.	$0.820_{20}^{20^\circ}$	-51.6	157.2	0.6^{20°	∞	∞
3625	col. lq.	$0.818_{4}^{16.8^\circ}$	....	139-40	sl. s.	∞	∞
3626	col. lq.	$0.818_{4}^{20^\circ}$	....	135	sl. s.	∞	∞
3627	lq. or nd.	0.812^{25°	5.5	120-1	v. sl. s.	∞	∞
3628	oily lq.	....	-60	....	v. sl. s.	∞	∞
3629	lq.	$0.821_{0}^{20^\circ}$	-14	120-1	v. sl. s.	∞	∞
3630	lq.	$0.826_{4}^{20^\circ}$	....	148^{762mm}	v. sl. s.	∞	∞
3631	lq.	$0.809_{4}^{20^\circ}$	-107	$122.5\text{-}3.5^{762mm}$	v. sl. s.	∞	∞
3632	lq.	$0.826_{4}^{18^\circ}$	....	127.5^{721mm}	v. sl. s.	∞	∞
3633	lq.	$0.813_{4}^{20^\circ}$	....	131.8	1.6^{20°	∞	∞

* Crysts./al., m. 87-95°.
** Crysts. + 1 H_2O, m. 118-20°.
*** Crysts. + 1 H_2O, mn. pl.
Hexene 3655-61

Hexophan 3801
Hexone 4164
Hexyl, cf. also dihexyl.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3634	**Hexyl** alcohol	2-Me-pentanol-5	$(CH_3)_2CH\cdot CH_2\cdot CH_2\cdot CH_2OH$	I-411	102.17
3635	alcohol (*act.*)	3-Me-pentanol-1	$C_2H_5\cdot CH(CH_3)\cdot CH_2\cdot CH_2OH$	I-411	102.17
3636	alcohol (*act.*)	3-Me-pentanol-2	$CH_3\cdot CHOH\cdot CH\cdot (CH_3)\cdot C_2H_5$	I-411	102.17
3637	alcohol	3-Me-pentanol-3	$C_2H_5\cdot C(CH_3)\cdot (OH)\cdot C_2H_5$	I-411	102.17
3638	alcohol	3-methylol-pentane	$(C_2H_5)_2CH\cdot CH_2OH$	I-412	102.17
3639	amine (*n*)	....	$CH_3(CH_2)_5\cdot NH_2$	IV-188	101.19
3640	amine	2-Et Bu-amine	$(C_2H_5)_2CHCH_2\cdot NH_2$	IV-192	101.19
3641	bromide (*n*)	1-bromohexane	$CH_3(CH_2)_4CH_2Br$	I-144	165.08
3642	bromide (*iso*)	5-bromo-2-methyl-pentane	$(CH_3)_2CH\cdot (CH_2)_2\cdot CH_2Br$	I-148	165.08
3643	bromide	2-bromo-2,3-diMe-butane	$(CH_3)_2CH\cdot CBr:(CH_3)_2$	I-152	165.08
3644	chloride (*n*)	1-chlorohexane	$CH_3\cdot (CH_2)_4\cdot CH_2Cl$	I-143	120.62
3645	chloride	2-chlorohexane	$CH_3(CH_2)_3CHCl\cdot CH_3$	I-144	120.62
3646	chloride	1-chloro-2,3-diMe-butane	$(CH_3)_2CH\cdot CH:(CH_2Cl)CH_3$	I-151	120.62
3647	chloride	2-chloro-2,3-diMe-butane	$(CH_3)_2CH\cdot CCl(CH_3)_2$	I-151	120.62
3648	cyanide (*n*)	oenanthylic nitrile	$CH_3(CH_2)_5\cdot CN$	II-341	111.18
3649	formate (*n*)	....	$HCO_2\cdot C_6H_{13}$	II-22	130.18
3650	iodide (*n*)	1-iodohexane	$CH_3\cdot (CH_2)_4\cdot CH_2I$	I-146	212.08
3651	iodide	2-iodo-2,3-dimethyl-butane	$(CH_3)_2CI\cdot CH(CH_3)_2$	I-153	212.08
3652	mercaptan (*n*)	hexanthiol-1	$CH_3(CH_2)_4\cdot CH_2\cdot SH$	I-408	118.23
3653	nitrite (*n*)	....	$C_6H_{13}\cdot O\cdot NO$	I-407	131.17
3654	resorcinol (*n*)	(1;2,4)	$C_6H_{13}\cdot C_6H_3(OH)_2$	....	194.26
3655	**Hexylene** (*α*)	1-hexene	$CH_3(CH_2)_3CH:CH_2$	I-215	84.16
3656	**Hexylene**	2,3-diMe-butene-1	$(CH_3)_2CH\cdot C(CH_3):CH_2$	I-218	84.16
3657	**Hexylene**	3,3-diMe-butene-1	$(CH_3)_3C\cdot CH:CH_2$	....	84.16
3658	**Hexylene**	2,3-diMe-butene-2	$(CH_3)_2C:C(CH_3)_2$	I-218	84.16
3659	**Hexylene**	2-methyl-pentene-2	$(CH_3)_2C:CH\cdot C_2H_5$	I-217	84.16
3660	**Hexylene** (*cis?*)	3-methyl-pentene-2	$(C_2H_5)(CH_3)C:CH\cdot CH_3$	I-217	84.16
3661	*trans?*	3-methyl-pentene-2	C_6H_{12}	I-217	84.16
3662	glycol (2,3)	hexandiol-2,3	$C_3H_7\cdot (CHOH)_2\cdot CH_3$	I-484	118.17
3663	**Hexylphenyl-carbinol** (*n*)	*α*-Ph-*n*-heptyl alcohol	$C_6H_{13}\cdot CHOH\cdot C_6H_5$	*VI-272	192.29
3664	**Hippuric** acid	benzoyl glycine	$C_6H_5CO\cdot NHCH_2\cdot CO_2H$	IX-225	179.17
3665	calcium salt	Ca hippurate	$(C_9H_8O_3N)_2Ca\cdot 3H_2O$	IX-229	450.45
3666	sodium salt	Na hippurate	$C_9H_8O_3NNa$	IX-229	201.16
3667	**Histamine**	*β*-imidazolyl-4-ethylamine	$C_3H_3N_2\cdot C_2H_4\cdot NH_2$	*XXV-629	111.15
3668	hydrochloride, di	....	$C_5H_9N_3\cdot 2HCl$	*XXV-630	184.08
3669	**Histidine** (*l*)(−)	*β*-imidazolyl-*α*-alanine	$C_3H_3N_2\cdot CH_2\cdot CH\cdot (NH_2)\cdot CO_2H$	XXV-513	155.16
3670	hydrochloride, di	....	$C_6H_9O_2N_3\cdot 2HCl$	XXV-515	228.09

Hexylene bromide 1842
Hexylene iodide 2393
Holocaine HCl 2910

Homoatropine, cf. alkd.
Homocatechol 2374
Homogentisic acid 3673

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3634	lq.	$0.816_{4}^{20°}$	....	$151\text{-}2^{747mm}$	v. sl. s.	∞	∞
3635	lq.	$0.826^{20°}$	....	152-3	i.	s.	s.
3636	oil	$0.831_{4}^{18°}$	....	135^{762mm}	....	....	....
3637	lq.	$0.824_{0}^{20°}$	<−38	122.5^{758mm}	i.	....	....
3638	lq.	$0.833_{20}^{20°}$	<−15	148.9	0.43	....	....
3639	col. lq.	$0.763_{4}^{25°}$	−19	$129\text{-}30^{742mm}$	v. sl. s.	∞	∞
3640	col. lq.	....	....	125.3	s.	∞	∞
3641	lq.	$1.173^{20°}$	....	155.5^{744mm}	....	....	....
3642	col. lq.	$1.168^{20°}$	....	146-7	....	....	....
3643	col. cr.	$1.177_{0}^{20°}$	24-5	$132\text{-}3^{742mm}$	....	....	....
3644	lq.	$0.876_{4}^{20°}$	....	132.9^{765mm}	i.	....	....
3645	lq.	$0.869_{4}^{21°}$	....	122.5^{754mm}	....	....	....
3646	lq.	$0.887^{22°}$	....	122	....	....	....
3647	lq.	$0.878^{19°}$	−10.4	112	....	....	....
3648	col. lq.	$0.811_{0}^{20°}$	−64	$183\text{-}4^{765mm}$	i.	....	....
3649	lq.	$0.898^{0°}$	....	153.6	....	∞	∞
3650	lq.	$1.439_{4}^{20°}$	....	180^{763mm}	....	....	....
3651	nd.	$1.446_{0}^{20°}$	....	140^{749mm}	....	....	....
3652	col. lq.	$0.849^{20°}$	....	$149\text{-}50^{768mm}$	i.	....	....
3653	yel. lq.	$0.885^{20°}$	....	$129\text{-}30^{774mm}$	i.	s.	s.
3654	col. nd.	....	68-70	179^{7mm}	0.05	v. s.; s. bz.	s.; s. act.
3655	col. lq.	$0.673_{4}^{20°}$	−139	63.6	i.	∞	∞
3656	col. lq.	$0.678^{20°}$	−140.0	55.6	i.; ∞ CS_2	∞	∞
3657	col. lq.	$0.653^{20°}$	−115.5	41.2	i.	....	....
3658	lq.	$0.708^{20°}$	−75.4	73.2^{760mm}	....	s. act.	s.
3659	lq.	$0.686^{20°}$	....	67.2	s. 2 vol. H_2SO_4 + 1 aq.	....	....
3660	lq.	$0.699^{20°}$	−138.4	70.5	....	....	....
3661	lq.	$0.694^{20°}$	−135.2	67.8	....	....	....
3662	cr.	$0.967^{0°}$	60	206-7	∞	s.	....
3663	lq.	0.946	....	275	....	....	....
3664	rhb.	$1.371_{4}^{20°}$	187-8	d.	$0.4^{20°}$; i. pet.	s. h.; i. bz.	$0.25^{18°}$
3665	col. pr.	1.32	....	....	5 c.; 16 h.	....	....
3666	wh. pd.	....	....	....	s.	s.	....
3667	col. hyg. cr./aq.	....	86*	$209\text{-}10^{18mm}$	v. s.; s. h. chl.	s.	i.
3668	pr./aq. al.	....	239-46 (d.)	....	s.	sl. s.	i.
3669	lf./aq.	....	d. 287-8	....	s.	v. sl. s.	i.
3670	rhb.	....	245	....	s. d.	i.	i.

* Sealed tube.

Homohydroquinone 2372
Homopyrocatechin 2374
Homosalicylaldehyde 4379
Homosalicylic acid 3833, 3836, 3839, 3841
Hot stuff gas 1985

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3671	**Histidine** hydrochloride, mono	....	$C_6H_9O_2N_3 \cdot HCl \cdot H_2O$	XXV-515	209.64
3672	**Homo-**eriodictyol	5,7,4′-triOH-3′-methoxy-flavanone	$C_{16}H_{14}O_6$†	....	......
3673	gentisinic acid	2,5-diOH-phenyl-acetic acid	$(HO)_2C_6H_3CH_2 \cdot CO_2H \cdot H_2O$	X-407	186.16
3674	phthalic acid (*o*)	....	$HO_2C \cdot C_6H_4 \cdot CH_2 \cdot CO_2H$	IX-857	180.15
3675	**Hordenine** (*p*)‡	....	$HO \cdot C_6H_4 \cdot CH_2 \cdot CH_2 \cdot N(CH_3)_2$	XIII-626	165.23
3676	sulfate	....	$(C_{10}H_{15}ON)_2 \cdot H_2SO_4 \cdot H_2O$	XIII-626	446.55
3677	sulfate	....	$(C_{10}H_{15}ON)_2 \cdot H_2SO_4 \cdot 2H_2O$	*XIII-236	464.56
3678	**Hydantoic acid**	....	$H_2N \cdot CO \cdot NH \cdot CH_2 \cdot CO_2H$	IV-359	118.09
3679	**Hydantoin**	glycolyl urea	$HN \cdot CH_2 \cdot CO \cdot NH \cdot CO$	XXIV-242	100.08
3680	**Hydnocarpic acid**	....	$C_5H_7(CH_2)_{10}CO_2H$	IX-79	252.38
3681	**Hydracetamide**	....	$(CH_3 \cdot CH)_3N_2$	I-608	112.17
3682	**Hydracrylic acid**	ethylene lactic acid	$HO \cdot CH_2CH_2 \cdot CO_2H$	III-295	90.08
3683	**Hydratropic acid**	α-Ph-propionic acid	$C_6H_5CH(CH_3)CO_2H$	IX-524	150.17
3684	**Hydrazinobenzoic acid** (*p*)	....	$H_2N \cdot NH \cdot C_6H_4 \cdot CO_2H$	XV-631	152.15
3685	**Hydrazo-**benzene	*N,N′*-diphenyl-hydrazine	$C_6H_5NH \cdot NHC_6H_5$	XV-123	184.23
3686	benzoic acid (*o*)	....	$(HO_2C \cdot C_6H_4 \cdot NH \cdot)_2$	XV-626	272.25
3687	benzoic acid (*m*)	....	$(HO_2C \cdot C_6H_4 \cdot NH \cdot)_2$	XV-629	272.25
3688	benzoic acid (*p*)	....	$(HO_2C \cdot C_6H_4 \cdot NH \cdot)_2$	XV-632	272.25
3689	dicarbonamide	....	$(H_2N \cdot CO \cdot NH \cdot)_2$	III-116	118.10
3690	naphthalene (α,α′)	....	$C_{10}H_7NH \cdot NHC_{10}H_7$	XV-562	284.34
3691	naphthalene (β,β′)	....	$C_{10}H_7NH \cdot NHC_{10}H_7$	XV-569	284.34
3692	toluene (*o*)	....	$(CH_3 \cdot C_6H_4 \cdot NH \cdot)_2$	XV-497	212.28
3693	toluene (*m*)	....	$(CH_3 \cdot C_6H_4 \cdot NH \cdot)_2$	XV-506	212.28
3694	toluene (*p*)	....	$(CH_3 \cdot C_6H_4 \cdot NH \cdot)_2$	XV-511	212.28
3695	**Hydrindene** (1,2)	indane	$C_6H_4 \cdot CH_2 \cdot CH_2 \cdot CH_2$	V-486	118.17
3696	dicarboxylic acid	(β,β)	$C_9H_8(CO_2H)_2$	IX-904	206.19
3697	dicarboxylic acid	(α,β)	$C_9H_8(CO_2H)_2$	*IX-391	206.19
3698	**Hydrindone** (α)	indanone-1	$C_6H_4 \cdot CH_2 \cdot CH_2 \cdot CO$	VII-360	132.15
3699	**Hydrindone** (β)	indanone-2	$C_6H_4 \cdot CH_2 \cdot CO \cdot CH_2$	VII-363	132.15
3700	**Hydro-**benzamide	tribenzaldiamine	$C_6H_5CH:(N:CHC_6H_5)_2$	VII-215	298.37
3701	benzoin	....	$(C_6H_5 \cdot CHOH \cdot)_2$	VI-1003	214.25
3702	benzoin (*iso*)	....	$C_{14}H_{12}(OH)_2$	VI-1004	214.25
3703	carbostyril	....	C_9H_9ON	XXI-288	147.17
3704	cinnamic acid	β-Ph-propionic acid	$C_6H_5CH_2CH_2CO_2H$	IX-508	150.17
3705	cinnamic alcohol	γ-Ph-Pr-alcohol	$C_6H_5(CH_2)_3OH$	VI-503	136.19
3706	cinnamic aldehyde	....	$C_6H_5CH_2CH_2 \cdot CHO$	VII-304	134.17

† Beilstein gives structure as a chalcone.
‡ See also Alkaloid table.
HS (hot stuff) gas 1985
Hydracetin 111

Hydraergotocin, cf. alkd.
Hydramine, mixt. of 2314 and 5260
Hydrastine, cf. alkd.
Hydrastinine, cf. alkd.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3671	col. rhb./aq.	....	250-5	$-H_2O$, 100	s.	i.	i.
3672	col. nd./ac.	....	224-5	....	i.; i. chl.	s.; i. bz.	sl. s. EtOAc
3673	pr./aq.	....	152(anh.)	....	v. s.	v. s.	v. s.; i. bz.
3674	cr./aq.	....	175-80	....	s. h.	v. s.	sl. s.
3675	col. rhb.	....	117.8 subl. > 140	$173\text{-}4^{11mm}$	s.; i. pet.; s. chl.	v. s.; s. dil. a.	v. s.; s. alk.
3676	pr. nd.	....	205(anh.)	....	s.	v. sl. s.	....
3677	col. cr.	....	197	....	s.	sl. s.	i.
3678	mn.	....	160-1	....	$3^{20°}$; s. h.	$0.5^{20°}$; s. h.	....
3679	nd.	....	220-1	....	s. h.; s. alk.	1.7 h.	i.
3680	lf./al.	....	59-60	....	i.	v. sl. s.	v. sl. s.
3681	yel. pd.	....	....	....	v. s. d.	v. s.	....
3682	syrup	....	....	d.	....	....	....
3683	col. lq.	$1.1^{0°}$	<-20	266-7	v. sl. s.	....	....
3684	nd. or pl./aq.	....	220-5 d.	....	sl. s. h.	....	....
3685	lt. yel./al.	$1.158^{16°}$	131	d.	v. sl. s.	$5^{16°}$	i. ac.
3686	lf./al.	....	205	....	i.	s. h.	s. alk.
3687	lt. yel./al.	....	....	....	i.	sl. s. h.	....
3688	nd./al.	....	....	....	v. sl. s.	sl. s. h.	....
3689	pl./aq.	....	254-9	....	$0.02^{16°}$; sl. s. h.	i.; s. in 30% NaOH	i.
3690	lf./bz.	....	274(271)	....	s. bz.	s.	s.
3691	lt. red lf.	....	140-1	....	i.	v. s.	v. s.
3692	lf./al.	....	165	....	s. bz.	v. sl. s. aq. al.	s.
3693	col. oil	....	....	....	....	v. s.	....
3694	mn.	0.957	133-4(126)	d.	v. s. bz.	v. s.	v. s.
3695	col. lq.	$0.963^{\frac{16}{4}°}$	....	177	i.	∞	∞
3696	lf./aq.	....	199	$-CO_2 > 200$	....	....	....
3697	cr.	....	222	....	v. sl. s. bz.	s.; s. act.	sl. s.
3698	nd./aq.	$1.099^{42°}$	41-2	243-5	sl. s.	v. s.	v. s.
3699	nd./al.	$1.071^{67°}$	58-61	250-5 sl. d.	i.	v. s.	v. s.
3700	cr./al.	....	101-2	....	i.	v. s.	v. s.
3701	mn.	$0.927^{134°}$	138-9	>300	$0.25^{15°}$	v. s. h.	....
3702	mn./al.	....	121-2	$133^{0.02mm}$	$0.19^{15°}$; 1.25 h.	s.	s.
3703	rhb./al.	....	163	....	i.; s. h. HCl	s.	s.
3704	mn.	$1.071^{\frac{48.7}{4}°}$	48.5	279.8	$0.6^{20°}$	s.; s. chl.	s.; s. bz.
3705	oil	$1.008^{\frac{20}{4}°}$	<-18	235-7	s.	∞	∞
3706	lq.	....	....	$221\text{-}4^{744mm}$	i.	16.7	....

Hydrazine yellow 5694
Hydrazino-benzene 5196
Hydrazino-diphenyl 2727
Hydrazino-toluene 6022-7
Hydrazino-xylene 6500-2
Hydrazo-methane 2494
Hydrazo-phenylene 2279
Hydrindic acid 2686
Hydro-berberine, cf. alkd.
Hydro-cinchonine, cf. alkd.
Hydro-cinnamyl alcohol 3705

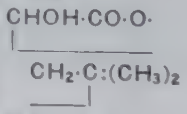
No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Hydro				
3707	cinnamic amide	*β*-Ph-propionamide	$C_6H_5CH_2CH_2CONH_2$	IX-511	149.19
3708	cinnamic chloride	....	$C_6H_5CH_2CH_2COCl$	IX-511	168.62
3709	cinnamic nitrile	*β*-Ph-propionitrile	$C_6H_5CH_2CH_2CN$	IX-512	131.17
3710	corulignone (4;3,5)	....	$[HOC_6H_2(OCH_3)]_2$	VI-1200	306.30
3711	coumaric acid (*o*)	melilotic acid	$HOC_6H_4(CH_2)_2CO_2H$	X-241	166.17
3712	coumaric acid (*m*)	phenol propionic acid	$HOC_6H_4(CH_2)_2CO_2H$	X-244	166.17
3713	coumaric acid (*p*)	phlorentinic acid	$HOC_6H_4(CH_2)_2CO_2H$	X-244	166.17
3714	cyanic acid	formonitrile	HCN	II-29	27.03
3715	cyanic acid (dimolecular)	prussic acid	$HN{:}CH{\cdot}NC$	II-28	54.05
3716	**Hydroquinone** acetate, di	diacetyl-hydroquinone (*p*)	$(CH_3CO_2)_2{:}C_6H_4$	VI-846	194.18
3717	benzyl ether, di	....	$(C_6H_5CH_2O)_2C_6H_4$	VI-845	290.34
3718	benzyl ether, mono	....	$C_6H_5CH_2O{\cdot}C_6H_4OH$	VI-845	200.23
3719	dicarboxylic acid	(2,5;1,4)	$(HO)_2C_6H_2(CO_2H)_2$	X-554	198.13
3720	**Hydroquinophthalein**	2,7-dihydroxyfluorane	$C_{20}H_{12}O_5$	XIX-219	332.30
3721	**Hydroxy**-acetophenone (*o*)†	....	$HO{\cdot}C_6H_4{\cdot}CO{\cdot}CH_3$	VIII-85	136.14
3722	acetophenone (*m*)	....	$HO{\cdot}C_6H_4{\cdot}CO{\cdot}CH_3$	VIII-86	136.14
3723	acetophenone (*p*)	....	$HO{\cdot}C_6H_4{\cdot}CO{\cdot}CH_3$	VIII-87	136.14
3724	anthraquinone (1)	....	$C_6H_4(CO)_2C_6H_3{\cdot}OH$	VIII-338	224.20
3725	anthraquinone (2)	....	$C_6H_4(CO)_2C_6H_3{\cdot}OH$	VIII-342	224.20
3726	anthraquinone (2)	2-hydroxy-anthraquinone-1,4	$C_{10}H_6(CO)_2CH{:}COH$	VIII-337	224.20
3727	azobenzene (*o*)	....	$HO{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_5$	XVI-90	198.22
3728	azobenzene (*m*)	....	$HO{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_5$	XVI-94	198.22
3729	azobenzene (*p*)	....	$HO{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_5$	XVI-96	198.22
3730	azobenzene sulfonic acid (4,4′)	....	$HO{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_4{\cdot}SO_3H$	XVI-272	278.28
3731	azobenzene sulfonic Na	(4,4′)	$HO{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_4{\cdot}SO_3Na{\cdot}2H_2O$	XVI-272	336.30
3732	1,1′-azonaphthalene-3,6,4′-trisulfonic acid (2) Na	bordeaux S; fast red D	$NaO_3S{\cdot}C_{10}H_6N{:}N{\cdot}C_{10}H_4(OH)(SO_3Na)_2$	*XVI-305	604.48
3733	benzaldehyde (*o*)	salicylaldehyde	$HO{\cdot}C_6H_4{\cdot}CHO$	VIII-31	122.12
3734	benzaldehyde (*m*)	....	$HO{\cdot}C_6H_4{\cdot}CHO$	VIII-58	122.12
3735	benzaldehyde (*p*)	....	$HO{\cdot}C_6H_4{\cdot}CHO$	VIII-64	122.12
3736	benzaldehyde oxime (*o*)	salicylaldoxime	$HO{\cdot}C_6H_4{\cdot}CH{:}NOH$	VIII-49	137.13
3737	benzaldehyde phenylhydrazone	(*o*)	$HO{\cdot}C_6H_4{\cdot}CH{:}N{\cdot}NH{\cdot}C_6H_5$	XV-188	212.24
3738	benzamide (*o*)	salicylamide	$HO{\cdot}C_6H_4{\cdot}CO{\cdot}NH_2$	X-87	137.13
3739	benzamide (*m*)	....	$HO{\cdot}C_6H_4{\cdot}CO{\cdot}NH_2$	X-140	137.13
3740	benzamide (*p*)	....	$HOC_6H_4CONH_2{\cdot}H_2O$	X-164	155.15
3741	benzanilide (*o*)	salicylanilide	$HO{\cdot}C_6H_4CO{\cdot}NHC_6H_5$	XII-500	213.23
3742	benzoic acid (*o*)	salicylic acid	$HO{\cdot}C_6H_4{\cdot}CO_2H$	X-43	138.12

† See also No. 754.

Hydro-cotarnine, cf. alkd.
Hydro-naphthoquinone 2348, 2350
Hydro-phloron 2379
Hydro-quinine, cf. alkd.
Hydro-quinone 2314
Hydro-quinone diethyl ether 2093
Hydro-quinone dimethyl ether 2408
Hydro-quinone ethyl ether 2929
Hydro-quinone methyl ether 4081
Hydro-resorcin 2285
Hydro-sulfite N.F. 3293
Hydrol 4435
Hydrolit 3295
Hydropyrin 119

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3707	nd./aq.	....	104-5	....	....	s.	s.
3708	lq.	1.135^{21°	<-60	225 d.	....	....	....
3709	lq.	1.001^{18°	....	261	....	....	....
3710	mn./al.	....	190 ±	d.	v. sl. s.	i. CS_2	v. sl. s.
3711	cr./aq.	....	82-3	....	5^{18°; 108^{40°	v. s.	v. s.
3712	mn./bz. lg.	....	111	....	i. lg.	s.; s. bz.	s.
3713	mn./et.	....	128-30	....	v. s. h.	v. s.	v. s.; i. CS_2
3714	poison. lq.	0.697^{18°	-12	25-6	∞	∞	∞
3715	rhb.	....	87	120-5	v. s.	sl. s.	sl. s.
3716	pl./al.	....	123-4	....	sl. s. h.	s.	s.; s. chl.
3717	pl./al.	....	128	....	v. sl. s. ac.	2.5 h.	v. sl. s.
3718	pl./aq.	....	122-3	....	s. h.	s.; s. alk.	s.; s. bz.
3719	yel. cr./al.	....	d.	....	sl. s. h.	sl. s. h.	sl. s.
3720	nd./et.	....	227-32	....	v. sl. s. h.	s.; s. alk.	s.; i. lg.
3721	oil	$1.131_{4}^{21^\circ}$	....	213^{717mm}	sl. s.	∞	∞; ∞ ac.
3722	nd. or lf.	1.099^{109°	95-6	296^{756mm}	s. h.	s.	s.; s. bz.
3723	nd./aq. al.	1.109	109	$147\text{-}8^{3mm}$	1^{22°; 7.1^{100°	s.	s.
3724	or. red/al.	....	194-5	subl.	....	s.	v. s.
3725	yel. nd./al.	....	306-8	subl.	v. sl. s. c.	s.	s.
3726	yel. nd./al.	....	d. 235	subl.	s. alk.	s. alk. carb.	....
3727	or. nd./et.	....	82.5-3	....	sl. s.	s.	s.
3728	yel. pr./bz.	....	114-6	....	0.08 h.	s.	s.
3729	or. rhb./al.	....	155-6	$220\text{-}30^{20mm}$ sl. d.	0.002^{25°; 0.08 h.	31^{25°; $0.6^{25^\circ}CCl_4$	v. s.; 2^{25° bz.
3730	yel. red pr./aq.	....	d. > 200	....	sl. s.; i. HCl	s.	i.
3731	red yel. pl.	....	....	....	0.7^{15°; v. s. h.	....	....
3732	red brn. pd.	....	....	....	s.	sl. s.	....
3733	col. oil	$1.153_{4}^{25^\circ}$	-7	196.5	sl. s.	∞	∞
3734	nd./aq.	....	106-8	240 ±	s. h.	s.	s.
3735	nd./aq.	1.129^{130°	116-7	subl.	1.38^{31°	70^{25° act.	4^{25° bz.
3736	col. pr./bz.-pet.	....	57-9	d.	v. sl. s. c.	s.; s. dil. HCl	s.; i. lg.; s. bz.
3737	col. nd.	....	142-3	234^{28mm}	sl. s. h.	s. h.	s.
3738	lf./aq.	....	140	d. 270	sl. s.	s.; s. chl.	s.
3739	lf./aq.	....	170.5	....	s. h.	s.; i. chl.	s.; i. CS_2
3740	nd./aq.	....	162(anh.)	H_2O, 100	s. h.	s.; i. chl.	s.; i. CS_2
3741	pr./al.	....	135	d.	v. sl. s. h.	s.; s. bz.; s. chl.	s.; sl. s. CS_2
3742	mn.	$1.443_{4}^{20^\circ}$	159; subl. 76	211^{20mm} ±	0.16^{4°; 2.6^{75°	49.6^{15° abs. al.	50.5^{15°

Hydroxy-acetaldehyde 3470
Hydroxy-acetamide 3472
Hydroxy-acetanilide 33-5
Hydroxy-acetic acid 3468
Hydroxy-acetonaphthone 48
Hydroxy-aniline 345-52
Hydroxy-anthracene 545, 561-2
Hydroxy-benzalacetophenone 3763
Hydroxy-benzene 5118

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Hydroxy				
3743	benzoic Ca (*o*)	calcium salicylate	$(C_7H_5O_3)_2Ca \cdot H_2O$†	X-60	332.32
3744	benzoic Na (*o*)	sodium salicylate	$HO \cdot C_6H_4 \cdot CO_2Na$	X-59	160.11
3745	benzoic acid (*m*)	....	$HO \cdot C_6H_4 \cdot CO_2H$	X-134	138.12
3746	benzoic acid (*p*)	....	$HO \cdot C_6H_4 \cdot CO_2H$	X-149	138.12
3747	benzoic anhydride (*o*)	salicylide; *β*-disalicylide	$(C_6H_4)_2O_2(CO)_2$	XIX-171	240.20
3748	benzonitrile (*o*)	salicylic nitrile	$HO \cdot C_6H_4 \cdot CN$	X-96	119.12
3749	benzophenone (*p*)	....	$C_6H_5 \cdot CO \cdot C_6H_4 \cdot OH$	VIII-158	198.21
3750	benzyl alcohol (*o*)	salicyl alcohol	$HO \cdot C_6H_4 \cdot CH_2OH$	VI-891	124.13
3751	benzyl alcohol (*m*)	....	$HO \cdot C_6H_4 \cdot CH_2OH$	VI-896	124.13
3752	benzyl alcohol (*p*)	....	$HO \cdot C_6H_4 \cdot CH_2OH$	VI-897	124.13
3753	butyric acid (*α*) (***dl***)	....	$C_2H_5 \cdot CHOH \cdot CO_2H$	III-303	104.10
3754	butyric acid (*β*)(***l***)	....	$CH_3 \cdot CHOH \cdot CH_2 \cdot CO_2H$	III-307	104.10
3755	butyric acid (*β*)(***dl***)	....	$HO \cdot C_3H_6 \cdot CO_2H$	III-308	104.10
3756	butyric acid (*γ*)	....	$HO(CH_2)_3CO_2H$	III-311	104.10
3757	butyric acid (***iso***)(*α*)	acetonic acid	$(CH_3)_2COH \cdot CO_2H$	III-313	104.10
3758	butyric nitrile (*γ*)	(***dl***)	$HO \cdot (CH_2)_3 \cdot CN$	III-311	85.10
3759	caproic acid (*α*)(***dl***)	oxycaproic acid	$CH_3(CH_2)_3CHOH \cdot CO_2H$	III-332	132.16
3760	caproic acid(***iso***)(*α*)	leucic acid (***dl***)	$HO \cdot C_5H_{10} \cdot CO_2H$	III-336	132.16
3761	caprylic acid (*α*)	....	$C_6H_{13} \cdot CHOH \cdot CO_2H$	III-348	160.21
3762	caprylic acid (***iso***) (*α*)	tetramethyl-hydracrylic acid	$[(CH_3)_2CH]_2 : C(OH) \cdot CO_2H$	III-348	160.21
3763	chalcone (2)‡	***o***-OH-benzalacetophenone	$C_6H_5 \cdot CO \cdot CH : CH \cdot C_6H_4 \cdot OH$	VIII-191	224.25
3764	*γ*-chloro-***n***-butyronitrile (*β*)(***dl***)	....	$ClCH_2 \cdot CHOH \cdot CH_2 \cdot CN$	III-310	119.55
3765	*β*,*β*-dimethyl-*γ*-butyrolactone (*α*)	(***dl***)§	 $CHOH \cdot CO \cdot O \cdot$ $CH_2 \cdot C:(CH_3)_2$	XVIII-3	130.14
3766	*β*,*β*-dimethyl-*γ*-butyrolactone (*α*)	(***l***)§	$C_6H_{10}O_3$	....	130.14
3767	diphenylamine (*o*)	anilino-phenol	$HO \cdot C_6H_4 \cdot NH \cdot C_6H_5$	XIII-365	185.22
3768	diphenylamine (*m*)	anilino-phenol	$HO \cdot C_6H_4 \cdot NH \cdot C_6H_5$	XIII-410	185.22
3769	diphenylamine (*p*)	anilino-phenol	$HO \cdot C_6H_4 \cdot NH \cdot C_6H_5$	XIII-444	185.22
3770	diphenyl ether (*o*)	phenoxy-phenol	$HO \cdot C_6H_4 \cdot O \cdot C_6H_5$	VI-772	186.20
3771	ethyl ethylenediamine	....	$HO \cdot CH_2 \cdot CH_2 \cdot NH \cdot CH_2 \cdot CH_2 \cdot NH_2$	IV-286	104.15
3772	glutamic acid (*β*)	(***l***+)	$HO_2C \cdot CH_2 \cdot CHOH \cdot CH(NH_2) \cdot CO_2H$	*IV-550	163.13
3773	glutaric acid (*α*) (***dl***)	....	$HO_2C \cdot CHOH \cdot CH_2 \cdot CH_2 \cdot CO_2H$	III-442	148.11
3774	glutaric acid (*β*)	....	$HOCH:(CH_2CO_2H)_2$	III-443	148.11

† Crysts. + $2H_2O$, $2.8^{16°}$ aq., $-H_2O$ 100°; + $3H_2O$, $2.3^{15°}$, $35.8^{100°}$ aq.
‡ See also No. 1781.
§ Lactone portion of pantothenic acid is the *l*-form.

Hydroxy-benzoquinone-oxime 4900
Hydroxy-brasilin 3500
Hydroxy-butene 4422
Hydroxy-butyraldehyde 169
Hydroxy-chlorobenzaldehyde 1461
Hydroxy-cinchonine, cf. alkd.
Hydroxy-cinnamic acid 1531-3, 1537
Hydroxy-coniine, cf. alkd.
Hydroxy-coumarin 6369
Hydroxy-cumene 5433-5
Hydroxy-deguelin 5699

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Water	Alcohol	Ether
3743	col. nd.	....	....	....	1.4 c.; 4 h.	s.	s.
3744	col. pl./al.	....	....	....	$125^{25°}$	$17^{15°}$	25 gly.
3745	rhb./aq.	1.473	201	....	$0.8^{19°}$; s. h.	s. h.	$10^{10°}$
3746	mn./aq. al.	$1.468^{4°}$	214.5-5.5	....	$0.17^{0°}$; $2.7^{55°}$	v. s.	$23^{25°}$; i. CS_2
3747	nd./chl.	....	200-1	d.	i.	s. h.	....
3748	pr./bz.	....	97-8	149^{14mm}	v. sl. s.	v. s.	v. s.
3749	rhb.	....	134-5	....	s. h.	$25^{25°}$ act.	$8^{25°}$
3750	rhb./aq.	$1.161^{25°}$	86-7	subl.	$6.6^{15°}$	v. s.	v. s.; s. bz.
3751	cr./bz.	....	67	300 ±, d.	v. s. h.	v. s.	v. s.
3752	pr./aq.	....	125	252	v. s.	v. s.	v. s.
3753	hyg. cr.	$1.125^{20°}$	43-4	subl. > 60; 225-60 d.	s.	s.	s.
3754	mn.	....	48-50	....	v. s.	v. s.	v. s.; i. bz.
3755	hyg. syrup	....	....	130^{12mm} ±	....	....	....
3756	lq.	....	<-17	d. slowly room temp.	....	....	....
3757	hyg. pr.	....	79; subl. 50	212	v. s.	v. s.	v. s.; v. sl. s. bz.
3758	lq.	$1.029^{8°}$	....	238-40	s.	s.; i. CS_2	s.; s. chl.
3759	nd.	....	60-2	subl. 100 sl. d.	v. s.	v. s.	v. s.
3760	pl./et. + pet.	....	76-7	....	s.	s.	s.
3761	pl.	....	69.5	....	v. sl. s.	v. s.	v. s.
3762	cr./et.	....	152-3 d.	192-3 d.	v. s.	v. s.	v. s.
3763	yel. lf./aq. al.	....	154-5 d.	....	v. sl. s. CS_2	v. s.	sl. s. chl.
3764	yel. lq.	....	....	250 ±, d.	s.	s.	s.
3765	col. hyg. nd.	....	56-8	$119\text{-}21^{15mm}$	s.; s. bz.	s.; s. chl.; s. CS_2	s.; sl. s. pet.
3766	cr./bz. pet.	....	91-2	....	s.; sl. s. pet.	s.	s.
3767	pr./aq.	....	69-70	$180\text{-}9^{20mm}$	sl. s. h.	s.	s.; sl. s. bz.
3768	lf./aq.	....	81.5-2.0	340	sl. s. h.; s. alk.	s.; s. dil. a.	s.; sl. s. lg.
3769	lf.	....	70	330	v. sl. s. c.; s. alk.	s.; s. dil. a.	s.; s. chl.
3770	nd./aq.	....	106-7	$151\text{-}5^{11mm}$	sl. s. h.	v. s. h.	v. s. h.
3771	lq.	....	....	238-40	v. s.	v. s.	i.
3772	pr./aq.	....	softens 100	d. > 100	v. s.	i.	i.; v. s. ac.
3773	col. cr.	....	98-100 d.	....	s.	....	....
3774	nd./aq.	....	95	....	v. s.	v. s.	sl. s.

Hydroxy-diethylaniline 2116
Hydroxy-dimethylbenzene 6465-70
Hydroxy-diphenyl 5216-8
Hydroxy-diphenylmethane 823
Hydroxy-ditane 824
Hydroxy-ethyl acetate 3446
Hydroxy-ethylamine 2907
Hydroxy-ethylaniline 2930
Hydroxy-ethyl formate 3456
Hydroxy-hydroquinone 6217
Hydroxy-isophenoxazone 5554
Hydroxy-lepidine 4179
Hydroxy-malonic acid 5695
Hydroxy-methoxybenzaldehyde 6418, 6421
Hydroxy-methoxybenzoic acid 6417
Hydroxy-methoxybenzyl alcohol 6422

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Hydroxy				
3775	hydroquinone triacetate (1,2,4)	triacetyl-hydroxy-hydroquinone	$(CH_3CO_2)_3C_6H_3$	VI-1089	252.22
3776	3-methoxyacetophenone (4)	acetovanillone; apocynin	$CH_3CO\cdot C_6H_3(OH)\cdot OCH_3$	VIII-272	166.17
3777	methyl benzoic acid	(*o*)	$HO\cdot CH_2\cdot C_6H_4\cdot CO_2H$	X-218	152.14
3778	α-naphthoic acid	(2,1)	$HO\cdot C_{10}H_6\cdot CO_2H$	X-328	188.17
3779	α-naphthoic acid	(5,1)	$HO\cdot C_{10}H_6\cdot CO_2H$	X-330	188.17
3780	α-naphthoic acid	(6,1)	$HO\cdot C_{10}H_6\cdot CO_2H$	X-330	188.17
3781	α-naphthoic acid	(7,1)	$HO\cdot C_{10}H_6\cdot CO_2H$	X-330	188.17
3782	β-naphthoic acid	(1,2)	$HO\cdot C_{10}H_6\cdot CO_2H$	X-331	188.17
3783	β-naphthoic acid	(3,2)	$HO\cdot C_{10}H_6\cdot CO_2H$	X-333	188.17
3784	β-naphthoic acid	(5,2)	$HO\cdot C_{10}H_6\cdot CO_2H$	X-337	188.17
3785	β-naphthoic acid	(7,2)	$HO\cdot C_{10}H_6\cdot CO_2H$	X-337	188.17
3786	α-naphthoquinone	(2)	$C_{10}H_5O_2\cdot OH$	VIII-300	174.15
3787	α-naphthoquinone	(5); juglon; nucin	$C_{10}H_5O_2\cdot OH$	VIII-308	174.15
3788	β-naphthoquinone	(7)	$C_{10}H_5O_2\cdot OH$	VIII-299	174.15
3789	β-naphthoquinone	(6)	$C_{10}H_5O_2\cdot OH$	*VIII-638	174.15
3790	naphthyl-*o*-hydroxy-*m*-toluic acid (β)	epicarin	$HO\cdot C_{10}H_6\cdot CH_2\cdot C_6H_3(OH)\cdot CO_2H$	....	294.29
3791	nicotinic acid (α)	....	$HO\cdot C_5H_3N\cdot CO_2H$	XXII-214	139.11
3792	nicotinic acid (*p*)	....	$HO\cdot C_5H_3N\cdot CO_2H$	XXII-215	139.11
3793	oenanthylic acid (α)	....	$C_5H_{11}\cdot CHOH\cdot CO_2H$	III-342	146.18
3794	phenylacetic acid (*o*)	....	$HO\cdot C_6H_4\cdot CH_2\cdot CO_2H$	X-187	152.14
3795	phenylacetic acid	(*m*)	$HO\cdot C_6H_4\cdot CH_2\cdot CO_2H$	X-189	152.14
3796	phenylacetic acid (*p*)	....	$HO\cdot C_6H_4\cdot CH_2\cdot CO_2H$	X-190	152.14
3797	phenylarsonic acid	(*p*)	$HO\cdot C_6H_4\cdot AsO(OH)_2$	XVI-874	218.03
3798	phenylarsonate Na	(*p*)	$HO\cdot C_6H_4\cdot As{:}O(OH)ONa\cdot 2\frac{1}{2}H_2O$	XVI-874	285.06
3799	phenylethylamine (*p*)	tyramine	$HO\cdot C_6H_4\cdot CH_2\cdot CH_2\cdot NH_2$	XIII-625	137.18
3800	phenylglycine (*p*)	photo-glycin	$HO\cdot C_6H_4\cdot NH\cdot CH_2\cdot CO_2H$	XIII-488	167.16
3801	phenyl-quinoline-dicarboxylic acid	2-(4-OH-3-CO_2H-Ph)cinchoninic acid	$HO_2C\cdot C_9H_5N\cdot C_6H_3(OH)CO_2H$	*XXII-567	309.27
3802	*o*-phthalic acid	(3;1,2)	$HO\cdot C_6H_3(CO_2H)_2$	X-498	182.13
3803	*o*-phthalic acid	(4;1,2)	$HO\cdot C_6H_3(CO_2H)_2$	X-499	182.13
3804	*m*-phthalic acid	(2;1,3)	$HO\cdot C_6H_3(CO_2H)_2\cdot H_2O$	X-501	200.14
3805	*m*-phthalic acid	(4;1,3)	$HO\cdot C_6H_3(CO_2H)_2$	X-502	182.13
3806	*m*-phthalic acid	(5;1,3)	$HO\cdot C_6H_3(CO_2H)_2\cdot 2H_2O$	X-504	218.16
3807	*p*-phthalic acid	(2;1,4)	$HO\cdot C_6H_3(CO_2H)_2$	X-505	182.13
3808	proline (4)(*dl*)	4-OH-pyrrolidine-2-carboxylic acid	$HN{:}C_4H_6(OH)CO_2H$	XXII-190	131.13
3809	proline (4)(*l*−)	....	$C_5H_9O_3N$	XXII-191	131.13
3810	propiophenone (*o*)	*o*-propionyl-phenol	$HOC_6H_4COC_2H_5$	VIII-102	150.17

Hydroxy-methoxycoumarin 5604
Hydroxy-methyl-azobenzene 657-8
Hydroxy-methylbenzaldehyde 4379
Hydroxy-methylcoumarin 4406
Hydroxy-methylene acetone 3304
Hydroxy-naphthalene 4489-90
Hydroxy-phenetole 5136
Hydroxy-phenylalanine 6367
Hydroxy-phenyl-mercurichloride 4034-5
Hydroxy-propionitrile 3195
Hydroxy-purine, cf. alkd.
Hydroxy-quinol 6217
Hydroxy-quinoline carboxylic acid 3937
Hydroxy-stachydrine, cf. alkd.
Hydroxy-styrene 6443-4
Hydroxy-succinic acid 3997-8

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3775	nd./abs. al.	....	96-7	>300 sl. d.	d. a.	d. alk.	....
3776	col. pr./aq.	....	115	295-300	v. s. h.; i. pet.	7.7^{9°	s.; s. bz.
3777	nd.	....	128 d.	....	0.4^{20°	s.	s.
3778	nd./aq. al.	....	156-7 d.	....	v. sl. s.	v. s. abs.	s.; s. bz.
3779	nd./h. aq.	....	234-7	subl.	s. h.	v. s.	s.; s. ac.
3780	nd./aq.	....	208-9	....	sl. s. h.	v. s.	....
3781	nd./aq.	....	253-4	....	s. h.	s.	....
3782	nd./al.	....	188-91	....	v. sl. s. h.	s.; s. alk.	s.; s. bz.
3783	yel. lf./aq.	....	216	....	sl. s. h.	s.; s. bz.	s.; s. chl.
3784	nd./al.	....	211-2	....	sl. s. h.	s.	....
3785	lf.	....	262	....	s.	s.	s.
3786	red cr./ac.	....	190d.	subl.	sl. s. h.	s.	s.
3787	yel. red/bz.	....	153-4	d.	i.; s. h. ac.	sl. s. c.	sl. s.
3788	brn. nd.	....	194	....	i. bz.	s.; s. ac.	i.
3789	lt. yel./aq. al.	....	>200	d. > 220	s. h.	s.	....
3790	wh. pd.	....	90 ±, d.	....	i.	s.; i. chl.	s.; s. act.
3791	nd./aq.	....	256	....	v. sl. s.	....	....
3792	nd./aq.	....	301-2 d.	subl.	sl. s. h.	v. sl. s.	v. sl. s.
3793	pr.	....	65	d.	v. sl. s. c.	....	....
3794	nd./et.	....	145-7	240-3 d.	s.	sl. s. c. chl.	s.
3795	nd./bz. lg.	....	129	190^{11mm}	v. s.	v. s.	v. s.
3796	nd./aq.	....	148	....	v. s. h.	v. s.	v. s.
3797	wh. pd.	....	170 ±, d.	....	v. s.	s.	....
3798	nd./aq. al.	....	$-2\frac{1}{2}H_2O$, 100	....	s.	....	....
3799	lf./bz.	....	161	$175\text{-}81^{8mm}$	<10 h.	10 ± h.; s. bz.	sl. s. h. xylene
3800	lf./aq.	....	240-1 d.	....	sl. s.; s. alk.	sl. s.	i.
3801	yel. pd.	....	283-4 d.	....	i.; s. alk.	sl. s.; sl. s. EtOAc	i. lg.
3802	nd./aq.	....	150 ±, d.	....	s.	s.	s.
3803	cr./aq.	....	204-5 d.	....	v. sl. s. bz.	s.	s.; sl. s. pet.
3804	nd./aq.	....	243-4 (anh.)	$-H_2O$, 100	0.14^{24°; 2.6^{100°	s.	s.; sl. s. chl.
3805	nd./aq.	....	310	....	0.02^{10°; 0.7^{100°	s.; s. h. ac.	s.; i. chl.
3806	nd./aq.	....	288(anh.)	$-2H_2O$, 100	0.03^{5°; 18^{99°	s.	s.; s. bz.
3807	pd./aq.	....	>330	subl. sl. d.	v. sl. s.	s.; s. Me al.	sl. s.
3808	col. pl./Me al.	....	261-2 d.	....	v. s.	v. sl. s.	....
3809	lf./aq. al.	....	270	....	v. s.	v. sl. s.	....
3810	lq.	....	....	115^{15mm}	v. sl. s.	s.; s. alk.	s.

Hydroxy-toluene 1545-7
Hydroxy-tyrosine 2361
Hydroxy-xanthene 6453
Hyoscine, cf. alkd.
Hyoscyamine, cf. alkd.
Hypaphorine, cf. alkd.
Hypnal 567
Hypnone 51
Hypotonin 3200
Hypoxanthine, cf. alkd.
Hystazarin 2302
Hystazin 2302
I acid 337
Idryl 3245
Ignotine 1251
Imidazolyl-alanine 3669
Imidazolyl-ethylamine 3667
Imino-ethyl alcohol 2090
Imino-urea 3488
Indane 3695
Indanone 3698-9
Indican, cf. glcdo.
Indigo-disulfonic acid 3858
Indigo red 3862

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Hydroxy				
3811	propiophenone (*p*)	*p*-propionyl-phenol	$HOC_6H_4COC_2H_5$	VIII-102	150.17
3812	pyridine (2)(α)	α-pyridone	$HO{\cdot}C_5H_4N$	XXI-43	95.10
3813	pyridine (3)	β-pyridone	$HO{\cdot}C_5H_4N$	XXI-46	95.10
3814	pyridine (γ)	γ-pyridone	$HO{\cdot}C_5H_4N{\cdot}H_2O$	XXI-48	113.11
3815	pyrotartaric acid (α)	....	$HO_2C{\cdot}CH(CH_3){\cdot}CHOH{\cdot}CO_2H$	III-445	148.11
3816	quinaldine (3)	....	$C_{10}H_9ON$	XXI-103	159.18
3817	quinaldine (4)	....	$C_{10}H_9ON$	XXI-104	159.18
3818	quinaldine (5)	....	$C_{10}H_9ON$	XXI-106	159.18
3819	quinaldine (6)	....	$C_{10}H_9ON$	XXI-106	159.18
3820	quinoline (2)(α)	carbostyril	$HO{\cdot}C_9H_6N$	XXI-77	145.15
3821	quinoline (4)(γ)	kyanurin	$HO{\cdot}C_9H_6N{\cdot}3H_2O$	XXI-83	199.20
3822	quinoline (5)(*ana*)	....	$HO{\cdot}C_9H_6N$	XXI-84	145.15
3823	quinoline (6)(*p*)	....	$HO{\cdot}C_9H_6N$	XXI-85	145.15
3824	quinoline (7)(*m*)	....	$HO{\cdot}C_9H_6N$	XXI-91	145.15
3825	quinoline (8)(*o*)	oxine	$HO{\cdot}C_9H_6N$	XXI-91	145.15
3826	*iso*-quinoline (1)	*iso*-carbostyril	$C_6H_4CO{\cdot}NH{\cdot}CH{:}CH$	XXI-100	145.15
3827	quinoline (8) sulfate	chinosol; quinosol	$(HO{\cdot}C_9H_6N)_2{\cdot}H_2SO_4$	XXI-92	388.38
3828	quinoline-5-sulfonic acid (8)	....	$HOC_9H_5N{\cdot}SO_3H{\cdot}2H_2O$	XXII-407	261.25
3829	stearic acid (α)	....	$C_{16}H_{33}CHOH{\cdot}CO_2H$	III-364	300.47
3830	stearic acid (10)	....	$CH_3(CH_2)_7{\cdot}CHOH{\cdot}(CH_2)_8CO_2H$	III-365	300.47
3831	stearic acid (λ)	....	$CH_3(CH_2)_5{\cdot}CHOH{\cdot}(CH_2)_{10}CO_2H$	III-366	300.47
3832	*o*-toluic acid (1;2,6)	....	$CH_3C_6H_3(OH)CO_2H$	X-214	152.14
3833	*o*-toluic acid (1;3,2)	Me-salicylic acid (6)	$CH_3C_6H_3(OH)CO_2H$	X-217	152.14
3834	*o*-toluic acid (1;3,6)	....	$CH_3C_6H_3(OH)CO_2H{\cdot}\frac{1}{2}H_2O$	X-214	161.15
3835	*o*-toluic acid (1;4,2)	....	$CH_3C_6H_3(OH)CO_2H$	X-215	152.14
3836	*m*-toluic acid (1;2,3)	β-cresotinic acid	$CH_3C_6H_3(OH)CO_2H$	X-220	152.14
3837	*m*-toluic acid (1;2,5)	....	$CH_3C_6H_3(OH)CO_2H{\cdot}\frac{1}{2}H_2O$	X-225	161.15
3838	*m*-toluic acid (1;3,5)	....	$CH_3C_6H_3(OH)CO_2H$	X-227	152.14
3839	*m*-toluic acid (1;4,3)	α-cresotinic acid	$CH_3C_6H_3(OH)CO_2H$	X-227	152.14
3840	*p*-toluic acid (1;2,4)	....	$CH_3C_6H_3(OH)CO_2H$	X-237	152.14
3841	*p*-toluic acid (1;3,4)	γ-cresotinic acid	$CH_3C_6H_3(OH)CO_2H$	X-233	152.14
3842	urea	....	$NH_2{\cdot}CO{\cdot}NHOH$	III-95	76.06
3843	valeric acid (α)(*n*)	....	$C_3H_7{\cdot}CHOH{\cdot}CO_2H$	III-320	118.13
3844	*iso*-valeric acid (α)	(*dl*)	$(CH_3)_2CH{\cdot}CHOH{\cdot}CO_2H$	III-328	118.13
3845	*iso*-valeric acid (β)	....	$(CH_3)_2COH{\cdot}CH_2{\cdot}CO_2H$	III-327	118.13

Indigotin 3857
Indirubin 3862
Indolyl-alanine 6365
Indoxyl-glucoside 3856
Indoxyl-β-glucoside, cf. glcde.
Inositol 1602-3
Iodal 5817
Iodeikon 5814
Iodeosin 2896
Iodistol 5940
Iodo-acetol 2398
Iodo-acetonitrile 3890
Iodo-allylene 5344
Iodo-aspirin 93-4
Iodo-butane 1095-8
Iodo-butene 1568
Iodo-cyanogen 1592
Iodo-cyclohexane 1614
Iodo-decane 1647
Iodo-dimethylbenzene 3909
Iodo-ethane 3077
Iodo-ethanol 3208
Iodo-ethyl allophanate 179
Iodo-ethylene 6442

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3811	nd./aq.	....	149-50	....	$0.04^{15\circ}$	$3.3^{100\circ}$ aq.	$4^{25\circ}$
3812	nd./bz.	....	106-7	280-1	v. s.	v. s.	s.; sl. s. lg.
3813	nd./bz.	....	129	subl.	s.	s.	sl. s. bz.
3814	mn.	....	92; 148.5 (anh.)	>350	$100^{15\circ}$	s.; v. sl. s. chl.	i.; i. bz.
3815	mn.	....	123	d.	....	....	....
3816	nd./al.	....	265 d.	....	sl. s.	s.	....
3817	cr.	....	230-1	>360 d.	1 c.; 10 h.	s.; v. sl. s. bz.	v. sl. s.
3818	lf./al.	....	232-4	sl. d.	i.	sl. s. c.	s.
3819	cr./aq.	....	213	sl. d.	sl. s.	s.	s.
3820	pr./al.	....	199-200	subl.	s. h.	v. s.	v. s.
3821	nd./aq.	....	52*	>300 d.	$0.47^{15\circ}$	v. s. h.	v. sl. s.
3822	nd./al.	....	224 d.	subl.	v. s. h. Na_2CO_3	s.	sl. s.; i. lg.
3823	pr./abs. al.	....	193	>360	v. sl. s. c.	sl. s.; s. alk.	v .sl. s. ;s. a.
3824	pr./abs. al.	....	235-8 d.	....	v. sl. s.	v. s.	s. alk.
3825	pr./aq. al.	....	75-6	266.6^{752mm}	v. sl. s. c.	s.; s. dil. alk.	sl. s.
3826	mn./bz.	....	208-9	subl.	sl. s.	s.; s. chl.	sl. s.; sl. s. bz.
3827	yel. cr. pd.	....	177-8	....	v. s.	sl. s.	i.; s. gly.
3828	pa. yel. cr./HCl	....	275±, d.	....	sl. s. h.	sl. s.	v. sl. s.
3829	nd./chl.	....	92-3	....	v. s. h. bz.	$0.6^{20\circ}$	s.
3830	tab./al.	....	83-5	....	....	$9.7^{20\circ}$	$2.4^{20\circ}$
3831	cr./al.	....	78	....	s. chl.; i. lg.	$13^{20\circ}$	$5.4^{19\circ}$
3832	cr./aq.	....	142-5	....	....	....	....
3833	nd./aq.	....	167-8	....	$0.14^{25\circ}$	v. s.	v. s.
3834	cr./aq.	....	178 (anh.)	$-H_2O$, 100	s. h.	v. s.	v. s.; i. chl.
3835	nd./aq.	....	180-2	subl.	s.	v. s.	v. s.
3836	nd./h. aq.	....	163-4	....	s. h.	s.	s.; s. chl.
3837	nd./aq.	....	173-4 (anh.)	$-H_2O$, 100	s. h.	s.	s.; i. CS_2
3838	nd./aq.	....	208-10	subl.	s.	....	....
3839	nd./aq.	....	152-3	subl. sl. d.	s. h.	s.	s.; s. chl.
3840	nd./aq.	....	206-7	subl.	s. h.	s.	s.; i. chl.
3841	nd./aq.	....	177-8	subl.	s.	s.	s. chl.
3842	nd./al.	....	139-40	d.	v. s.	s. h.	....
3843	hyg. pl.	....	34	subl.	v. s.	v. s.	v. s.
3844	rhb.	....	86	....	v. s.	v. s.	v. s.
3845	syrup	....	....	....	v. s.	v. s.	v. s.

* Losses $3H_2O$, 110°; m. p. anh. 201°.

Iodo-gorgonic acid 2401-2
Iodo-heptane 3549
Iodo-hexadecane 1277
Iodo-hexahydrobenzene 1614
Iodo-hexane 3650-1
Iodo-hydrin 3208, 6287
Iodo-methane 4287
Iodo-nonane 4929
Iodo-octadecane 4940
Iodo-octane 4980
Iodo-pentane 459-63
Iodo-propene 208
Iodo-phthalein 5813
Iodo-propane 5417-8
Iodo-propyl alcohol 6287
Iodo-propylene 208
Iodo-propylene glycol 3402
Iodo-propylene oxide 2881
Iodo-quinine sulfate, cf. alkd.
Iodo-thymol 5940
Iodo-toluene (ω) 813
Iodol 5817
Iodophen 5813

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3846	**Hydroxy** valeric lactone (γ)	....	$CH_3 \cdot CHCH_2CH_2CO \cdot O$	XVII-235	100.11
3847	**Hyenic acid**	....	$CH_3(CH_2)_{23} \cdot CO_2H$	II-394	382.65
3848	**Hypnoacetin**	....	$C_{16}H_{15}O_3N$	XIII-464	269.29
3849	**Hypogaeic acid**	....	$C_{15}H_{29} \cdot CO_2H$	II-461	254.40
3850	**Imesatin**	....	$C_6H_4 \cdot C(NH)CO \cdot NH$	XXI-440	146.14
3851	**Imidazol**	glyoxalin	$C_3H_4N_2$	XXIII-45	68.08
3852	**Imino**-diacetic acid	....	$HN:(CH_2 \cdot CO_2H)_2$	IV-365	133.10
3853	diaceto-dinitrile	....	$HN:(CH_2 \cdot CN)_2$	IV-367	95.10
3854	**Indandione** (1,3)	α,γ-diketo-hydrindene	$C_6H_4 \cdot CO \cdot CH_2 \cdot CO$	VII-694	146.14
3855	**Indene**	....	$C_6H_4 \cdot CH_2 \cdot CH:CH$	V-515	116.15
3856	**Indican** (β)	indoxyl-β-glucoside	$C_{14}H_{17}O_6N \cdot 3H_2O$	....	349.33
3857	**Indigo**	indigotin	$C_{16}H_{10}O_2N_2$	XXIV-417	262.26
3858	carmine	soluble indigo	$C_{16}H_8O_2N_2(SO_3Na)_2$	XXV-304	466.35
3859	dicarboxylic acid	....	$C_{18}H_{10}O_6N_2$	XXV-273	350.28
3860	disulfonic acid	....	$C_{16}H_8O_2N_2(SO_3H)_2$	XXV-304	422.38
3861	monosulfonic acid	....	$C_{16}H_9O_2N_2(SO_3H)$	XXV-303	342.32
3862	purpurin	indirubin	$(NH \cdot C_6H_4CO \cdot C:)_2$	XXIV-430	262.26
3863	white	....	$(C_6H_4C(OH):C \cdot NH)_2$	XXIII-538	264.27
3864	**Indole**	benzopyrrole	C_8H_7N	XX-304	117.14
3865	**Indolyl**-acetic acid (3)	skatole carboxylic acid (ω)	$C_8H_6N \cdot CH_2CO_2H$	XXII-66	175.18
3866	butyric acid (3)(γ)	....	$C_8H_6N \cdot (CH_2)_3CO_2H$	....	203.23
3867	propionic acid (3)(β)	skatole-ω-acetic	$C_8H_6N \cdot (CH_2)_2CO_2H$	XXII-69	189.21
3868	**Indophenin**	....	$(C_{12}H_7NOS)_2$	XXI-438	426.49
3869	**Indophenol**	....	$HO \cdot C_6H_4 \cdot N:C_6H_4:O$	....	199.20
3870	**Indoxyl**	....	$HN \cdot CH:C(OH) \cdot C_6H_4$	XXI-69	133.14
3871	**Indoxylic acid**	....	$C_6H_4 \cdot COH \cdot C(CO_2H):$ NH	XXII-226	177.15
3872	**Inulin**	dahlin; alantin; alant starch	$(C_6H_{10}O_5)_6 \cdot H_2O$	....	990.86
3873	**Iodo**-acetanilide (*p*)	....	$I \cdot C_6H_4 \cdot NH \cdot COCH_3$	XII-671	261.07
3874	acetic acid	....	$I \cdot CH_2 \cdot CO_2H$	II-222	185.96
3875	aniline (*o*)	....	$I \cdot C_6H_4 \cdot NH_2$	XII-669	219.04
3876	aniline (*m*)	....	$I \cdot C_6H_4 \cdot NH_2$	XII-670	219.04
3877	aniline (*p*)	....	$I \cdot C_6H_4 \cdot NH_2$	XII-670	219.04
3878	anisole (*o*)	....	$CH_3O \cdot C_6H_4 \cdot I$	VI-207	234.05
3879	benzene	phenyl iodide	$C_6H_5 \cdot I$	V-215	204.02
3880	benzoic acid (*o*)	....	$I \cdot C_6H_4 \cdot CO_2H$	IX-363	248.03
3881	benzoic acid (*m*)	....	$I \cdot C_6H_4 \cdot CO_2H$	IX-365	248.03
3882	benzoic acid (*p*)	....	$I \cdot C_6H_4 \cdot CO_2H$	IX-366	248.03
3883	benzoyl chloride (*o*)	....	$I \cdot C_6H_4 \cdot CO \cdot Cl$	IX-364	266.48

Iodosol 5940
Iopropane 3401
Iothion 3401
Iothymol 5940
Iotone 3401
Iridin, cf. glcde.
Isacen 1675
Iso-γ-acid 337
Isoamyl, isobutyl, etc., cf. amyl, butyl, etc.
Isodibutylene 1923
Isobutylene chloride 4060
Isoephedrine 2878
Isoequilenin 2887-8
Isonitroso-amyl ketone 79
"Isooctane" 4947
Isophthalic, cf. also phthalic.
Isophthalic acid 5276
Isophthalyl dichloride 5285
Isopral 6168
Isoprene 4154
Isopropanol 5369
Isopropenyl-benzene 5224
Isopurpurin 6215
Istazin 2301

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3846	lq.	$1.050_{4}^{22^\circ}$	<−18	207-8	∞; i. aq. K_2CO_3	....	....
3847	cr./et.	....	77-8	....	....	v. sl. s. c.	v. s.
3848	lf./al.	....	160 ±	....	i.	0.3^{23°	i.
3849	col. nd.	....	33	236^{15mm}	i.	v. s.	....
3850	yel. pr.	....	175-6	....	i.	s. h.	sl. s.
3851	pr.	....	89-90	255-6	s.	v. s.	sl. s.
3852	rhb.	....	d. 225-36	....	2.4^{5°	i.	i.
3853	lf./et.	....	78	....	s.	s.	sl. s.
3854	cr./lg.	....	129-31 d.	....	v. sl. s. c.	s. h.	s. bz.
3855	col. lq.	$0.991_{25}^{25^\circ}$	−2	181-2	i.	s.	∞
3856	brn. rhb.	....	57; 176-8 (anh.)	....	v. s.	v. s.; sl. s. bz.	sl. s.
3857	b. cr./ aniline	1.35	390-2	subl.	i.	i.	i.; s. h. act.
3858	b. amor.	....	....	....	sl. s. c.	i.	i. aq. NaCl
3859	b. bl. ppt.	....	....	....	s. H_2SO_4	i.	i.; i. chl.
3860	b. amor.	....	....	....	v. s.	v. s.	....
3861	b. amor.	....	d. 200	....	v. s.	v. s.	....
3862	brn. nd.	....	....	subl.	i.	sl. s.	s. ac.
3863	col.-gray	....	....	....	i.; s. alk.	s.	s.
3864	lf./aq.	....	52	253-4	s. h.	s. h.	s.; s. bz.
3865	col. lf./bz.	....	164-5	....	v. sl. s. c.	s.; s. act.	s.; i. chl.
3866	rhb./bz. pet.	....	124-5	....	i.	s.; s. act.	s.; i. chl.
3867	cr./aq.	....	133-4	....	v. sl. s. c.	s.; s. ac.	s.
3868	b. pd.	....	d.	....	i.; s. H_2SO_4	v. sl. s.	v. sl. s.; i. bz.
3869	pl./act. pet.	....	160	....	s.; i. pet.	s.; s. bz.	s.; s. chl.
3870	yel. pr.	....	85	110	s.; s. act.	s.	s.; v. sl. s. pet.
3871	cr.	....	subl. 122-3	d.	v. sl. s; d. h.	....	....
3872	hyg. pd.	1.4(anh.)	d. 160	....	0.01^{0°; 37^{100°	0.02^{16°	....
3873	mn.	1.989^{15-20°	183-4	....	s. h.	6.4^{21°	v. s. ac.
3874	col. pl.	....	82-3	....	s.	s.	sl. s.
3875	nd.	....	60-1	....	v. sl. s.	v. s.	v. s.
3876	lf. or nd.	....	33	....	i.	s.	....
3877	nd./aq.	....	67-8	....	sl. s.	s.; s. chl.	s.
3878	yel. lq.	1.8^{20°	....	240-1	i.; s. bz.	∞; ∞ chl.	∞
3879	col. lq.	$1.824_{4}^{25^\circ}$	−28.5	188.6	i.; ∞ chl.	s.	∞
3880	nd./aq.	2.25	162	....	sl. s. h.	v. s.	v. s.
3881	cr./act.	....	187-8	subl.	sl. s.	s.	....
3882	lf.	....	269-70	subl.	sl. s. h.	s.	....
3883	cr.	....	30-1	159^{27mm}	d.	d.	....

Isuretin 3298
J acid 337
Jalapin, cf. glcde.
Japaconitine, cf. alkd.
Jervine, cf. alkd.
Juglon 3787
Kachin 2312
Kalmin, cf. glcde.
Kalmopyrin 116
Kalsetal 116
Kelene 3015
Ketine 2533
Keto-glutaric acid (β) 59
Keto-heptanone 1597
Keto-hexahydrotoluene 4204-6
Keto-hydroxyestrin 2903
Keto-pentamethylene 1620
Ketone 4436
Ketone base 4436
Koch acid 4555
Kodelon 350
Kryofine 4064
Kryogenin 1569
K. S. K. gas 3078

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3884	**Iodo** diphenyl (*o*)		$I\cdot C_6H_4\cdot C_6H_5$	**V-486	280.11
3885	diphenyl (*p*)		$I\cdot C_6H_4\cdot C_6H_5$	V-581	280.11
3886	ethylacetate (β)		$CH_3CO_2\cdot CH_2\cdot CH_2I$	II-129	214.02
3887	form	triiodomethane	HCI_3	I-73	393.78
3888	8-hydroxyquinoline-5 sulfonic acid (7)	loretin; ferron	$IC_9H_4N(OH)\cdot SO_3H$	XXII-408	351.13
3889	lepidine (2)	2-I-4-Me-quinoline	$C_{10}H_8NI$	XX-397	269.09
3890	methyl cyanide	iodoacetonitrile	$I\cdot CH_2\cdot CN$	II-223	166.96
3891	naphthalene (α)	α-naphthyl iodide	$C_{10}H_7I$	V-550	254.08
3892	naphthalene (β)	β-naphthyl iodide	$C_{10}H_7I$	V-552	254.08
3893	nitrobenzene (*o*)		$I\cdot C_6H_4\cdot NO_2$	V-252	249.02
3894	nitrobenzene (*m*)		$I\cdot C_6H_4\cdot NO_2$	V-253	249.02
3895	nitrobenzene (*p*)		$I\cdot C_6H_4\cdot NO_2$	V-253	249.02
3896	phenetole (*o*)		$I\cdot C_6H_4\cdot O\cdot C_2H_5$	VI-207	248.07
3897	phenetole (*p*)		$I\cdot C_6H_4\cdot O\cdot C_2H_5$	VI-208	248.07
3898	phenol (*o*)		$I\cdot C_6H_4\cdot OH$	VI-207	220.02
3899	phenol (*m*)		$I\cdot C_6H_4\cdot OH$	VI-207	220.02
3900	phenol (*p*)		$I\cdot C_6H_4\cdot OH$	VI-209	220.02
3901	propionic acid (α)		$CH_3\cdot CHI\cdot CO_2H$	II-261	199.99
3902	propionic acid (β)		$ICH_2\cdot CH_2\cdot CO_2H$	II-261	199.99
3903	propyne-1 (1)†		$CH_3\cdot C\vdots CI$	I-248	165.97
3904	salicylic acid (3)	*m*-I-salicylic acid	$I\cdot C_6H_3(OH)CO_2H$	X-112	264.03
3905	toluene (*o*)	*o*-tolyl iodide	$I\cdot C_6H_4\cdot CH_3$	V-310	218.05
3906	toluene (*m*)	*m*-tolyl iodide	$I\cdot C_6H_4\cdot CH_3$	V-311	218.05
3907	toluene (*p*)	*p*-tolyl iodide	$I\cdot C_6H_4\cdot CH_3$	V-312	218.05
3908	trinitromethane		$IC(NO_2)_3$	I-79	276.95
3909	*m*-xylene (2)	2-I-1,3-diMe-benzene	$I\cdot C_6H_3(CH_3)_2$	V-375	232.07
3910	**Iodoso**-benzene		C_6H_5IO	V-217	220.02
3911	benzoic acid (*o*)		$OI\cdot C_6H_4\cdot CO_2H$	IX-363	264.03
3912	**Iodoxybenzene**		$C_6H_5IO_2$	V-218	236.02
3913	**Ionone** (α)		$C_{10}H_{16}:CH\cdot CO\cdot CH_3$	VII-168	192.29
3914	**Ionone** (β)		$C_{10}H_{16}:CH\cdot CO\cdot CH_3$	VII-167	192.29
3915	**Ionone** (*pseudo*)	citrylidene acetone	$C_{13}H_{20}O$	I-757	192.29
3916	semicarbazone (α)		$C_{13}H_{20}:NNHCONH_2$	VII-169	249.35
3917	semicarbazone (β)		$C_{13}H_{20}:NNHCONH_2$	VII-168	249.35
3918	**Irone** (β)	irone	$C_{14}H_{22}O$	VII-169	206.32
3919	**Isatin**		$C_6H_4\cdot CO\cdot COH:N$	XXI-432	147.13
3920	chloride		$C_6H_4\cdot CO\cdot CCl:N$	XXI-302	165.58
3921	**Isatinic acid**	anilino-glyoxylic acid	$NH_2\cdot C_6H_4\cdot CO\cdot CO_2H$	XIV-648	165.14
3922	**Isatoic anhydride**		$C_6H_4\cdot CO_2\cdot CO\cdot NH$	XXVII-264	163.13
3923	**Isatoxime**	nitroso-oxindol	$C_6H_4\cdot N:C(OH)C:NOH$	XXI-443	162.14
3924	**Isatropic acid** (α)	1-Ph-1,2,3,4-tetrahydronaphthalene-1,4-dicarboxylic acid	$(C_9H_8O_2)_2$	IX-957	296.31

† See also No. 5344.

Kyanol 513
Kyanurin 3821
L acid 4503
Laburnine, cf. alkd.
Lactic anhydride 3948
Lactophenin 3949
Lactyl urea 4268
Lambda acid 4544
Lantaruric acid 182

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3884	lq.	$1.604_{25}^{25°}$	....	189-92^{36mm}	....	....	....
3885	col. cr./al.	....	112-3	320 sl. d.	i.; s. bz.	s. h.	s.; s. ac.
3886	col. lq.	2.441$^{20°}$	....	184^{743mm}	....	....	....
3887	yel. hex.	4.008$^{17°}$	119	subl.	0.01$^{25°}$	1.5$^{17°}$; 11 h.	13.6$^{25°}$
3888	yel. lf.	....	d. 260 ±	....	0.2 c.; 0.6 h.	sl. s.; s. H_2SO_4	i.; i. bz.; i. chl.
3889	nd. lg.	....	90	....	....	s.	s.; s. lg.
3890	oil	2.307	....	182-4^{720} d.	s. d.	....	....
3891	oil	1.734$^{15°}$	....	305	i.	∞	∞
3892	lf.	$1.632\frac{99°}{4}$	54-5	308-10	i.	v. s.	v. s.
3893	yel. nd.	$1.883\frac{100°}{4}$	52-4	288-9^{729mm}	i.	s. h.	v. s.
3894	mn.	$1.878\frac{100°}{4}$	37-8	280 ±	....	....	....
3895	yel. nd./al.	2.273 (solid)	171.5	287^{726mm}	....	....	....
3896	lq.	....	....	245^{736mm}	i.	s.	s.
3897	cr.	....	29	249^{729mm}	i.	s.	s.; s. chl.
3898	nd. or pl.	1.876$^{80°}$	40.4	186-7^{160mm}	s. h.	v. s.	v. s.
3899	nd., lg.	....	40	d.	....	....	s.
3900	nd., aq.	1.857$^{112°}$	93-4	d.	sl. s.	v. s.	v. s.
3901	nd.	....	44.5-5.5	105$^{0.3mm}$	v. sl. s.	s.	s.
3902	lf.	....	82	....	s. h.	v. s.	v. s.
3903	col. oil	2.08$^{22°}$	....	110.2^{757mm}	....	....	....
3904	col. nd./aq.	....	199	....	s. h.	s.	s. alk.
3905	lq.	1.698$^{20°}$	....	211-2	i.	∞	∞
3906	lq.	1.698$^{20°}$	....	213	i.	∞	∞
3907	lf.	1.678$^{40°}$	35-6	211.5	i.	v. s.	v. s.
3908	unstable, yel. pr.	....	55-6	48^{13mm}	i.	s. h.	s. bz., lg.
3909	lq.	....	....	228-30	....	....	....
3910	yel. amor.	....	expl. 210	....	s. h.	s. h.	v. sl. s.
3911	col. lf./aq.	....	>200 d.	....	s. h.	s. h.	v. sl. s.
3912	nd./aq.	....	expl. 236-7	....	s. h.	i.; i. bz.	s. h. ac.
3913	col. oil	0.930$^{20°}$	....	136.1^{17mm}	sl. s.	∞	∞
3914	col. oil	0.944$^{20°}$	....	140^{18mm}	sl. s.	∞	∞
3915	oil	0.898$^{20°}$	....	143-5^{12mm}	....	....	....
3916	cr./bz. lg.	....	107-8 (137-8)	....	....	s.	....
3917	nd./al.	....	148-9	....	i.	s.	s.; s. bz.
3918	col. oil	0.939$^{20°}$	....	144^{16mm}	v. sl. s.	v. s.	v. s.
3919	yel. red mn.	....	200-1	....	s. h.	v. s. h.	sl. s.; s. alk.
3920	brn. nd.	....	180 ±, d.	....	i.	s.	s.; blue
3921	wh. pd.	....	d.	....	s.	....	....
3922	mn./act.	....	240 d.	....	d. h.	3$^{8°}$	sl. s.; 1.3 h. act.
3923	yel. nd.	....	202 d.	....	v. sl. s; s. a.	sl. s.	s. KOH; i. bz.
3924	cr.	....	237	....	sl. s. h.	sl. s.; i. CS_2	i.; i. bz.

Laricin, cf. glcde.
Larocaine 276
Laudanine, cf. alkd.
Laudanosine, cf. alkd.
Laurane 1017

Laurent's acid 4548
Laurone 2850
Lauroyl chloride 3955
Lauryl alcohol 2859
Lauryl bromide 2860

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3925	**Isatropic acid** (*β*)	....	$(C_9H_8O_2)_2$	IX-957	296.31
3926	**Isomannide**	....	$C_6H_{10}O_4$	I-540	146.14
3927	**Isonitrosoacetone**	....	$CH_3\cdot CO\cdot CH{:}NOH$	I-763	87.08
3928	**Itaconic acid**	methylene succinic acid	$CH_2{:}C(CO_2H)\cdot CH_2\cdot CO_2H$	II-760	130.10
3929	**Itamalic acid**	free acid non-existant	$CH_2OH\cdot CH(CO_2H)\cdot CH_2\cdot CO_2H$	III-446	148.11
3930	**Kairoline**	*N*-methyl-tetrahydroquinoline	$C_9H_{10}N\cdot CH_3$	XX-264	147.21
3931	**Kawain**	....	$CH_3O\cdot C_{13}H_{11}O_2$	....	230.25
3932	**Ketazine**	acetone azine	$[(CH_3)_2C{:}N\cdot]_2$	I-651	112.17
3933	**Ketene**	....	$H_2C{:}C{:}O$	I-724	42.04
3934	**Keto-**butyric acid (*α*)	....	$CH_3\cdot CH_2\cdot CO\cdot CO_2H$	III-629	102.09
3935	dihydroquinazoline (4)	....	$C_6H_4\cdot N{:}CH\cdot NH\cdot CO$	XXIV-143	146.14
3936	pyrrolidine	*α,γ*-butyrolactam	$NH\cdot(CH_2)_3\cdot CO\cdot H_2O$	XXI-236	103.12
3937	**Kynurenic acid**	4-hydroxyquinoline-3-carboxylic acid	$C_9H_5N(OH)CO_2H\cdot H_2O$	XXII-230	207.18
3938	**Lacmoid**	resorcinol blue	†	*VI-399	......
3939	**Lactic** acid (*l*) (+)	paralactic acid	$CH_3\cdot CHOH\cdot CO_2H$	III-261	90.08
3940	acid (*dl*)	....	$CH_3\cdot CHOH\cdot CO_2H$	III-268	90.08
3941	Ca salt	calcium lactate	$(C_3H_5O_3)_2Ca\cdot 5H_2O$	III-277	308.30
3942	aldehyde	....	$CH_3\cdot CHOH\cdot CHO$	I-819	74.08
3943	amide	....	$CH_3\cdot CHOH\cdot CO\cdot NH_2$	III-283	89.09
3944	nitrile	aldehyde-cyanohydrin	$CH_3\cdot CHOH\cdot CN$	III-284	71.08
3945	**Lactide** (*dl*)	dilactide	$C_6H_8O_4$	XIX-154	144.12
3946	**Lactoic acid** (*d*)	*d*-galactonic acid	$CH_2OH\cdot(CHOH)_4\cdot CO_2H$	III-549	196.16
3947	**Lactose**	milk sugar	$C_{12}H_{22}O_{11}\cdot H_2O$	....	360.31
3948	**Lactyl lactic acid**	"lactic anhydride"	$C_2H_5O\cdot CO_2\cdot C_2H_4\cdot CO_2H$	III-282	162.14
3949	phenetidine (*p*)	lactophenin	$C_2H_5O\cdot C_6H_4\cdot NH\cdot CO\cdot CHOH\cdot CH_3$	XIII-491	209.24
3950	**Lauric** acid	dodecanoic acid	$CH_3(CH_2)_{10}\cdot CO_2H$	II-359	200.31
3951	ammonium salt	ammonium laurate	$C_{11}H_{23}CO_2NH_4$	*II-156	217.34
3952	aldehyde	dodecanal	$CH_3(CH_2)_{10}\cdot CHO$	I-714	184.31
3953	amide	....	$C_{11}H_{23}\cdot CO\cdot NH_2$	II-363	199.33
3954	anhydride	....	$(C_{11}H_{23}CO)_2O$	II-362	382.61
3955	chloride	lauroyl chloride	$CH_3(CH_2)_{10}\cdot CO\cdot Cl$	II-363	218.76
3956	nitrile	undecyl cyanide	$C_{11}H_{23}\cdot CN$	II-363	181.31
3957	**Lead** tetraethyl	tetraethyl lead	$(C_2H_5)_4Pb$	IV-639	323.45
3958	tetramethyl	tetramethyl lead	$(CH_3)_4Pb$	IV-639	267.35
3959	tetraphenyl	tetraphenyl lead	$(C_6H_5)_4Pb$	XVI-917	515.61
3960	**Lecithin**	protagon	$C_{42}H_{84}O_9PN$	....	778.08
3961	**Lepamine**	....	$C_{20}H_{32}N_2$	....	300.47
3962	**Leuco-**aniline	3-Me; NH₂,4,4′,4″	$CH_3\cdot C_6H_3(NH_2)CH{:}(C_6H_4\cdot NH_2)_2$	XIII-321	303.39
3963	aurine (4,4′,4″)	....	$(HO\cdot C_6H_4)_3CH$	VI-1143	292.32
3964	malachite green	Me₂N, 4,4′	$[(CH_3)_2N\cdot C_6H_4]_2{:}CH\cdot C_6H_5$	XIII-275	330.45

† Mixed dye; no formula.

Lauryl chloride 2861
Lauth's violet 5922
Lemonflavin, of. quercitrin, glcde.

Lenigallol 5516
Lepidine 4370
Lepidine ethiodide 4371
Lepidone 4179

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3925	pl./aq.	....	206	d. to α, 220	....	....	....
3926	hyg., mn.	....	87	176^{30mm}	v. s.	s.; sl. s. chl.	i.; i. bz.
3927	lf./et.	$1.074^{67.5^\circ}$	69	subl.	v. s.	v. sl. s. pet.	v. s.
3928	rhb.	1.63	165-6 sl. d.	....	8.3^{20°; v. sl. s. bz.	25^{15°, 88% al.	v. sl. s.; v. sl. s. chl.
3929	....	....	....	....	....	....	....
3930	lq.	$1.022^{20^\circ}_{4}$	....	$247\text{-}50^{758mm}$	....	v. s.	sl. s.
3931	col. cr.	....	105-6	$195\text{-}7^{0.1mm}$	i.	s.	s.; s. act.
3932	lq.	$0.843^{20^\circ}_{4}$	....	131	∞	∞	∞
3933	col. gas	....	−151	−56	d.	d.	s.; s. act.
3934	hyg. pl.	....	31.5-2.0	85^{21mm}	v. s.	v. s.	v. sl. s.
3935	col. nd.	....	213-4	....	s. h.	s.	s. NaOH
3936	cr.	$1.120^{20^\circ}_{4}$	35	251*	v. s.	....	....
3937	nd.	....	290(anh.)	$-H_2O$, 140-5	0.09^{100°	s. h.	i.
3938	vl. pd.	....	....	....	sl. s.	s.	i.; s. act.
3939	delq. pr.	....	52.8	....	∞	∞	∞
3940	hyg.	$1.249^{15^\circ}_{4}$	16.8	122^{14mm}	∞	∞	∞
3941	col. cr.	....	$-5H_2O$, 100	....	10 c.	3	∞ h. aq.
3942	nd.	....	101-5	....	s.; v. s. ac.	s.; s. act.	i.; i. bz.
3943	cr.	$1.138^{80^\circ}_{4}$	74	....	v. s.	v. s.	....
3944	col. lq.	$0.992^{18^\circ}_{4}$	−40	182-4 sl. d.	∞	∞	i. pet.
3945	tri./al.	$0.862^{10^\circ}_{4}$	124.5	255^{757mm}	v. sl. s. c.; d. h.	v. sl. s. c. abs. al.	....
3946	nd./aq.	....	147.5	....	s.	....	....
3947	col. rhb.	1.525^{20°	202(anh.)	d.	17 c.; 40 h.	i.	i.
3948	lt. yel. oil.	....	....	d. 250-60	v. sl. s.	s.	s.
3949	col. nd./aq.	....	118	....	0.3 c.; 1.8 h.	13; sl. s. lg.	sl. s.; s. h. bz.
3950	col. nd.	$0.869^{50^\circ}_{4}$	48 (44)	225^{100mm}	i.; s. bz.	s.	s.; s. pet.
3951	waxy	0.88	48-55	$-NH_3 > 50$	s. h.	s.; i. chl.	i.; i. bz.
3952	col. lf.	....	44.5	$184\text{-}5^{100mm}$	i.	s.	s.
3953	col. nd.	....	102	$200^{12.5mm}$	i.	v. s.	....
3954	col. cr.	$0.855^{70^\circ}_{4}$	41	$166^{0.1mm}$	....	....	....
3955	col. lq.	....	−17	145^{18mm}	d.	d.	s.
3956	oil	0.827^{15°	4	198^{100mm}	....	....	....
3957	col. lq.	$1.659^{18^\circ}_{4}$	−136	152^{291mm}	i.; s. bz.	sl. s.	∞
3958	col. lq.	$1.995^{20^\circ}_{4}$	−27.5	110^{760mm}	i.	∞	∞
3959	tet./bz.	1.530^{20°	228-9	d. 270	i.	0.1^{30°	1.7^{30° bz.
3960	waxy	....	150-200 d.	....	i.; s. chl.	s. h.	s. h.
3961	lq.	....	....	275	....	....	....
3962	cr./aq.	....	100	....	sl. s. h.	v. s.	sl. s.
3963	col. pr./ac.	....	....	....	sl. s.	s.; s. alk.	s. ac.
3964	nd./bz.	....	102(94)	d.	i.	s.; s. bz.	s.; sl. s. lg.

* B. p. of anh. compound.

Leucic acid 3760
Leucine 283, 285-7
Leuco-aniline 6071-3
Leuco-alizarin 2295
Leuco-crystal violet 3595
Leuco-dimethylphenylene green 5833
Leucoline 5538

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
3965	**Leucyl glycine** (*dl*)	....	$C_5H_{12}NCO{\cdot}NHCH_2{\cdot}CO_2H$	IV-448	188.22
3966	**Levulin**	....	$C_6H_{10}O_5$	I-925	162.14
3967	**Levulinic** acid	acetopropionic acid	$CH_3CO(CH_2)_2CO_2H$	III-671	116.11
3968	aldehyde	....	$CH_3CO(CH_2)_2CHO$	I-774	100.11
3969	**Lichenin**	moss starch	$(C_6H_{10}O_5)_x$	....	(162.14)
3970	**Lignoceric acid**	....	$C_{24}H_{48}O_2$	II-393	368.62
3971	**Limettin**	5,7-diMeO-coumarin	$(CH_3O)_2C_9H_4O_2$	XVIII-97	206.19
3972	**Limonene** (*dl*)	dipentene	$C_{10}H_{16}$	V-137	136.23
3973	**Limonene** (*d* or *l*)	*p*-menthadiene-1,8(9)	$C_{10}H_{16}$	V-133	136.23
3974	**Linalool** (*d*)†	coriandrol	$C_{10}H_{18}O$	I-461	154.24
3975	**Linalyl acetate**	bergamol	$CH_3CO_2{\cdot}C_{10}H_{17}$	II-141	196.28
3976	**Linoleic acid**	octadecadienoic acid	$C_{18}H_{32}O_2$	II-496	280.44
3977	**Linolenic acid**	octadecatrienoic acid	$C_{18}H_{30}O_2$	II-499	278.42
3978	**Lophine**	triphenyl-imidazole	$(C_6H_5)_3C{:}C{\cdot}N{:}C{\cdot}NH$	XXIII-318	296.35
3979	**Lumisterol**	....	$C_{28}H_{43}OH$	....	396.63
3980	**Luteol**	oxychloro-diphenyl-quinoxaline	$C_{19}H_{14}ONCl$	....	307.77
3981	**Lutidine** (2,5)‡	dimethyl-pyridine	$(CH_3)_2C_5H_3N$	XX-244	107.15
3982	**Lutidine** (2,4)(α,α')	dimethyl-pyridine	$(CH_3)_2C_5H_3N$	XX-244	107.15
3983	**Lutidine** (2,6)	dimethyl-pyridine	$(CH_3)_2C_5H_3N$	XX-244	107.15
3984	**Lutidine** (3,4)	dimethyl-pyridine	$(CH_3)_2C_5H_3N$	XX-246	107.15
3985	**Lycopene**	lycopin	$C_{40}H_{56}$	XXX-81	536.85
3986	**Lysine** (*dl*)	α,ϵ-diaminocaproic acid	$NH_2{\cdot}(CH_2)_4{\cdot}CHNH_2{\cdot}CO_2H$	IV-436	146.19
3987	dihydrochloride	....	$C_6H_{14}O_2N_2{\cdot}2HCl$	IV-437	219.12
3988	**Lysine** (*l*+)	....	$(NH_2)_2C_5H_9{\cdot}CO_2H$	IV-435	146.19
3989	hydrochloride (*d*)	....	$C_6H_{14}O_2N_2{\cdot}2HCl$	IV-436	219.12
3990	monohydrochloride	(*d*)	$C_6H_{14}O_2N_2{\cdot}HCl$	....	219.12
3991	**Lyxose** (α)(*d*)	....	$CH_2(CHOH)_4{\cdot}O$	....	150.13
3992	**Lyxose** (β)(*d*)	....	$CH_2(CHOH)_4{\cdot}O$	....	150.13
3993	**Malachite** green§	benzaldehyde green; (zinc salt)	$3C_{23}H_{25}N_2Cl{\cdot}2ZnCl_2{\cdot}2H_2O$	XIII-745	1403.33
3994	green	(oxalate salt)	$2C_{23}H_{25}N_2{\cdot}C_2HO_4{\cdot}H_2C_2O_4$	XIII-745	926.98
3995	**Maleic** acid (*cis*)	butendioic acid; toxilic acid	$(:CH{\cdot}CO_2H)_2$	II-748	116.07
3996	anhydride	....	$(:CH{\cdot}CO)_2O$	XVII-432	98.06
3997	**Malic** acid (*dl*)	hydroxysuccinic acid	$HO_2C{\cdot}CHOH{\cdot}CH_2{\cdot}CO_2H$	III-435	134.09
3998	acid (*d* or *l*)	....	$HO{\cdot}C_2H_3(CO_2H)_2$	III-417	134.09
3999	Ca acid salt (*l*)	Ca bimalate	$Ca(HC_4H_4O_5)_2{\cdot}6H_2O$	....	414.34
4000	acid (α), *iso*-	methyl tartronic acid	$CH_3{\cdot}C(OH)(CO_2H)_2$	III-440	134.09
4001	amide (*l*)	*l*-malamide	$HO{\cdot}C_2H_3(CO{\cdot}NH_2)_2$	III-435	132.12
4002	**Malonic** acid	propandioic acid	$CH_2{:}(CO_2H)_2$	II-566	104.06
4003	Ca salt	calcium malonate	$CaC_3H_2O_4{\cdot}4H_2O$	II-570	214.19
4004	amide	malonamide	$CH_2{:}(CO{\cdot}NH_2)_2$	II-582	102.09

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† See also No. 2518.
‡ See also No. 3147.
§ In medicinal use without $ZnCl_2$

Levulose 3616
Lewisite 1473
Light green 3594
Lilacin, cf. glcde.
Linalool tetrahydride 2519
Linaloolene 2515
Linamarin, cf. glcde.
Lindol 6351
Litmopyrin 117
Lobeline, cf. alkd.
Lodal 2413
Loretin 3888
Luminal 5113
Luminol 359
Lupanine, cf. alkd.
Lupinidine, cf. alkd.
Lupinine, cf. alkd.
Lutein 6452
Luteosterone 5334
Lutidinic acid 5498

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
3965	cr./aq.	....	243 d.	....	6.6 h.	v. sl. s.	v. sl. s.
3966	delq. amor.	....	d. 140-5	....	v. s.	v. sl. s.	i.
3967	lf.	$1.140^{20^\circ}_{20}$	33.5	245-6 sl. d.	v. s.	v. s.	v. s.
3968	col. lq.	$1.018^{20^\circ}_{4}$	<-21	186-8 sl. d.	∞	∞	s.
3969	col. amor.	....	....	....	s. h.	s. HCl	i.
3970	col. nd.	....	81-2	....	s. bz.	s.; s. ac.	s.; s. CS_2
3971	col. cr./al.	....	147.5	200 sl. d.	i.; s. chl.	s. h.	v. sl. s.
3972	col. lq.	0.844^{20°	....	178	i.	∞	∞
3973	lq.	$0.842^{20^\circ}_{4}$	−96.9	177	i.	∞	∞
3974	col. oil	0.868^{20°	....	198-200	v. sl. s.	10, 50% al.	∞
3975	col. lq.	0.895^{20°	....	220^{762} ±, d.	v. sl. s.	∞	∞
3976	lt. yel. oil	$0.903^{18^\circ}_{4}$	−9.5	$229\text{-}30^{16mm}$	i.	∞	∞
3977	oil	$0.914^{18^\circ}_{4}$	....	$230\text{-}2^{17mm}$	i.	s.	v. s.
3978	nd.	....	275	....	i.	2.8 h., abs.	0.3^{20°
3979	col. nd.	....	118	....	i.; s. act.	s.; s. chl.	v. s.
3980	yel. nd.	....	246	....	i.	s.	s.
3981	lq.	0.938^{0°	....	156.5	25 c.; sl. s. h.	∞	∞
3982	lq.	$0.949^{0^\circ}_{4}$	....	157-9	20 c.; sl. s. h.	s.	s.
3983	lq.	0.942^{0°	....	142-3	sl. s. h.	20 c. aq.	....
3984	lq.	....	....	163.5-4.5	....	....	....
3985	red pr./pet.	....	174-5	....	i.; s. h. bz.	v. sl. s. h.	0.03 h.
3986	syrup	....	....	....	s.	....	i.
3987	cr.	....	192-3	....	v. s.	....	....
3988	nd./aq.	....	224-5 d.	....	v. s.	i.	....
3989	cr./HCl	....	193	....	....	....	....
3990	wh. pd.	....	235-6	....	s.	i.	i.
3991	cr./al. et.	....	106-7	....	v. s.	2.5^{17°	....
3992	nd./al.	....	117-8	....	v. s.	sl. s.	....
3993	gn. pr./ aq. al.	....	130±	....	v. s.	v. s.	....
3994	gn. pr.	....	....	....	v. s. h.	s.	....
3995	mn.	1.609	130.5	138 ±; d., anhyd.	79^{25°; 393^{98°	70^{30°	8^{25°
3996	cr./chl.	1.5	57-60	202; subl.	16.3^{30°	v. sl. s. CCl_4	....
3997	col. cr.	$1.601^{20^\circ}_{4}$	128-9	150 d.	144^{26°; 411^{79°	v. s.	v. s.
3998	col. cr.	$1.595^{20^\circ}_{4}$	99-100	140 ±, d.	v. s.	v. s.	8.4^{15°
3999	col. rhb.	....	....	....	sl. s. c.	sl. s. ac.	s. a.
4000	col. cr.	....	142 d.	d. 170 ±	v. s.	v. s.	v. s.
4001	pr./aq.	....	156-8 d.	....	s.	....	....
4002	col. tri.	1.631^{15°	130-5 d.	....	138^{16°	42^{25°	8^{15° abs.
4003	col. nd.	....	$-4H_2O$,180	$-3H_2O$, 100	0.4^{0°	0.7^{100° aq.	....
4004	tet. or mn.	....	170	....	8.3^{8°	i. abs.	i.

Lycine 846-7
Lycopin 3985
Lycorin, cf. alkd.
Lysidine 4256
Maclayin, cf. glcde.
Macleyin, cf. glcde.
Macleyine, cf. alkd.
Maclurin 5070
Magisal 118
Magnespirin 118
Malachite green leuco base 3964
Malachite green-G (base) 5762
Malakin 5588
Malamide 4001
Malonamide 4004
Malonanilide 4005
Malonic amide nitrile 1581
Malonic ester 2184

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4005	**Malonic** anilide	malonanilide	$CH_2(CONH\cdot C_6H_5)_2$	XII-293	254.28
4006	nitrile	methylene dicyanide	$CH_2(CN)_2$	II-589	66.06
4007	**Maltose**	malt sugar	$C_{12}H_{22}O_{11}\cdot H_2O$	....	360.31
4008	**Mandelic** acid (*dl*)	....	$C_6H_5\cdot CHOH\cdot CO_2H$	X-197	152.14
4009	sodium salt	sodium mandelate	$C_6H_5\cdot CHOH\cdot CO_2Na$	....	174.13
4010	nitrile (*dl*)	....	$C_6H_5\cdot CHOH\cdot CN$	X-206	133.14
4011	**Mannitol hexanitrate**	....	$C_6H_8(O\cdot NO_2)_6$	I-543	452.17
4012	**Mannoheptose** (*d*)	....	$C_7H_{14}O_7$	I-935	210.18
4013	**Mapharsen**	3-NH₂-4-OH-phenyl-arsinoxide HCl	$O{:}As\cdot C_6H_3(OH)NH_2\cdot HCl\cdot \frac{1}{2}C_2H_5OH$	*XVI-447	258.53
4014	**Margaric** acid	heptadecanoic acid	$CH_3\cdot(CH_2)_{15}\cdot CO_2H$	II-376	270.44
4015	aldehyde	heptadecanal	$CH_3\cdot(CH_2)_{15}\cdot CHO$	I-717	254.44
4016	**Meconic** acid	....	$C_7H_4O_7\cdot 3H_2O$	XVIII-503	254.15
4017	lactone	6,7-diMeO-phthalide; meconine; opianyl	$CO\cdot O\cdot CH_2\cdot C_6H_2:$ |__________| $(OCH_3)_2$	XVIII-89	194.18
4018	**Melam**	....	$C_6H_9N_{11}$	III-169	235.22
4019	**Melamine**	cyanuramide	$C_3N_3(NH_2)_3$	XXVI-245	126.13
4020	hydrochloride	....	$C_3H_6N_6\cdot HCl\cdot \frac{1}{2}H_2O$	XXVI-246	171.60
4021	**Melene**	....	$C_{30}H_{60}$ (or $C_{30}H_{62}$)?	I-227	420.78 422.80
4022	**Melissic acid**	....	$C_{30}H_{61}\cdot CO_2H$	II-396	466.81
4023	**Menthene** (*d*)	....	$C_{10}H_{18}$	V-87	138.24
4024	**Menthol** (*α*)(*l*)	hexahydrothymol	$C_{10}H_{19}OH$	VI-28	156.26
4025	**Menthol** (*d*)(*neo*)	*p*-menthanol-3	$C_{10}H_{19}OH$	VI-28	156.26
4026	**Menthone** (*l*)	....	$C_{10}H_{18}O$	VII-38	154.24
4027	**Menthyl** acetate (*l*)	....	$CH_3\cdot CO_2\cdot C_{10}H_{19}$	VI-32	198.30
4028	acetate (*d*)(*neo*)	....	$CH_3\cdot CO_2\cdot C_{10}H_{19}$	....	198.30
4029	amine (*l*)	aminomenthane	$C_{10}H_{19}\cdot NH_2$	XII-26	155.28
4030	benzoate (*α*)	....	$C_6H_5\cdot CO_2\cdot C_{10}H_{19}$	IX-115	260.36
4031	salicylate	salimenthol	$HO\cdot C_6H_4\cdot CO_2\cdot C_{10}H_{19}$	X-76	276.36
4032	*iso*-valerate (*l*)	validol	$C_4H_9\cdot CO_2\cdot C_{10}H_{19}$	VI-33	240.37
4033	**Mercaptobenzothiazole** (2)	....	$C_6H_4\cdot N{:}C(SH)\cdot S$ |______________|	XXVII-185	167.24
4034	**Mercuri**-hydroxyphenyl chloride (*o*)	*o*-Cl-mercuriphenol	$HO\cdot C_6H_4\cdot HgCl$	XVI-959	329.17
4035	hydroxyphenyl chloride (*p*)	*p*-Cl-mercuriphenol	$HO\cdot C_6H_4\cdot HgCl$	XVI-961	329.17
4036	phenyl acetate	Ph-mercuric acetate	$C_6H_5\cdot Hg\cdot O_2CCH_3$	XVI-954	336.75
4037	phenyl chloride	Ph-mercuric chloride	$C_6H_5\cdot HgCl$	XVI-953	313.17
4038	phenyl nitrate	Ph-mercuric nitrate	$C_6H_5\cdot Hg\cdot O\cdot NO_2$	XVI-953	339.72
4039	tolyl chloride (*p*)	....	$CH_3\cdot C_6H_4\cdot HgCl$	XVI-956	327.19
4040	**Mercuric fulminate**	....	$Hg(ONC)_2\cdot \frac{1}{2}H_2O$	....	293.65
4041	**Mercurochrome**	diNa-diBr-hydroxymercury-fluorescein	$C_{20}H_7O_5Br_2Na_2HgOH\cdot 3H_2O$	....	804.75
4042	**Mercury** dibutyl	di-*n*-butyl mercury	$(C_4H_9)_2Hg$	**IV-1049	314.83
4043	diethyl	diethyl mercury	$(C_2H_5)_2Hg$	IV-679	258.73
4044	dimethyl	dimethyl mercury	$(CH_3)_2Hg$	IV-678	230.68

Malonyl thiourea 5887
Malonyl urea 621
Malt sugar 4007
Mandelonitrile glucoside, cf. glcde.
Mannite 3609
Mannitol 3609
Mannitol hexaacetate 3610
Mannoheptitol 5090
Mannose 3619
Marsh gas 4061
Martius yellow 2642
Matecite 4286
Matezite 4286
Mecholin 100
Mecholyl 100
Mecholyl bromide 99
Mecholyl iodide 101
Meconine 4017
Medinal 2125
Melaniline 2723
Meletin 5807

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4005	nd./al.	....	225-6	....	i.; s. ac.	v. s. h.	i.
4006	col. cr.	$1.049_{4}^{34^\circ}$	30-2	223-4	13	40	20
4007	col. nd.	1.540^{17°	d.	....	v. s.	v. sl. s. c.	i.
4008	rhb./aq.	$1.300_{4}^{20^\circ}$	118.1	d.	16^{20°	s.	s.
4009	wh. cr. pd.	....	....	....	99	2	....
4010	oil	1.124	−10	d. 170	i.	s.	s.; s. chl.
4011	nd.	1.604^{0°	112-3	expl.	i.	2.9^{13°	4^{9°
4012	nd.	....	134-5	....	v. s.	sl. s. abs.	....
4013	wh. pd.	....	....	....	v. s.; s. alk.	v. s.; v. sl. s. act.	v. sl. s.
4014	col. pl.	0.853^{60°	60-1	227^{100mm}	i.	32^{28° abs.	v. s.
4015	cr.	....	36	$203\text{-}4^{26mm}$	sl. s. c. al.	v. s. h.	v. s.
4016	rhb.	....	$-3H_2O$, 100	d.	d. h.	s.; d. h. a.	sl. s.
4017	col. nd./aq.	....	102-2.5	subl.	0.14^{15°; 4.5^{100°	s.; s. chl.	s.; s. bz.
4018	pd.	....	d.	....	i.	sl. s. a.	s. h. KOH
4019	mn.	1.573^{250°	250 ±	subl.	s. h.	sl. s. h.	i.
4020	nd.	....	....	....	....	i.	....
4021	cr.	0.913^{25°	62-3	$218^{0.5mm}$	i.; v. sl. s. bz.	3.6 h., abs.	v. sl. s.
4022	nd./al.	....	90-1	....	i.	v. s. h.	v. sl. s.
4023	lq.	$0.814_{4}^{16^\circ}$	....	168-9	....	....	....
4024	col. cr.	$0.890_{15}^{15^\circ}$	42-3*	212	0.04 c.; s. pet.	v. s.; v. s. chl.	v. s.; v. s. ac.
4025	col. lq.	0.9 ±	−22	98^{16mm}	....	....	....
4026	oil	$0.896_{20}^{20^\circ}$	−6.6	207	sl. s.	∞	∞
4027	col. lq.	$0.919_{4}^{20^\circ}$	....	227	sl. s.	∞	∞
4028	col. cr.	....	37-8	....	i.	s.	v. s.
4029	oil	$0.861_{4}^{20^\circ}$	....	209 ±	s. c.	v. s.	....
4030	rhb./al.	$**1.002_{4}^{20^\circ}$	54-5	301^{748mm}	....	....	....
4031	col. oil	$1.045_{25}^{25^\circ}$	....	$203\text{-}5^{20mm}$	i.	s.	s.
4032	col. lq.	$0.907_{4}^{15^\circ}$	....	129^{9mm}	i.	s.	s.; s. chl.
4033	col. nd./ aq. al.	$1.42_{4}^{20^\circ}$	179	d.	i.; s. alk.; s. ac.	s.; s. alk. carb.	sl. s.
4034	col. cr./ aq. al.	....	152.5	....	sl. s.	s.; v. sl. s. chl.	s. h. bz.
4035	lf./act.	....	225-6	....	....	sl. s. h.	....
4036	col. pr./bz.	....	149	....	s. h.	s.; s. ac.	s. bz.
4037	col. lf./bz.	....	251	subl.	i.; s. pyr.	sl. s. h.	s.; s. bz.
4038	pl./al.	....	188-9 d.	....	v. sl. s. h.	s. h.	s. bz.
4039	col. lf./bz.	....	232-3	....	i.	v. sl. s. h.	i.
4040	cr./aq.	4.42(anh.)	expl.	....	0.07^{12°; 0.17^{49°	s.; d. h. aq. KOH	s. NH_4OH
4041	gn. scales	....	....	....	s.	0.02	i.; i. chl.
4042	col. lq.	$1.778_{4}^{20^\circ}$	....	$120\text{-}3^{23mm}$	i.	sl. s.	v. s.
4043	col. lq.	$2.423_{4}^{23^\circ}$	....	159	i.	sl. s.	v. s.
4044	col. lq.	$2.954_{4}^{22^\circ}$	....	95-6	v. sl. s.	v. s.	v. s.

* M. p. β 35.5°; γ 33.5°; δ 31.5°.

** Supercooled liquid.

Melilotic acid 3711
Melin, cf. glcde.
Melissyl alcohol 4449
Melitose 5549
Mellitic acid 667
Mellophanic acid 681
Menthadiene 3973, 5092-3, 5704-5, 5709
Menthane 3579
Menthanol 4025
Menthone 1258
Mercapto-, cf. also thio- and sulfo-.
Mercapto-ethanol 5904
Mercapto-succinic acid 5911

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4045	**Mercury** dinaphthyl (*α*)	. . . .	$(C_{10}H_7)_2Hg$	XVI-949	454.92
4046	dipropyl	dipropyl mercury	$(C_2H_5\cdot CH_2)_2Hg$	IV-679	286.78
4047	diphenyl	diphenyl mercury	$(C_6H_5)_2Hg$	XVI-946	354.81
4048	ditolyl (*o*)	ditolyl mercury	$(CH_3\cdot C_6H_4)_2Hg$	XVI-947	382.86
4049	ditolyl (*m*)	ditolyl mercury	$(CH_3\cdot C_6H_4)_2Hg$	XVI-947	382.86
4050	ditolyl (*p*)	ditolyl mercury	$(CH_3\cdot C_6H_4)_2Hg$	XVI-947	382.86
4051	mercaptide	. . . .	$(C_2H_5\cdot S)_2Hg$	I-342	322.85
4052	**Merthiolate**	Na ethylmercurithiosalicylate	$C_2H_5\cdot Hg\cdot S\cdot C_6H_4\cdot CO_2Na$	. . . .	404.83
4053	**Mesityl oxide**	. . . .	$(CH_3)_2C:CH\cdot CO\cdot CH_3$	I-736	98.14
4054	**Mesorcin** (1,3,5;2,4)	. . . .	$(CH_3)_3C_6H(OH)_2$	VI-939	152.19
4055	**Mesoxalic acid**	dihydroxy malonic	$(HO)_2C(CO_2H)_2$	III-766	136.06
4056	**Metanil yellow**	Na *m*-sulfonate-azo-diphenylamine	$C_6H_5\cdot NH\cdot C_6H_4\cdot N:N\cdot C_6H_4\cdot SO_3Na$	XVI-330	375.37
4057	**Metaphen**	4-NO_2-5-OH-mercuri-*o*-cresol	$Hg\cdot C_7H_5O_3N$	. . . .	351.73
4058	**Methacrolein**	*α*-Me-acrolein	$CH_2:C(CH_3)\cdot CHO$	I-731	70.09
4059	**Methallyl** alcohol	isopropenyl carbinol	$CH_2:C(CH_3)\cdot CH_2OH$	I-443	72.10
4060	chloride (*β*)	*γ*-Cl-isobutylene	$CH_2:C(CH_3)\cdot CH_2Cl$	I-209	90.55
4061	**Methane**	marsh gas	CH_4	I-56	16.04
4062	**Methionine** (*l*–)	*α*-NH_2-*γ*-methyl-thiolbutyric acid	$CH_3\cdot S\cdot (CH_2)_2\cdot CHNH_2\cdot CO_2H$	**IV-938	149.21
4063	**Methoxy**-acetic acid	glycolic methyl ether	$CH_3O\cdot CH_2\cdot CO_2H$	III-232	90.08
4064	acetophenetidine	kryofine	$C_2H_5O\cdot C_6H_4\cdot NH\cdot CO\cdot CH_2\cdot OCH_3$	XIII-489	209.24
4065	acetophenone (*p*)	*p*-acetyl-anisole	$CH_3O\cdot C_6H_4\cdot COCH_3$	VIII-87	150.17
4066	*tert*-amylbenzene	(*p*)	$CH_3O\cdot C_6H_4\cdot C_5H_{11}$	VI-549	178.26
4067	benzoic acid (*o*)	salicylic methyl ether	$CH_3O\cdot C_6H_4\cdot CO_2H$	X-64	152.14
4068	benzoic acid (*m*)	. . . .	$CH_3O\cdot C_6H_4\cdot CO_2H$	X-137	152.14
4069	benzoic acid (*p*)	*p*-anisic acid	$CH_3O\cdot C_6H_4\cdot CO_2H$	X-154	152.14
4070	benzophenone (*p*)	*p*-benzoyl anisole	$CH_3O\cdot C_6H_4COC_6H_5$	VIII-159	212.24
4071	benzoyl chloride (*p*)	anisoyl chloride	$CH_3O\cdot C_6H_4\cdot COCl$	X-163	170.59
4072	benzyl alcohol (*o*)	saligenin-2-Me-ether	$CH_3O\cdot C_6H_4\cdot CH_2OH$	VI-893	138.16
4073	diphenyl (*o*)	Ph-phenol-Me-ether	$CH_3O\cdot C_6H_4\cdot C_6H_5$	VI-672	184.23
4074	diphenyl (*p*)	Me Ph-phenol ether	$CH_3O\cdot C_6H_4\cdot C_6H_5$	VI-674	184.23
4075	ethyl chloroformate (*β*)	*β*-methoxyethyl chlorocarbonate	$Cl\cdot CO_2\cdot CH_2\cdot CH_2\cdot OCH_3$	. . . .	138.55
4076	ethyl formate (*β*)	. . . .	$HCO_2\cdot CH_2\cdot CH_2\cdot OCH_3$	*II-19	104.10
4077	methylal	. . . .	$(CH_3O\cdot CH_2)_2O$	I-576	106.12
4078	methyl salicylate	mesotan; salmester	$HO\cdot C_6H_4\cdot CO_2CH_2\cdot OCH_3$	X-83	182.17
4079	phenol (*o*)	guaiacol	$CH_3O\cdot C_6H_4\cdot OH$	VI-768	124.13
4080	phenol (*m*)	resorcinol Me ether	$CH_3O\cdot C_6H_4\cdot OH$	VI-813	124.13
4081	phenol (*p*)	hydroquinone methyl ether	$CH_3O\cdot C_6H_4\cdot OH$	VI-843	124.13
4082	pyridine (*p*)(*γ*)	. . . .	$CH_3O\cdot C_5H_4N$	XXI-49	109.12
4083	quinoline (*p*)	quinanisole	$CH_3O\cdot C_9H_6N$	XXI-85	159.18
4084	**Methyl** abietate	abalyn	$C_{19}H_{29}CO_2\cdot CH_3$	. . . .	316.47
4085	acetamide (*N*)	acet-methylamide	$CH_3\cdot CO\cdot NH\cdot CH_3$	IV-58	73.09
4086	acetanilide (*N*)	exalgin	$CH_3CO\cdot N(CH_3)C_6H_5$	XII-245	149.19
4087	acetate	. . . .	$CH_3CO_2\cdot CH_3$	II-124	74.08
4088	acetoacetate	. . . .	$CH_3CO\cdot CH_2\cdot CO_2\cdot CH_3$	III-632	116.11

Meritol, mixt. of 2312 and 5260.
Mersalyl 5591
Mesaconic acid 4243
Mescaline, cf. alkd.
Mesidine 6251
Mesitol 6266
Mesitylene 6255
Mesitylenic acid 2463
Mesotan 4078
Mesoxalylurea 184-6
Metacresol purple 1551
Metacrolein 147
Metaldehyde 6
Metanilic acid 524
Methacetin 20

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4045	cr./bz.	1.929	243	d.	i.; s. h. chl.	sl. s. h.	s. CS_2
4046	col. lq.	2.124^{16°	....	189-91	i.	sl. s.	v. s.
4047	nd./bz.	2.318^{4°	124-5	>300 d.	i.; s. chl.	sl. s. h.	sl. s.
4048	tri., bz.	....	141(107)	$219^{14\text{mm}}$	....	....	....
4049	nd.	....	102(89)	....	sl. s. chl.	sl. s.	sl. s.
4050	nd./bz.	....	238	....	s. h. bz.	sl. s. h.	s. CS_2
4051	lf., al.	....	76-7	....	....	7 h.	....
4052	pd.	....	....	....	100	14	i.; i. bz.
4053	lq.	$0.858^{20^\circ}_{4}$	−59	$129\text{-}30^{750\text{mm}}$	3^{20°	∞	∞
4054	lf.	....	149-50	274.5-5.5	v. sl. s.	s.	s.
4055	hyg. cr.	....	119-20 sl. d.	....	v. s.	s.	s.
4056	brn. yel. pd.	....	....	....	s.	....	....
4057	yel. pd.	....	....	....	i.; s. h. ac.	i.; s. dil. NaOH	i.; s. NH_4OH
4058	lq.	$0.837^{20^\circ}_{4}$	....	68.4	6.4	....	....
4059	lq.	$0.852^{20^\circ}_{4}$	....	114.5	25	....	....
4060	col. lq.	$0.926^{20^\circ}_{4}$	....	72-3	<0.1	....	....
4061	col. gas	$(A)0.554^{0^\circ}_{760}$	−182.5	−161.5	0.35^{20° cc.	47.1^{20° cc.	104^{10° cc.
4062	hex. pl./ 65% al.	....	283 d.	....	s. c.	s.; i. abs.	i.; i. bz.; i. act.
4063	hyg. lq.	$1.177^{20^\circ}_{4}$	8	203-4	∞	∞	∞
4064	col. nd.	....	98-9	....	0.17 c.; 2 h.	s.	s.
4065	pl./et.	$1.082^{41^\circ}_{4}$	38-9	258	v. sl. s.	v. s.	v. s.
4066	lq.	....	....	$113\text{-}4^{13\text{mm}}$	....	....	....
4067	pl./aq.	1.180	98.5-9.0	200	0.5^{30°	v. s.	v. s.
4068	nd./aq.	....	107-9	$170\text{-}2^{10\text{mm}}$	s. h.	s.	s.
4069	mn./aq.	1.385^{4°	184.2	275-80	0.03^{19°	v. s.	v. s.
4070	pr./et.	....	61-2	$354\text{-}5^{729\text{mm}}$	....	v. s.	v. s.
4071	col. nd.	....	22-3	263 sl. d.	i. d.	s. d.	s. bz.
4072	col. lq.	$1.043^{25^\circ}_{25}$	....	248-50	v. sl. s.	s.	∞
4073	pr./pet.	....	29-30	274	....	....	....
4074	lf./al.	....	90	....	....	s. h.	....
4075	col. lq.	....	....	$54\text{-}60^{13\text{mm}}$	....	....	....
4076	col. lq.	$1.048^{15^\circ}_{4}$	....	131-1.5	....	....	....
4077	col. lq.	$0.959^{20^\circ}_{20}$	....	106-8	....	....	....
4078	col. oil	1.2^{15°	....	$162^{42\text{mm}}$	v. sl. s.	∞; ∞ bz.	∞; ∞ chl.
4079	pr.	$1.140^{15^\circ}_{15}$	28.3	205	1.7^{15°	v. s.	v. s.
4080	lq.	>1	<−17.5	243.3-4.3	sl. s.	∞; s. alk.	∞
4081	lf./aq.	....	53	243	....	....	v. s. bz.
4082	lq.	....	....	$190\text{-}1^{738\text{mm}}$	∞	....	....
4083	lq.	1.154^{20°	26.8	$254^{310\text{mm}}$	....	s.	....
4084	pa. yel. lq.	$1.040^{20^\circ}_{20}$	....	360-5 d.	i.	∞	∞
4085	col. nd.	....	28	206	v. s.	v. s.	v. s.; i. lg.
4086	rhb./al.	$1.004^{105^\circ}_{4}$	102-4	$253^{712\text{mm}}$	1.7 c.	2	14
4087	col. lq.	$0.924^{20^\circ}_{4}$	−98.7	57.1	33^{22°	∞	∞
4088	col. lq.	$1.077^{20^\circ}_{4}$	−80	169-70 sl. d.	38	∞	∞

Methallyl ether 2403
Methanal 3288
Methane sulfonic acid 4382
Methane sulfonic chloride 4383
Methanoic acid 3301
Methanol 4100
Methanthiol 4298
Methenamine 3599
Methenyl-diphenylamine 2721
Methionic acid 4432
Methone 2475
Methoxy-acetaminophenol 18-20
Methoxy-allyl-phenol 2901
Methoxy-aniline 534-6
Methoxy-benzalacetone 528

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4089	**Methyl** acetophenone (*p*)	methyl-*p*-tolyl ketone	$CH_3\cdot C_6H_4\cdot CO\cdot CH_3$	VII-307	134.17
4090	acetylsalicylate	methyl aspirin; methyl rhodin	$CH_3CO_2\cdot C_6H_4\cdot CO_2\cdot CH_3$	X-73	194.18
4091	acetylurea	....	$CH_3\cdot NH\cdot CO\cdot NH\cdot CO\cdot CH_3$	IV-66	116.12
4092	acridine (4)	....	$CH_3\cdot C_{13}H_8N$	XX-470	193.24
4093	acridine (2)	....	$CH_3\cdot C_{13}H_8N$	XX-470	193.24
4094	acridine (9)	....	$CH_3\cdot C_{13}H_8N$	XX-470	193.24
4095	acrylate	....	$CH_2{:}CH\cdot CO_2\cdot CH_3$	II-399	86.09
4096	acrylic acid (*α*)	....	$CH_2{:}C(CH_3)\cdot CO_2H$	II-421	86.09
4097	hydrogen adipate	Me adipate (mono)	$CH_3O_2C(CH_2)_4\cdot CO_2H$	II-652	160.17
4098	adipic acid (*α*)	....	$HO_2C\cdot CH(CH_3)\cdot (CH_2)_3\cdot CO_2H$	II-672	160.17
4099	adipic acid (*β*)(*d*)	....	$HO_2C\cdot (CH_2)_2\cdot CH\cdot (CH_3)\cdot CH_2\cdot CO_2H$	II-673	160.17
4100	alcohol	wood alcohol	$CH_3\cdot OH$	I-273	32.04
4101	alizarin (2;3,4)	3-methyl-alizarin	$CH_3(OH)_2C_6H(CO)_2{:}C_6H_4$	VIII-469	254.23
4102	allylamine	....	$CH_3\cdot NH\cdot C_3H_5$	IV-206	71.12
4103	allyl carbinol	amylene alcohol	$(CH_3)(C_3H_5){:}CHOH$	I-443	86.14
4104	allyl ether	....	$CH_3\cdot O\cdot CH_2\cdot CH{:}CH_2$	I-437	72.10
4105	amine	amino-methane	$CH_3\cdot NH_2$	IV-32	31.06
4106	amine hydrochloride	....	$CH_3NH_2\cdot HCl$	IV-36	67.52
4107	aminoacetate	methyl glycinate	$NH_2\cdot CH_2\cdot CO_2\cdot CH_3$	IV-340	89.09
4108	aminobenzoate (*o*)	methyl anthranilate	$NH_2\cdot C_6H_4\cdot CO_2\cdot CH_3$	XIV-317	151.16
4109	aminobenzoate (*p*)	....	$NH_2\cdot C_6H_4\cdot CO_2\cdot CH_3$	XIV-422	151.16
4110	aminobenzoic acid (*o*)	*N*-methyl anthranilic acid	$CH_3NH\cdot C_6H_4\cdot CO_2H$	XIV-323	151.16
4111	amino ethanol (*β*)	....	$CH_3NH\cdot CH_2\cdot CH_2OH$	IV-276	75.11
4112	3-amino-4-hydroxy benzoate	orthoform new	$NH_2(OH)C_6H_3\cdot CO_2\cdot CH_3$	XIV-593	167.16
4113	amino-*p*-hydroxybenzoic acid (3)	....	$CH_3NH(OH)C_6H_3\cdot CO_2H$	XIV-593	167.16
4114	amino-2-methyl-heptene (6)	octin	$C_8H_{15}\cdot NHCH_3$	....	141.25
4115	amino-phenol (*o*)	....	$CH_3NH\cdot C_6H_4\cdot OH$	XIII-362	123.15
4116	amino-phenol H_2SO_4	(*o*)	$(C_7H_9ON)_2\cdot H_2SO_4$	XIII-362	344.38
4117	amino-phenol H_2SO_4	(*p*); metol; elon	$(C_7H_9ON)_2\cdot H_2SO_4$	XIII-442	344.38
4118	amino-propionic acid (*α*)(*dl*)	....	$CH_3\cdot CH(NHCH_3)\cdot CO_2H$	IV-391	103.12
4119	amylbenzene (*m*)	amyl toluene	$CH_3\cdot C_6H_4\cdot C_5H_{11}$	V-446	162.26
4120	*n*-amyl ether	....	$CH_3\cdot O\cdot C_5H_{11}$	*I-193	102.17
4121	*iso*-amyl ether	....	$CH_3\cdot O\cdot C_5H_{11}$	I-400	102.17
4122	*n*-amyl ketone	heptanone-2	$CH_3(CH_2)_4\cdot CO\cdot CH_3$	I-699	114.18
4123	*iso*-amyl ketone	2-Me-hexanone-5	$CH_3\cdot CO\cdot C_5H_{11}$	I-701	114.18
4124	*iso*-amyl ketoxime	....	$CH_3\cdot C({:}NOH)\cdot C_5H_{11}$	I-701	129.20
4125	aniline†	Me-Ph-amine	$C_6H_5\cdot NH\cdot CH_3$	XII-135	107.15

† See also Nos. 5995-6000.

Methoxy-benzaldehyde 531-2
Methoxy-benzene 537
Methoxy-benzyl alcohol 530
Methoxy-cinchonine, cf. alkd.
Methoxy-cinchoninic acid 5537
Methoxy-coniferin, cf. glcde.
Methoxy-hydroxycinnamic acid 3236-7
Methoxy-styrene 6431-3
Methoxy-styryl ketone 528
Methoxy-tetrahydroquinoline 5874
Methoxylamine 4280
Methyl, cf. also dimethyl.
Methyl-acetanilide 26-8
Methyl-acetoacetic ester 3085
Methyl-acetopyrandione 1656

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4089	nd.	$0.989^{22\circ}$	28	228^{759mm}	i.	v. s.	v. s.
4090	col. cr./al.	....	50-1	$134\text{-}6^{9mm}$	i.	s.; s. gly.	s.; s. chl.
4091	mn./aq.	....	180	....	v. s. h.	s. h.	v. sl. s. h.
4092	nd./al.	....	88	....	v. sl. s. h.	s.	....
4093	yel. nd./ aq. al.	....	134	....	s. bz.	s.	s.
4094	pl./lg.	....	114-7	360^{740mm}	....	....	....
4095	col. lq.	$0.974^{0\circ}$	....	80.3*	....	s.	s.
4096	pr.	$1.015^{20\circ}_{4}$	15-16	161-3	s. h.	∞	∞
4097	lq.	....	8-9	162^{10mm}	....	....	....
4098	col. cr.	....	64	$216\text{-}20^{28mm}$	v. s.	v. s.	v. s.
4099	col. cr.	....	93-4.5	230^{30mm}	v. s.	v. s.	v. s.
4100	col. lq.	**$0.792^{20\circ}_{4}$	−97.8	64.7	∞	∞	∞
4101	yel. nd.	....	250-2	....	s. alk.	s.	s.
4102	lq.	....	....	64-6	s.	....	....
4103	lq.	$0.834^{20\circ}_{0}$	....	$115\text{-}6^{750mm}$	12.5	∞	∞
4104	lq.	$0.77^{11\circ}$	....	$42\text{-}3^{757mm}$	v. sl. s.	∞	∞
4105	col. gas	$0.699^{-11\circ}$	−92.5	-6.7^{758mm}	$959^{25\circ}$ cc. , cc.	s.	....
4106	pl./al.	1.23	226-8	$225\text{-}30^{15mm}$	v. s.	23 h. abs.	i.; i. chl.
4107	lq.	....	....	130 d.	....	....	....
4108	col. lq.	$1.168^{18.6\circ}_{4}$	24(8.2)	135.5^{15mm}	sl. s.	s.	s.
4109	lf./al.	....	112	....	....	....	....
4110	lf./al.	....	179-82	subl. d.	0.2 c.; 0.4 h.	s.	s.
4111	col. oil	$0.937^{20\circ}$	....	159^{747mm}	∞	∞	∞
4112	nd./bz. cr./chl.	....	142§ 110-1	....	v. sl. s.; i. pet.	18; s. act.	2; s. alk.; s. bz.
4113	cr.	....	142(110)	....	s. h.	s.	s.
4114	col. oil	0.795	....	176-8	i.	s.	s.; s. a.
4115	pl./bz. pet.	....	86-7	....	i.	s.	s. bz.
4116	col. cr.	....	....	....	s.	i.	i.
4117	col. nd./aq.	....	250-60 d.	....	$4^{25\circ}$	sl. s.	i.
4118	rhb./al.	....	307-17 d.	subl. 292 sl. d.	s.	10 h.; i. c. abs.	....
4119	lq.	$0.868^{22\circ}$	....	207-8	....	....	....
4120	col. lq.	0.75	....	99-100	....	....	....
4121	lq.	$0.687^{21\circ}_{4}$	....	91^{765mm}	....	....	....
4122	col. lq.	$0.817^{20\circ}_{20}$	−35.5	151.5	$0.4^{20\circ}$	s.	s.
4123	col. lq.	$0.813^{20\circ}$	....	144	v. sl. s.	∞	∞
4124	oil	$0.888^{20\circ}_{4}$	....	$195\text{-}6^{761mm}$	....	....	....
4125	lq.	$0.989^{20\circ}_{4}$	−57	195.5	$0.01^{25\circ}$	s.	∞

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* Polymerizes readily.

** See also special table of specific gravities.

§ HCl salt, m. p. 225°; s. 10/100 aq.

Methyl acet-toluidide 102-4
Methyl-acetyl carbinol 43
Methyl-acetylene 225
Methyl-acrolein 4058
Methyl adipate 2428, 4097
Methyl-allene 1018
Methyl-amyl alcohol 3630-7
Methyl-amyl carbinol (*n*) 3542
Methyl-amyl carbinol (*iso*) 3538
Methyl-aniline violet 5076
Methyl anisate 4301

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4126	**Methyl** *p*-anisyl ketone	*p*-acetonyl-anisole	$CH_3O\cdot C_6H_4\cdot CH_2\cdot CO\cdot CH_3$	VIII-106	164.20
4127	anthracene (*α*)	....	$CH_3\cdot C_{14}H_9$	V-674	192.25
4128	anthracene (*β*)	....	$CH_3\cdot C_{14}H_9$	V-674	192.25
4129	anthraquinone (2)	....	$CH_3\cdot C_6H_3(CO)_2C_6H_4$	VII-809	222.23
4130	arsenic acid	methyl arsonic acid	$CH_3\cdot AsO(OH)_2$	IV-613	139.96
4131	arsenious oxide	....	$CH_3\cdot As{:}O$	IV-610	105.94
4132	arsine	....	$CH_3\cdot AsH_2$	IV-599	91.96
4133	auramine	....	$[(CH_3)_2N\cdot C_6H_4]_2C{:}N\cdot CH_3$	XIV-93	281.39
4134	azide	....	$CH_3\cdot N(N)_2$	I-80	57.06
4135	benzamide (*N*)	....	$C_6H_5\cdot CO\cdot NH\cdot CH_3$	IX-201	135.16
4136	benzimidazole (2)	....	$C_6H_4\cdot N{:}C(CH_3)NH$	XXIII-145	132.16
4137	benzimidazole (5)	*m*-toliminazole	$CH_3\cdot C_6H_3\cdot N{:}CHNH$	XXIII-151	132.16
4138	benzoate	oil of niobe	$C_6H_5\cdot CO_2\cdot CH_3$	IX-109	136.14
4139	benzoylacetate	....	$C_6H_5CO\cdot CH_2\cdot CO_2CH_3$	X-673	178.18
4140	*o*-benzoylbenzoate	....	$C_6H_5CO\cdot C_6H_4\cdot CO_2\cdot CH_3$	X-748	240.25
4141	benzoylene urea (1)	....	$C_6H_4N(CH_3)CONHCO$	XXIV-375	176.17
4142	benzoylene urea (3)	....	$C_6H_4NHCON(CH_3)CO$	XXIV-375	176.17
4143	benzoylsalicylate	benzosalin	$C_6H_5CO_2\cdot C_6H_4\cdot CO_2\cdot CH_3$	X-73	256.25
4144	benzylaniline (*N*)	....	$C_6H_5\cdot CH_2\cdot N(CH_3)\cdot C_6H_5$	XII-1024	197.27
4145	benzyl ether	....	$CH_3\cdot O\cdot CH_2\cdot C_6H_5$	VI-431	122.16
4146	benzyl ketone	phenyl acetone	$CH_3\cdot CO\cdot CH_2\cdot C_6H_5$	VII-303	134.17
4147	bromide	bromomethane	$CH_3\cdot Br$	I-67	94.95
4148	bromoacetate	....	$Br\cdot CH_2\cdot CO_2\cdot CH_3$	II-213	152.99
4149	*o*-bromobenzoate	....	$Br\cdot C_6H_4\cdot CO_2\cdot CH_3$	IX-348	215.05
4150	*m*-bromobenzoate	....	$Br\cdot C_6H_4\cdot CO_2\cdot CH_3$	IX-350	215.05
4151	*p*-bromobenzoate	....	$Br\cdot C_6H_4\cdot CO_2\cdot CH_3$	IX-352	215.05
4152	4-bromohydrindene (7)	....	$CH_3(Br)C_6H_2(CH_2)_3$	....	211.10
4153	*α*-bromolaurate	....	$C_{10}H_{21}CHBrCO_2CH_3$	....	293.25
4154	butadiene-1,3 (2)	isoprene	$CH_2{:}CH\cdot C(CH_3){:}CH_2$	I-252	68.11
4155	butadiene-2,3 (2)	dimethyl-allene (*uns*)	$(CH_3)_2C{:}C{:}CH_2$	I-252	68.11
4156	butylamine (*n*)	....	$CH_3\cdot NH\cdot C_4H_9$	IV-157	87.16
4157	*iso*-butylamine	....	$CH_3\cdot NH\cdot C_4H_9$	IV-164	87.16
4158	*n*-butylbenzene (*o*)	butyl-toluene	$CH_3\cdot C_6H_4\cdot C_4H_9$	V-437	148.24
4159	*n*-butylbenzene (*m*)	....	$CH_3\cdot C_6H_4\cdot C_4H_9$	V-437	148.24
4160	*n*-butylbenzene (*p*)	....	$CH_3\cdot C_6H_4\cdot C_4H_9$	V-437	148.24
4161	*n*-butyl ether	....	$CH_3\cdot O\cdot C_4H_9$	I-369	88.15
4162	*iso*-butyl ether	....	$CH_3\cdot O\cdot C_4H_9$	I-376	88.15
4163	*n*-butyl ketone	hexanone-2	$CH_3\cdot CO\cdot C_4H_9$	I-689	100.16
4164	*iso*-butyl ketone	2-Me-pentanone-4	$CH_3\cdot CO\cdot C_4H_9$	I-691	100.16
4165	butyl ketone (*sec*)	3-Me-pentanone-2	$CH_3\cdot CO\cdot C_4H_9$	I-693	100.16
4166	butyl ketone (*tert*)	pinacolin	$CH_3\cdot CO\cdot C(CH_3)_3$	I-694	100.16
4167	*n*-butyl sulfide	....	$CH_3\cdot S\cdot C_4H_9$	....	104.21

Methyl-anisyl ketone 4065
Methyl anthranilate 4108
Methyl-anthranilic acid 4110
Methyl-arsine dichloride 4214
Methyl-arsonic acid 4130
Methyl-aspirin 4090
Methyl-benzaldehyde 5985-7
Methyl-benzene 5960
Methyl-benzoic acid 5982-4
Methyl-benzophenone 5249-51
Methyl-benzoquinone 6001
Methyl-benzothiazole 2909
Methyl-benzoxazol 2908
Methyl-benzoyl-ecgonine, cf. alkd.
Methyl-benzoyl ketoxime 4899

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4126	oil	$1.071^{17°}_{17}$	<-15	267-9	i.	s.	s.
4127	lf./al.	$1.047^{99.4°}$	86	....	s. bz.	....	....
4128	col. lf.	$1.181^{0°}_{4}$	207	....	i.; s. bz.	v. sl. s.	v. sl. s.
4129	col. nd./al.	....	176-7	subl.	s. H_2SO_4	s.	s.; v. s. bz.
4130	mn.	....	161	....	v. s.	s.	....
4131	cr./CS_2	....	95	275±, d.	....	....	....
4132	col. lq.	....	....	2	0.01	∞	∞
4133	yel. cr./al.	....	133	....	v. sl. s.	s.	v. s. ac.
4134	col. lq.	$0.869^{8°}_{15}$	expl. > 500	20-1	....	....	....
4135	pl./al.	....	82	291^{765mm}	s.	sl. s. lg.	i. alk.
4136	nd./aq.	....	175-6	....	s. h.; s. NaOH	sl. s.	sl. s.
4137	cr./aq.	....	114	....	....	....	....
4138	col. lq.	$1.087^{25°}_{25}$	-12.5	198-9	$0.016^{30°}$	∞	∞
4139	lt. yel. lq.	$1.173^{0°}_{4}$	....	152^{15mm}	i.	∞	∞
4140	mn. pr.	$1.190^{19.4°}_{4}$	52	350-2	....	....	....
4141	col. nd.	....	264-5	....	s. h.	sl. s.	s. aq. NaOH
4142	col. nd.	....	242	....	i.	s.	....
4143	pr./al.	....	84-5	$270\text{-}80^{120mm}$	i. c.	3; s. bz.	s.; s. chl.
4144	lq.	....	9.2	305-6	i.	s.	s.
4145	lq.	$0.971^{15°}_{15}$	....	174	i.	s.	s.
4146	cr.	$1.003^{20°}$	27	210-2	i.	s.	s.
4147	col. gas	$1.732^{0°}_{0}$	-93	4.5^{758mm}	v. sl. s.	s.; s. CS_2	s.; s. chl.
4148	lq.	....	....	$51\text{-}2^{15mm}$	....	....	....
4149	lq.	....	....	244-6	....	....	....
4150	pl.	....	31-2	122.5^{15mm}	....	....	....
4151	rhb./aq. al.	1.689	79-80	....	....	s.	s.
4152	lt. yel. lq.	....	....	$120\text{-}2^{10mm}$	i.	sl. s.	s.
4153	col. lq.	....	....	$145\text{-}8^{8mm}$	....	....	....
4154	col. lq.	$0.681^{20°}_{4}$	-146.0	34.1	i.	∞	∞
4155	lq.	$0.680^{20°}$	-120	40	....	....	....
4156	lq.	$0.736^{18°}_{4}$	-75	91-2	....	....	....
4157	lq.	$0.722^{18°}$	....	76-8	....	....	....
4158	oil	$0.870^{18°}_{4}$	....	200-1	i.	sl. s.	s.
4159	oil	$0.861^{20°}_{4}$	....	197.5	i.	sl. s.	s.
4160	oil	$0.864^{20°}_{4}$	....	197-8	i.	sl. s.	s.
4161	lq.	$0.744^{20°}_{4}$	-115.5	71	i.	∞	∞
4162	lq.	$0.731^{20°}_{4}$	....	59^{741mm}	i.	∞	∞
4163	col. lq.	$0.830^{0°}$	-56.9	127.5^{755mm}	v. sl. s.	∞	∞
4164	col. lq.	$0.801^{20°}_{4}$	-84.7	117-9	$2^{20°}$	∞	∞; ∞ bz.
4165	col. lq.	$0.815^{18°}_{4}$	....	117.8	....	....	....
4166	col. lq.	$0.800^{16°}$	-52.5	106.2	$2.5^{15°}$	s.; v. s. act.	s.
4167	col. lq.	....	....	122-4	....	....	....

Methyl blue 6345
Methyl borate 6262
Methyl-bromoacetophenone 4333
Methyl butylacetate 399-400
Methyl-butyl carbinol (*n*) 3625
Methyl-butyl carbinol (*iso*) 3633
Methyl-butyl carbinol (*sec*) 3636
Methyl-butyl carbinol (*tert*) 3627
Methyl-butyl-phenol 1079

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Methyl				
4168	butyne-3 (2)	*iso*-propyl acetylene	$(CH_3)_2CH\cdot C\vdots CH$	I-251	68.11
4169	butyrate (*n*)	....	$C_2H_5\cdot CH_2\cdot CO_2\cdot CH_3$	II-270	102.13
4170	*iso*-butyrate	....	$(CH_3)_2CH\cdot CO_2\cdot CH_3$	II-290	102.13
4171	butyric acid†(α)(*dl*)	Me-Et-acetic acid	$C_2H_5\cdot CH(CH_3)CO_2H$	II-304	102.13
4172	caprate	....	$C_9H_{19}\cdot CO_2\cdot CH_3$	II-356	186.29
4173	caproate (*n*)	....	$CH_3(CH_2)_4CO_2\cdot CH_3$	II-323	130.18
4174	caprylate	....	$CH_3(CH_2)_6CO_2\cdot CH_3$	II-348	158.23
4175	carbamate	"methyl urethane"	$NH_2\cdot CO_2\cdot CH_3$	III-21	75.07
4176	carbanilide	....	$C_6H_5\cdot N(CH_3)\cdot CO\cdot$ $NH\cdot C_6H_5$	XII-418	226.27
4177	carbitol	diethylene-glycol (mono)methylether	$CH_3O\cdot CH_2\cdot CH_2\cdot O\cdot$ $CH_2\cdot CH_2\cdot OH$	....	120.15
4178	carbitol acetate	....	$CH_3CO_2\cdot C_5H_{11}O_2$	....	162.18
4179	carbostyril (γ)	lepidone	$CH_3\cdot C_9H_6ON$	XXI-107	159.18
4180	carbostyril (*N*)	*N*-Me-α-quinolone	$C_6H_4CH{:}CH\cdot CO\cdot N\cdot$ CH_3	XXI-304	159.18
4181	carvacryl ketone	2-aceto-*p*-cymene	$CH_3\cdot CO\cdot C_{10}H_{13}$	VII-336	176.25
4182	cellosolve acetate	....	$CH_3CO_2\cdot CH_2\cdot CH_2\cdot$ OCH_3	II-141	118.13
4183	chloride	chloromethane	$CH_3\cdot Cl$	I-59	50.49
4184	chloroacetate	....	$ClCH_2\cdot CO_2\cdot CH_3$	II-197	108.53
4185	*o*-chlorobenzoate	....	$Cl\cdot C_6H_4\cdot CO_2\cdot CH_3$	IX-336	170.59
4186	β-chloroethyl ether	....	$CH_3\cdot O\cdot CH_2\cdot CH_2Cl$	I-337	94.54
4187	chloroformate	Me-chlorocarbonate	$Cl\cdot CO_2\cdot CH_3$	III-9	94.50
4188	4-chloro-hydrindene (7)	....	$CH_3(Cl)C_6H_2(CH_2)_3$	....	166.65
4189	4-chlorophenyl-4-toluene sulfonate	(3,4′-diMe;4-Cl)	$CH_3\cdot C_6H_4\cdot SO_3\cdot$ $C_6H_3(Cl)\cdot CH_3$	....	296.76
4190	cholanthrene	....	$C_{20}H_{13}\cdot CH_3$	....	268.34
4191	cinnamate	....	$C_6H_5\cdot C_2H_2\cdot CO_2\cdot CH_3$	IX-581	162.18
4192	coumarin (β)	....	$C_6H_4\cdot C(CH_3){:}CH\cdot CO_2$	XVII-336	160.16
4193	crotonate (α)	....	$C_3H_5\cdot CO_2\cdot CH_3$	II-410	100.11
4194	*iso*-cyanate	methyl-carbonimide	$CH_3\cdot N{:}CO$	IV-77	57.05
4195	*iso*-cyanide	methyl-carbylamine	$CH_3\cdot NC$	IV-56	41.05
4196	cyanoacetate	....	$CH_3O\cdot CO\cdot CH_2\cdot CN$	II-584	99.09
4197	*iso*-cyanurate	....	$(CH_3)_3(CON)_3$	XXVI-249	171.16
4198	cyclobutane	Me-tetramethylene	$CH_3\cdot C_4H_7$	V-20	70.13
4199	cyclohexane	toluene hexahydride	$CH_3(CHC_5H_{10})$	V-29	98.18
4200	cyclohexanol (*o*)	hexahydro-*o*-cresol (*cis*)	$CH_3\cdot C_6H_{10}\cdot OH$	VI-11	114.18
4201	cyclohexanol (*o*)	(*trans*)	$CH_3\cdot C_6H_{10}\cdot OH$	....	114.18
4202	cyclohexanol (*p*)	4-methylhexalin (*cis*)	$CH_3\cdot C_6H_{10}\cdot OH$	VI-14	114.18
4203	cyclohexanol (*p*)	(*trans*)	$CH_3\cdot C_6H_{10}\cdot OH$	....	114.18
4204	cyclohexanone (*o*)	....	$CH_3\cdot C_6H_9{:}O$	VII-14	122.17
4205	cyclohexanone (*m*)	(*dl*)	$CH_3\cdot C_6H_9{:}O$	VII-17	122.17
4206	cyclohexanone (*p*)	....	$CH_3\cdot C_6H_9{:}O$	VII-18	122.17
4207	cyclohexene (Δ¹)	toluene tetrahydride	$CH_3\cdot C_6H_9$	V-66	96.17
4208	cyclohexene (Δ³)	....	$CH_2CH{:}CH(CH_2)_2CH\cdot$ CH_3	V-67	96.17

† See also No. 6406.

Methyl carbonate 2468
Methyl-carbonimide 4194
Methyl-carbylamine 4195
Methyl cellosolve 3460
Methyl chlorocarbonate 4187
Methyl-chloroform 6151
Methyl-cinnamyl ketone 626

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4168	col. lq.	0.665^{20°	....	28	i.	∞	∞
4169	col. lq.	$0.898^{20^\circ}_{4}$	<−95	102.3	1.7	∞	∞
4170	col. lq.	$0.891^{20^\circ}_{4}$	−84.7	92.6	v. sl. s.	∞	∞
4171	col. lq.	$0.938^{20^\circ}_{20}$	<−80	174-7	sl. s.	∞	∞
4172	lq.	....	−18	223-4	i.	∞	∞
4173	col. lq.	$0.904^{0^\circ}_{0}$	....	149.5	i.	∞	∞
4174	col. lq.	0.887^{18°	−40	192-4	i.	∞	∞
4175	col. pl.	$1.136^{56^\circ}_{4}$	54.2	177	217^{11°	73^{15°	s.
4176	nd./al.	....	104	203-5	sl. s. h.	sl. s. c.	v. s.; v. s. bz.
4177	col. lq.	$1.035^{20^\circ}_{20}$	....	193.2	∞	....	....
4178	col. lq.	$1.040^{20^\circ}_{20}$	....	209.1	∞	....	....
4179	nd./aq.	....	223.7	270^{17mm}	sl. s. h.; s. a.	s. h.; i. alk.	sl. s.; sl. s. bz.
4180	col. nd./lg.	....	74	324^{728mm} sl. d.	1.4 c.	s.; s. chl.; sl. s. lg.	s. act.; v. s. bz.
4181	lq.	$0.956^{20^\circ}_{4}$	<−10	240-4	....	....	....
4182	col. lq.	$1.007^{20^\circ}_{20}$	solid. −70	144.5	∞	....	....
4183	col. gas	(A)1.785	−97.7	−24	280^{16° cc.	3500^{20°cc.	4000 cc., ac.
4184	col. lq.	$1.236^{20^\circ}_{4}$	−32.7	130^{740mm}	v. sl. s.	∞	∞
4185	col. lq.	....	....	234-5	....	....	....
4186	col. lq.	$1.031^{20^\circ}_{4}$	....	90.5	8 c.	∞	∞
4187	col. lq.	1.236^{15°	....	71-2	d.	∞; ∞ chl.	∞; ∞ bz.
4188	yel. lq.	....	....	$111\text{-}4^{10mm}$	....	....	....
4189	col. cr.	....	94-5	....	i.	sl. s.	v. s.
4190	yel. nd./bz.	....	176.5-7.5	....	....	....	....
4191	cr.	$1.042^{36^\circ}_{0}$	33.4	263	i.	v. s.	v. s.
4192	nd./bz.	....	82	....	....	s.	s. bz.
4193	lq.	0.981^{4°	....	128	i.	∞	∞
4194	col. lq.	$0.967^{16^\circ}_{4}$	....	43-5	....	....	....
4195	col. lq.	$0.734^{18^\circ}_{4}$	−45	59.6	10^{15°	∞	∞
4196	lq.	$1.123^{15^\circ}_{4}$	−22.5	203	i.	∞	∞
4197	mn.	....	175-6	274	sl. s. h.	s.	....
4198	lq.	$0.694^{20^\circ}_{4}$	....	39-42	i.	....	s.
4199	col. lq.	$0.769^{20^\circ}_{4}$	−126.6	100.9	i.	s.	s.
4200	col. lq.	$0.934^{20^\circ}_{4}$	−9.5	165	v. sl. s.	∞	∞
4201	col. lq.	$0.924^{20^\circ}_{4}$	−21	166.5	....	....	....
4202	lq.	$0.913^{21^\circ}_{4}$	....	$173\text{-}4^{750mm}$	v. sl. s.	∞	∞
4203	lq.	$0.912^{21^\circ}_{4}$	....	$173\text{-}4^{745mm}$	....	....	....
4204	lq.	$0.925^{18^\circ}_{4}$	....	162-5	i.	s.	s.
4205	lq.	$0.921^{19^\circ}_{4}$	....	$168\text{-}9^{738mm}$	i.	s.	s.
4206	lq.	$0.913^{20^\circ}_{4}$	....	170^{760mm}	i.	s.	s.
4207	lq.	$0.809^{20^\circ}_{4}$	....	110-1	i.	s.	s.
4208	lq.	$0.800^{20^\circ}_{20}$	....	103	i.	s.	s.

Methyl citraconate 2469
Methyl citrate 6263
Methyl-cresyl ether 4399-4401
Methyl-cresyl sulfide 4402]
Methyl cyanide 49
Methyl-cyclohexadiene 2286-8

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4209	**Methyl** cyclopentane	....	$CH_3(CH\cdot C_4H_8)$	V-27	84.16
4210	cyclopropane	methyl-trimethylene	$CH_3\cdot CH\cdot CH_2\cdot CH_2$	V-18	56.10
4211	diazoaminobenzene (4)	....	$CH_3\cdot C_6H_4\cdot N{:}N\cdot NH\cdot C_6H_5$	XVI-705	211.26
4212	dibromoanthranilate	(3,5)	$Br_2C_6H_2(NH_2)\cdot CO_2CH_3$	*XIV-553	308.98
4213	dibromocinnamate (*α,β*)(*dl*)	Me *β*-Ph-*α*,*β*-diBr-propionate	$C_6H_5\cdot CHBr\cdot CHBr\cdot CO_2CH_3$	IX-518	322.01
4214	dichloroarsine	....	$CH_3\cdot AsCl_2$	IV-601	160.86
4215	diethylamine	....	$CH_3\cdot N(C_2H_5)_2$	IV-99	87.16
4216	diethylaminobenzene (*o*)	*o*-diethyltoluidine	$CH_3\cdot C_6H_4\cdot N(C_2H_5)_2$	XII-786	163.25
4217	diethylaminobenzene (*m*)	*m*-diethyltoluidine	$CH_3\cdot C_6H_4\cdot N(C_2H_5)_2$	XII-857	163.25
4218	diethylaminobenzene (*p*)	*p*-diethyltoluidine	$CH_3\cdot C_6H_4\cdot N(C_2H_5)_2$	XII-904	163.25
4219	diphenylamine (*N*)	....	$CH_3\cdot N(C_6H_5)_2$	XII-180	183.24
4220	diphenylamine (*p*)	Ph-*p*-tolylamine	$CH_3\cdot C_6H_4\cdot NH\cdot C_6H_5$	XII-905	183.24
4221	diphenyl carbinol	....	$(C_6H_5)_2C(OH)\cdot CH_3$	VI-685	198.25
4222	disulfide	dimethyl-disulfide	$CH_3\cdot S\cdot S\cdot CH_3$	I-291	94.19
4223	epichlorohydrin(*β*)	....	$O\cdot CH_2\cdot C(CH_3)\cdot CH_2Cl$	....	106.55
4224	ethyl-acetaldehyde	2-methyl-butanal-1	$C_2H_5\cdot CH(CH_3)\cdot CHO$	I-682	86.13
4225	*β*-ethylacrolein(*α*)	2-Me-pentene-2-al-1	$C_2H_5\cdot CH{:}C(CH_3)CHO$	I-735	98.14
4226	ethylamine	....	$CH_3\cdot NH\cdot C_2H_5$	IV-94	59.11
4227	ethylamine HCl	....	$C_2H_5(CH_3)NH\cdot HCl$	IV-94	95.58
4228	ethylaniline	....	$C_6H_5\cdot N(CH_3)C_2H_5$	XII-162	135.20
4229	ethyl carbonate	....	$CH_3O\cdot CO\cdot OC_2H_5$	III-4	104.10
4230	ethyl ether	....	$CH_3\cdot O\cdot C_2H_5$	I-314	60.09
4231	ethyl ethyl-phenyl-malonate	....	$CH_3O_2C\cdot C(C_6H_5){:}(C_2H_5)CO_2C_2H_5$	....	250.28
4232	ethyl ketone	butanone	$CH_3\cdot CO\cdot C_2H_5$	I-666	72.10
4233	ethyl ketoxime	butanoxime	$CH_3\cdot C({:}NOH)\cdot C_2H_5$	I-668	87.12
4234	ethyl ketone semicarbazone	....	$C_3H_8{:}N\cdot NHCONH_2$	III-102	129.16
4235	ethyl malonic acid	....	$C_2H_5(CH_3)C{:}(CO_2H)_2$	II-664	146.14
4236	ethyl oxalate	....	$CH_3O\cdot (CO)_2\cdot OC_2H_5$	II-535	132.11
4237	ethyl succinate	....	$C_7H_{12}O_4$	II-609	160.17
4238	ethyl sulfide	....	$CH_3\cdot S\cdot C_2H_5$	I-343	76.15
4239	ethyl sulfone	....	$CH_3\cdot SO_2\cdot C_2H_5$	I-343	108.15
4240	fluoride	fluoromethane	$CH_3\cdot F$	I-59	34.03
4241	formanilide	....	$C_6H_5(CH_3)N\cdot CHO$	XII-234	135.16
4242	formate	....	$HCO_2\cdot CH_3$	II-18	60.05
4243	fumaric acid (*trans*)	mesaconic acid	$CH_3\cdot C(CO_2H){:}CH\cdot CO_2H$	II-763	130.10
4244	furfural (2,5)	....	$CH_3\cdot C_4H_2O\cdot CHO$	XVII-289	110.11
4245	furfurane (2)	sylvane	$CH_3\cdot C_4H_3O$	XVII-36	82.10
4246	furoate	....	$C_4H_3O\cdot CO_2CH_3$	XVIII-274	126.11
4247	furoylacetate (*α*)	....	$C_4H_3O\cdot CO\cdot CH_2\cdot CO_2CH_3$	....	168.14
4248	furylacrylate (*β*)	....	$C_4H_3O\cdot CH{:}CH\cdot CO_2CH_3$	XVIII-300	152.14
4249	gallate	gallicin	$(HO)_3C_6H_2\cdot CO_2CH_3$	X-483	184.14
4250	glucoside (*α*)(*d*)	....	$CH_3O\cdot C_6H_{11}O_5$	....	194.18

Methyl-cyclopentadecanone 4446
Methyl-diethyl carbinol 3637
Methyl-dihydroxyfuchsone 5573
Methyl-dioxolane 3207
Methyl-diphenylyl ketone 5144
Methyl-dipropyl carbinol 4969
Methyl enanthylate 4263
Methyl-esculetin 5604
Methyl ether 2478
Methyl-ethyl-, cf. also ethyl-methyl-.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4209	col. lq.	$0.744^{20^\circ}_{4}$	−142.5	71.8	i.	....	s.
4210	col. gas	$0.691^{-20^\circ}_{0}$	....	4-5	i.	....	s.
4211	yel. lf.	....	90-1	d.	i.	....	....
4212	nd.	....	87-8	....	....	s.	....
4213	mn. pl./ CS_2	....	115-6	....	....	....	....
4214	col. lq.	$1.838^{20^\circ}_{4}$	−59	133-6	sl. s.	v. s.	s.
4215	col. lq.	....	....	65-7	v. s.	s.	s.
4216	lq.	....	....	$208\text{-}9^{755mm}$	i.	s.	s.
4217	lq.	....	....	231-2	i.	s.	s.
4218	lq.	$0.924^{15.5^\circ}$	....	228-9	....	....	....
4219	col. lq.	$1.048^{20^\circ}_{4}$	−7.6	295-6	i.	s.	s.
4220	cr.	....	87-9	$317\text{-}8^{728mm}$	i.	s.	s.
4221	pr./et.	....	80-1	$175\text{-}80^{20mm}$	v. s. bz.	....	v. s.
4222	lq.	$1.057^{16^\circ}_{4}$	....	116-8	....	....	....
4223	lq.	$1.103^{20^\circ}_{4}$	....	122.3	3.1	....	....
4224	lq.	0.807^{20°	....	90-2	i.	....	....
4225	lq.	$0.854^{25^\circ}_{4}$	....	137.3^{759mm}	i.	....	....
4226	col. lq.	....	....	34-5	....	....	....
4227	lf./al. et.	....	130-3	....	v. s.	v. s.	i.; s. chl.
4228	lq.	....	....	201	i.	∞	∞
4229	lq.	1.002^{27°	−14.5	109.2	i.	∞	∞
4230	col. lq.	$0.725^{0^\circ}_{0}$	....	6.4^{724mm}	s.	∞	∞
4231	yel. lq.	....	....	$165\text{-}70^{20mm}$	i.	s.	s.
4232	col. lq.	$0.805^{20^\circ}_{4}$	−85.9	79.6	37	∞	∞; ∞ bz.
4233	col. oil	$0.923^{20^\circ}_{4}$	−29.5	152-3	10	∞	∞
4234	lf./aq.	....	148; slowly 143	....	v. s. h.	v. s.	....
4235	pr. or nd.	....	122	d. 180	v. s.	v. s.	v. s.
4236	lq.	$1.156^{0^\circ}_{0}$	....	173.7	i.	v. s.	v. s.
4237	lq.	1.093^{0°	<−20	208.2	i.	v. s.	v. s.
4238	oil	0.837^{20°	−104.8	66.9	i.	∞	∞
4239	nd.	....	36	....	v. s.	v. s.	v. sl. s. c.
4240	gas	....	....	−78.2	166^{15° cc.	....	....
4241	lq.	$1.095^{20^\circ}_{4}$	13	253^{716mm}	v. sl. s.	v. s.	....
4242	lq.	$0.974^{20^\circ}_{4}$	−99.8	32	30^{20°	∞	s. Me al.
4243	cr. pd.	1.466	202	250 d.	2.7^{18°; 118^{100°	30.6^{17°, 90% al.	v. sl. s. chl.
4244	oil	1.109^{18°	....	186-7	3.3	v. s.	....
4245	col. lq.	0.916	....	65^{759mm}	....	....	....
4246	col. lq.	$1.179^{21.4^\circ}_{4}$	....	181.3	i.	∞	∞
4247	yel. lq.	....	....	$148\text{-}52^{13mm}$	i.	s.	s.
4248	col. lq.	....	27.5	$227\text{-}8^{774mm}$	i.; s. lg.	s.; s. bz.	s.
4249	mn./Me al.	....	194-8	....	1.07^{23°	v. s.	s.
4250	col. nd./al.	....	165-6	....	63	1.6	i.

Methyl-ethylacetic acid 4171
Methyl-ethyl acetone 4165
Methyl-ethyl-acetylene 5087
Methyl-ethylbenzene 3166-8
Methyl-ethyl-*n*-butyl carbinol 4968
Methyl-ethyl carbinol 1035
Methyl-ethyl ketone diethylsulfone 6326
Methyl-ethyl-*n*-propyl carbinol 3540
Methyl-ethyl-*iso*-propyl carbinol 3529
Methyl-ethyl-protocatechuic aldehyde 6419

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4251	**Methyl** glutaric acid (α)	2-methyl-pentandioic acid	$CH_3 \cdot CH(CO_2H) \cdot CH_2 \cdot CH_2 \cdot CO_2H$	II-655	146.14
4252	glutaric acid (β)	3-Me-pentandioic	$CH_3 \cdot CH(CH_2CO_2H)_2$	II-659	146.14
4253	glycerinate (*d*)	....	$CH_2OH \cdot CHOH \cdot CO_2 \cdot CH_3$	III-397	120.10
4254	glycerine chlorohydrin (β), mono	....	$ClCH_2 \cdot C(CH_3)OH \cdot CH_2OH$	....	124.57
4255	glycolate	....	$HO \cdot CH_2 \cdot CO_2 \cdot CH_3$	III-236	90.08
4256	glyoxalidine	2-Me-Δ²-imidazoline	$CH_3 \cdot C{:}N(CH_2)_2NH$	XXIII-31	84.12
4257	glyoxaline (1)	1-methyl-imidazole	$CH_3 \cdot N \cdot CH{:}N \cdot CH{:}CH$	......	82.10
4258	guanidine	....	$CH_3NH \cdot CH_3N_2$	IV-68	73.10
4259	guanidine nitrate	....	$C_2H_7N_3 \cdot HNO_3$	IV-69	138.12
4260	guanidine sulfate	....	$(C_2H_7N_3)_2 \cdot H_2SO_4$	....	244.28
4261	heptadecyl ketone	nonadecanone-2	$CH_3(CH_2)_{16}CO \cdot CH_3$	I-718	282.49
4262	heptenone	....	$(CH_3)_2C{:}CH(CH_2)_2 \cdot CO \cdot CH_3$	I-741	126.19
4263	*n*-heptylate	Me oenanthylate	$CH_3(CH_2)_5CO_2CH_3$	II-339	144.21
4264	*n*-heptyl ether	....	$CH_3 \cdot O \cdot (CH_2)_6CH_3$	I-414	130.22
4265	heptyl ketone	nonanone-2	$CH_3 \cdot CO \cdot (CH_2)_6CH_3$	I-709	142.23
4266	hexyl ketone	octanone-2	$CH_3 \cdot CO \cdot (CH_2)_5CH_3$	I-704	128.21
4267	hydantoin (β)	....	$C_4H_6O_2N_2$	XXIV-244	114.10
4268	hydantoin (γ)	lactyl urea	$C_4H_6O_2N_2 \cdot H_2O$	XXIV-279	132.12
4269	hydrazine	....	$CH_3 \cdot NH \cdot NH_2$	IV-546	46.07
4270	hydrazine sulfate	....	$CH_3 \cdot NH \cdot NH_2 \cdot H_2SO_4$	IV-547	144.15
4271	hydrazobenzene (*o*)	β-Ph-*o*-tolylhydrazine	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH \cdot C_6H_5$	XV-497	198.26
4272	hydrazobenzene (*m*)	....	$CH_3 \cdot C_6H_4(NH)_2C_6H_5$	XV-506	198.26
4273	hydrazobenzene (*p*)	....	$CH_3 \cdot C_6H_4(NH)_2C_6H_5$	XV-511	198.26
4274	hydroxybenzoate (*p*)	nipagin	$HO \cdot C_6H_4 \cdot CO_2CH_3$	X-158	152.14
4275	3-hydroxy-1,4-naphthoquinone (2)	phthiocol	$CH_3(OH)C_{10}H_4O_2$	....	188.17
4276	hydroxynaphthoquinone acetate	phthiocol monoacetate	$C_{13}H_{10}O_4$	....	230.21
4277	hydroxynaphthoquinone acetate	phthiocol triacetate	$C_{17}H_{16}O_6$	....	316.30
4278	hydroxynaphthoquinone oxime	phthiocol monoxime	$C_{11}H_8O_2{:}NOH$	....	203.19
4279	hydroxylamine (β)	....	$CH_3 \cdot NH \cdot OH$	IV-534	47.06
4280	hydroxylamine HCl	(α)	$CH_3O \cdot NH_2 \cdot HCl$	I-288	83.52
4281	hypochlorite	....	$CH_3 \cdot O \cdot Cl$	I-282	66.49
4282	indole (1)	....	C_9H_9N	XX-308	131.17
4283	indole (2)	methyl ketole	$C_6H_4 \cdot CH{:}C(CH_3) \cdot NH$	XX-311	131.17
4284	indole (3)	skatole	$C_6H_4C(CH_3){:}CH \cdot NH$	XX-316	131.17
4285	indole (5)	....	$CH_3 \cdot C_6H_3 \cdot CH{:}CH \cdot NH$	XX-317	131.17
4286	inositol	*d*-inositol Me ether	$(HO)_5C_6H_5 \cdot OCH_3$	VI-1193	194.18

Methyl-ethyl-pyridine 161, 1524-5
Methyl-exaltone 4446
Methyl fumarate 2487
Methyl glycinate 4107
Methyl-glycine 5600
Methyl-glycocyamidine 1540
Methyl-granatonine, cf. alkd.
Methyl green 3594
Methyl-guanylglycine 1539
Methyl-heptyl carbinol (*n*) 4919

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Water	Alcohol	Ether
4251	pr./aq.	....	78-80	214-5$^{22\text{mm}}$	v. s.	v. s.	v. s.
4252	pr. or pl.	....	86-7	....	v. s.	v. s.	v. s.
4253	lq.	$1.281^{15°}_{15}$	....	119-20$^{14\text{mm}}$	∞	∞	v. sl. s.
4254	lq.	$1.237^{20°}_{4}$	....	95-6$^{7\text{mm}}$	∞	....	....
4255	lq.	$1.168^{18°}$	....	151.2	....	....	....
4256	col. hyg. cr.	....	105	195-8	s.	s.	i.; s. chl.
4257	lq.	$1.036^{10°}$	–6	197-9	∞	....	....
4258	col. delq.	....	d.	....	v. s.	s.	....
4259	col. cr./al.	....	149-50	....	s.	....	....
4260	cr./aq.	....	239-40	....	....	....	....
4261	lf.	$0.811^{55.5°}$	55-6	266.5$^{110\text{mm}}$	v. s. chl.	v. s.	v. s.
4262	lq.	$0.860^{20°}$	–67.1	173-4	i.	∞	∞
4263	lq.	$0.881^{15°}_{4}$	....	172-3	i.	....	....
4264	lq.	$0.795^{0°}_{0}$	....	149.8	i.	∞	∞
4265	lq.	$0.832^{20°}$	–19 ±	194-6	i.	s.	s.
4266	col. lq.	$0.819^{20°}_{4}$	–16	172.9	i.	∞	∞
4267	pr.	....	156-7	subl.	s.	s.	3
4268	rhb.	....	145(anh.)	....	s.	s.	sl. s.
4269	hyg. lq.	....	<–80	87$^{745\text{mm}}$	s.	∞	∞; i. lg.
4270	cr./Me al.	....	142	....	v. s.	v. sl. s.	....
4271	lf./al.	....	101-2	....	i.	sl. s. c.	s.
4272	lt. yel. cr.	....	59-61	....	i.; s. bz.	v. s.	sl. s.
4273	pl./lg.	....	86-7	....	v. s. bz.	v. s.	v. s.
4274	nd./aq. al.	....	131	270-80 d.	0.25	s.; s. act.	s.
4275	yel. pr./aq. Me al.	....	172-3	vol. in steam	s.; s. dil. alk.	s.	s.
4276	yel. nd.	....	106-7	....	i.; s. alk.	s. Me al.	s. pyr.
4277	col. pr.	....	158-9	....	i.	s. Me al.	....
4278	yel. nd.	....	199-200 d.	....	i.	s.	s. pyr.
4279	hyg. pr.	$1.000^{20°}_{4}$	42	62.5$^{15\text{mm}}$	v. s.	v. s.	sl. s.
4280	pr./al. et.	....	149	....	s.	s.	i.
4281	gas	....	....	12$^{726\text{mm}}$	....	....	....
4282	lq.	$1.071^{10°}$	< 20	242.4	i.	v. s.	v. s.
4283	nd.	1.07	59-60	272$^{750\text{mm}}$	s. h.; s. HCl	v. s.	v. s.
4284	lf./lg.	....	95	265-6$^{755\text{mm}}$	0.05 c.	s.; s. chl.	s.; s. bz.
4285	nd./aq.	....	58.5	....	s. h.	s.	s.; s. bz.
4286	cr./aq.	1.52	186-7	....	v. s.	i. abs.	i.; i. chl.

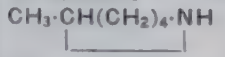
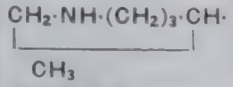
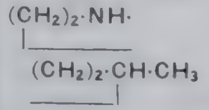
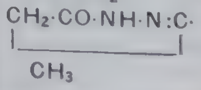
Methyl-hexalin 4200-3
Methyl-hexyl carbinol 4962
Methyl-hydrocupreine, cf. alkd.
Methyl hydrogen sulfate 4384
Methyl-hydroquinone 2372
Methyl-imidazole 4257
Methyl-imidazoline 4256

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4287	**Methyl** iodide	iodomethane	CH_3I	I-70	141.95
4288	iodobenzoate (*o*)	....	$I\cdot C_6H_4\cdot CO_2CH_3$	IX-364	262.06
4289	iodobenzoate (*m*)	....	$I\cdot C_6H_4\cdot CO_2CH_3$	IX-365	262.06
4290	iodobenzoate (*p*)	....	$I\cdot C_6H_4\cdot CO_2CH_3$	IX-367	262.06
4291	isatin (*O*)	....	$C_6H_4\cdot N{:}C(OCH_3)CO$	XXI-583	161.15
4292	isatin (*N*)	....	$C_6H_4N(CH_3)\cdot CO\cdot CO$	XXI-446	161.15
4293	isatin (5)	*p*-methyl isatin	$CH_3\cdot C_6H_3\cdot CO\cdot CO\cdot NH$	XXI-509	161.15
4294	lactate	....	$CH_3\cdot CHOH\cdot CO_2CH_3$	III-280	104.10
4295	laurate	....	$CH_3(CH_2)_{10}CO_2CH_3$	II-361	214.34
4296	levulinate	....	$CH_3CO(CH_2)_2CO_2CH_3$	III-675	130.14
4297	*d*-mannoside (*α*)	....	$CH_3O\cdot C_6H_{11}O_5$	I-907	194.18
4298	mercaptan	methanthiol	$CH_3\cdot SH$	I-288	48.10
4299	mercaptobenzothiazole (2)	....	$C_6H_4\cdot N{:}C(SCH_3)\cdot S$	XXVII-109	181.26
4300	methoxybenzoate (*o*)	....	$CH_3O\cdot C_6H_4CO_2CH_3$	X-71	166.17
4301	methoxybenzoate (*p*)	methyl anisate	$CH_3O\cdot C_6H_4CO_2CH_3$	X-159	166.17
4302	methylanthranilate (*N*)	methylaminomethyl benzoate	$CH_3NH\cdot C_6H_4\cdot CO_2\cdot CH_3$	XIV-324	165.19
4303	myristate	....	$CH_3(CH_2)_{12}CO_2CH_3$	II-365	242.39
4304	naphthalene (*α*)	....	$C_{10}H_7\cdot CH_3$	V-566	142.19
4305	naphthalene (*β*)	....	$C_{10}H_7\cdot CH_3$	V-567	142.19
4306	1,4-naphthoquinone (2)	....	$CH_3\cdot C_{10}H_5O_2$	....	172.17
4307	naphthoquinone diacetate	(2;1,4)	$CH_3\cdot C_{10}H_5{:}(O_2C\cdot CH_3)_2$	....	258.26
4308	naphthoquinone monoxime	(2;4,1)	$CH_3\cdot C_{10}H_5O{:}NOH$	....	187.19
4309	naphthylamine (*α*)	....	$C_{10}H_7\cdot NHCH_3$	XII-1221	157.21
4310	naphthylamine (*β*)	....	$C_{10}H_7\cdot NHCH_3$	XII-1273	157.21
4311	naphthyl ether (*α*)	....	$CH_3\cdot O\cdot C_{10}H_7$	VI-606	158.19
4312	naphthyl ether (*β*)	nerolin; yara yara	$CH_3\cdot O\cdot C_{10}H_7$	VI-640	158.19
4313	naphthyl ketone (*β*)	*β*-acetonaphthone	$CH_3\cdot CO\cdot C_{10}H_7$	VII-402	170.20
4314	nitramine	nitraminomethane	$CH_3\cdot NH\cdot NO_2$	IV-567	76.06
4315	nitrate	....	$CH_3O\cdot NO_2$	I-284	77.04
4316	nitrite	....	$CH_3O\cdot NO$	I-284	61.04
4317	nitrobenzoate (*o*)	....	$NO_2\cdot C_6H_4\cdot CO_2CH_3$	IX-372	181.14
4318	nitrobenzoate (*m*)	....	$NO_2\cdot C_6H_4\cdot CO_2CH_3$	IX-378	181.14
4319	nitrobenzoate (*p*)	....	$NO_2\cdot C_6H_4\cdot CO_2CH_3$	IX-390	181.14
4320	nitrocinnamate (*o*)	....	$NO_2\cdot C_6H_4\cdot CH{:}CH\cdot CO_2CH_3$	IX-605	207.18
4321	nitrocinnamate (*m*)(*trans*)	....	$NO_2\cdot C_6H_4\cdot CH{:}CH\cdot CO_2CH_3$	IX-606	207.18
4322	nitrocinnamate (*p*)(*trans*)	....	$NO_2\cdot C_6H_4\cdot CH{:}CH\cdot CO_2CH_3$	IX-607	207.18
4323	nitrolic acid	....	$HC({:}NOH)NO_2$	II-92	90.04
4324	*n*-nonyl ketone	undecanone-2	$CH_3(CH_2)_8\cdot CO\cdot CH_3$	I-713	170.29
4325	octadiene-4,6 (2)	....	$CH_3\cdot CH{:}(CH)_2{:}CH\cdot CH_2CH(CH_3)_2$	I-260	124.22
4326	*n*-octyl ketone	decanone-2	$CH_3\cdot CO\cdot C_8H_{17}$	I-711	156.26
4327	oleate	....	$C_{17}H_{33}CO_2CH_3$	II-467	296.48

Methyl-iodoform 6237
Methyl-isoeugenol 3224
Methyl itaconate 2498
Methyl-ketole 4283
Methyl malate 2500
Methyl maleate 2501
Methyl-maleic acid 1510
Methyl-malic acid 1514
Methyl malonate 2502
Methyl-malonic acid 5652
Methyl mesaconate 2504
Methyl-morphine, cf. alkd.
Methyl mustard oil 4388
Methyl nonylate 4331
Methyl oenanthylate 4263

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4287	col. lq.	$2.279_{4}^{20^\circ}$	−64.4	42.4	1.8^{15°	∞	∞
4288	lq.	....	....	$277\text{-}8^{729\text{mm}}$	....	....	....
4289	nd.	....	50	$276\text{-}7^{739\text{mm}}$	i.; i. lg.	s. h.	s. h.
4290	rhb./et. al.	2.020^{10°	114	subl.	....	....	....
4291	red lf./aq.	....	101-2	....	sl. s. c.	s. alk.	s. h. HCl
4292	red nd./ aq.	....	134	....	s. aq. NaOH	....	....
4293	red nd./ aq. al.	....	187	....	v. sl. s. h.; s. alk.	s.; s. h. HCl	sl. s.
4294	lq.	1.090^{19°	....	144.8	∞; d.	s.	s.
4295	lq.	....	5	$148^{18\text{mm}}$	i.	....	....
4296	lq.	$1.047_{4}^{20^\circ}$	....	196	....	....	....
4297	col. nd./al.	$1.473_{4}^{7^\circ}$	193-4	....	30.7^{15°	3	i.
4298	lq. or gas	0.896^{0°	−121	$5.8^{752\text{mm}}$	s.	v. s.	v. s.
4299	pr./aq. al.	....	52	....	s. conc. a.	....	....
4300	lq.	$1.157_{4}^{19^\circ}$	....	245-6	....	s.	....
4301	pl./al.	....	48-9	255-6	i.	s.	s.
4302	cr./pet.	1.120^{15°	18-9	256	i.	s.	s.
4303	cr./al.	....	18-9	$295^{751\text{mm}}$	i.	....	....
4304	oil	$1.025_{4}^{14^\circ}$	−19	244.6	i.	v. s.	v. s.
4305	mn.	$0.994_{4}^{40^\circ}$	35-6	241-2	i.	v. s.	v. s.
4306	yel. nd./ al.	....	106	volt. in steam	i.; sl. s. pet.	s.; s. bz.	s.
4307	col. pr./aq. Me al.	....	114	....	i.	s.	v. s. act.
4308	hex. pl./aq. Me al.	....	166-8	....	i.	s.	s. pyr.
4309	oil	....	....	293-5	s. CS_2	s.	s.
4310	oil	....	....	$308\text{-}10^{761\text{mm}}$	....	....	....
4311	col. oil	$1.096_{4}^{14^\circ}$	<−10	265-9	i.	s.	s.; s. bz.
4312	lf./et.	....	72	274	sl. s. CS_2	sl. s.	s.; s. bz.
4313	nd./lg.	....	55-6	301-3	....	....	....
4314	nd./et.	$1.243_{4}^{49^\circ}$	38	....	v. s.	v. s.	sl. s.
4315	lq.	1.203^{25°	expl.	65	sl. s.	s.	s.
4316	gas	lq. 0.991^{15°	....	−12	....	s.	s.
4317	yel. lq.	1.286^{20°	−8	275	i. pet.	s.	s.
4318	col. nd.	....	78.5	279	....	sl. s.	sl. s.
4319	mn.	....	96	....	i.	s.	s.
4320	col. nd./ aq.	....	72-3	$187\text{-}9^{15\text{mm}}$	v. sl. s. h.	s. h.	....
4321	yel. pr./ Me al.	....	123-4	d.	i.; v. sl. s. CS_2	v. sl. s.; s. chl.	v. sl. s.; s. bz.
4322	col. nd./al.	....	160-1	281-6	....	sl. s.	i.
4323	nd./et.	....	64-8 d.	....	s.	s.	s.
4324	col. oil	$0.828_{20}^{20^\circ}$	13.5	223	i.	s.	s.
4325	lq.	$0.752_{4}^{18^\circ}$	....	149	i.	....	....
4326	lq.	0.825^{20°	14	$209^{750\text{mm}}$	i.	s.	s.
4327	oil	0.879^{18°	....	$190\text{-}1^{10\text{mm}}$	i	∞	∞

Methyl oxalate 4329
Methyl pentenal 4225
Methyl phenol 1545-7
Methyl-phenylamine 4125
Methyl-phenyl carbinol 5186
Methyl phenyl-dibromopropionate 4213
Methyl-phenyl diketone 72
Methyl-phenyl ether 537
Methyl-phenyl glyoxal 72
Methyl-phenyl ketone 51

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4328	**Methyl** orange	tropeolin D; orange III	$(CH_3)_2N\cdot C_6H_4\cdot N:N\cdot C_6H_4\cdot SO_3Na$	XVI-331	327.33
4329	oxalic acid	Me acid oxalate	$CH_3O_2C\cdot CO_2H$	II-534	104.06
4330	palmitate	....	$C_{15}H_{31}CO_2CH_3$	II-372	270.44
4331	pelargonate	methyl nonylate	$CH_3(CH_2)_7CO_2CH_3$	II-353	172.26
4332	2,4-pentandiol (2)	....	$(CH_3)_2C(OH)\cdot CH_2\cdot CHOH\cdot CH_3$	I-486	118.17
4333	phenacyl bromide (*p*)	ω-Br-*p*-methyl-acetophenone	$CH_3\cdot C_6H_4\cdot CO\cdot CH_2Br$	VII-309	213.08
4334	phenazine (2)	tolazine	$CH_3\cdot C_6H_3:N_2:C_6H_4$	XXIII-237	194.23
4335	phenylacetate	....	$C_6H_5\cdot CH_2\cdot CO_2CH_3$	IX-434	150.17
4336	phenylenediamine	(*N*)(*p*)	$CH_3NH\cdot C_6H_4\cdot NH_2$	XIII-71	122.17
4337	phenylenediamine HCl (*N*)(*p*)	*p*-amino-methyl-aniline di-HCl	$C_7H_{10}N_2\cdot 2HCl$	....	195.10
4338	phenylhydrazine	(*α*,*α*)	$C_6H_5\cdot N(CH_3)\cdot NH_2$	XV-117	122.17
4339	phenylhydrazine sulfate (*α*,*α*)	....	$(C_7H_{10}N_2)_2\cdot H_2SO_4$	XV-118	342.41
4340	phenylhydrazine	(*α*,*β*)	$C_6H_5\cdot NH\cdot NH\cdot CH_3$	XV-118	122.17
4341	phosphine	....	$CH_3\cdot PH_2$	IV-580	48.03
4342	3-phytyl-1,4-naphthoquinone (2)	vitamin K-1	$C_{31}H_{46}O_2$	....	450.68
4343	3-phytyl-1,4-naphthoquinone diacetate (2)	dihydrovitamin K-1 diacetate	$C_{35}H_{52}O_4$	....	536.77
4344	piperidine (*N*)	....	$C_5H_{10}N\cdot CH_3$	XX-16	99.17
4345	piperidine (2)	*α*-pipecoline	 $CH_3\cdot CH(CH_2)_4\cdot NH$	XX-95	99.17
4346	piperidine (3)	*β*-pipecoline	 $CH_2\cdot NH\cdot (CH_2)_3\cdot CH\cdot$ CH_3	XX-100	99.17
4347	piperidine (4)	*γ*-pipecoline	 $(CH_2)_2\cdot NH\cdot$ $(CH_2)_2\cdot CH\cdot CH_3$	XX-101	99.17
4348	propargyl ether	....	$CH_3\cdot O\cdot CH_2\cdot C\vdots CH$	I-454	70.09
4349	propionate	....	$C_2H_5\cdot CO_2CH_3$	II-239	88.10
4350	*n*-propylamine	....	$CH_3\cdot NH\cdot CH_2\cdot C_2H_5$	IV-137	73.14
4351	*n*-propylbenzene (*m*)	*m*-propyl toluene	$CH_3\cdot C_6H_4\cdot CH_2\cdot C_2H_5$	V-418	134.21
4352	*n*-propylbenzene (*p*)	*p*-propyl toluene	$CH_3\cdot C_6H_4\cdot CH_2\cdot C_2H_5$	V-419	134.21
4353	*n*-propyl ether	....	$CH_3\cdot O\cdot CH_2\cdot C_2H_5$	I-354	74.12
4354	*iso*-propyl ether	....	$CH_3\cdot O\cdot CH(CH_3)_2$	I-362	74.12
4355	*n*-propyl ketone	pentanone-2	$CH_3\cdot CO\cdot CH_2\cdot C_2H_5$	I-676	86.13
4356	propyl ketone oxime	(*n*)	$CH_3\cdot C(:NOH)\cdot C_3H_7$	I-677	101.15
4357	*iso*-propyl ketone	2-methyl-butanone-3	$CH_3\cdot CO\cdot CH(CH_3)_2$	I-682	86.13
4358	*iso*-propyl ketoxime	....	$CH_3\cdot C(:NOH)\cdot C_3H_7$	I-683	101.15
4359	*iso*-propyl ketone semicarbazone	....	$C_3H_7(CH_3)C:N\cdot NH\cdot CO\cdot NH_2$	III-103	143.19
4360	5-pyrazolone (3)	....	 $CH_2\cdot CO\cdot NH\cdot N:C\cdot$ CH_3	XXIV-19	98.10

Methyl-phenyl-nitrosoamine 4887
Methyl-phenylphenol ether 4073-4
Methyl phosphate 6268
Methyl phthalate 2530-2
Methyl *iso*-phthalic acid 6397
Methyl picrate 6290
Methyl-picrylnitramine 5873
Methyl pivalate 4404
Methyl-proline-methylbetaine, cf. alkd.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4328	red pd.	....	....	....	0.2 c.	i.	....
4329	cr.	....	37 ±	$108\text{-}9^{12mm}$	....	....	....
4330	col. cr.	....	29.5-30.5	196^{15mm}	i.	s.	s.
4331	lq.	$0.877^{17.5^\circ}$	....	$213\text{-}4^{757mm}$	i.	s.	s.
4332	lq.	$0.924^{\frac{17^\circ}{4}}$	....	196	s.	s.	s.
4333	lf./al.	....	50-1	....	i. d.	v. s. d.	v. s.
4334	nd.	....	117	350 ±, sl. d.	sl. s. h.	s.; s. H_2SO_4	s.; s. chl.
4335	lq.	1.044^{16°	d. 360	220	i.	∞	∞
4336	col. lf.	....	35.5	257-9.5	s.	s.	s.
4337	yel. pd.	....	....	....	v. s.	sl. s.	i.
4338	yel. lq.	$1.038^{\frac{21.6^\circ}{4}}$	....	131^{35mm}	sl. s. h.	∞; ∞ chl.	∞; ∞ bz.
4339	lf.	....	....	....	v. s.	v. sl. s. c.	....
4340	oil	$1.04^{\frac{15^\circ}{15}}$	....	$110\text{-}2^{12\text{-}15mm}$	....	s.	s.
4341	col. gas	....	....	-14^{759mm}	i.	sl. s.	7000^{0° cc.
4342	pa. yel. oil	....	....	....	i.	s. abs.	s. act.; s. pet.
4343	col. nd./al.	....	62-3	....	i.	v. s.; v. s. bz.	v. s. act.
4344	lq.	0.821^{15°	....	107	....	....	....
4345	lq.	0.862^{0°	....	$118\text{-}9^{753mm}$	s.	i. aq. KOH	....
4346	lq.	$0.864^{\frac{0^\circ}{4}}$	....	125-6	s.	....	....
4347	lq.	0.867^{0°	....	127-9	s.	....	....
4348	lq.	$0.83^{12.5^\circ}$	....	63	v. sl. s.	∞	∞
4349	col. lq.	$0.915^{\frac{20^\circ}{4}}$	−87.5	79.7	0.5^{20°	∞	∞
4350	lq.	0.720^{17°	....	62-4	s.	s.	....
4351	lq.	0.863^{16°	....	182	i.	s. abs.	∞
4352	lq.	$0.864^{\frac{15.4^\circ}{4}}$	−63	183.5	i.	s. abs.	∞
4353	col. lq.	0.738^{20°	....	39-40	sl. s.	∞	∞
4354	col. lq.	$0.735^{\frac{20^\circ}{20}}$	....	32.5^{777mm}	v. sl. s.	∞	∞
4355	col. lq.	$0.812^{\frac{15^\circ}{15}}$	−77.8	102	v. sl. s.	∞	∞
4356	oil	$0.910^{\frac{20^\circ}{4}}$	....	168^{748mm}	s.	∞	∞
4357	col. lq.	$0.803^{\frac{20^\circ}{0}}$	−92	95	v. sl. s.	∞	∞
4358	lq.	....	....	157-8	s.	∞	∞
4359	cr./et.	....	110-4	....	s.	v. s.	v. s.
4360	pr./aq.; nd./al.	....	216-7	subl.	v. s. h.; sl. s. Na_2CO_3	sl. s. h.	sl. s. aq. a.

Methyl-propenyl ketone 3213
Methyl-*iso*-propyl-acetophenone 4181
Methyl-*iso*-propylbenzene 1622-4
Methyl-propyl carbinol (*n*) 405
Methyl-propyl carbinol (*iso*) 407
Methyl-*iso*-propyl-phenanthrene 5555
Methyl-*iso*-propyl-phenol 1255, 5938
Methyl-pyridine 5300-2

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4361	**Methyl** pyrogallol (1;3,4,5)	trihydroxy-toluene	$CH_3 \cdot C_6H_2(OH)_3$	VI-1112	140.13
4362	pyrrole (1)	*N*-methyl pyrrole	$C_4H_4N \cdot CH_3$	XX-163	81.11
4363	pyrrole (2)(*α*)	....	$CH_3 \cdot C_4H_4N$	XX-170	81.11
4364	pyrrole (3)(*β*)	....	$CH_3 \cdot C_4H_4N$	XX-171	81.11
4365	pyrroline (*N*)	1-Me-3-pyrroline	$CH_3 \cdot N \cdot CH_2(CH)_2CH_2$	XX-133	83.13
4366	pyruvate	....	$C_3H_3O_3 \cdot CH_3$	III-616	102.09
4367	quinoline (2)	quinaldine	$CH_3 \cdot C_9H_6N$	XX-388	143.18
4368	quinoline ethiodide	quinaldine ethiodide	$CH_3 \cdot C_9H_6N:(I)C_2H_5$	XX-392	299.16
4369	quinoline (3)	*Py*-3 (*β*)	$CH_3 \cdot C_9H_6N$	XX-394	143.18
4370	quinoline (4)	cincholepidine; lepidine (4)	$C_6H_4N:CH \cdot CH:C \cdot CH_3$	XX-395	143.18
4371	quinoline ethiodide	lepidine ethiodide	$CH_3 \cdot C_9H_6N:(I)C_2H_5$	XX-396	299.16
4372	quinoline (6)	*p*-toluquinoline	$CH_3 \cdot C_9H_6N$	XX-398	143.18
4373	quinoline ethiodide	*p*-toluquinoline EtI	$CH_3 \cdot C_9H_6N:(I)C_2H_5$	XX-398	299.16
4374	quinoline (7)	*m*-toluquinoline	$CH_3 \cdot C_9H_6N$	XX-400	143.18
4375	quinoline (8)	*o*-toluquinoline	$CH_3 \cdot C_9H_6N$	XX-401	143.18
4376	red	*p*-di Me-amino-azobenzene-*o'*-carboxylic	$HO_2C \cdot C_6H_4 \cdot N:N \cdot C_6H_4 \cdot N(CH_3)_2$	XVI-329	269.29
4377	red, Na salt	....	$C_{15}H_{14}O_2N_3Na$	*XVI-316	291.28
4378	red, para	(4',4)	$NaO_2C \cdot C_6H_4 \cdot N:N \cdot C_6H_4 \cdot N(CH_3)_2$	XVI-329	291.28
4379	salicylaldehyde (3)	(3;6,1)	$CH_3 \cdot C_6H_3(OH)CHO$	VIII-100	136.14
4380	salicylate (*o*)	oil of wintergreen	$HO \cdot C_6H_4 \cdot CO_2CH_3$	X-70	152.14
4381	stearate	....	$C_{17}H_{35}CO_2CH_3$	II-379	298.49
4382	sulfonic acid	methane sulfonic acid	$CH_3 \cdot SO_3H$	IV-4	96.10
4383	sulfonic chloride	Me-sulfone chloride	$CH_3 \cdot SO_2Cl$	IV-5	114.55
4384	sulfuric acid	Me-hydrogen sulfate	$CH_3O \cdot SO_2 \cdot OH$	I-283	112.10
4385	tetraacetyl-*d*-glucoside (*α*)	....	$CH_3O \cdot C_{14}H_{19}O_9$	....	362.33
4386	tetramethyl-glucoside	....	$(CH_3O)_5C_6H_7O$	....	250.29
4387	thiocyanate	....	$CH_3 \cdot S \cdot CN$	III-175	73.11
4388	*iso*-thiocyanate	methyl mustard oil	$CH_3 \cdot N:C:S$	IV-77	73.11
4389	thiotoluene (*β*)	3-methyl-thiophene	$CH_3 \cdot C_4H_3S$	XVII-38	98.16
4390	thiourea	Me-thiocarbamide	$NH_2 \cdot CS \cdot NH \cdot CH_3$	IV-70	90.14
4391	*iso*-thiourea sulfate	....	$(C_2H_6N_2S)_2 \cdot H_2SO_4$	*III-78	278.36
4392	toluate (*o*)	....	$CH_3 \cdot C_6H_4 \cdot CO_2CH_3$	IX-463	150.17
4393	toluate (*m*)	....	$CH_3 \cdot C_6H_4 \cdot CO_2CH_3$	IX-475	150.17
4394	toluate (*p*)	....	$CH_3 \cdot C_6H_4 \cdot CO_2CH_3$	IX-484	150.17
4395	toluene sulfonate	(1,4)	$CH_3 \cdot C_6H_4 \cdot SO_3CH_3$	XI-99	186.22
4396	toluidine (*o*)	....	$CH_3 \cdot C_6H_4 \cdot NHCH_3$	XII-784	121.18
4397	toluidine (*m*)	....	$CH_3 \cdot C_6H_4 \cdot NHCH_3$	XII-856	121.18
4398	toluidine (*p*)	....	$CH_3 \cdot C_6H_4 \cdot NHCH_3$	XII-902	121.18
4399	*o*-tolyl ether	Me *o*-cresyl ether	$CH_3 \cdot O \cdot C_6H_4 \cdot CH_3$	VI-352	122.16
4400	*m*-tolyl ether	*m*-cresyl Me ether	$CH_3 \cdot O \cdot C_6H_4 \cdot CH_3$	VI-376	122.16
4401	*p*-tolyl ether	....	$CH_3 \cdot O \cdot C_6H_4 \cdot CH_3$	VI-392	122.16
4402	*p*-tolyl sulfide	thiocresol Me ether	$CH_3 \cdot S \cdot C_6H_4 \cdot CH_3$	VI-417	138.22
4403	trichloroacetate	....	$Cl_3C \cdot CO_2CH_3$	II-208	177.43
4404	trimethylacetate	methyl pivalate	$(CH_3)_3C \cdot CO_2CH_3$	II-320	116.16

Methyl-quercetin 5556
Methyl-quinaldine 2541, 2544
Methyl quinolinate 2539
Methyl-quinoline carboxylic acid 5528-32
Methyl-quinolone 4180
Methyl-resorcinol 2371, 2373, 4998
Methyl-rhodin 4090
Methyl rosaniline 3593
Methyl-salicylic acid 3833, 4067
Methyl sebacate 2551
Methyl-styrene (*α*) 5224
Methyl-styrene (dimer) 2476
Methyl-styryl ketone 626
Methyl succinate 2554-5
Methyl-succinic acid 5520
Methyl sulfate 2559

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4361	nd./bz.	....	129	....	d. fused alk.	....	....
4362	lq.	$0.920^{10°}$	....	$114\text{-}5^{748mm}$	i.	∞	∞
4363	lq.	0.945	....	$147\text{-}8^{750mm}$	sl. d. a.	....	....
4364	lq.	....	....	$142\text{-}3^{743mm}$	sl. d. a.	....	....
4365	col. lq.	....	....	79-80	∞	s.	s.; s. chl.
4366	lq.	$1.154^{0°}$	....	134-7	....	....	....
4367	lq.	$1.059^{20°}_{4}$	−1	$244\text{-}5^{750mm}$	v. sl. s.	s. chl.	s.
4368	yel. nd./al.	....	233-4	....	s.	v. sl. s.	i.
4369	cr.	$1.067^{20°}_{4}$	16	250^{710mm}	i.	s.	s.
4370	lq.	$1.086^{20°}$	9-10	261-3	sl. s.	∞; ∞ bz.	∞; ∞ lg.
4371	yel. cr./al.	....	142-3	....	s.	s.	i.
4372	lq.	$1.068^{20°}$	−22	258-9	v. sl. s.	s.	s.
4373	cr.	....	171-3	....	....	....	....
4374	yel. oil	$1.061^{20°}_{4}$	39	257.6^{750mm}	v. sl. s.	s.	s.
4375	lq.	$1.073^{20°}$	....	247.8^{760mm}	v. sl. s.	∞	∞
4376	vl. nd. or red pd.	....	179-83	....	v. sl. s.	s.	s. ac.
4377	red pl.	....	....	....	s.	....	....
4378	or. pd.	....	....	....	....	....	....
4379	lf./aq.al.	$1.091^{50°}_{4}$	56	217-8	v. sl. s.	s.	s.; s. chl.
4380	col. lq.	$1.182^{25°}_{25}$	−8.3	222.2	$0.07^{30°}$	∞; s. chl.	∞
4381	col. cr.	....	38-9	$214\text{-}5^{15mm}$	i.	s.	s.
4382	col. lq.	$1.481^{18°}_{4}$	20	167^{10mm}	∞	....	....
4383	lq.	$1.481^{18°}_{4}$	....	161.5^{730mm}	i. c.; d. h.	....	s.
4384	oil	....	<−30	d.	v. s.	s.	∞ abs.
4385	col. rhb./al.	....	101	....	i.; s. chl.	s.; s. act.	s.; s. pet.
4386	col. lq.	$1.108^{20°}$	....	$145\text{-}50^{13mm}$	sl. s.	s.; s. chl.	sl. s.
4387	lq.	$1.069^{24°}_{4}$	−51	130-3	v. sl. s.	∞	∞
4388	col. cr.	$1.069^{37°}_{4}$	35-6	119^{759mm}	v. sl. s.	∞	∞
4389	oil	1.025	....	114	....	....	....
4390	pr.	....	118-9	....	v. s.	v. s.	sl. s.
4391	cr. pd.	....	241-2 d.	....	s. h.	i.	....
4392	col. lq.	$1.073^{15°}$	<−50	213	i.	∞	∞
4393	col. lq.	$1.066^{15°}$	....	215	i.	....	....
4394	cr./pet.	....	33-4	217	i.	v. s.	v. s.
4395	cr./et. lg.	....	28	....	i.; s. bz.	v. s.	v. s.
4396	lq.	$0.973^{15°}$	....	206-7	i.	∞	∞
4397	lq.	....	....	206-7	i.	∞	∞
4398	lq.	$0.935^{55°}_{4}$	....	$209\text{-}11^{761mm}$	i.	∞	∞
4399	lq.	$0.985^{15°}_{15}$	....	171-2	i.	v. s.	v. s.
4400	lq.	$0.977^{15°}_{15}$	....	177	....	....	....
4401	lq.	$0.976^{15°}_{15}$	....	176	....	....	....
4402	lq.	$1.030^{16°}_{4}$	....	209^{747mm}	....	....	....
4403	lq.	$1.489^{18:2°}_{18:2}$	−17.5	$152\text{-}3^{765mm}$	d.	d.	s.
4404	lq.	$0.891^{0°}_{4}$	....	100-2	....	....	....

Methyl sulfide 2560
Methyl sulfite 2561
Methyl sulfonal 6326
Methyl sulfone chloride 4383
Methyl tartrate 2564-5
Methyl-tartronic acid 4000
Methyl-tertrahydroquinoline 3930
Methyl-tetramethylene 4198
Methyl-theobromine, cf. alkd.
Methyl-thiocarbamide 4390
Methyl-thionine chloride 4427
Methyl-thiophene 4389
Methyl-tolyl ketone 4089
Methyl-trimethylene 4210
Methyl-tritane 2756-7
Methyl-trityl ether 6332

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4405	**Methyl** (tyrosine *N*)(*i*+)	ratanhin; andirine	$CH_3NH\cdot C_9H_9O_3$	XIV-612	195.21
4406	umbelliferone (*β*)	7-OH-4-Me coumarin	$C_{10}H_8O_3$	XVIII-31	176.16
4407	undecylenate	....	$CH_2{:}CH(CH_2)_8CO_2\cdot CH_3$	II-459	198.30
4408	*n*-undecyl ketone	tridecanone-2	$CH_3\cdot CO(CH_2)_{10}CH_3$	I-715	198.34
4409	*n*-undecyl ketone semicarbazone	....	$C_{11}H_{23}(CH_3)C{:}N\cdot NH\cdot CO\cdot NH_2$	*I-371	255.40
4410	uracil (1)	....	$\underbrace{CO\cdot(CH)_2NH\cdot CO\cdot N}\cdot$ CH_3	XXIV-316	126.11
4411	uracil (3)	....	$\underbrace{CO\cdot NH\cdot CO(CH)_2\cdot N}\cdot$ CH_3	XXIV-316	126.11
4412	uracil (4)	....	$(\underbrace{NH\cdot CO)_2CH{:}C}\cdot CH_3$	XXIV-342	126.11
4413	uracil (5)	thymine	$(\underbrace{CO\cdot NH)_2CH{:}C}\cdot CH_3$	XXIV-353	126.11
4414	urea (*N*)	....	$CH_3\cdot NH\cdot CO\cdot NH_2$	IV-64	74.08
4415	urea nitrate	....	$C_2H_6ON_2\cdot HNO_3$	IV-65	137.10
4416	urethane	*cf. also* Me-carbamate	$CH_3\cdot NH\cdot CO_2C_2H_5$	IV-64	103.12
4417	uric acid (1)	....	$C_6H_6O_3N_4$	XXVI-524	182.14
4418	uric acid (3)	....	$C_6H_6O_3N_4\cdot\frac{1}{2}H_2O$	XXVI-524	191.15
4419	uric acid (7)	....	$C_6H_6O_3N_4\cdot H_2O$	XXVI-525	200.16
4420	*n*-valerate	....	$CH_3\cdot(CH_2)_3\cdot CO_2CH_3$	II-301	116.16
4421	*iso*-valerate	....	$(CH_3)_2C_2H_3\cdot CO_2CH_3$	II-311	116.16
4422	vinyl carbinol	buten-1-ol-3	$CH_2{:}CH\cdot CHOH\cdot CH_3$	I-441	72.10
4423	*l*-xyloside (*β*)	....	$CH_3O\cdot C_5H_9O_4$	....	164.16
4424	**Methylal**	dimethoxy-methane	$CH_2(OCH_3)_2$	I-574	76.09
4425	**Methylene**-amino-acetonitrile	(dimolecular)	$(CH_2{:}N\cdot CH_2\cdot CN)_2$	II-89	136.16
4426	blue (base)	*N,N,N′,N′*,-tetra-Me-thionine	$[(CH_3)_2N]_2C_{12}H_6\cdot NS(OH)$	XXVII-393	301.40
4427	blue chloride	Me-thionine chloride	$C_{16}H_{18}N_3S(Cl)\cdot 3H_2O$	XXVII-395	373.89
4428	bromide	dibromomethane	$CH_2{:}Br_2$	I-67	173.86
4429	chloride	dichloromethane	$CH_2{:}Cl_2$	I-60	84.94
4430	diacetate	....	$(CH_3CO_2)_2CH_2$	II-152	132.11
4431	dianiline	....	$(C_6H_5\cdot NH)_2CH_2$	XII-184	198.26
4432	disulfonic acid	methionic acid	$CH_2{:}(SO_2OH)_2$	I-579	176.16
4433	fluoride	difluoromethane	$CH_2{:}F_2$	I-59	52.03
4434	iodide	diiodomethane	$CH_2{:}I_2$	I-71	267.87
4435	**Michler's** hydrol (*p,p′*)	....	$[(CH_3)_2N\cdot C_6H_4]_2{:}CHOH$	XIII-698	270.36
4436	ketone (*p,p′*)	....	$[(CH_3)_2N\cdot C_6H_4]_2CO$	XIV-89	268.35
4437	**Morpholine-ethanol ethyl ether**	....	$O{:}(CH_2CH_2)_2{:}N\cdot C_2H_4\cdot O\cdot C_2H_5$	....	159.22
4438	**Mucic** acid	....	$(CHOH)_4(CO_2H)_2$	III-581	210.14
4439	acid, allo-	....	$(CHOH)_4(CO_2H)_2$	III-576	210.14

"Methyl urethane" 4175
Methyl violet 5076-7
Methyl yellow 2431
Methylene-aniline 512
Methylene dicyanide 4006
Methylene-diethyl ether 2172
Methylene-diphenyl ether 6447
Methylene-dipropyl ether 5458
Methylene-propylene dioxide 6285
Methylene-succinic acid 3928
Methylol-acetamide 3291
Metol 4117
Metoquinone, mixt. of 2314 and 4117
Metrazol 5079
Metycaine 764
Mezcaline, cf. alkd.
MI (mustard imitator) gas 1473
Mianine 1290
Michler's hydride 5834
Milk sugar 3947
Mirbane 4646

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4405	col. nd.	....	257	d. 280	$0.14^{20°}$; $0.5^{100°}$	0.007 abs.	i.; s. NH_4OH
4406	nd./al.*	....	185-6	d.	v. sl. s. h.; s. alk.	s.; s. ac.; i. Na_2CO_3	v. sl. s.; sl. s. chl.
4407	lq.	$0.889^{15°}$	-27.5	248-9	....	....	....
4408	cr.	$0.823^{28°}$	28-9	260-5	i.	v. s.	v. s.
4409	cr.	....	122-6	....	....	....	....
4410	pr./aq. al.	....	174-5	....	v. s.	v. s.	i. bz.
4411	pr./al.	....	232	....	s.; i. dil. HCl	s. h.	s. aq. NaOH
4412	nd./al.	....	d. 270-80	....	$0.7^{22°}$; s. alk.	sl. s.; s. H_2SO_4	v. sl. s.; s. NH_4OH
4413	pl./aq.	....	326 d.	....	$0.4^{25°}$; s. alk.	sl. s.; s. H_2SO_4	v. sl. s.
4414	pr./aq.	1.204	101-2	d.	v. s.	v. s.	i.
4415	col. cr.	....	128-32	....	....	....	....
4416	col. lq.	$1.009^{19°}_{4}$	....	170	$69^{16°}$	s.	....
4417	cr.	....	>360 d.	....	0.05 h.	v. sl. s.	....
4418	cr.	....	>360 d.	....	0.2 h.	....	s. alk.
4419	cr.	....	>370 d.	....	$1.3^{100°}$	....	s. alk.
4420	lq.	$0.895^{15°}_{4}$	-91	127.3	v. sl. s.	∞	∞
4421	col. lq.	$0.881^{20°}_{4}$	....	$116\text{-}7^{764mm}$	v. sl. s.	∞	∞
4422	lq.	$0.831^{20°}_{4}$	<-80	97	∞	....	....
4423	cr./EtOAc	....	155-6	....	....	....	....
4424	col. lq.	$0.866^{18°}_{4}$	-104.8	42-3	33	∞	∞
4425	col. pr./aq.	....	129.5	....	s. h.	s. h.	i.; i. bz.
4426	dark, amor.	....	....	....	v. s.	v. s.	i.
4427	gn. b. met. /aq. HCl	....	$-2H_2O$, 100	$-3H_2O$, 150	4	2	i.; s. chl.
4428	col. lq.	$2.495^{20°}_{4}$	-52.8	98.5^{756mm}	$1.173^{0°}$; $1.15^{20°}$	∞; ∞ act.	∞
4429	col. lq.	$1.336^{20°}_{4}$	-96.7	40-1	$2^{20°}$	∞	∞
4430	lq.	$1.132^{20°}_{20}$	-23	164-5	sl. s.	v. s.	∞
4431	pl./et. pet.	....	65	208-9 d.	i.; i. pet.	s.	s.
4432	hyg. nd.	....	....	....	$245.8^{25°}$	s.	....
4433	gas	....	....	....	....	....	....
4434	col. lq.	$3.325^{20°}_{4}$	5.7(5.2)	180 d.	$1.6^{0°}$; $1.4^{20°}$	∞	∞
4435	gn. lf./bz.	....	96-7	....	i.; s. bz.	s. h.	s.; s. ac.
4436	lf./al.	....	174	>360 d.	i.; v. s. bz.	sl. s.	v. sl. s.
4437	col. lq.	$0.965^{20°}_{20}$	....	206.2	∞	....	....
4438	pd.	....	206-14 d. (108)	....	$0.33^{14°}$; $1.6^{100°}$	i.	i.; s. alk.
4439	nd./aq.	....	166-71 d.	....	9 h.	sl. s.	....

* Crysts. + $1H_2O$/aq.; $-H_2O$, 110°.

Monacetin 3382
Monazol 3800
Monobutyrin 3392
Monochlorohydrin 3395-6
Monoethanolamine 2907
Monopropionin 3413
Monosalicylin 3414
Monostearin 3415-6
Monosulfonic acid-F 4510
Monotol 4117
Monotropitoside, cf. glcde.
Moogrol 3014
Morin 5806
Mor(in)tannic acid 5070
Morphine, cf. alkd.
Morphol 2360
Morpholine 2235
Morpholine-ethanol 2236
Morpholine-ethanol ethyl ether 4437
Moss starch 3969

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4440	**Mucic** acid, talo-	(*d* or *l*)	$(CHOH)_4(CO_2H)_2$	III-577	210.14
4441	**Mucobromic acid**	....	$HO_2C·CBr:CBr·CHO$	III-728	257.89
4442	**Mucochloric acid**	....	$HO_2C·CCl:CCl·CHO$	III-727	168.97
4443	**Muconic acid**	....	$(·CH:CH·CO_2H)_2$	II-803	142.11
4444	**Mudarol**	mudarin	$C_{30}H_{47}O(OH)$	....	440.68
4445	**Murexide**	ammonium salt purpuric acid	$C_8H_4O_6N_5·NH_4·H_2O$	XXV-499	302.21
4446	**Muscone** (*l*)	3-Me-cyclopentadecanone	$CH_3·C_{15}H_{27}:O$	....	238.40
4447	**Myochrysine**	Na aurothiomalate	$NaO_2C·CH_2·CH:(SAu)CO_2Na$	....	390.32
4448	**Myricyl** acetate	....	$CH_3CO_2·C_{31}H_{63}$	*II-63	494.86
4449	alcohol	melissyl alcohol	$C_{31}H_{63}OH$ $C_{30}H_{61}OH(?)$	*I-222	452.82 438.80
4450	**Myristic** acid	tetradecanoic acid	$CH_3(CH_2)_{12}·CO_2H$	II-365	228.36
4451	aldehyde	tetradecanal	$CH_3(CH_2)_{12}·CHO$	I-716	212.36
4452	amide	myristamide	$C_{13}H_{27}·CO_2NH_2$	II-368	227.38
4453	anhydride	....	$(C_{13}H_{27}CO)_2O$	II-367	438.71
4454	anilide	myristanilide	$C_{13}H_{27}CO·NHC_6H_5$	XII-257	303.47
4455	chloride	myristoyl chloride	$C_{13}H_{27}·COCl$	II-368	246.81
4456	nitrile	tridecyl cyanide	$C_{13}H_{27}·CN$	II-368	209.36
4457	**Myristyl bromide**	....	$CH_3(CH_2)_{12}CH_2Br$	**I-136	277.29
4458	**Naphthalene**	....	$C_{10}H_8$	V-531	128.16
4459	dicarboxylic acid	naphthalic acid (1,4)	$C_{10}H_6(CO_2H)_2$	IX-917	216.18
4460	dicarboxylic acid	naphthalic acid (1,8)	$C_{10}H_6(CO_2H)_2$	IX-918	216.18
4461	disulfonic acid (1,5)	Armstrong's acid	$C_{10}H_6(SO_3H)_2$	XI-212	288.28
4462	disulfonic acid (1,6)	(δ)	$C_{10}H_6(SO_3H)_2$	XI-213	288.28
4463	disulfonic acid (2,6)	....	$C_{10}H_6(SO_3H)_2$	XI-215	288.28
4464	disulfonic acid (2,7)	(α)	$C_{10}H_6(SO_3H)_2$	XI-216	288.28
4465	sulfinic acid (α)	....	$C_{10}H_7·SO_2H$	XI-15	192.22
4466	sulfinic acid (β)	....	$C_{10}H_7·SO_2H$	XI-16	192.22
4467	sulfone amide (α)	....	$C_{10}H_7·SO_2NH_2$	XI-157	207.24
4468	sulfone chloride (α)	....	$C_{10}H_7·SO_2Cl$	XI-157	226.67
4469	sulfone chloride (β)	....	$C_{10}H_7·SO_2Cl$	XI-173	226.67
4470	sulfonic acid (α)	....	$C_{10}H_7·SO_3H·2H_2O$	XI-155	244.26
4471	sulfonic acid (β)	....	$C_{10}H_7·SO_3H·H_2O$	XI-171	226.24
4472	sulfonic Na salt	(β)	$C_{10}H_7O_3SNa$	XI-171	230.21
4473	tetrachloride	(1,2,3,4)	$C_{10}H_8Cl_4$	V-492	269.99
4474	**Naphthalic anhydride**	(1,8)	$C_{10}H_6:(CO)_2O$	XVII-521	198.17
4475	**Naphthasultam**	(1,8)	$C_{10}H_7O_2NS$	....	205.22
4476	disulfonate Na	(2,4)	$C_{10}H_4O_8NS_3Na_3·8\frac{1}{2}H_2O$	XXVII-356	584.45
4477	**Naphthazarin** (5,8;1,4)	5,8-dihydroxy-α-naphthoquinone	$(HO)_2C_{10}H_4O_2$	VIII-412	190.15
4478	*iso*-**Naphthazarin**	(2,3;1,4)	$(HO)_2C_{10}H_4O_2$	VIII-411	190.15
4479	**Naphthoflavone** (α)	7,8-benzoflavone	$C_{19}H_{12}O_2$	XVII-390	272.29
4480	**Naphthoic** acid (α)	....	$C_{10}H_7·CO_2H$	IX-647	172.17
4481	acid (β)	isonaphthoic acid	$C_{10}H_7·CO_2H$	IX-656	172.17
4482	aldehyde (α)	....	$C_{10}H_7·CHO$	VII-400	156.17
4483	aldehyde (β)	....	$C_{10}H_7·CHO$	VII-401	156.17
4484	amide (α)	....	$C_{10}H_7·CONH_2$	IX-648	171.19

Mudarin 4444
Munjistin 2305
Murexan 6384
Murrayin, cf. glcde.
Muscarine, cf. alkd.
Muscle sugar 1602-3
Musk, artificial 6296
Musk xylene 6297
Mustard gas 1985
Mustard imitator gas 1473
Mustard oils, cf. also **iso**-thiocyanates.
Mustard oil 220
Mustard oil acetic acid 2369
Mycose 6054
Myrbane oil 4646

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4440	lf./act.	....	158 ± d.	....	v. s.	v. s. h.	i.
4441	pl./et. lg.	....	122-5	....	v. s. h.	v. s.	v. s.
4442	pl./aq.	....	127	....	s. h.	s.	s.; i. lg.
4443	nd./aq.	....	298 d.	....	0.002 c.	s. h.	s. h. ac.
4444	hex./al. et.	....	176	....	i.	s.	s.
4445	gn. red pd.	....	....	....	v. sl. s. c.	i.	i.
4446	col. oil	$0.922^{17^\circ}_{4}$	*	328	v. sl. s.	∞	....
4447	lt. yel. pd.	....	....	....	v. s.	....	....
4448	nd.	....	73-5	$311\text{-}3^{8\text{mm}}$	....	....	....
4449	nd. or lf.	0.777^{95°	88	....	i.	v. sl. s. c.; v. sl. s. pet.	v. s.; v. s. bz.
4450	col. lf.	$0.853^{70^\circ}_{4}$	57-8	$250.5^{100\text{mm}}$	i.; v. s. bz.	v. s. abs.	v. s.
4451	cr.	....	23.5	$166^{24\text{mm}}$	....	....	....
4452	nd.	....	102	$217^{12\text{mm}}$	i.	s.	sl. s.
4453	col. cr.	$0.850^{20^\circ}_{4}$	53.5	$198^{0.1\text{mm}}$	....	....	....
4454	nd./al.	....	84	$113^{10\text{mm}}$	i.; s. chl.	v. s. bz.	v. s.
4455	col. lq.	....	−1	$168^{15\text{mm}}$	d.	d.	s.
4456	cr.	$0.828^{19^\circ}_{4}$	19	$226.5^{100\text{mm}}$	....	s.	....
4457	col. lq.	....	3-5	....	i.	....	s.
4458	col. pl./al.	$1.145^{20^\circ}_{4}$	80.2	217.9	0.003^{25°; v. s. CCl_4	$9.5^{19.5^\circ}$; v. s. CS_2	v. s.; 46^{16° bz.
4459	nd.	....	>240	....	i. h.	s.	....
4460	nd./al.	....	d. >140	....	v. sl. s.	s. h.	sl. s.
4461	lf.	....	d.	....	102^{20°	s.	i.
4462	cr.	....	....	d. 125	164^{20°	s.	i.
4463	hyg. lf.	....	....	....	s.	....	....
4464	hyg. nd.	....	....	....	s.	sl. c. HCl	....
4465	nd./aq.	....	98-9	....	s.	s.	sl. s.
4466	nd.	....	105	....	s.	s.	s.
4467	cr./al.	....	150	....	....	v. s.	v. s.
4468	lf./et.	....	68	$195^{13\text{mm}}$	i.	v. s.	v. s.
4469	lf.	....	79	$201^{13\text{mm}}$	i.	sl. s. pet.	s. bz.
4470	cr.	....	90	....	v. s.	v. s.	sl. s.
4471	hyg. cr.	....	125**	....	77^{30°	0.2 h. bz.	....
4472	cr./aq.	....	....	d.	$6^{23.9^\circ}$	....	....
4473	mn./chl.	....	182	....	i.	v. sl. s. h.	sl. s. h.
4474	nd./al.	....	273-4	....	sl. s. ac.	v. sl. s.	v. sl. s.
4475	nd./bz.	....	177-8	....	s. h.	sl. s.	s.
4476	yel. lf./aq. al.	....	$-8H_2O$, 160	....	v. s.	sl. s.	....
4477	brn. nd./al.	....	subl. vac.	....	sl. s. h.	sl. s.; s. alk.	sl. s.
4478	brn. lf./ac.	....	276-80	subl.	sl. s. h.	sl. s.	v. sl. s.
4479	cr./aq. al.	....	155-6	....	....	....	....
4480	nd./aq. al.	....	160-1	300	v. sl. s. h.	s. h.	s.
4481	mn.	$1.077^{100^\circ}_{4}$	184	>300	0.007^{25°	s.	s.
4482	lq.	$1.148^{20^\circ}_{4}$	....	291.6	....	....	....
4483	lf./h. aq.	$1.078^{99.4^\circ}$	60.5–1.0	....	s. h.	v. s.	v. s.
4484	nd./al.	....	202	....	....	v. sl. s.	....

* Oxime, m. p. 45°; semicarbazone, m. p. 134°.

** Crysts. + $3H_2O$, m. p. 83°; anh., m. p. 91°.

Myristamide 4452
Myristanilide 4454
Myristoyl chloride 4455
Myristyl alcohol 5750
Nandinine, cf. alkd.
Napelline, cf. alkd.
Naphthacetol 31
Naphthalene acetic acid 4528
Naphthalene decahydride 1631-2
Naphthalic acid 4459-60
Naphthalidine 4529

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Naphthoic				
4485	amide (β)	....	$C_{10}H_7{\cdot}CONH_2$	IX-657	171.19
4486	chloride (β)	β-naphthoyl chloride	$C_{10}H_7{\cdot}COCl$	IX-657	190.62
4487	nitrile (α)	α-naphthyl cyanide	$C_{10}H_7{\cdot}CN$	IX-649	153.17
4488	nitrile (β)	β-naphthyl cyanide	$C_{10}H_7{\cdot}CN$	IX-659	153.17
4489	**Naphthol** (α)	α-hydroxy naphthalene	$C_{10}H_7{\cdot}OH$	VI-596	144.16
4490	**Naphthol** (β)	β-hydroxy naphthalene	$C_{10}H_7{\cdot}OH$	VI-627	144.16
4491	disulfonic acid (β)	(2;3,6); R-acid	$HO{\cdot}C_{10}H_5(SO_3H)_2$	XI-288	304.28
4492	disulfonic Ca	R-acid Ca salt	$HO{\cdot}C_{10}H_5(SO_3)_2Ca$	....	342.35
4493	disulfonic K	R-acid K salt	$HO{\cdot}C_{10}H_5(SO_3K)_2$	....	380.46
4494	disulfonic Na	R-acid Na salt	$HO{\cdot}C_{10}H_5(SO_3Na)_2$	XI-289	348.26
4495	disulfonic K (β)	(2;6,8); G-acid K	$HO{\cdot}C_{10}H_5(SO_3K)_2$	....	380.46
4496	disulfonic Na (β)	G-acid Na salt	$HO{\cdot}C_{10}H_5(SO_3Na)_2$	XI-290	348.26
4497	phthalein (α)	....	$C_8H_4O_2(C_{10}H_6OH)_2$	XVIII-157	418.42
4498	sulfonic acid (α)	(1,2); Schaeffer's (α)	$HO{\cdot}C_{10}H_6{\cdot}SO_3H$	XI-269	224.22
4499	sulfonic Ca (α)	Schaeffer's Ca (α)	$(C_{10}H_7O_4S)_2Ca{\cdot}H_2O$	XI-270	504.53
4500	sulfonic K (α)	Schaeffer's K	$C_{10}H_7O_4SK{\cdot}\frac{1}{2}H_2O$	XI-270	271.32
4501	sulfonic Na (α)	Schaeffer's Na	$C_{10}H_7O_4SNa$	XI-269	246.21
4502	sulfonic acid (α)	(1,4); Neville-Winther	$HO{\cdot}C_{10}H_6{\cdot}SO_3H$	XI-271	224.22
4503	sulfonic acid (α)	(1-OH; 5-SO_3H)	$HO{\cdot}C_{10}H_6{\cdot}SO_3H$	XI-273	224.22
4504	sulfonic acid (α)	(1,8)	$HO{\cdot}C_{10}H_6{\cdot}SO_3H{\cdot}H_2O$	XI-275	242.24
4505	sulfonic acid (β)	(2-OH; 1-SO_3H)	$HO{\cdot}C_{10}H_6{\cdot}SO_3H$	XI-281	224.22
4506	sulfonic Ca (β)	(2,1); asaprol	$(C_{10}H_7O_4S)_2Ca{\cdot}3H_2O$	....	540.56
4507	sulfonic acid (β)	(2,6); Schaeffer's (β)	$HO{\cdot}C_{10}H_6{\cdot}SO_3H$	XI-282	224.22
4508	sulfonic Ca (β)	Schaeffer's Ca (β)	$(C_{10}H_7O_4S)_2Ca{\cdot}5H_2O$	XI-282	576.59
4509	sulfonic K (β)	Schaeffer's K (β)	$C_{10}H_7O_4SK{\cdot}xH_2O$	XI-283	(262.31)
4510	sulfonic acid (β)	(2-OH; 7-SO_3H)	$HO{\cdot}C_{10}H_6{\cdot}SO_3H$	XI-285	224.22
4511	sulfonic Na (β)	(2,7); F-acid Na	$C_{10}H_7O_4SNa{\cdot}2\frac{1}{2}H_2O$	XI-286	291.25
4512	sulfonic Na (β)	(2,8) Bayer-acid Na	$C_{10}H_7O_4SNa$	XI-286	246.21
4513	**Naphtho**-phenazine	(α,β)	$C_{10}H_6{:}N_2{:}C_6H_4$	XXIII-276	230.26
4514	quinaldine (α)	....	$C_{13}H_8NCH_3$	XX-471	193.24
4515	quinaldine (β)	....	$C_{13}H_8NCH_3$	XX-471	193.24
4516	quinaldine (γ)	....	$C_{13}H_8NCH_3$	....	193.24
4517	quinoline (α)	....	$C_{13}H_9N$	XX-463	179.21
4518	quinoline (β)	5,6-benzoquinoline	$C_{13}H_9N$	XX-464	179.21
4519	quinoline HCl (β)	....	$C_{13}H_9N{\cdot}HCl{\cdot}2H_2O$	XX-465	251.71
4520	quinone (α)(1,4)	....	$C_{10}H_6O_2$	VII-724	158.15
4521	quinone (β)(1,2)	....	$C_{10}H_6O_2$	VII-709	158.15
4522	quinone-4-sulfonate Na (β)	....	$C_{10}H_5O_2{\cdot}SO_3Na$	XI-330	260.20
4523	quinone (amphi)	(2,6)	$C_{10}H_6O_2$	VII-733	158.15
4524	sulfone (1,8)	naphthosultone	$\underbrace{C_{10}H_6O{\cdot}SO_2}$	XIX-43	206.21
4525	**Naphthoylacetonitrile** (β)	....	$C_{10}H_7{\cdot}CO{\cdot}CH_2{\cdot}CN$	....	195.21
4526	**Naphthyl** acetate (α)	....	$CH_3CO_2{\cdot}C_{10}H_7$	VI-608	186.20
4527	acetate (β)	....	$CH_3CO_2{\cdot}C_{10}H_7$	VI-644	186.20
4528	acetic acid (α)	....	$C_{10}H_7{\cdot}CH_2CO_2H$	IX-666	186.20
4529	amine (α)	1-NH_2-naphthalene	$C_{10}H_7{\cdot}NH_2$	XII-1212	143.18

Naphthane 1631-2
Naphthanthracene 650
Naphthenic acid 3577
Naphthionic acid 4541, 4544
Naphthol yellow 2642
Naphthol yellow-S 3241
Naphtho-hydroquinone 2348, 2350
Naphtho-nitrile 4487-8
Naphtho-picric acid 6305
Naphtho-quinone oxime 4892

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4485	pl./al.	....	192	....	s. bz.	s. h.	s.; s. chl.
4486	cr.	....	43	304-6	d.	s. h. bz.	s. h.
4487	nd./lg.	$1.111^{25^{\circ}}_{25}$	36-7	299	....	v. s.	....
4488	lf./lg.	$1.094^{60^{\circ}}_{60}$	66	305-6	v. sl. s.	s.	s.
4489	mn.	$1.224^{4^{\circ}}$	96; subl.	278-80	sl. s. h.; s. alk.	v. s.; s. bz.	v. s.; s. chl.
4490	mn.	$1.217^{4^{\circ}}$	122-3	285-6	0.1c.; 1.25 h.	v. s.	v. s.; s. chl.
4491	delq. nd.	....	....	....	v. s.	v. s.	i.
4492	cr.	....	....	....	$30.6^{25^{\circ}}$	$61^{90^{\circ}}$ aq.	....
4493	cr.	....	....	....	$29.5^{25^{\circ}}$	$58^{100^{\circ}}$ aq.	....
4494	col. nd.	....	....	....	$25.2^{25^{\circ}}$	v. sl. s.	$41^{90^{\circ}}$ aq.
4495	col. cr.	....	....	....	$8.01^{25^{\circ}}$	....	$32^{90^{\circ}}$ aq.
4496	col. cr.	....	....	....	$34.2^{20^{\circ}}$	....	$63^{90^{\circ}}$ aq.
4497	cr./bz.*	....	253-5*	....	i.	s.	s. alk.
4498	pl./aq.	....	>250	....	v. s. h.	....	i.
4499	cr.	....	....	....	v. sl. s.	....	....
4500	pr./aq.	....	....	....	$2.8^{18^{\circ}}$	v. sl. s.	i. KCl
4501	cr./al.	....	....	....	$6.29^{25^{\circ}}$	$23^{90^{\circ}}$ aq.	....
4502	pl./aq.	....	170 d.	....	v. s.	....	....
4503	hyg. cr.	....	110-20	....	v. s.	....	....
4504	cr.	....	106-7	$-H_2O$, 180	v. s.	....	....
4505	cr.	....	....	....	v. s.	....	....
4506	wh. pd.	....	50 ±	....	6.6	4	....
4507	lf.	....	125	....	v. s.	v. s.	....
4508	col. lf.	....	....	....	$4.76^{20^{\circ}}$	s.	$16^{90^{\circ}}$ aq.
4509	nd. or lf.	....	....	....	v. s. h.	i.	i.
4510	nd./HCl	....	115-6**	d. 150	s.	s.	i.; i. bz.
4511	lf.	....	....	....	$8^{15^{\circ}}$	....	....
4512	lf.	....	....	....	v. s.	v. sl. s.	....
4513	yel. nd./bz.	....	142.5	>360	sl. s. bz.	v. sl. s.	v. sl. s.
4514	lq.	....	....	>300	....	....	....
4515	nd./aq. al.	....	82	>300	sl. s.	s.	s.
4516	cr.	....	91-2	....	....	....	....
4517	mn./et.	....	52	$223^{47 mm}$	v. sl. s.	s.	s.; s. bz.
4518	pl./h. aq.	....	93.5	$350^{721 mm}$	sl. s. h.; s. aq. a.	v. s.	v. s.; v. s. bz.
4519	nd.	....	....	....	v. s.	i.	....
4520	yel. tri.	....	125-6	subl. 100	v. sl. s. c.	v. s. h.	s.
4521	red nd./et.	....	d. 115-20	....	s.; s. H_2SO_4	s. bz.	s.
4522	cr./50% al.	....	....	....	v. s.	i.	....
4523	red pr.	....	135	....	i. pet.	s. d.	v. sl. s.
4524	pr./bz.	....	154	>360 sl. d.	sl. s. CS_2	sl. s.; v. s. chl.	s. h. bz.
4525	yel. nd.	....	118-20	....	i.	s.	sl. s.
4526	nd./al.	....	46-9	....	....	s.	s.
4527	nd./al.	....	69-70	....	s. chl.	s.	s.
4528	col. nd./aq.	....	133	....	s. h.	3.3	s.; s. bz.
4529	rhb./aq. al.	$1.123^{25^{\circ}}_{25}$	50; subl.	300.8	0.17 c.	v. s.	v. s.

* Crysts. + C_6H_6; loses C_6H_6 > 100°; m. anh. 253-5°.

** Crysts. + $1H_2O$, m. p. 108-9; + $2H_2O$, m. p. 95°; + $4H_2O$, m. p. 67°.

Naphtho-resorcinol 2349

Naphtho-salol 4569

Naphtho-sultone 4524

Naphthoyl chloride 4486

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4530	**Naphthyl** amine (β)	amino-naphthalene	$C_{10}H_7 \cdot NH_2$	XII-1265	143.18
4531	amine HCl (α)	....	$C_{10}H_7 \cdot NH_2 \cdot HCl$	XII-1220	179.65
4532	amine HCl (β)	....	$C_{10}H_7 \cdot NH_2 \cdot HCl$	XII-1272	179.65
4533	amine-4,8-disulfonic acid (α)	α,S-acid; δ-acid	$NH_2 \cdot C_{10}H_5(SO_3H)_2$	XIV-787	303.30
4534	amine-4,8-disulfonic acid (β)	β,C-acid	$NH_2 \cdot C_{10}H_5(SO_3H)_2$	XIV-786	303.30
4535	amine-5,7-disulfonic acid (β)	....	$C_{10}H_9O_6NS_2 \cdot 5H_2O$	XIV-783	303.30
4536	amine-5,7-disulfonic K salt (β)	....	$C_{10}H_8O_6NS_2K$	....	341.39
4537	amine-6,8-disulfonic acid (β)	β,γ-acid; amido-G acid	$NH_2 \cdot C_{10}H_5(SO_3H)_2 \cdot 4H_2O$	XIV-784	375.36
4538	amine-6,8-disulfonic K salt (β)	....	$C_{10}H_8O_6NS_2K$	....	341.39
4539	amine-6,8-disulfonic Na salt (β)	....	$C_{10}H_8O_6NS_2Na$	....	325.29
4540	amine-6,8-disulfonic Na salt (β)	....	$C_{10}H_7O_6NS_2Na_2$	....	348.29
4541	amine-*p*-sulfonic acid (α)	naphthionic acid; (1,4)	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-739	223.24
4542	amine-*p*-sulfonic Na (α)	naphthionic Na salt	$C_{10}H_8O_3NSNa \cdot 4H_2O$	XIV-739	317.33
4543	amine sulfonic acid (α)	Schollkopf's acid; peri acid; (1,8)	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-752	223.24
4544	amine sulfonic acid	(α)(1,2)	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-757	223.24
4545	amine sulfonic acid (α)(4,2)	Cleve's γ-acid	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-757	223.24
4546	amine sulfonic (α)	(5,2); Cleve's β-acid	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-758	223.24
4547	amine sulfonic (α)	(8,2); Cleve's θ-acid	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-765	223.24
4548	amine sulfonic (α)	(5,1); Laurent's acid	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-744	223.24
4549	amine sulfonic (β)	(2,1); Tobias' acid	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-738	223.24
4550	amine sulfonic (β)	(6,1); Dahl's acid	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-748	223.24
4551	amine sulfonic (β)	(7,1); Dahl's acid	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-750	223.24
4552	amine sulfonic (β)	(6,2); Bronner's acid	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-760	223.24
4553	amine sulfonic (β)	(7,2); δ-acid	$NH_2 \cdot C_{10}H_6 \cdot SO_3H$	XIV-763	223.24
4554	amine-3,6,8-trisulfonic acid (α)	Koch acid; amino-H acid	$NH_2 \cdot C_{10}H_4(SO_3H)_3 \cdot 6H_2O$	XIV-801	487.42
4555	amine-3,6,8-trisulfonic Na (β)	Koch acid Na; amino-H acid Na	$C_{10}H_6O_9NS_3Na_3$	....	449.33
4556	benzoate (α)	....	$C_6H_5CO_2 \cdot C_{10}H_7$	IX-125	248.27
4557	benzoate (β)	....	$C_6H_5CO_2 \cdot C_{10}H_7$	IX-125	248.27
4558	*iso*-cyanate (α)	....	$C_{10}H_7 \cdot N{:}CO$	XII-1244	169.17
4559	*iso*-cyanate (β)	....	$C_{10}H_7 \cdot N{:}CO$	XII-1297	169.17
4560	ether (α)	dinaphthyl ether	$C_{10}H_7 \cdot O \cdot C_{10}H_7$	VI-607	270.31
4561	ether (α,β′)	dinaphthyl ether	$C_{10}H_7 \cdot O \cdot C_{10}H_7$	VI-642	270.31
4562	ether (β)	dinaphthyl ether	$C_{10}H_7 \cdot O \cdot C_{10}H_7$	VI-642	270.31
4563	hydrazine (α)	....	$C_{10}H_7 \cdot NH \cdot NH_2$	XV-561	158.20

Naphthylamine red-G 3732
Naphthyl-benzamidine 689
Naphthyl bromide 956-7
Naphthyl chloride 1402-3
Naphthyl cyanide 4487-8
Naphthyl-ethyl ether 3093-4
Naphthyl fluoride 3273
Naphthyl iodide 3891-2
Naphthyl-mercaptan 5913-4
Naphthyl-nitrosohydroxylamine 4581

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4530	lf./aq.	$1.061^{98\circ}_{4}$	111-2	306.1	v. s. h.	s.	s.
4531	nd.	....	....	subl.	$3.8^{20\circ}$	s.	s.
4532	lf.	....	....	....	v. s.	v. s.	....
4533	cr.	....	....	....	s. alk.	....	....
4534	pr.	....	....	....	s. alk.	v. sl. s. H_2SO_4	....
4535	rhb./aq.	....	....	....	$23^{20\circ}$	$10^{20\circ}$ aq.*	$24^{54\circ}$ aq.*
4536	cr.	....	....	....	$3.4^{18\circ}$	$6^{71\circ}$ aq.	....
4537	nd./aq.	....	....	....	$9^{20\circ}$	sl. s.	....
4538	cr.	....	....	....	$12.8^{20\circ}$	$34^{78\circ}$ aq.	....
4539	cr.	....	....	....	$2.7^{18\circ}$	$12^{78\circ}$ aq.	....
4540	cr.	....	....	....	v. sl. s.	....	....
4541	nd. + $\frac{1}{2}H_2O$	....	d.	....	$0.03^{10\circ}$; $0.2^{100\circ}$	i.; s. alk.	i.
4542	mn. or rhb.	....	$-3\frac{1}{2}H_2O$, 80	$-4H_2O$, 130	s.; v. sl. s. aq. alk.	sl. s.	i.
4543	nd. + $1H_2O$	....	d.	....	$0.02^{21\circ}$; $0.4^{100\circ}$	s. ac.	....
4544	nd./aq.	....	262-5 d.	....	$0.2^{40\circ}$; $3.1^{100\circ}$	i.	i. bz.
4545	nd.	....	....	....	sl. s.	....	....
4546	cr./aq.	....	....	....	$0.1^{16\circ}$	i.	i.
4547	nd. + $1H_2O$	....	....	....	$0.46^{25\circ}$	v. sl. s.	v. sl. s.
4548	cr. + $1H_2O$	....	d.	$-H_2O$, 110	0.1 c.	i.	i.
4549	cr./HCl	....	....	....	d. h.	....	....
4550	pl./aq.	....	....	....	$0.03^{20\circ}$	i.	i.
4551	pr./aq.	....	....	....	$0.06^{20\circ}$	i.	....
4552	cr. + $1H_2O$	....	....	....	$0.01^{20\circ}$; $0.16^{100\circ}$	....	....
4553	cr. + $1H_2O$	....	....	....	$0.02^{20\circ}$; $0.3^{100\circ}$	....	....
4554	cr.	....	....	....	$200^{18\circ}$	$12.5^{18\circ}$	....
4555	cr.	....	....	....	$7.21^{20\circ}$	$16^{54\circ}$ aq.	....
4556	cr./et. al.	....	56	....	....	....	v. s.
4557	nd./al.	....	107-10	....	i.; s. chl.	s. h.	sl. s.
4558	col. lq.	1.18	....	269-70	d.	s.; s. pet.	s.; s. chl.
4559	lf.	....	55-6	....	d.	v. s.	s.; s. bz.
4560	lf./al.	....	110	>360	i.; s. bz.	sl. s. c.	s.
4561	nd./et. al.	....	81	264^{15mm}	s. bz.	....	s.
4562	nd./al.	....	105; d. 380	250^{19mm} sl. d.	v. s. bz.	s. h.	v. s.; sl. s. c. ac.
4563	col. cr.	....	116-7	203^{20mm}	v. sl. s. c.	v. s. h.	sl. s.

* Solubility of anhy. compd.

Naphthalene ethylene 2
Narceine, cf. alkd.
Narcissine, cf. alkd.
Narcosine, cf. alkd.
Narcotine, cf. alkd.
Naringin, cf. glcde.
Neoarsphenamine 5593
Neobornyval 868
Neocincophen 3130
Neol 376
Neomenthol 4025
Neomenthyl acetate 4028
Neonal 2999
Neoquinophan 3130

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Naphthyl				
4564	hydrazine HCl (α)	....	$C_{10}H_7\cdot NH\cdot NH_2\cdot HCl$	XV-562	194.66
4565	hydrazine (β)	....	$C_{10}H_7\cdot NH\cdot NH_2$	XV-568	158.20
4566	hydrazine HCl (β)	....	$C_{10}H_7\cdot NH\cdot NH_2\cdot HCl$	XV-568	194.66
4567	hydroxylamine (α)	....	$C_{10}H_7\cdot NHOH$	XV-32	159.18
4568	salicylate (α)	alphol	$HOC_6H_4CO_2C_{10}H_7$	X-80	264.27
4569	salicylate (β)	betol	$HOC_6H_4CO_2C_{10}H_7$	X-80	264.27
4570	***iso***-thiocyanate (α)	....	$C_{10}H_7\cdot N{:}CS$	XII-1244	185.23
4571	**Naphthylene** diamine (1,2)	diamino-naphthalene	$C_{10}H_6(NH_2)_2$	XIII-196	158.20
4572	diamine (1,4)	....	$C_{10}H_6(NH_2)_2$	XIII-201	158.20
4573	diamine (1,5)	....	$C_{10}H_6(NH_2)_2$	XIII-203	158.20
4574	diamine (1,6)	....	$C_{10}H_6(NH_2)_2$	XIII-204	158.20
4575	diamine (1,7)	....	$C_{10}H_6(NH_2)_2$	XIII-205	158.20
4576	diamine (1,8)	....	$C_{10}H_6(NH_2)_2$	XIII-205	158.20
4577	diamine (2,3)	....	$C_{10}H_6(NH_2)_2$	XIII-207	158.20
4578	diamine (2,6)	....	$C_{10}H_6(NH_2)_2$	XIII-208	158.20
4579	diamine (2,7)	....	$C_{10}H_6(NH_2)_2$	XIII-208	158.20
4580	**Neo**-dorm(e)	α-***iso***-Pr-α-Br-butyramide	$(CH_3)_2CH\cdot C(C_2H_5)\cdot(Br)CONH_2$	....	208.11
4581	cupfer(r)on	α-naphthyl-nitroso-hydroxylamine NH_4	$C_{10}H_7N(NO)ONH_4$	*XVI-396	205.21
4582	synephrine HCl	α-OH-β-methyl-aminoethyl-3-OH benzene HCl	$HO\cdot C_6H_4\cdot CHOH\cdot CH_2\cdot NHCH_3\cdot HCl$	....	203.67
4583	**Nembutal**	pentobarbital Na	$C_2H_5\cdot C_4HN_2O_3Na\cdot CH(CH_3)\cdot C_3H_7$	....	248.26
4584	**Neurine**	trimethyl vinyl ammonium hydroxide	$CH_2{:}CH\cdot N(CH_3)_3\cdot OH$	IV-203	103.16
4585	**Neutral red**	toluylene red	$C_{15}H_{16}N_4\cdot HCl$	XXV-401	288.78
4586	**Nitranilic acid**	3,6-diNO_2-2,5-diOH-quinone	$(NO_2)_2C_6(OH)_2O_2\cdot aq.$	VIII-384	230.09
4587	**Nitro**-acenaphthene	(5-nitro)	$(NO_2)C_{10}H_5{:}(CH_2)_2$	V-588	199.20
4588	acetanilide (*o*)	....	$NO_2\cdot C_6H_4\cdot NHCOCH_3$	XII-691	180.16
4589	acetanilide (*m*)	....	$NO_2\cdot C_6H_4\cdot NHCOCH_3$	XII-703	180.16
4590	acetanilide (*p*)	....	$NO_2\cdot C_6H_4\cdot NHCOCH_3$	XII-719	180.16
4591	*p*-acetanisidide (3)	(3;1,4)	$NO_2\cdot C_6H_3(OCH_3)\cdot NHCOCH_3$	XIII-522	210.19
4592	acetic acid	....	$NO_2\cdot CH_2\cdot CO_2H$	II-225	105.05
4593	2-acetnaphthalide (1)	1-NO_2-2-acetyl-naphthylamine	$NO_2\cdot C_{10}H_6\cdot NHCOCH_3$	XII-1313	230.22
4594	acetophenone (ω)	benzoyl-nitro-methane	$C_6H_5\cdot CO\cdot CH_2\cdot NO_2$	VII-289	165.14
4595	acetophenone (*m*)	....	$NO_2\cdot C_6H_4\cdot CO\cdot CH_3$	VII-288	165.14
4596	*p*-acetphenetidide	(3;1,4)	$NO_2\cdot C_6H_3(OC_2H_5)\cdot NHCOCH_3$	XIII-522	224.21
4597	acet-*p*-toluidide	3-NO_2-4-acetyl-aminotoluene	$NO_2\cdot C_6H_3(CH_3)\cdot NHCOCH_3$	XII-1002	194.19
4598	4-acetylamino-phenylacetate	(3;4,1)	$NO_2\cdot C_6H_3(NHCO\cdot CH_3)\cdot O_2CCH_3$	....	238.20
4599	alizarin (3)(β)	alizarin orange	$(HO)_2C_{14}H_5O_2\cdot NO_2$	VIII-447	285.20
4600	alizarin (4)(α)	....	$(HO)_2C_{14}H_5O_2\cdot NO_2$	VIII-447	285.20

Neosalvarsan 5593
Neothesin 764
Neotropin 1709
Nepaline, cf. alkd.
Neriine, cf. alkd.
Nerol 1724 or 2516
Neroli, artificial 4108
Nerolin 4312
Neroline 3094
Neuronal 2131
Neville Winther acid 4502
Niamid 5488
Niazo 1709
Nicotinamide 5493
Nicotinamide flavionate 5494
Nicotinamide picrate 5495
Nicotine, cf. alkd.
Nicotinic acid 5488, 5496
Nicotinic flavionate 5491
Nicotinic picrate 5492

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts Water	Alcohol	Ether
4564	pl./HCl	....	....	....	s. c.	....	....
4565	col. lf./aq.	....	124-5	....	sl. s. h.	s. h.	sl. s.
4566	nd./aq.	....	....	....	s. h.	....	....
4567	cr./aq.	....	79	....	s.	s.	s.
4568	col. cr.	....	83	....	i.; s. oil	s.	s.
4569	col. cr./al.	....	95	....	i.	s. h.	s.; s. bz.
4570	nd./al.	....	58	....	i.	s. h.	s.
4571	lf./aq.	....	96-8	$150\text{-}1^{0.5mm}$	sl. s. h.	s.	s.
4572	pr./h. aq.	....	120	....	sl. s. h.	v. s.	v. s.
4573	pr./et.	....	189.5	....	s. h.	s. h.	s.
4574	nd./aq.	$1.147^{99.4°}_{4}$	77.5	....	s. h.	s. h.	s. h.
4575	nd./aq.	....	117.5	....	sl. s.	s.	v. sl. s.
4576	cr./aq. al.	$1.127^{99.4°}_{4}$	66.5	205^{12mm}	sl. s. h.	∞	∞
4577	lf./at.	....	191-3	....	....	s.	s.
4578	nd./aq.	....	216-8	....	v. sl. s. h.	sl. s.	sl. s.
4579	lf./aq.	....	159	....	....	....	....
4580	col. cr.	....	50-1	subl.	0.7 c.; d. h.	s.; s. pet.	s.; s. bz.
4581	lf./al. NH_3	....	125-6	....	s.	s. Me al.	i.
4582	col. cr.	....	139-41	....	s.	s.	....
4583	wh. cr. pd.	....	....	....	s.	s.	i.
4584	syrup, poison.	....	....	....	s.	d. aq. NH_4Cl	....
4585	gn. pd.	....	....	....	d., −HCl	s.	....
4586	yel. pl.	....	$-H_2O$, 100	expl. 170	v. s.	v. s.	i.
4587	yel. nd./lg.	....	101-2	....	s. h.	s.	s.
4588	yel. mn.	$1.419^{15°}$	93-4	....	s. h.; s. chl.	s.; v. s. 10% KOH	s.
4589	col. lf.	....	154	....	sl. s. h.	s.	i.; s. chl.
4590	rhb.	....	215-6	....	s. h.	s.; s. KOH	s.
4591	yel. nd./al.	....	117-8	....	s. h.	s.; s. bz.	s.; s. ac.
4592	nd./chl.	....	87-9 d.	....	d.	v. s.	v. s.; i. pet.
4593	yel. rhb. nd./al.	....	123.5	....	sl. s. h.; v. sl. s. lg.	s.; s. bz.; s. ac.	v. sl. s.
4594	lf./aq. al.	....	106-8	....	i. c.	v. s.	v. s.
4595	nd.	....	80-1	202	i.	s.	....
4596	yel. nd./aq.	....	103-4	....	....	s. abs.	s.; s. chl.
4597	yel. nd./pet.	....	96; softens 94	....	sl. s. h.	s.	....
4598	yel. pr./aq. al.	....	147-8	....	....	....	....
4599	yel. lf./al.	....	244 d.	subl. sl. d.	sl. s.	s. chl., bz.	s. aq. alk.
4600	yel. nd./al.	....	289 d.	....	v. sl. s.; s. H_2SO_4	s. chl., bz.	s. aq. alk.

Nicotyrine 2809
Ninhydrin 6239
Niobe oil 4138
Nioform 1392
Nipagin 4274
Nipasol 5415
Nirvanol 3126
Nitramine 5873
Nitramino-methane 4314
Nitraniline 4618-20
Nitric ether 3096
Nitrilo-malonic acid 1583
Nitro-acetamino-dimethylbenzene 4871
Nitro-acetylamino-anisole 4591
Nitro-acetylamino-phenetole 4596

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Nitro				
4601	2-aminoanisole (4)	(4;1,2)	$NO_2\cdot C_6H_3(OCH_3)NH_2$	XIII-389	168.15
4602	2-aminoanisole (5)	5-nitro-*o*-anisidine	$NO_2\cdot C_6H_3(OCH_3)NH_2$	XIII-390	168.15
4603	4-aminoanisole (3)	(3;1,4)	$NO_2\cdot C_6H_3(OCH_3)NH_2$	XIII-521	168.15
4604	*o*-aminobenzoic acid (3)	(3;1,2) nitro-anthranilic acid	$NO_2\cdot C_6H_3(CO_2H)\cdot NH_2$	XIV-373	182.13
4605	*o*-aminobenzoic acid (4)	(4;1,2)	$NO_2\cdot C_6H_3(CO_2H)\cdot NH_2$	XIV-374	182.13
4606	*o*-aminobenzoic acid (5)	(5;1,2)	$NO_2\cdot C_6H_3(CO_2H)\cdot NH_2$	XIV-375	182.13
4607	*o*-aminobenzoic acid (6)	(6;1,2)	$NO_2\cdot C_6H_3(CO_2H)\cdot NH_2$	XIV-378	182.13
4608	*m*-aminobenzoic acid (5)	(5;1,3)	$NO_2\cdot C_6H_3(CO_2H)\cdot NH_2$	XIV-415	182.13
4609	*p*-aminobenzoic acid (2)	(2;1,4)	$NO_2\cdot C_6H_3(CO_2H)\cdot NH_2$	XIV-439	182.13
4610	*o*-aminophenol (3)	(3;2,1)	$NO_2\cdot C_6H_3(NH_2)OH$	....	154.12
4611	*o*-aminophenol (4)	(4;2,1)	$NO_2\cdot C_6H_3(NH_2)OH$	XIII-388	154.12
4612	*o*-aminophenol (5)	(5;2,1)	$NO_2\cdot C_6H_3(NH_2)OH$	XIII-390	154.12
4613	*o*-aminophenol (6)	(6;2,1)	$NO_2\cdot C_6H_3(NH_2)OH$	XIII-391	154.12
4614	*m*-aminophenol (5)	(5;3,1)	$NO_2\cdot C_6H_3(NH_2)OH$	XIII-422	154.12
4615	*p*-aminophenol (2)	(2;4,1)	$NO_2\cdot C_6H_3(NH_2)OH$	XIII-520	154.12
4616	*p*-aminophenol (3)	(3;4,1)	$NO_2\cdot C_6H_3(NH_2)OH$	XIII-521	154.12
4618	aniline (*o*)	*o*-nitraniline	$NO_2\cdot C_6H_4\cdot NH_2$	XII-687	138.12
4619	aniline (*m*)	*m*-nitraniline	$NO_2\cdot C_6H_4\cdot NH_2$	XII-698	138.12
4620	aniline (*p*)	*p*-nitraniline	$NO_2\cdot C_6H_4\cdot NH_2$	XII-711	138.12
4621	aniline-4-sulfonic acid (2)	nitrosulfanilic acid	$NO_2\cdot C_6H_3(NH_2)SO_3H$	XIV-708	218.18
4622	aniline-2-sulfonic acid (4)	(4;1,2)	$NO_2\cdot C_6H_3(NH_2)SO_3H$	XIV-686	218.18
4623	anisole (*o*)	....	$CH_3O\cdot C_6H_4\cdot NO_2$	VI-217	153.13
4624	anisole (*m*)	....	$CH_3O\cdot C_6H_4\cdot NO_2$	VI-224	153.13
4625	anisole (*p*)	....	$CH_3O\cdot C_6H_4\cdot NO_2$	VI-230	153.13
4626	anthracene (9)	nitrosoanthron	$C_{14}H_9\cdot NO_2$	V-666	223.22
4627	anthraquinone (1)	....	$C_6H_4(CO)_2C_6H_3\cdot NO_2$	VII-791	253.20
4628	anthraquinone (2)	....	$O_2C_{14}H_7\cdot NO_2$	VII-792	253.20
4629	anthraquinone-2-carbonyl chloride	(1-NO_2)	$O_2C_{14}H_6(NO_2)COCl$	....	315.66
4630	anthraquinone-5-sulfonic acid (1)	(1-NO_2)	$O_2C_{14}H_6(NO_2)SO_3H$	XI-336	333.26
4631	anthraquinone-8-sulfonic acid (1)	(1-NO_2)	$O_2C_{14}H_6(NO_2)SO_3H$	XI-337	333.26
4632	barbituric acid (5)	dilituric acid	$NO_2\cdot C_4H_3O_3N_2\cdot 3H_2O$	XXIV-474	227.14
4633	benzalacetophenone	(1,3)	$NO_2\cdot C_6H_4\cdot CH{:}CH\cdot CO\cdot C_6H_5$	VII-482	253.25
4634	benzal bromide (*p*)	....	$NO_2\cdot C_6H_4\cdot CH{:}Br_2$	V-336	294.95
4635	benzal chloride (*m*)	....	$NO_2\cdot C_6H_4\cdot CH{:}Cl_2$	V-332	206.03
4636	benzal chloride (*p*)	....	$NO_2\cdot C_6H_4\cdot CH{:}Cl_2$	V-332	206.03

Nitro-acetylamino-toluene 4597
Nitro-acetylnaphthylamine 4593
Nitro-allyl 4829
Nitro-aminophenetole 4795
Nitro-aminotoluene 4849-58
Nitro-amylene glycol 4789
Nitro-anisidine 4602
Nitro-anthranilic acid 4604-7
Nitro base 4883

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4601	red nd./al.	$1.207^{156°}$	118	....	s. h. bz.	s.; s. ac.	v. sl. s. lg.
4602	pa. yel. nd.	$1.211^{156°}$	139-40	....	....	....	....
4603	red/aq. al.	....	123	....	sl. s.	s.	s.
4604	yel. mn.	$1.558^{15°}$	204	....	i.	v. s.	v. s.
4605	yel. red nd.	....	269.5	....	v. sl. s. h.	s. xylene	....
4606	lt. yel. nd.	....	270-80 d.	....	s. h.	s.	s.
4607	yel. lf./aq.	....	183-4 d.	....	s. h.	v. s.	v. s.
4608	yel. pr./aq.	....	208	....	sl. s.	s. h.	sl. s.; v. s. h. ac.
4609	red nd./ aq.	....	240	....	s. h.	v. s.	v. s. ac.
4610	cr.	....	136	....	....	....	....
4611	or. pr.	....	142-3	....	sl. s. c.	v. s.	v. s.
4612	brn.nd./aq.	....	201-2	....	....	s. h.	....
4613	red nd./ aq. al.	....	110-1	....	v. sl. s. c.	s.; v. s. chl.	v. s.; v. s. bz.
4614	yel. cr.	....	165	....	v. sl. s. bz., chl.	v. s.	v. s.
4615	red nd. al.	....	128-31	....	....	....	....
4616	red pr./et. al.	....	154	....	s.	s.	s.
4618	yel. rhb.	$1.442^{15°}$	71.5	284.1	s. h.	v. s.	v. s.
4619	yel. rhb.	1.43	114	306.4	$0.11^{20°}$	$7.1^{20°}$	$7.9^{20°}$
4620	yel. mn.	$1.437^{14°}$	146-7	331.7	$0.08^{18.5°}$; 2.2 h.	$5.8^{20°}$	$6.1^{20°}$
4621	yel. nd.	....	....	....	v. s.; s. aq. H_2SO_4	sl. s.	s. conc. HCl
4622	yel. cr.	....	....	....	....	....	....
4623	col. cr.	$1.254^{20°}$	9.4	272-3	$0.17^{30°}$	∞	∞
4624	nd. al.	$1.373^{18°}$	38	258	i.	s.	....
4625	pr./al.	$1.233^{20°}$	54	274	$0.06^{30°}$	v. s.	v. s.
4626	yel. nd./al.	....	146	>360	i. aq. alk.	sl. s.	v. s. bz.
4627	nd./ac.	....	230	270^{7mm}	i.	sl. s.	v. sl. s.
4628	yel. nd./al.	....	184.5-5.0	$270\text{-}1^{7mm}$	s. H_2SO_4	v. sl. s. c.	sl. s.; v. s. chl.
4629	tan flakes	....	230 d.	....	i.	i.	i.
4630	yel. cr./aq.	....	....	....	s.	i.	i.
4631	yel. cr./aq.	....	....	....	sl. s.	i.	i.
4632	pr./aq.	....	176 d. (anh.)	....	$0.09^{25°}$	s.; s. alk.	i.
4633	yel. nd./ al. or bz.	....	144-5	....	i. lg.; v. s. bz.	s.; s. chl.	i.; s. ac.
4634	nd./al.	....	82.0-2.5	....	i.	s.	s.
4635	mn.	....	65	....	i.	v. s. h.	v. s.
4636	pr./al.	....	46	....	i.	v. s.	v. s.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4637	**Nitro** benzaldehyde (*o*)	....	$NO_2{\cdot}C_6H_4{\cdot}CH{:}O$	VII-243	151.12
4638	benzaldehyde phenylhydrazone (*o*)	....	$NO_2{\cdot}C_6H_4{\cdot}CH{:}N{\cdot}NH{\cdot}C_6H_5$	XV-136	241.24
4639	benzaldehyde (*m*)	....	$NO_2{\cdot}C_6H_4{\cdot}CH{:}O$	VII-250	151.12
4640	benzaldehyde (*p*)	....	$NO_2{\cdot}C_6H_4{\cdot}CH{:}O$	VII-256	151.12
4641	benzalfurfuralacetone (*m*)	....	$NO_2{\cdot}C_6H_4{\cdot}CH{:}CH{\cdot}CO{\cdot}CH{:}CH{\cdot}C_4H_3O$	....	269.25
4642	benzamide (*o*)	....	$NO_2{\cdot}C_6H_4{\cdot}CO{\cdot}NH_2$	IX-373	166.13
4643	benzamide (*m*)	....	$NO_2{\cdot}C_6H_4{\cdot}CO{\cdot}NH_2$	IX-381	166.13
4644	benzamide (*p*)	....	$NO_2{\cdot}C_6H_4{\cdot}CO{\cdot}NH_2$	IX-394	166.13
4645	benzanilide (*m*)	....	$NO_2C_6H_4CONHC_6H_5$	XII-267	242.23
4646	benzene	oil of mirbane	$C_6H_5{\cdot}NO_2$	V-233	123.11
4647	benzeneazochromotropic Na salt	*p*-nitrobenzeneazo-1,8-diOH-naphthalene-3,6-disulfonic Na	$NO_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_{10}H_3(OH)_2(SO_3Na)_2$	....	513.37
4648	benzeneazo-α-naphthol (*p*)	....	$NO_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_{10}H_6(OH)$	XVI-151	293.27
4649	benzeneazo-orcinol (*p*)	(4′;4,6,2)	$NO_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_2(OH)_2CH_3$	....	273.24
4650	benzeneazo-resorcinol (*m*)	(3′;2,4)	$NO_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_3(OH)_2$	....	259.22
4651	benzeneazo-resorcinol (*p*)	(4′;2,4)	$NO_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_3(OH)_2$	XVI-181	259.22
4652	benzeneazo-salicylic acid (*p*)	(4′;4,3)	$NO_2{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_6H_3(OH)CO_2H$	XVI-247	287.23
4653	benzeneazo-salicylic Na (*p*)	alizarin yellow R	$C_{13}H_8O_5N_3Na$	....	309.22
4654	benzene sulfonic acid (*o*)	....	$NO_2{\cdot}C_6H_4{\cdot}SO_3H$	XI-67	203.17
4655	benzene sulfonic acid (*m*)	....	$NO_2{\cdot}C_6H_4{\cdot}SO_3H$	XI-68	203.17
4656	benzene sulfonic Na	(*m*)	$NO_2{\cdot}C_6H_4{\cdot}SO_3Na$	XI-68	225.16
4657	benzene sulfonic chloride (*m*)	....	$NO_2{\cdot}C_6H_4{\cdot}SO_2Cl$	XI-69	221.62
4658	benzhydrazide (*o*)	....	$NO_2{\cdot}C_6H_4CO{\cdot}NH{\cdot}NH_2$	IX-375	181.15
4659	benzhydrazide (*m*)	....	$NO_2{\cdot}C_6H_4CO{\cdot}NH{\cdot}NH_2$	IX-388	181.15
4660	benzhydrazide (*p*)	....	$NO_2{\cdot}C_6H_4CO{\cdot}NH{\cdot}NH_2$	IX-399	181.15
4661	benzidine (2)	....	$NO_2(NH_2)C_6H_3{\cdot}C_6H_4{\cdot}NH_2$	XIII-235	229.23
4662	benzimidazole (6)	....	$\underline{HN{\cdot}CH{:}N{\cdot}C_6H_3}{\cdot}NO_2$	XXIII-135	163.13
4663	benzoic acid (*o*)	....	$NO_2{\cdot}C_6H_4{\cdot}CO_2H$	IX-370	167.12
4664	benzoic acid (*m*)	....	$NO_2{\cdot}C_6H_4{\cdot}CO_2H$	IX-376	167.12
4665	benzoic Na (*m*)	....	$C_7H_4O_4NNa{\cdot}3H_2O$	IX-377	243.16
4666	benzoic acid (*p*)	....	$NO_2{\cdot}C_6H_4{\cdot}CO_2H$	IX-389	167.12
4667	benzonitrile (*o*)	....	$NO_2{\cdot}C_6H_4{\cdot}CN$	IX-374	148.12
4668	benzonitrile (*m*)	....	$NO_2{\cdot}C_6H_4{\cdot}CN$	IX-385	148.12

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4637	yel. nd./aq.	....	40.9 (37.9)	$153^{23\text{mm}}$	v. sl. s.	v. s.	v. s.; s. bz.
4638	red nd.	....	154-5	....	v. s. act.; i. lg.	sl. s.	sl. s.
4639	nd./aq.	....	58	$164^{23\text{mm}}$	$0.16^{25°}$	v. s. h.	s.; s. chl.
4640	pr./aq.	....	106.5	....	v. sl. s.	v. s.	sl. s.
4641	yel. pd.	....	120-4	....	i.	sl. s. h.	i.
4642	nd./aq. al.	$1.462_{4}^{32°}$	176.6	317	s. h.	s. h.	s.
4643	yel. mn./aq.	....	142-3	310-5	v. sl. s.	s.	s.
4644	nd./aq.	....	200-1.4	....	sl. s.	s.	s.
4645	lf./al.	....	153-4	subl.	sl. s.	s.	s.; s. bz.
4646	lt. yel. lq.	$1.205_{4}^{18°}$	5.6-5.7	210.9	$0.19^{20°}$	v. s.	∞; ∞ bz.
4647	red brn. pd.	....	....	....	s.	i.	....
4648	red gn. nd.	....	234-5	d. 255-60	s. am. al.; v. sl. s. chl.	v. sl. s.; s. xylene	v. sl. s.; v. sl. s. bz.
4649	dark red pd.	....	210-2 d.	....	i.	s.	sl. s.
4650	brn. pd.	....	174-5 d.	....	i.	s.	sl. s.
4651	red pd./Me al.	....	199-200	....	s. alk.; v. sl. s. ac.	v. sl. s. h.	v. sl. s. toluene
4652	or. brn. nd./aq. ac.	....	254-7 d.	....	s. ac.	s.	sl. s. h. toluene
4653	brn. yel. pd.	....	....	....	s.	....	....
4654	hyg. lf.	....	70	d.	v. s.	s.; s. alk.	i.
4655	hyg. lf.	....	....	....	....	s. h.	....
4656	pl./aq.	....	....	....	v. s.	....	....
4657	mn. pr./et.; nd./lg.	....	63-4	....	i.; d. h.	s. h.	....
4658	yel. brn./aq.	....	120-1	....	s.	s.; i. chl.	i.; i. bz.
4659	nd./aq.	....	152	....	sl. s.	sl. s.	i.; i. bz.
4660	yel. nd./aq.	....	210	....	v. sl. s.	v. sl. s.	i.; i. bz.
4661	red nd./aq.	....	143(117)	....	sl. s. h.	....	....
4662	nd./aq.	....	204	....	sl. s.; s. alk. carb.	s.; s. a.; sl. s. chl.	sl. s.; sl. s. bz.
4663	tri./aq.	1.575	147.5	....	$0.65^{20°}$	$28^{11°}$, 90%	$22^{11°}$
4664	mn.	1.494	140-1	....	$0.24^{16.5°}$	$31^{11.7°}$	$25^{10.2°}$
4665	mn.	....	....	....	s. h.	....	....
4666	pa. yel. mn.	$1.550_{4}^{32°}$	240-2	subl.	$0.02^{15°}$	$0.9^{10°}$, 90%	$2.2^{12.5°}$
4667	nd./aq.	....	109-10	....	s. h.	s.	s. ac.
4668	nd./aq.	....	117-8	subl.	s. h.	s.	v. s.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4669	**Nitro** benzonitrile (*p*)	....	$NO_2\cdot C_6H_4\cdot CN$	IX-397	148.12
4670	benzophenone (*o*)	....	$NO_2\cdot C_6H_4\cdot CO\cdot C_6H_5$	VII-425	227.21
4671	benzophenone (*m*)	....	$NO_2\cdot C_6H_4\cdot CO\cdot C_6H_5$	VII-425	227.21
4672	benzophenone (*p*)	....	$NO_2\cdot C_6H_4\cdot CO\cdot C_6H_5$	VII-426	227.21
4673	benzoyl chloride (*o*)	....	$NO_2\cdot C_6H_4\cdot COCl$	IX-373	185.57
4674	benzoylchloride(*m*)	....	$NO_2\cdot C_6H_4\cdot COCl$	IX-381	185.57
4675	benzoyl chloride (*p*)	....	$NO_2\cdot C_6H_4\cdot COCl$	IX-394	185.57
4676	benzoyl formic acid (*o*)	....	$NO_2\cdot C_6H_4\cdot CO\cdot CO_2H\cdot$ aq.	X-664	195.13
4677	benzyl acetate (*p*)	....	$NO_2\cdot C_6H_4\cdot CH_2\cdot O_2C\cdot CH_3$	VI-451	195.17
4678	benzyl alcohol (*o*)	....	$NO_2\cdot C_6H_4\cdot CH_2OH$	VI-447	153.13
4679	benzyl alcohol (*m*)	....	$NO_2\cdot C_6H_4\cdot CH_2OH$	VI-449	153.13
4680	benzyl alcohol (*p*)	....	$NO_2\cdot C_6H_4\cdot CH_2OH$	VI-450	153.13
4681	benzyl bromide (*p*)	ω-Br-*p*-nitrotoluene	$NO_2\cdot C_6H_4\cdot CH_2Br$	V-334	216.04
4682	benzyl chloride (*o*)	ω-Cl-*o*-nitrotoluene	$NO_2\cdot C_6H_4\cdot CH_2Cl$	V-327	171.58
4683	benzyl chloride (*m*)	....	$NO_2\cdot C_6H_4\cdot CH_2Cl$	V-329	171.58
4684	benzyl chloride (*p*)	....	$NO_2\cdot C_6H_4\cdot CH_2Cl$	V-329	171.58
4685	benzyl cyanide (*o*)	nitro-α-toluic nitrile	$NO_2\cdot C_6H_4\cdot CH_2\cdot CN$	IX-455	162.14
4686	benzyl cyanide (*m*)	....	$NO_2\cdot C_6H_4\cdot CH_2\cdot CN$	IX-455	162.14
4687	benzyl cyanide (*p*)	....	$NO_2\cdot C_6H_4\cdot CH_2\cdot CN$	IX-456	162.14
4688	bromoform	bromopicrin	$NO_2\cdot CBr_3$	I-77	297.77
4689	butandiol	2-nitro-2-methyl-1, 3-propandiol	$CH_3\cdot C\cdot NO_2:(CH_2OH)_2$	I-480	135.12
4690	butane (1)	1-nitrobutane	$C_2H_5\cdot CH_2\cdot CH_2\cdot NO_2$	I-123	103.12
4691	butane (2)	2-nitrobutane	$C_2H_5\cdot CHNO_2\cdot CH_3$	I-123	103.12
4692	butane (α)(*iso*)	1-nitro-2-Me-propane	$(CH_3)_2CH\cdot CH_2\cdot NO_2$	I-129	103.12
4693	butane (*tert*)	2-nitro-2-Me-propane	$(CH_3)_3C\cdot NO_2$	I-129	103.12
4694	1-butanol (2)	β-NO_2-butyl alcohol	$C_2H_5\cdot CHNO_2\cdot CH_2OH$	I-370	119.12
4695	butanol	2NO_2-2-Me-propanol	$(CH_3)_2CNO_2\cdot CH_2OH$	I-378	119.12
4696	camphor (α)(3)	....	$\underbrace{C_8H_{14}\cdot CO\cdot CH}\cdot NO_2$	VII-129	197.23
4697	chloroform	chloropicrin	$NO_2\cdot CCl_3$	I-76	164.39
4698	chlorophenol	(1;2,4)	$HO\cdot C_6H_3(Cl)\cdot NO_2$	VI-240	173.56
4699	chlorophenol	(1;2,3)	$HO\cdot C_6H_3(Cl)\cdot NO_2$	VI-239	173.56
4700	chlorophenol	(1;3,4)	$HO\cdot C_6H_3(Cl)\cdot NO_2$	VI-240	173.56
4701	chlorophenol	(1;4,2)	$HO\cdot C_6H_3(Cl)\cdot NO_2$	VI-238	173.56
4702	chlorophenol	(1;4,3)	$HO\cdot C_6H_3(Cl)\cdot NO_2$	VI-239	173.56
4703	chlorophenol	(1;5,2)	$HO\cdot C_6H_3(Cl)\cdot NO_2$	VI-238	173.56
4704	chlorophenol	(1;5,3)	$HO\cdot C_6H_3(Cl)\cdot NO_2$	VI-239	173.56
4705	chlorophenol	(1;6,2)	$HO\cdot C_6H_3(Cl)\cdot NO_2$	VI-239	173.56
4706	chlorophenol	(1;6,3)	$HO\cdot C_6H_3(Cl)\cdot NO_2$	VI-240	173.56
4707	cinnamic acid (*o*)	....	$NO_2\cdot C_6H_4\cdot CH:CH\cdot CO_2H$	IX-604	193.15
4708	cinnamic acid (*m*)	....	$NO_2\cdot C_6H_4\cdot CH:CH\cdot CO_2H$	IX-605	193.15
4709	cinnamic acid (*p*)	....	$NO_2\cdot C_6H_4\cdot CH:CH\cdot CO_2H$	IX-606	193.15
4710	*p*-cresol (2)	3-NO_2-4-OH-toluene	$NO_2\cdot C_6H_3(CH_3)OH$	VI-412	153.13

Nitro-benzoylhydrazine 4658-60
Nitro-benzylidene bromide 4634
Nitro-benzylidene chloride 4635-6
Nitro-bromobenzene 960-2
Nitro-bromobenzoic acid 964
Nitro-butyl alcohol 4694-5
Nitro-carb(in)ol 4765

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4669	yel. lf./al.	....	147-9	....	sl. s.	s. h.	s. ac.
4670	mn./al.	....	105	....	....	sl. s. abs.	....
4671	nd., al.	....	94-5	$234^{18\text{mm}}$	....	s. h.	....
4672	lf./abs. al.	....	138	....	v. sl. s.	s. h.	sl. s. CS_2
4673	col. cr.	....	75(20)	$205^{105\text{mm}}$	d.	d.	s.
4674	cr.	....	34-5	275-8 sl. d.	d.	d.	v. s.
4675	nd./lg.	....	72	$154^{15\text{mm}}$	d.	d.	s.
4676	pr., aq.	....	46-7; 122 d. (anh.)	....	∞ h.	....	....
4677	yel. nd./al.	....	78	....	....	s. h.	....
4678	nd./aq.	....	74	270 sl. d.	sl. s.	v. s.	v. s.
4679	cr.	....	27	$175\text{-}80^{3\text{mm}}$	....	....	....
4680	nd., aq.	....	93	$185^{12\text{mm}}$	s. h.	v. s.	v. s.
4681	nd./al.	....	99-100	....	i.	2^{19°	v. s.
4682	cr.	....	48-9	....	i.	26.3^{30°	v. s. h.
4683	yel. nd.	....	45-7	$173\text{-}83^{30\text{mm}}$	i.	30.4^{30°	v. s.
4684	nd./al.	....	71	....	i.	8.2^{30°	s.
4685	nd./aq.	....	84	....	v. s. h.	s.	s.
4686	cr.	....	61-2	....	v. sl. s.	s.	s.
4687	lf./al.	....	116-7	....	i.	s.	....
4688	pr.	$2.811^{12.5^\circ}$	10.3	$*127^{118\text{mm}}$	i.	s.	s.
4689	mn. cr.	....	147-9	d.	80^{20°	45^{20°	4^{20°
4690	lq.	....	....	151-2	....	....	....
4691	lq.	0.988^{0°	....	$138\text{-}9^{747\text{mm}}$	....	....	....
4692	col. lq.	0.987^{7°	....	$158\text{-}9^{755\text{mm}}$	i.	s.	s.
4693	cr.	....	24	$126^{748\text{mm}}$	i. alk.	∞	∞; ∞ bz.
4694	lq.	$1.134^{20^\circ}_{20}$	-47	$105^{10\text{mm}}$	20^{20°	∞^{20°	∞^{20°
4695	cr./Me al.	....	90.5	$95.5^{10\text{mm}}$	350^{20°	490^{20°	120^{20°
4696	mn./bz.	....	102-3	....	i.	s.	s.; v. s. bz.
4697	lq.	$1.651^{22.8^\circ}_{4}$	-64	$112.3^{766\text{mm}}$	0.17^{18°	37 cc., 80% al.	s.
4698	col. nd./aq.	....	111	....	v. s. chl.	v. s.	v. s.
4699	cr./aq.	....	120	....	....	....	....
4700	nd./bz.	....	133	....	....	....	....
4701	yel. mn.	....	87	....	v. sl. s.	s.	v. s.
4702	nd./aq.	....	126-7	....	....	....	....
4703	yel. pr./aq.	....	38.9 (32.7)	....	sl. s.	s.	s.; s. ac.
4704	cr.	....	147	....	....	....	....
4705	yel. nd./aq.	....	70-1	....	v. sl. s.	v. s. chl.	....
4706	nd./aq.	....	118-9	....	....	....	....
4707	nd./al.	....	243-5	subl.	i.	0.2^{25° abs.	....
4708	col./al.	....	200-1	....	....	1^{25° abs.	....
4709	lt. yel./al.	....	286-8	....	v. sl. s. h.	0.01^{25°	v. sl. s.; i. CS_2
4710	yel./aq. al.	$1.240^{38.0^\circ}_{4}$	32	$125^{22\text{mm}}$	v. sl. s.	v. s.	v. s.

* Explosive.

Nitro-chalcone 4633
Nitro-chloroaniline 1407-11
Nitro-chlorobenzene 1412-4
Nitro-chlorobenzene sulfonic acid 1415
Nitro-chloroethane 1416-7
Nitro-chloronaphthalene 1418-9
Nitro-chloropropane 1420-1

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Nitro				
4711	cumene (*o* and *p*)	....	$NO_2\cdot C_6H_4\cdot CH(CH_3)_2$	**V-307	165.19
4712	cumene, pseudo-	(5;1,2,4)	$NO_2\cdot C_6H_2(CH_3)_3$	V-404	165.19
4713	cumene, pseudo-	(6;1,2,4)	$NO_2\cdot C_6H_2(CH_3)_3$	V-404	165.19
4714	*p*-cymene (2;1,4)	2-nitrocymene	$NO_2\cdot C_6H_3(CH_3)\cdot C_3H_7$	V-424	179.21
4715	decane	1-nitro-2,7-dimethyl-octane	$(CH_3)_2CH(CH_2)_4\cdot CH(CH_3)CH_2NO_2$	I-169	187.28
4716	decane	2-nitro-2,7-dimethyl-octane	$(CH_3)_2C(NO_2)(CH_2)_4\cdot CH(CH_3)_2$	I-169	187.28
4717	diethylaniline (*o*)	....	$NO_2\cdot C_6H_4\cdot N(C_2H_5)_2$	....	194.23
4718	diethylaniline (*m*)	....	$NO_2\cdot C_6H_4\cdot N(C_2H_5)_2$	XII-702	194.23
4719	diethylaniline (*p*)	....	$NO_2\cdot C_6H_4\cdot N(C_2H_5)_2$	XII-715	194.23
4720	dimethylaniline (*o*)	....	$NO_2\cdot C_6H_4\cdot N(CH_3)_2$	XII-690	166.18
4721	dimethylaniline (*m*)	....	$NO_2\cdot C_6H_4\cdot N(CH_3)_2$	XII-701	166.18
4722	dimethylaniline (*p*)	....	$NO_2\cdot C_6H_4\cdot N(CH_3)_2$	XII-714	166.18
4723	diphenyl (2)	....	$C_6H_5\cdot C_6H_4\cdot NO_2$	V-582	199.20
4724	diphenyl (3)	....	$C_6H_5\cdot C_6H_4\cdot NO_2$	V-582	199.20
4725	diphenyl (4)	....	$C_6H_5\cdot C_6H_4\cdot NO_2$	V-583	199.20
4726	diphenylamine (*o*)	....	$C_6H_5\cdot NH\cdot C_6H_4\cdot NO_2$	XII-690	214.22
4727	diphenylamine (*p*)	....	$C_6H_5\cdot NH\cdot C_6H_4\cdot NO_2$	XII-715	214.22
4728	diphenylamine-2-sulfonic acid (4)	....	$C_6H_5\cdot NH\cdot C_6H_3(NO_2)\cdot SO_3H$	XIV-686	294.26
4729	diphenyl ether (2)	....	$C_6H_5\cdot O\cdot C_6H_4\cdot NO_2$	VI-218	215.20
4730	diphenyl ether (3)	....	$C_6H_5\cdot O\cdot C_6H_4\cdot NO_2$	VI-224	215.20
4731	diphenyl ether (4)	....	$C_6H_5\cdot O\cdot C_6H_4\cdot NO_2$	VI-232	215.20
4732	diphenylene oxide	2-NO_2-dibenzfuran	$NO_2\cdot C_{12}H_7{:}O$	XVII-72	213.18
4733	ethane	....	$CH_3\cdot CH_2\cdot NO_2$	I-99	75.07
4734	ethylacetanilide	(*p*)	$NO_2\cdot C_6H_4\cdot N(C_2H_5)\cdot COCH_3$	XII-720	208.21
4735	ethyl alcohol	2-nitro-ethanol-1	$HO\cdot CH_2\cdot CH_2\cdot NO_2$	I-339	91.07
4736	ethylbenzene (*o*)	....	$NO_2\cdot C_6H_4\cdot C_2H_5$	V-358	151.16
4737	ethylbenzene (*p*)	....	$NO_2\cdot C_6H_4\cdot C_2H_5$	V-358	151.16
4738	fluorene (2)	....	$NO_2\cdot C_{12}H_7{:}CH_2$	V-628	211.21
4739	formaldehyde-phenylhydrazone	benzene-azo-nitro-methane	$C_6H_5NH\cdot N{:}CH\cdot NO_2$	XV-235	165.15
4740	furan (2)	....	$NO_2\cdot C_4H_3O$	XVII-28	113.07
4741	furoic acid (5)	nitro-pyromucic acid	$NO_2\cdot C_4H_2O\cdot CO_2H$	XVIII-287	157.08
4742	guaiacol (4)	(4;2,1)	$NO_2\cdot C_6H_3(OCH_3)OH$	VI-788	169.13
4743	guanidine	....	$NO_2\cdot NH\cdot C(NH)\cdot NH_2$	III-126	104.07
4744	heptane (1)	....	$C_6H_{13}\cdot CH_2\cdot NO_2$	I-155	145.20
4745	heptane (2)	....	$C_5H_{11}\cdot CHNO_2\cdot CH_3$	I-156	145.20
4746	heptane	2-NO_2-2,4-dimethylpentane	$(CH_3)_2CNO_2\cdot CH_2\cdot CH(CH_3)_2$	I-158	145.20
4747	heptane	3-NO_2-2,2-dimethylpentane	$(CH_3)_3C\cdot CH(NO_2)\cdot C_2H_5$	I-157	145.20
4748	heptane	3-NO_2-3-Et-pentane	$(C_2H_5)_3C\cdot NO_2$	I-157	145.20
4749	hexane (1)	....	$CH_3(CH_2)_4CH_2NO_2$	I-147	131.17

Nitro-dibenzfuran 4732
Nitro-dichloroaniline 2021
Nitro-dichlorobenzene 2022-6
Nitro-dichlorophenol 2029-30
Nitro-dimethylbenzene 4865-70

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4711	yel. oil	$1.1^{12°}$	-35	224 d.	....	....	....
4712	col. or gn.	....	65(45-6)	265	col.: v. sl. s. pet.	s. h.	gn.: v. s. pet.
4713	pr.	....	20	....	....	....	....
4714	oil	$1.067\frac{20°}{4}$	....	152^{15mm}	i.	....	....
4715	lq.	$0.925\frac{21°}{0}$	....	235-7 d.	....	....	....
4716	lq.	$0.909\frac{20°}{4}$	....	235-7^{749mm} d.	....	....	....
4717	yel. oil	....	....	153-5^{20mm}	sl. s.	s.	s.
4718	yel. oil	....	....	288-90	....	....	....
4719	yel. mn./al.	1.225	77-8	....	....	v. s. h.	sl. s. lg.
4720	yel. oil	$1.179\frac{20°}{4}$	....	151-3^{30mm}	sl. s.	v. s.	v. s.
4721	red mn.	$1.313^{17°}$	60-1	280-5	i.	s.	s.
4722	yel. nd.	....	163-4	....	i.	s. h.	s. h. ac.
4723	rhb.	1.44	37	320	i.	s.	v. s.
4724	yel. lf.	....	61	....	i.	v. s.	v. s. ac.
4725	nd./al.	....	113-4	340	i.	sl. s. c.	v. s.
4726	or./aq. al.	....	75-6	....	....	....	....
4727	yel. nd.	....	132-3	....	i. dil. a.	s.	s. ac.
4728	gn. lf./HCl	....	....	....	v. s.	v. s.	....
4729	yel. oil	$1.258^{15°}$	<-20	235^{60mm}	i.	s. abs.	s. bz.
4730	yel. oil	$1.245^{15°}$	....	202-4^{14mm}	....	....	....
4731	tab.	....	56-7	320 ±	i.	sl. s. c.	v. s.
4732	yel. nd./ac.	....	181-2	....	s. h. ac.	sl. s. h.	sl. s.
4733	lq.	$1.052\frac{20°}{20}$	-90	114.8^{761mm}	$4.5^{20°}$; s. a., alk.	∞; ∞ chl.	∞
4734	lf.	....	118-9	....	v. sl. s.; s. bz.	s.; i. lg.	v. sl. s.; s. CS_2
4735	col. lq.	$1.270^{15°}$	<-80	194^{765mm}	v. s.	v. s.	v. s.
4736	col. oil	$1.126^{24.5°}$	-23	227-8	i.	v. s.	s.
4737	col. oil	$1.124^{25°}$	-32	245-6	i.	v. s.	v. s.
4738	nd./50% ac.	....	156-7	....	....	....	....
4739	or. pr.	....	85-6 (75-6)	....	s. lg.	s. chl.	s. bz.
4740	lt. yel./pet.	....	28	....	v. sl. s.	s. alk.	s.
4741	lt. yel./aq.	....	185	subl.	v. sl. s.	s.	s.; i. chl.
4742	yel. nd./aq.	....	104-5	....	....	....	....
4743	nd./aq.	....	246-7	....	$9^{100°}$	sl. s.	v. sl. s.
4744	lt. yel. oil	$0.948^{17°}$	....	193-5	i.	v. s.	v. s.
4745	lq.	$0.947^{0°}$	....	194-8 sl. d.	s. conc. alk.	....	....
4746	lq.	$0.956\frac{0°}{0}$	....	181-2^{742mm}	....	....	....
4747	lq.	$0.940\frac{20°}{20}$	....	89-90^{40mm}	....	....	....
4748	lq.	$0.955^{0°}$	....	185-90	....	....	....
4749	col. lq.	$0.949^{20°}$	....	193-4^{765mm}	i.	v. s.	v. s. al. alk.

Nitro-erythrite 2895
Nitro-fluorobenzene 3274

Nitro-form 6300
Nitro-glycerin(e) 3428

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4750	**Nitro** hexane	3-NO$_2$-2,2-dimethylbutane	$(CH_3)_3C\cdot CH(NO_2)\cdot CH_3$	I-151	131.17
4751	hexane	2-NO$_2$-2-Me-pentane	$(CH_3)_2C(NO_2)\cdot C_3H_7$	I-149	131.17
4752	hippuric acid (*m*)	....	$NO_2\cdot C_6H_4\cdot CO\cdot NH\cdot CH_2\cdot CO_2H$	IX-383	224.17
4753	*o*-hydroxybenzoic acid (3;2,1)	3-nitrosalicylic acid	$NO_2\cdot C_6H_3(OH)\cdot CO_2H\cdot H_2O$	X-114	201.13
4754	*o*-hydroxybenzoic acid (4;2,1)	4-nitrosalicylic acid	$NO_2\cdot C_6H_3(OH)CO_2H$	X-116	183.12
4755	*o*-hydroxybenzoic acid (5;2,1)	5-nitrosalicylic acid	$NO_2\cdot C_6H_3(OH)CO_2H$	X-116	183.12
4756	*o*-hydroxybenzoic acid (6;2,1)	6-nitrosalicylic acid	$NO_2\cdot C_6H_3(OH)CO_2H$	....	183.12
4757	*m*-hydroxybenzoic acid (2;3,1)	....	$NO_2C_6H_3(OH)CO_2H\cdot H_2O$	X-146	201.13
4758	*m*-hydroxybenzoic acid (4;3,1)	....	$NO_2\cdot C_6H_3(OH)CO_2H$	X-146	183.12
4759	*m*-hydroxybenzoic acid (6;3,1)	....	$NO_2C_6H_3(OH)CO_2H\cdot H_2O$	X-147	201.13
4760	*p*-hydroxybenzoic acid (3;4,1)	....	$NO_2\cdot C_6H_3(OH)CO_2H$	X-181	183.12
4761	isatin (5)	....	$NO_2\cdot C_6H_3\cdot NH\cdot CO\cdot CO$	XXI-456	192.13
4762	malonic dialdehyde	2-nitro-propandial	$NO_2\cdot CH(CHO)_2$	I-766	117.06
4763	malonic ester	....	$NO_2\cdot CH(CO_2C_2H_5)_2$	II-596	205.17
4764	mesitylene (1,3,5;2)	....	$(CH_3)_3C_6H_2\cdot NO_2$	V-410	165.19
4765	methane	....	$CH_3\cdot NO_2$	I-74	61.04
4766	*N*-methylacetanilide (*p*)	....	$NO_2\cdot C_6H_4\cdot N(CH_3)\cdot COCH_3$	XII-719	194.19
4767	*N*-methylaniline (*o*)	....	$NO_2\cdot C_6H_4\cdot NHCH_3$	XII-689	152.15
4768	*N*-methylaniline (*m*)	....	$NO_2\cdot C_6H_4\cdot NHCH_3$	XII-700	152.15
4769	*N*-methylaniline (*p*)	....	$NO_2\cdot C_6H_4\cdot NHCH_3$	XII-714	152.15
4770	2-methylanthraquinone (1)	....	$NO_2(CH_3)C_{14}H_6O_2$	VII-811	267.23
4771	4′-methyldiphenylamine (4)	....	$NO_2\cdot C_6H_4\cdot NH\cdot C_7H_7$	XII-906	228.24
4772	naphthalene (α)	....	$NO_2\cdot C_{10}H_7$	V-553	173.16
4773	naphthalene (β)	....	$NO_2\cdot C_{10}H_7$	V-555	173.16
4774	naphthoic acid (8,1)	....	$NO_2\cdot C_{10}H_6\cdot CO_2H$	IX-653	217.17
4775	α-naphthol (2,1)	....	$NO_2\cdot C_{10}H_6\cdot OH$	VI-615	189.16
4776	α-naphthol (4,1)	....	$NO_2\cdot C_{10}H_6\cdot OH$	VI-615	189.16
4777	β-naphthol (1,2)	....	$NO_2\cdot C_{10}H_6\cdot OH$	VI-653	189.16
4778	β-naphthol (5,2)	....	$NO_2\cdot C_{10}H_6\cdot OH$	VI-654	189.16
4779	β-naphthol (8,2)	....	$NO_2\cdot C_{10}H_6\cdot OH$	VI-655	189.16
4780	α-naphthylamine	(2,1)	$NO_2\cdot C_{10}H_6\cdot NH_2$	XII-1258	188.18
4781	β-naphthylamine	(1,2)	$NO_2\cdot C_{10}H_6\cdot NH_2$	XII-1313	188.18
4782	β-naphthylamine	(5,2)	$NO_2\cdot C_{10}H_6\cdot NH_2$	XII-1314	188.18
4783	β-naphthylamine	(8,2)	$NO_2\cdot C_{10}H_6\cdot NH_2$	XII-1315	188.18

Nitro-hydroxytoluene 4710
Nitro-iodobenzene 3893-5
Nitro-malonyl urea 4632
Nitro-mannite 4011
Nitro-methylquinoline 4830

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4750	col. pr.	....	40	167.5-8^{748mm}	v. s. pet.	v. s.	v. s.
4751	lq.	$0.949^{0°}_{0}$	....	172-6^{756mm}	i. alk.	....	....
4752	nd./aq.	....	165-7	....	0.4$^{23°}$	s.	s.
4753	rhb./aq.	....	123-5; 148-9(anh.)	....	0.13$^{15.5°}$	v. s.; s. bz.	v. s.; s. chl.
4754	col. nd./aq.	....	226-35	....	s. h.; s. chl.	s.; i. lg.	sl. s. bz.
4755	nd./aq.	1.650$^{20°}$	228-30	....	0.18$^{22°}$	v. s.; s. act.	v. s.
4756	cr.	....	130	....	s. act.	sl. s.	v. s.
4757	pl./aq.	....	178	....	v. sl. s.	s.	s.
4758	yel. lf./aq.	....	230	....	v. sl. s.	....	....
4759	yel. nd./aq.	....	169	....	v. s.	v. s.	v. s.
4760	nd./aq.	....	185-6	....	v. s. h.	v. s.	s.
4761	nd./al.	....	248-50	....	sl. s.	s.	s. alk.
4762	pr.	....	50-1	....	d.; v.s.chl.	v. s.	v. s.
4763	col. oil	$1.199^{20°}_{4}$	....	152-3^{38mm}	i.	....	....
4764	rhb./al.	....	44	255	....	v. s. h.	....
4765	oil	$1.138^{20°}_{20}$	-28.5	101.5^{765mm}	9.5$^{20°}$	s.; s. alk.	s.
4766	lf./aq.	....	152-3	....	....	s.	s.
4767	red nd./pet.	....	36-7	....	v. sl. s. c.	s.	s.
4768	red yel./al.	....	67-8	....	s. h.	s.	s.
4769	br. yel./al.	....	151-2	....	s. bz.	s.	v. sl. s. lg.
4770	pa. yel. nd./ac.	....	269-70	subl.; d. 330-2	sl. s. bz.; s. $C_6H_5NO_2$	v. sl. s.; sl. s. chl.	v. sl. s.
4771	yel. nd./al. or bz.	....	138-9	....	v. s. ac.; v.sl.s.bz.	v. s. h.	v. sl. s.
4772	yel. nd./al.	1.223$^{61.5°}$	59-60	304	i.; s. CS_2	s.; s. chl.	s.
4773	col./al.	....	79	165^{15mm}	i.	v. s.	v. s.
4774	pr./al.	....	215	....	0.04	4.7	sl. s.
4775	yel. nd./al.	....	128	....	v. sl. s.	s.	....
4776	col. cr.	....	164	....	s. h.	v. s.	v. s. ac.
4777	yel. nd./al.	....	103	....	i.; s. alk.	s.; s. ac.	v. s.
4778	lt. yel./aq.	....	147	....	v. s. h.	v. s.	v. s.
4779	yel. nd./aq.	....	144-5	....	s. bz.	s.; s. chl.	s.
4780	red yel. mn.	....	144	....	....	s.	....
4781	red yel./al.	....	126-7	....	s. h.	s.	s. ac.
4782	red nd./al.	....	143.5	....	s. bz.	s.	i. lg.
4783	red nd.	....	104-5	....	i. lg.	s.	s.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4784	**Nitro** nonane (1)	....	$CH_3(CH_2)_7CH_2NO_2$	I-166	173.25
4785	nonane	2-NO_2-2,6-dimethylheptane	$(CH_3)_2C(NO_2)\cdot(CH_2)_3CH(CH_3)_2$	I-167	173.25
4786	octane (1)	....	$CH_3(CH_2)_6CH_2NO_2$	I-161	159.22
4787	octane	1-NO_2-2,5-dimethylhexane	$(CH_3)_2CH(CH_2)_2\cdot CH(CH_3)CH_2NO_2$	I-163	159.22
4788	octane	2-NO_2-2,5-dimethylhexane	$(CH_3)_2C(NO_2)\cdot(CH_2)_2CH(CH_3)_2$	I-163	159.22
4789	pentandiol	2-NO_2-2-Et-1,3-propandiol	$C_2H_5\cdot C(NO_2)\cdot(CH_2OH)_2$	I-483	149.15
4790	pentane (1)	....	$CH_3(CH_2)_3CH_2NO_2$	I-133	117.15
4791	pentane (3)	....	$(C_2H_5)_2CH\cdot NO_2$	I-133	117.15
4792	pentane	2-NO_2-2-Me-butane	$(CH_3)_2C(NO_2)C_2H_5$	I-140	117.15
4793	pentane	4-NO_2-2-Me-butane	$(CH_3)_2CH(CH_2)_2NO_2$	I-140	117.15
4794	phenanthraquinone	(2)	$NO_2\cdot C_6H_3(CO)_2C_6H_4$	VII-806	253.20
4795	***p***-phenetidine (3)	3-NO_2-4-NH_2-phenetole	$NO_2\cdot C_6H_3(NH_2)OC_2H_5$	XIII-521	182.18
4796	phenetole (*o*)	....	$C_2H_5O\cdot C_6H_4\cdot NO_2$	VI-218	167.16
4797	phenetole (*m*)	....	$C_2H_5O\cdot C_6H_4\cdot NO_2$	VI-224	167.16
4798	phenetole (*p*)	....	$C_2H_5O\cdot C_6H_4\cdot NO_2$	VI-231	167.16
4799	phenol (*o*)	....	$HO\cdot C_6H_4\cdot NO_2$	VI-213	139.11
4800	phenol Na (*o*)	Na nitrophenoxide	$NaO\cdot C_6H_4\cdot NO_2$	VI-217	161.10
4801	phenol K (*o*)	K nitrophenoxide	$KO\cdot C_6H_4\cdot NO_2\cdot\frac{1}{2}H_2O$	VI-217	186.21
4802	phenol (*m*)	....	$HO\cdot C_6H_4\cdot NO_2$	VI-222	139.11
4803	phenol (*p*)	....	$HO\cdot C_6H_4\cdot NO_2$	VI-226	139.11
4804	phenol Na (*p*)	....	$NaC_6H_4O_3N\cdot 2H_2O$	VI-230	197.13
4805	phenol Na (*p*)	....	$NaC_6H_4O_3N\cdot 4H_2O$	VI-230	233.16
4806	***o***-phenol sulfonic acid	(1;4,2)	$HOC_6H_3(NO_2)SO_3H\cdot 3H_2O$	XI-237	273.22
4807	***p***-phenol sulfonic acid	(1;2,4)	$HOC_6H_3(NO_2)SO_3H\cdot 3H_2O$	XI-246	273.22
4808	phenylacetate (*o*)	....	$NO_2\cdot C_6H_4\cdot O_2CCH_3$	VI-219	181.14
4809	phenylacetic acid (*p*)	***p***-NO_2-***α***-toluic acid	$NO_2\cdot C_6H_4\cdot CH_2CO_2H$	IX-455	181.14
4810	phenylarsonic acid	(*m*)	$NO_2\cdot C_6H_4\cdot AsO(OH)_2$	XVI-869	247.03
4811	phenyl ***iso***-cyanate	....	$NO_2\cdot C_6H_4\cdot N{:}CO$	XII-725	164.12
4812	phenylglycine (*p*)	....	$NO_2\cdot C_6H_4\cdot NH\cdot CH_2\cdot CO_2H$	XII-725	196.16
4813	phenylhydrazine (*m*)	....	$NO_2\cdot C_6H_4\cdot NH\cdot NH_2$	XV-460	153.14
4814	phenylhydrazine (*m*)	HCl salt	$NO_2\cdot C_6H_4\cdot N_2H_3\cdot HCl$	XV-460	189.61
4815	phenylhydrazine (*p*)	....	$NO_2\cdot C_6H_4\cdot NH\cdot NH_2$	XV-468	153.14
4816	phenylhydrazine (*p*)	HCl salt	$NO_2\cdot C_6H_4\cdot N_2H_3\cdot HCl$	XV-468	189.61
4817	phenylpropiolic acid	(*o*)	$NO_2\cdot C_6H_4\cdot C\vdots C\cdot CO_2H$	IX-636	191.14
4818	phenylpropiolic acid	(*p*)	$NO_2\cdot C_6H_4\cdot C\vdots C\cdot CO_2H$	IX-637	191.14
4819	***o***-phthalic acid (3)	....	$NO_2\cdot C_6H_3(CO_2H)_2$	IX-823	211.13
4820	***o***-phthalic acid (4)	....	$NO_2\cdot C_6H_3(CO_2H)_2$	IX-828	211.13

Nitro-orthanilic acid 4622

Nitro-phenylacetonitrile 4685-7

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4784	lt. yel. lq.	$0.923^{17°}$	....	215-8 d.	....	....	....
4785	lq.	$0.915_{0}^{18°}$	....	$113\text{-}4^{25mm}$	....	....	....
4786	lt. yel. lq.	$0.935^{20°}$	....	206-10 sl. d.	....	....	....
4787	lq.	....	....	$100\text{-}5^{20mm}$	....	....	....
4788	lq.	$0.921_{0}^{20°}$	−18	$201\text{-}2^{755mm}$	s. alk.	....	....
4789	nd./aq.	....	57-8	d.	v. s.	s.	s.
4790	col. lq.	$0.948^{20°}$	....	172-3	....	....	....
4791	lq.	$0.958^{0°}$	....	$152\text{-}5^{746mm}$	i.	s.	s.
4792	lq.	$0.97^{0°}$	....	$149\text{-}51^{748mm}$	....	....	....
4793	lq.	$0.960_{4}^{20.6°}$	....	164^{756mm}	....	....	....
4794	yel. lf./ac.	....	257-8	....	....	v. sl. s.	sl. s. ac.
4795	red pr./al.	....	113	....	....	s. h.	s.; s. chl.
4796	oil	$1.190^{15°}$	5-6	275	v. sl. s.	v. s.	v. s.
4797	yel. cr.	....	34	169^{70mm}	v. sl. s.	v. s. h.	v. s.
4798	col. mn.	$1.18^{15°}$	59-60	283^{758mm}	v. sl. s.	v. s. h.	v. s.
4799	yel. mn.	$1.295^{45°}$	44-5	214.5	$0.21^{20°}$	v. s.	v. s.; s. bz.
4800	red lf./al.	....	....	....	v. s.	v. sl. s.	....
4801	or. nd./al.	$1.682^{20°}$	....	....	$16^{6°}$	NaOH $21^{15°}$ aq.	....
4802	col. mn.	$1.485^{20°}$	96-7	194^{70mm}	$1.35^{20°}$	v. s.	s.; i. pet.
4803	yel. pr.	$1.48^{20°}$	113-4	subl.	$1.6^{25°}$	v. s.	v. s.
4804	or. cr./aq.	....	$-2H_2O$, 110	....	6.5 c.	....	....
4805	yel. mn./aq.	....	....	....	s.	....	....
4806	nd.	....	d. 110	....	v. s.	v. s.	sl. s.
4807	nd./aq.	....	51.5; 141-2 (anh.)	....	v. s.	v. s.	v. s. chl.
4808	col. nd./lg.	....	39-40	253 d.	v. s. bz.	v. s.	v. s.
4809	nd./aq.	....	152-3	....	v. sl. s. c.	s.	s.; s. chl.
4810	lf./aq.	....	d.	....	$2^{18°}$	sl. s. chl.	i. lg.
4811	nd.	....	56-7	....	s. h. lg.	s. chl.	s.; s. bz.
4812	yel. cr./aq.	....	225-30 d.	....	v. sl. s.	v. s. h.	sl. s.
4813	yel. nd./al.	....	93	....	v. sl. s. h.	v. sl. s. bz.	s. ac.
4814	yel. pl.	....	....	....	v. sl. s. c.	v. sl. s. c.	sl. s. HCl
4815	or. red nd.	....	157	....	s. h.	v. s.	s.
4816	or. red pl.	....	214-5 d.	....	s.	i.	i.
4817	nd./aq.	....	157 d.	expl. 155-6	s. h.	s.; i. CS_2	v. sl. s. chl.
4818	nd./al.	....	181-93 d.	....	sl. s.	s. h.	s.; i. pet.
4819	lt. yel./aq.	....	222*	....	$2^{25°}$	v. s. h.	sl. s.
4820	lt. yel. cr.	....	164-5	....	v. s.	v. s.	s.

* Sealed tube.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4821	**Nitro** *m*-phthalic acid (5)	....	$NO_2{\cdot}C_6H_3(CO_2H)_2$	IX-840	211.13
4822	*p*-phthalic acid (2)	....	$NO_2{\cdot}C_6H_3(CO_2H)_2$	IX-851	211.13
4823	phthalic anhydride	(3)	$NO_2{\cdot}C_6H_3(CO)_2O$	XVII-486	193.11
4824	phthalide (6)	....	$NO_2{\cdot}C_6H_3{\cdot}CH_2{\cdot}O{\cdot}CO$	XVII-313	179.13
4825	phthalimide (3)	....	$NO_2{\cdot}C_6H_3(CO)_2NH$	XXI-505	192.13
4826	phthalimide (4)	....	$NO_2{\cdot}C_6H_3(CO)_2NH$	XXI-506	192.13
4827	propane (1)	....	$CH_3{\cdot}CH_2{\cdot}CH_2{\cdot}NO_2$	I-115	89.09
4828	propane (2)	*β*-nitropropane	$(CH_3)_2CH{\cdot}NO_2$	I-116	89.09
4829	propene (3,1)	nitroallyl	$CH_2{:}CH{\cdot}CH_2{\cdot}NO_2$	I-203	87.08
4830	quinaldine (6)	6-NO₂-2-Me-quinoline	$NO_2{\cdot}C_9H_5N{\cdot}CH_3$	XX-394	188.18
4831	quinoline (5)(*ana*)	....	$NO_2{\cdot}C_9H_6N$	XX-371	174.15
4832	quinoline (6)(*p*)	....	$NO_2{\cdot}C_9H_6N$	XX-372	174.15
4833	quinoline (7)(*m*)	....	$NO_2{\cdot}C_9H_6N$	XX-372	174.15
4834	quinoline (8)(*o*)	....	$NO_2{\cdot}C_9H_6N$	XX-373	174.15
4835	*iso*-quinoline (5 or 8)	....	$NO_2{\cdot}C_6H_3{:}C_3H_3N$	XX-386	174.15
4836	resorcinol (2)	(2;1,3)	$NO_2{\cdot}C_6H_3(OH)_2$	VI-823	155.11
4837	salol (*α*)	5-nitrosalol	$NO_2{\cdot}C_6H_3(OH){\cdot}CO_2{\cdot}C_6H_5$	X-118	259.21
4838	styrene (*o*)	....	$NO_2{\cdot}C_6H_4{\cdot}CH{:}CH_2$	V-478	149.14
4839	styrene (*m*)	....	$NO_2{\cdot}C_6H_4{\cdot}CH{:}CH_2$	V-478	149.14
4840	styrene (*p*)	....	$NO_2{\cdot}C_6H_4{\cdot}CH{:}CH_2$	V-478	149.14
4841	styrene (*ω*)(*β*)	....	$C_6H_5{\cdot}CH{:}CH{\cdot}NO_2$	V-478	149.14
4842	tartaric acid	....	$(NO_2{\cdot}O{\cdot}CH{\cdot}CO_2H)_2$	III-509	240.09
4843	thiophene (2)	....	$NO_2{\cdot}C_4H_3S$	XVII-35	129.13
4844	toluene† (*o*)	....	$CH_3{\cdot}C_6H_4{\cdot}NO_2$	V-318	137.13
4845	toluene (*m*)	....	$CH_3{\cdot}C_6H_4{\cdot}NO_2$	V-321	137.13
4846	toluene (*p*)	....	$CH_3{\cdot}C_6H_4{\cdot}NO_2$	V-323	137.13
4847	*o*-toluene sulfonic acid	(1;4,2)	$CH_3{\cdot}C_6H_3(NO_2){\cdot}SO_3H{\cdot}2H_2O$	XI-90	253.23
4848	*p*-toluene sulfonyl chloride	(1;2,4)	$CH_3{\cdot}C_6H_3(NO_2){\cdot}SO_2Cl$	XI-111	235.64
4849	*o*-toluidine (3;1,2)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-843	152.15
4850	*o*-toluidine (4;1,2)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-844	152.15
4851	*o*-toluidine (5;1,2)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-846	152.15
4852	*o*-toluidine (6;1,2)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-848	152.15
4853	*m*-toluidine (2;1,3)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-876	152.15
4854	*m*-toluidine (4;1,3)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-876	152.15
4855	*m*-toluidine (5;1,3)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-877	152.15
4856	*m*-toluidine (6;1,3)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-877	152.15
4857	*p*-toluidine (2;1,4)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-996	152.15
4858	*p*-toluidine (3;1,4)	....	$NO_2{\cdot}C_6H_3(CH_3)NH_2$	XII-1000	152.15
4859	trimethylol-methane	2-NO₂-2-methylol-1,3-propandiol	$NO_2{\cdot}C(CH_2OH)_3$	I-520	151.12
4860	tyrosine (3)(*l*)	....	$NO_2{\cdot}C_6H_3(OH){\cdot}CH_2{\cdot}CH(NH_2){\cdot}CO_2H$	XIV-620	226.19
4861	undecane (1)	....	$CH_3(CH_2)_9CH_2{\cdot}NO_2$	I-170	201.30
4862	uracil (5)	....	$NO_2{\cdot}C{:}CH{\cdot}(NHCO)_2$	XXIV-320	157.09

† See also No. 5213.

Nitro-propandial 4762
Nitro-*iso*-propyl-methyl-benzene 4714
Nitro-pyromucic acid 4741
Nitro-salicylic acid 4753-6
Nitro-sulfanilic acid 4621
Nitro-toluic acid (*α*) 4809
Nitro-toluic nitrile (*α*) 4685-7

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4821	col. cr.	....	255 sl. d.	....	0.15^{15°; 81^{99°	v. s.	v. s.
4822	nd./h. aq.	....	263-70	....	s. h.	s. h.	....
4823	col. nd./ac.	....	162-3	....	s. act.	s. h.	v. sl. s. bz.
4824	nd.	....	141	....	i. c.; v. s. h. chl.	sl. s. c.	sl. s.; i. alk. carb.
4825	yel. lf./al.	....	215-6	subl.	i.; s. ac.	s. h.	i.; i. lg.
4826	yel. lf.	....	195-7	subl.	v. sl. s. h.	s.; s. ac.	s. act.
4827	oil	$1.003_{20}^{20^\circ}$	−108	131.6	1.4^{20°	∞	∞
4828	lq.	1.024^{0°	−93	120.3	1.7^{20°	∞^{20°	∞^{20°
4829	col. lq.	1.051^{21°	....	125-30	i.	s.	s.
4830	yel. nd./aq.	....	163-4	....	v. sl. s.	s.	i.
4831	nd./aq.	....	72	subl.	v. sl. s. h.	s. h.	s. bz.
4832	nd.	....	149-50	subl.	sl. s. c.	sl. s. c.	sl. s.; s. bz.
4833	nd./al.	....	132-3	....	....	v. sl. s. c.	s.
4834	mn./al.	....	88-9	....	s. h.	s.	s.; s. bz.
4835	nd./aq.	....	110	subl.	s. h.	s.	s.; s. bz.
4836	or./aq. al.	....	83-5	d. > 180°	....	....	....
4837	nd./al.	....	151-2	....	....	s.	s. ac.
4838	oil	....	12-13.5	....	s. H_2SO_4	....	....
4839	yel. oil	....	−5	....	v. s. lg.	v. s. abs.	v. s.
4840	pr./lg.	....	29	d.	v. sl. s. c. lg.	s. h.	v. s. h.
4841	yel. pr./al.	....	58	250-60 d.	v. sl. s. h.	s.	v. s.
4842	silky nd.	....	d.	....	d. 0°	v. s. c.; d. h.	v. s.; i. bz.
4843	mn./al.	....	46	224-5	i. alk.	s.	s.
4844	yel. lq.	$1.163_{4}^{20^\circ}$	(α) −10.6; (β) −4.1	222.3	0.065^{30°; s. pet.	∞; ∞ bz.; s. SO_2	∞; sl. s. NH_3
4845	lq.	$1.160_{4}^{18^\circ}$	15.5-16	230-1	0.050^{30°	8.6^{15°	∞
4846	rhb.	$1.139_{55}^{55^\circ}$	51.9	237.7	0.004^{15°	s.; s. bz.	80.8^{15°
4847	pl./aq.	....	130 (anh.)	....	47.7^{23°	v. s.	v. s.; s. chl.
4848	pl./et.	....	33-4	....	d.	d.	....
4849	or./45% al.	....	97	....	sl. s.	s.; s. chl.	s.; s. bz.
4850	yel. mn.	1.365^{15°	105-7	....	v. sl. s.	s.	s.
4851	yel. mn.	1.366^{15°	129-30	....	v. sl. s. h.	s.	....
4852	yel. rhb.	1.378^{15°	91-2	305 d.	1.3 h.	v. s.	v. s.; v. s. bz.
4853	yel. nd.	....	53	....	sl. s. c.	s.	....
4854	yel. lf./aq.	....	109-10	....	s. bz.	s.	s.; s. chl.
4855	yel. brn. nd.	....	98	....	sl. s. c.	s.	v. s.; s. bz.
4856	yel. nd./aq.	....	135-8	....	s. h.	s.	s.
4857	yel. nd./aq.	....	81.5	....	sl. s. h.	v. s. h.	s.
4858	red mn.	1.312^{17°	116-7	....	sl. s. h.	s.	....
4859	nd. or pr.	....	165-70 d.	....	220^{20°	45^{20°	1^{20°
4860	pa. yel. nd./aq.	....	237	....	v. sl. s. h.	i.; s. alk.	i.; s. aq. a.
4861	yel. lq.	0.900^{15°	....	d.	....	v. s.	v. s.
4862	col. nd.	....	expl.	....	sl. s. c.	s.	....

Nitroso-amyl ketone 79
Nitroso-anthron 4626
Nitroso-barbituric acid 6445
Nitroso-benzylaniline 828
Nitroso-diethylamine 2191
Nitroso-dimethylamine 2513
Nitroso-diphenylamine 2733
Nitroso-dipropylamine 2790-1

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4863	**Nitro** urea	....	$NO_2\cdot NH\cdot CO\cdot NH_2$	III-125	105.06
4864	urethane	....	$NO_2\cdot NH\cdot CO_2C_2H_5$	III-125	134.09
4865	*o*-xylene (3;1,2)	....	$NO_2\cdot C_6H_3(CH_3)_2$	V-367	151.16
4866	*o*-xylene (4;1,2)	....	$NO_2\cdot C_6H_3(CH_3)_2$	V-368	151.16
4867	*m*-xylene (2;1,3)	....	$NO_2\cdot C_6H_3(CH_3)_2$	V-378	151.16
4868	*m*-xylene (4;1,3)	....	$NO_2\cdot C_6H_3(CH_3)_2$	V-378	151.16
4869	*m*-xylene (5;1,3)	....	$NO_2\cdot C_6H_3(CH_3)_2$	V-378	151.16
4870	*p*-xylene (2;1,4)	....	$NO_2\cdot C_6H_3(CH_3)_2$	V-387	151.16
4871	*m*-xylidine (5), aceto-	(5;1,3,4)	$NO_2\cdot C_6H_2(CH_3)_2\cdot NH\cdot COCH_3$	XII-1128	208.21
4872	**Nitron**	4,5-dihydro-1,4-diPh-3,5-phenylimino-1,2,4-triazole	$C_{20}H_{16}N_4$	XXVI-349	312.36
4873	**Nitroso**-acetone (*iso*)	pyroracemic aldoxime	$CH_3\cdot CO\cdot CH{:}NOH$	I-763	87.08
4874	acetophenone (*iso*)	Ph-glyoxaloxime	$C_6H_5\cdot CO\cdot CH{:}NOH$	VII-671	149.14
4875	aniline (*p*)	*p*-quinone-imide-oxime tautomer	$ON\cdot C_6H_4\cdot NH_2$ or $HN{:}C_6H_4{:}NOH$	VII-625	122.12
4876	benzene	....	$C_6H_5\cdot NO$	V-230	107.11
4877	benzoic acid (*o*)	....	$ON\cdot C_6H_4\cdot CO_2H$	IX-368	151.12
4878	benzoic acid (*m*)	....	$ON\cdot C_6H_4\cdot CO_2H$	IX-369	151.12
4879	benzoic acid (*p*)	....	$ON\cdot C_6H_4\cdot CO_2H$	IX-369	151.12
4880	*n*-butyric acid (*iso*)	(*α*)	$C_2H_5\cdot C({:}NOH)\cdot CO_2H$	III-629	117.10
4881	*m*-cresol (4)	(4;3,1)	$ON\cdot C_6H_3(CH_3)OH$	VII-648	137.13
4882	diethylaniline (*p*)	....	$ON\cdot C_6H_4\cdot N(C_2H_5)_2$	XII-684	178.23
4883	dimethylaniline (*p*)	....	$ON\cdot C_6H_4\cdot N(CH_3)_2$	XII-677	150.18
4884	diphenylamine (*p*)	*p*-NO-Ph aniline	$ON\cdot C_6H_4\cdot NH\cdot C_6H_5$	XII-207	198.22
4885	ethylaniline (*N*)	Et-Ph-nitrosoamine	$C_6H_5\cdot N(NO)C_2H_5$	XII-580	150.18
4886	*N*-ethyl-urethane	*N*-NO-*N*-Et carbamate	$C_2H_5N(NO)\cdot CO_2C_2H_5$	IV-129	146.15
4887	methylaniline (*N*)	....	$C_6H_5\cdot N(NO)CH_3$	XII-579	136.15
4888	methyl-ethyl ketone (*iso*)	diacetyl monoxime	$CH_3COC({:}NOH)\cdot CH_3$	I-772	101.10
4889	methyl-*n*-hexyl ketone	(*iso*)	$CH_3\cdot CO\cdot C({:}NOH)\cdot (CH_2)_4CH_3$	I-795	157.21
4890	methyl-propyl ketone (*iso*)	....	$CH_3\cdot CO\cdot C({:}NOH)\cdot C_2H_5$	I-776	115.13
4891	*N*-methyl-urethane	....	$CH_3N(NO)\cdot CO_2C_2H_5$	IV-85	132.12
4892	*α*-naphthol (1,4)	naphthoquinone oxime tautomer	$HO\cdot C_{10}H_6\cdot NO$ or $O{:}]C_{10}H_6{:}NOH$	VII-727	173.16
4893	*α*-naphthol (1,2)	2-nitroso-naphthol-1	$HO\cdot C_{10}H_6\cdot NO$	VII-715	173.16
4894	*β*-naphthol (2,1)	1-nitroso-naphthol-2	$HO\cdot C_{10}H_6\cdot NO$	VII-712	173.16
4895	*β*-naphthylamine	(2,1)	$ON\cdot C_{10}H_6\cdot NH_2$	VII-717	172.18
4896	nitrobenzene (*o*)	....	$ON\cdot C_6H_4\cdot NO_2$	V-256	152.11
4897	phenylhydrazine (*α*)	....	$C_6H_5\cdot N(NO)\cdot NH_2$	XV-416	137.14
4898	piperidine (*N*)	....	$C_5H_{10}N\cdot NO$	XX-83	114.15
4899	propiophenone (*α*)	(*iso*); methyl-benzoyl ketoxime (*β*)	$C_6H_5\cdot CO\cdot C({:}NOH)\cdot CH_3$	VII-677	163.17
4900	resorcinol (4)	2-OH-*p*-benzoquinone-1-oxime tautomer	$ON\cdot C_6H_3(OH)_2$ or $O{:}C_6H_3({:}NOH)OH$	VIII-235	139.11

Nitroso-naphthyl-hydroxylamine 4581
Nitroso-oxindol 3923
Nitroso-phenol 5546
Nitroso-phenylaniline 4884
Nitroso-phenyl-hydroxylamine 1574
Nitrous ether 3097
Noctal 5390
Nonadecanone 4261
Nonanal 5043
Nonanamide 5045
Nonandioic acid 596
Nonanoic acid 5042
Nonanol 4918-25
Nonanone 1900, 4265
Nonanoyl chloride 5046

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4863	wh. pd./aq.	....	158-9 d.	....	s. h.	s.; sl. s. bz	v. sl. s.
4864	lf./lg.	....	64	....	s.	v. s.	v. s.
4865	yel. oil	1.147^{15°	15	240-5	....	....	....
4866	yel. pr./al.	$1.139^{30^\circ}_{30}$	29-30	258 sl. d.	i.	∞^{30°	v. s.
4867	lq.	1.112^{15°	....	225^{744mm}	....	....	....
4868	yel. lq.	1.135^{15°	2	244	i.	s.	s.
4869	col. nd./al.	....	74-5	273^{739mm}	....	....	....
4870	yel. lq.	1.132^{15°	....	238.9^{739mm}	....	....	....
4871	yel. nd./aq.	....	172-3	....	....	....	....
4872	yel. lf./al.	....	189-90 d.	....	i.; s. act.	s. h.; s. bz.	v. sl. s.; s. chl.
4873	lf./et.	$1.074^{67.5^\circ}$	69	subl.	v. s.	v. sl. s. pet.	v. s.
4874	mn./aq. al.	....	126-8	....	s. h.	s. alk.	....
4875	b. nd./bz.	....	173-4	....	s.	s. bz.	....
4876	col. rhb.*	....	67.5-8.0	$57\text{-}9^{18mm}$	i.; i. NH_3	s.	sl. s. lg.
4877	cr./al.	....	210 d.	....	s. ac.	s. h.	v. sl. s.
4878	col. cr.	....	d. 230	....	....	....	....
4879	yel. pd.	....	d. 250	....	sl. s. bz.	sl. s. h.	sl. s. ac.
4880	nd./aq.	....	169-70	....	sl. s.	s.	sl. s.
4881	nd./aq.	....	158-60	....	sl. s. h.	s.; s. bz.	v. sl. s.
4882	gn. mn.	1.24^{15°	84	....	v. sl. s.	s.	s.
4883	gn. tri.	....	86-7	....	i.	s.	s.
4884	gn. pl./bz.	....	144.6	....	sl. s.; v. s. chl.	v. s.; sl. s. lg.	v. s.; s. bz.
4885	yel. oil	$1.087^{20^\circ}_{4}$	....	$119\text{-}20^{15mm}$	i.	....	....
4886	red oil	$1.071^{20^\circ}_{4}$	....	86^{36mm}	....	....	....
4887	yel. oil	$1.124^{20^\circ}_{4}$	12-15	128^{19mm}	....	s.	s.
4888	pr./chl.	....	76	185-6	sl. s.	v. s.; s. alk.	v. s.; s. chl.
4889	cr./lg.	....	58-9	133^{11mm}	....	....	v. s.
4890	lf./lg.	....	58-9	183-7 sl. d.	sl. s. c.	v. s.; v. s. chl.	v. s.
4891	yel. red lq.	$1.122^{20^\circ}_{4}$	<-20	65^{13mm}	sl. s. h.	∞	∞; ∞ bz.
4892	nd./aq. al.	....	193-4	....	i.	v. s.	v. s.
4893	yel. nd./aq.	....	162-4 d.	....	s. h.	v. s.	sl. s.
4894	brn. pr./al.	....	109.5	....	0.1^{20°	2.4^{13°	v. sl. s. pet.
4895	gn./aq. al.	....	150-2	....	sl. s. h.	v. s. h.	s. h.
4896	yel. cr./act.	....	126**	....	i.; i. pet.	s. h.	v. s. chl.
4897	lt. yel. lf.	....	51	....	s.	poisonous	s.
4898	lt. yel. oil	$1.063^{18.5^\circ}_{4}$	....	217-8	s.	v. s. aq. a.	....
4899	nd./aq.	....	113-4	....	s. alk.	....	....
4900	yel. nd. + $1H_2O$/ aq.	....	$-H_2O$, 105; d. 148	....	s.; s. chl.	v. s.; s. ac.	s.; i. bz.; i. CS_2

* Green as liquid or in solution.

** Green when liquid.

Nonene 4930
Nonyl cyanide 1207
Nonylic acid 5042
Nor-arecaidine, cf. alkd.
Nosophen 5813
Nostal 5390
Novacetyl 118
Novarsenobenzol 5593
Novatophan 3130
Novonal 2137
Nucin 3787
Numal 5370
Nupercaine 1025

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4901	**Nitroso** R salt	(1;3,6;2)	$ON\cdot C_{10}H_4(SO_3Na)_2\cdot OH$	....	377.26
4902	thymol (*p*)	(quinoneoxime tautomer)	$ON\cdot C_{10}H_{12}\cdot OH$ or $O:C_{10}H_{12}:NOH$	VII-664	179.21
4903	toluene (*o*)	....	$CH_3\cdot C_6H_4\cdot NO$	V-317	121.13
4904	toluene (*m*)	....	$CH_3\cdot C_6H_4\cdot NO$	V-318	121.13
4905	toluene (*p*)	....	$CH_3\cdot C_6H_4\cdot NO$	V-318	121.13
4906	triacetonamine (*N*)	....	$C_9H_{16}ON\cdot NO$	XXI-251	184.23
4907	**Nonacosane**	....	$C_{29}H_{60}$	I-176	408.77
4908	**Nonadecane** (*n*)	....	$CH_3\cdot(CH_2)_{17}\cdot CH_3$	I-174	268.51
4909	**Nonadecylic acid**	....	$CH_3\cdot(CH_2)_{17}\cdot CO_2H$	II-389	298.49
4910	**Nonane** (*n*)	....	$CH_3\cdot(CH_2)_7\cdot CH_3$	I-165	128.25
4911	**Nonane** (*iso*)	2-methyl-octane	$(CH_3)_2CH\cdot C_6H_{13}$	I-166	128.25
4912	**Nonane**	2,4-diMe-heptane	C_9H_{20}	*I-64	128.25
4913	**Nonane**	2,5-diMe-heptane	C_9H_{20}	I-167	128.25
4914	**Nonane**	2,6-diMe-heptane	$[(CH_3)_2CH\cdot CH_2]_2CH_2$	I-167	128.25
4915	**Nonane**	4-ethyl-heptane	$C_2H_5\cdot CH(CH_2C_2H_5)_2$	I-167	128.25
4916	**Nonane**	3-methyl-octane	$(C_2H_5)(CH_3)CH\cdot(CH_2)_4CH_3$	I-166	128.25
4917	**Nonane**	4-methyl-octane	C_9H_{20}	*I-63	128.25
4918	**Nonyl** alcohol (*n*)	nonanol-1	$CH_3(CH_2)_7CH_2OH$	I-423	144.25
4919	alcohol (*n*)	nonanol-2	$C_7H_{15}\cdot CHOH\cdot CH_3$	I-423	144.25
4920	alcohol (*n*)	nonanol-3	$C_6H_{13}\cdot CHOH\cdot C_2H_5$	I-424	144.25
4921	alcohol (*n*)	nonanol-5	$(C_4H_9)_2CHOH$	I-424	144.25
4922	alcohol	2-methyl-octanol-2	$(CH_3)_2C(OH)C_6H_{13}$	I-424	144.25
4923	alcohol	4-ethyl-heptanol-4	$C_2H_5\cdot C(OH):(CH_2\cdot CH_2\cdot CH_3)_2$	I-424	144.25
4924	alcohol	2-Me-4-Et-hexanol-4	$(C_2H_5)_2C(OH)\cdot CH_2\cdot CH(CH_3)_2$	I-425	144.25
4925	alcohol	2,6-diMe-heptanol-4	$[(CH_3)_2CH\cdot CH_2]_2:CHOH$	I-425	144.25
4926	amine (*n*)	1-amino-nonane	$CH_3(CH_2)_7CH_2NH_2$	IV-198	143.27
4927	bromide (2)	2-bromo-nonane	$C_7H_{15}\cdot CHBr\cdot CH_3$	I-166	207.16
4928	chloride (2)	2-chloro-nonane	$C_7H_{15}\cdot CHCl\cdot CH_3$	I-166	162.70
4929	iodide (*n*)	1-iodo-nonane	$CH_3(CH_2)_7\cdot CH_2I$	I-166	254.16
4930	**Nonylene** (*β*)	nonene-2	$C_6H_{13}\cdot CH:CH\cdot CH_3$	I-223	126.23
4931	**Norbixin** (*trans*)	(stable)(*β*)	$C_{24}H_{28}O_4$	XXX-109	380.46
4932	**Norbixin** (*cis*)	(labile)	$C_{24}H_{28}O_4$	XXX-110	380.46
4933	methyl ester (*cis*)	(labile)-bixin	$C_{25}H_{30}O_4$	XXX-112	394.49
4934	**Novocain**	ethocaine; procaine HCl	$C_{13}H_{20}O_2N_2\cdot HCl$	XIV-424	272.77
4935	base	procaine	$NH_2\cdot C_6H_4CO_2(CH_2)_2\cdot N(C_2H_5)_2$	XIV-424	236.31
4936	**Octa**-chloropropane	perchloro-propane	C_3Cl_8	I-108	319.69
4937	cosane	....	$C_{28}H_{58}$	I-176	394.74
4938	decane	*n*-octadecane	$CH_3\cdot(CH_2)_{16}\cdot CH_3$	I-173	254.48
4939	decyl alcohol (*n*)	octadecanol-1	$CH_3(CH_2)_{16}CH_2OH$	I-431	270.48
4940	iodide (*n*)	1-iodo-octadecane	$CH_3(CH_2)_{16}CH_2I$	I-173	380.40
4941	decylene (*α*)	octadecene-1	$CH_3(CH_2)_{15}CH:CH_2$	I-226	252.47
4942	decyne-1	hexadecyl acetylene	$CH_3(CH_2)_{15}C\vdots CH$	I-262	250.45
4943	**Octandiol** (1,8)	....	$HO\cdot(CH_2)_8\cdot OH$	I-490	146.22
4944	**Octane** (*n*)	....	$CH_3\cdot(CH_2)_6\cdot CH_3$	I-159	114.22
4945	**Octane**	2,2,3,3-tetramethyl-butane	$[(CH_3)_3C]_2$	I-165	114.22

NW acid 4502
Nyctanthin 1555
Octa-decadienoic acid 3976
Octa-decanal 5633
Octa-decanoic acid 5631
Octa-decanol 4939
Octa-decanoyl chloride 5637
Octa-decatrienoic acid 3977
Octa-decene 4941
Octa-decynoic acid 5639
Octa-diene 1530
Octa-methylene 1617
Octa-methylene dicyanide 5606
Octaldehyde 1222
Octandial 5650

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4901	yel. cr.	....	....	....	2.5	sl. s.	....
4902	lt. yel. nd./chl.	....	160-4 sl. d.	....	v. sl. s. h.; s. alk.	s.	s.; s. chl.
4903	nd. or pr.	....	72.5	....	v. s. chl.	v. s.	v. s.
4904	nd.	....	53.5	....	i.	....	s.
4905	col.nd./lg.*	....	48.5	....	v. sl. s.	v.s. Me al.	v. s. bz.
4906	nd./aq. al.	1.14	72-3	subl.	....	v. s.	v. s.
4907	cr.	lq. $0.780^{63.8^\circ}$	63.8	346-8$^{40\text{mm}}$	1.1^{15° chl.	v. s. h.	v. s.
4908	cr.	$0.777^{32^\circ}_{4}$	32	330	i.	sl. s.	s.
4909	lf./al.	....	66.5	297-8$^{100\text{mm}}$	i.	....	....
4910	col. lq.	$0.718^{20^\circ}_{4}$	−53.6	150.8	i.	s. abs.	s.
4911	lq.	$0.713^{20^\circ}_{4}$	−80.4	143.3	....	....	....
4912	col. lq.	$0.716^{20^\circ}_{4}$	....	133	i.	∞	∞
4913	col. lq.	$0.715^{20^\circ}_{4}$	....	136	....	....	....
4914	lq.	$0.709^{20^\circ}_{4}$	−102.9	135.2	i.	....	s.
4915	lq.	0.730^{20°	....	141.2	i.	....	s.
4916	lq.	0.721^{20°	−107.6	144.2	i.	....	s.
4917	col. lq.	$0.720^{20^\circ}_{4}$	−113.2	142.5	i.	....	....
4918	lq.	$0.828^{20^\circ}_{4}$	−5	213.5	i.	∞	∞
4919	lq.	$0.823^{20^\circ}_{4}$	−35	193-4	i.	s.	s.
4920	lq.	$0.825^{20^\circ}_{4}$	−22	194.5$^{750\text{mm}}$	i.	v. s.	v. s.
4921	oil	0.823^{20°	....	193$^{766\text{mm}}$	i.	∞	∞
4922	lq.	$0.823^{18^\circ}_{19}$	....	178	i.	s.	s.
4923	lq.	0.835^{20°	....	179.5	i.	s.	s.
4924	lq.	0.840^{22°	....	172	i.	s.	s.
4925	lq.	$0.816^{12^\circ}_{4}$	....	172-4$^{750\text{mm}}$	i.	s.	s.
4926	lq.	....	....	201	....	....	....
4927	lq.	1.081^{20°	....	208-9^{767} d.	....	....	....
4928	col. lq.	0.856^{20°	....	190$^{764\text{mm}}$	....	....	....
4929	lq.	$1.287^{16^\circ}_{4}$	....	117$^{15\text{mm}}$	....	....	....
4930	lq.	$0.754^{15^\circ}_{15}$	....	148-9	i.	....	....
4931	b. red cr.	....	>300	....	i.	i.	s. h. pyr.
4932	red nd./ac.	....	254-5	....	i.; s. pyr.	s. alk.	i.
4933	vl. cr./ac.	....	198	....	i.; s. pyr.	sl. s. h.	0.3^{20° chl.
4934	nd./abs. al.	....	156	....	v. s.	....	i.
4935	cr./lg.	....	59-60**	....	sl. s.	s.	s. chl.
4936	pl.	....	160	268-9$^{734\text{mm}}$	s. lg.	s.	s.
4937	cr.	lq. $0.779^{61.6^\circ}$	61.6	316-8$^{40\text{mm}}$	2^{15° chl.	....	....
4938	cr.	$0.775^{28^\circ}_{4}$	28.0(27.4)	317	i.	sl. s.	s.; s. act.
4939	lf.	$0.812^{59^\circ}_{4}$	58.5	210.5$^{15\text{mm}}$	i.	s.	s.
4940	cr. lf.	....	33.5-4.0	170$^{0.5\text{mm}}$	....	v. sl. s. c.	....
4941	cr.	$0.791^{18^\circ}_{4}$	18	179$^{15\text{mm}}$	....	....	....
4942	cr.	0.796^{30°	26	180$^{15\text{mm}}$	....	....	....
4943	nd.	....	63	172$^{20\text{mm}}$	sl. s.	v. s.	sl. s.
4944	col. lq.	$0.703^{20^\circ}_{4}$	−56.8	125.7	0.002^{16°	sl. s.	s.
4945	lf.	....	100.7	106.3	i.	sl. s.	s.

* Green as liquid or in solution.

** Needles + $2H_2O$/aq. al., m. p. 51°.

Octandioic acid 5649
Octandione 78
Octanoic acid 1220
Octanol 4961-9
Octanone 2963, 4266
Octanoyl chloride 1225
Octene 4984-90
Octin 4114

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4946	**Octane**	2,2,3-tri Me-pentane	$(CH_3)_3C\cdot CH(CH_3)\cdot C_2H_5$	*I-62	114.22
4947	**Octane** ("iso")	2,2,4-tri Me-pentane	$(CH_3)_3C\cdot CH_2\cdot CH:(CH_3)_2$	**I-127	114.22
4948	**Octane**	2,3,3-tri Me-pentane	$C_2H_5\cdot C(CH_3)_2\cdot CH:(CH_3)_2$	....	114.22
4949	**Octane**	2,3,4-tri Me-pentane	$[(CH_3)_2CH]_2CH\cdot CH_3$	....	114.22
4950	**Octane**	2-Me-3-Et-pentane	$(C_2H_5)_2CH\cdot CH:(CH_3)_2$	I-164	114.22
4951	**Octane**	2,3-dimethyl-hexane	$(CH_3)_2CH\cdot CH(CH_3)\cdot CH_2\cdot C_2H_5$	*I-62	114.22
4952	**Octane**	2,4-dimethyl-hexane	$C_2H_5\cdot CH(CH_3)\cdot CH_2\cdot CH(CH_3)_2$	I-162	114.22
4953	**Octane**	2,5-dimethyl-hexane	$[(CH_3)_2CH\cdot CH_2\cdot]_2$	I-162	114.22
4954	**Octane**	3,4-dimethyl-hexane	$[C_2H_5\cdot CH(CH_3)\cdot]_2$	I-163	114.22
4955	**Octane**	3-ethyl-hexane	$(C_2H_5)_2CH\cdot CH_2\cdot C_2H_5$	*I-62	114.22
4956	**Octane** (*iso*)	2-methyl-heptane	$(CH_3)_2CH(CH_2)_4CH_3$	I-161	114.22
4957	**Octane**	3-methyl-heptane	$C_2H_5\cdot CH(CH_3)\cdot(CH_2)_3\cdot CH_3$	I-162	114.22
4958	**Octane**	4-methyl-heptane	$(C_2H_5CH_2)_2CH\cdot CH_3$	I-162	114.22
4959	**Octyl** acetate (*n*)	(*See also* No. 1219)	$CH_3\cdot CO_2C_8H_{17}$	II-134	172.26
4960	acetate	2-Et-hexyl acetate	$CH_3\cdot CO_2CH_2\cdot CH:(C_2H_5)(C_4H_9)$	....	172.26
4961	alcohol (*n*)	octanol-1	$CH_3(CH_2)_6CH_2OH$	I-418	130.22
4962	alcohol (capryl alcohol)	octanol-2	$CH_3(CH_2)_5CHOH\cdot CH_3$	I-419	130.22
4963	alcohol	2-Me-3-Et-pentanol-3	$(C_2H_5)_2C(OH)\cdot CH(CH_3)_2$	I-423	130.22
4964	alcohol	2,2,4-trimethyl-pentanol-4	$(CH_3)_3CCH_2C(OH):(CH_3)_2$	I-423	130.22
4965	alcohol	2-Et-hexanol-1	$C_4H_9(C_2H_5)CH\cdot CH_2OH$	**I-453	130.22
4966	alcohol	3-Et-hexanol-3	$(C_2H_5)_2C(OH)\cdot C_3H_7$	I-421	130.22
4967	alcohol	2-methyl-heptanol-2	$(CH_3)_2C(OH)\cdot CH_2\cdot(CH_2)_3CH_3$	I-420	130.22
4968	alcohol (*dl*)	3-methyl-heptanol-3	$C_2H_5(CH_3)C(OH)\cdot CH_2\cdot CH_2\cdot C_2H_5$	I-421	130.22
4969	alcohol (*dl*)	4-methyl-heptanol-4	$(C_2H_5CH_2)_2C(OH)\cdot CH_3$	I-421	130.22
4970	amine (*n*)	1-amino-octane	$CH_3(CH_2)_7NH_2$	IV-196	129.24
4971	amine (*n*)(*sec*)	2-amino-octane	$C_6H_{13}\cdot CH(NH_2)\cdot CH_3$	IV-196	129.24
4972	amine	2-Et-1-amino-hexane	$C_4H_9(C_2H_5)CH\cdot CH_2\cdot NH_2$	....	129.24
4973	bromide (*n*)	1-bromo-octane	$CH_3(CH_2)_6CH_2Br$	I-160	193.13
4974	bromide (*n*)(*sec*)	2-bromo-octane	$C_6H_{13}\cdot CHBr\cdot CH_3$	I-160	193.13
4975	chloride (*n*)	1-chloro-octane	$CH_3(CH_2)_6CH_2Cl$	I-159	148.67
4976	chloride (*n*)(*sec*)	2-chloro-octane	$C_6H_{13}\cdot CHCl\cdot CH_3$	I-160	148.67
4977	cinnamate (*n*)(*sec*)	....	$C_6H_5\cdot CH:CH\cdot CO_2\cdot CH(CH_3)C_6H_{13}$	*IX-230	260.36
4978	fluoride (*n*)	1-fluoro-octane	$CH_3(CH_2)_6CH_2F$	I-159	132.22
4979	formate (*d*)	β-octyl formate	$HCO_2\cdot C_8H_{17}$	II-22	158.23
4980	iodide (*n*)	1-iodo-octane	$CH_3(CH_2)_6CH_2I$	I-160	240.14
4981	nitrate (*n*)	....	$CH_3(CH_2)_7O\cdot NO_2$	I-419	175.22
4982	nitrite (*n*)	....	$CH_3(CH_2)_7O\cdot NO$	I-419	159.22

Octyl acetate (*sec*) 1219
Octyl cyanide 5047
Octylene 1923
Oenanthaldoxime 3522
Oenanthole 3521
Oenanthone 2267
Oenanthylic acid 3520
Oenanthylic nitrile 3648
Oenanthylidene 3558
Oestriol 2902
Oestroform 2903
Oil of apples 496
Oil of bananas 398
Oil of bitter almonds 642
Oil of cinnamon 1501

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4946	col. lq.	$0.716_{4}^{20^\circ}$	−112.3	109.8^{760mm}	i.	sl. s.	s.
4947	col. lq.	$0.692_{4}^{20^\circ}$	−107.4	99.2	i.	sl. s.	s.
4948	col. lq.	$0.726_{4}^{20^\circ}$	−100.7	114.8	i.	sl. s.	s.
4949	col. lq.	$0.719_{4}^{20^\circ}$	−109.2	113.5	i.	sl. s.	s.
4950	lq.	$0.719_{4}^{20^\circ}$	−115.0	115.7	i.	sl. s.	s.
4951	lq.	$0.712_{4}^{20^\circ}$	....	115.6	i.	sl. s.	s.
4952	lq.	$0.700_{4}^{20^\circ}$	....	109.4	i.	sl. s.	s.
4953	col. lq.	$0.694_{4}^{20^\circ}$	−91.2	109.1	i.	sl. s.	s.
4954	lq.	$0.719_{4}^{20^\circ}$	....	117.7	i.	sl. s.	s.
4955	lq.	$0.714_{4}^{20^\circ}$	....	118.5	i.	sl. s.	s.
4956	col. lq.	$0.698_{4}^{20^\circ}$	−109.0	117.7	i.	sl. s.	s.
4957	lq.	$0.706_{4}^{20^\circ}$	−120.5	118.9	i.	sl. s.	s.
4958	lq.	$0.705_{4}^{20^\circ}$	−121.0	117.7	i.	sl. s.	s.
4959	col. lq.	$0.885_{4}^{0^\circ}$	−38.5	210	i.	s.	s.
4960	col. lq.	$0.873_{20}^{20^\circ}$	−93	199	$<0.03^{20^\circ}$	∞	∞
4961	col. lq.	$0.827_{4}^{20^\circ}$	−16	194-5	0.054^{20°	∞	∞; ∞ chl.
4962	col. lq.	$0.822_{4}^{20^\circ}$	−38.6	179-80	0.096^{25°	∞	∞
4963	lq.	0.830^{20°	....	$160\text{-}1^{750mm}$	....	s.	s.
4964	lq.	0.842^{0°	−20	146.5-7.5	i.	sl. s.	s.
4965	col. lq.	$0.834_{20}^{20^\circ}$	< −76	184	0.1^{20°	s.	s.
4966	lq.	$0.838_{4}^{20^\circ}$	....	160.5	....	∞	∞
4967	lq.	0.879^{20°	....	162	....	....	....
4968	lq.	0.820^{21°	....	162	i.	....	....
4969	lq.	0.825^{20°	....	161.5	i.	....	....
4970	col. lq.	0.777^{27°	....	$175\text{-}7^{745mm}$	v. sl. s.	s.	s.
4971	lq.	$0.771_{4}^{25^\circ}$	....	164-5	....	....	....
4972	lq.	$0.792_{20}^{20^\circ}$	....	167-8	....	....	....
4973	col. lq.	1.118^{15°	−15	202-3	i.	∞	∞
4974	lq.	1.099^{22°	....	188-9	....	....	....
4975	lq.	$0.892_{4}^{0^\circ}$	....	182.5-3.5	i.	....	....
4976	lq.	0.871^{15°	....	171-3	i.	....	s.
4977	lq.	$0.972_{4}^{17^\circ}$	....	240^{60mm}	....	....	....
4978	col. lq.	0.804^{21°	....	142.5^{754mm}	i.	....	....
4979	col. lq.	$0.872^{12.5^\circ}$	....	82^{20mm}	i.	....	....
4980	lq.	$1.337_{4}^{16^\circ}$	−45.9	225.5	....	....	....
4981	lq.	$0.975_{4}^{0^\circ}$	....	$110\text{-}2^{20mm}$	....	....	....
4982	gn. lq.	0.862^{17°	....	175-7	....	....	....

Oil of garlic 1684
Oil of mirbane 4646
Oil of mustard 220
Oil of niobe 4138
Oil of pears 398

Oil of wintergreen 4380
Oil red 5664
Oil scarlet 5664
Olein 3430
Olifiant gas 3192

Omal 6164
Ononin, cf. glcde.
Opianin, cf. alkd.
Opianyl 4017
Opin, cf. alkd.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
4983	**Octyl** stearate (*n*) (*sec*)	....	$C_{17}H_{35}CO_2\cdot CH(CH_3)\cdot C_6H_{13}$	*II-173	396.68
4984	**Octylene** (α)†	octene-1	$CH_3(CH_2)_5CH{:}CH_2$	I-221	112.21
4985	**Octylene**	2,3,3-trimethyl-pentene-1	$C_2H_5\cdot C(CH_3)_2\cdot C(CH_3){:}CH_2$	....	112.21
4986	**Octylene**	2,4,4-trimethyl-pentene-1	$(CH_3)_3C\cdot CH_2\cdot C(CH_3){:}CH_2$	I-222	112.21
4987	**Octylene**	2,3,4-trimethyl-pentene-2	$(CH_3)_2CH\cdot C(CH_3){:}C(CH_3)_2$	....	112.21
4988	**Octylene**	3,4,4-trimethyl-pentene-2	$(CH_3)_3C\cdot C(CH_3){:}CH\cdot CH_3$	....	112.21
4989	**Octylene**	3-ethyl-hexene-2	$CH_3\cdot CH{:}C(C_2H_5)\cdot CH_2\cdot C_2H_5$	I-222	112.21
4990	**Octylene**	2-methyl-heptene-2	$(CH_3)_2C{:}CH\cdot CH_2\cdot CH_2\cdot C_2H_5$	I-222	112.21
4991	**Octyne-1**	caprylidene	$CH_3\cdot(CH_2)_5\cdot C\vdots CH$	I-258	110.19
4992	**Oleic acid**	....	$CH_3(CH_2)_7CH{:}CH\cdot(CH_2)_7CO_2H$	II-463	282.45
4993	**Opianic acid**	(5,6;2,1)	$(CH_3O)_2C_6H_2{:}(CHO)CO_2H$	X-990	210.18
4994	**Orange I**	*p*-sulfobenzene-azo-α-naphthol Na	$NaO_3S\cdot C_6H_4\cdot N{:}N\cdot C_{10}H_6\cdot OH$	*XVI-296	350.32
4995	**Orange II**	*p*-sulfobenzene-azo-β-naphthol Na	$NaO_3S\cdot C_6H_4\cdot N{:}N\cdot C_{10}H_6\cdot OH$	*XVI-296	350.32
4996	**Orange IV**	4′-anilino-azo-benzene-4-sulfonic Na	$NaO_3S\cdot C_6H_4\cdot N{:}N\cdot C_6H_4\cdot NH\cdot C_6H_5$	*XVI-319	375.37
4997	**Orcein**	....	$C_{28}H_{24}O_7N_2$	....	500.49
4998	**Orcinol**	5-methyl resorcinol	$CH_3\cdot C_6H_3(OH)_2$	VI-882	124.13
4999	**Orcin-phthalein**	....	$C_{22}H_{16}O_5$	XIX-236	360.35
5000	**Ornithine**	α,δ-diaminovaleric acid	$H_2N\cdot(CH_2)_3\cdot CH{:}(NH_2)CO_2H$	IV-420	132.16
5001	**Orsellinic acid** (4,6;2,1)	....	$(HO)_2C_6H_2(CH_3)\cdot CO_2H\cdot aq.$	X-412	168.14
5002	**Ortal sodium**	*n*-hexyl-ethyl-barbituric Na	$C_6H_{13}(C_2H_5){:}C_4HO_2N_2ONa$	....	262.29
5003	**Orthochrom T**	....	$C_{23}H_{22}N_2\cdot(C_2H_5I)$	XXIII-310	482.40
5004	**Ostruthin**	....	$C_{19}H_{22}O_3$	....	298.37
5005	**Oxalenediuramidoxime**	oxaldiureide-dioxime	$[H_2N\cdot CO\cdot NH\cdot C\cdot({:}NOH)]_2$	III-65	204.15
5006	**Oxalic** acid	ethandioic acid	$HO_2C\cdot CO_2H$	II-502	90.04
5007	acid	ethandioic acid	$(CO_2H)_2\cdot 2H_2O$	II-502	126.07
5008	Na salt	sodium oxalate	$(CO_2Na)_2$	II-513	134.01
5009	amide	oxamide	$(CONH_2)_2$	II-545	88.07
5010	anilide	oxanilide	$(CO\cdot NH\cdot C_6H_5)_2$	XII-284	240.25
5011	chloride	oxalyl chloride	$Cl\cdot CO\cdot CO\cdot Cl$	II-542	126.93
5012	imide	oximide	$CO\cdot CO\cdot NH$ |______|	XXI-368	71.04
5013	**Oxaluric** acid	....	$NH_2\cdot CO\cdot NH\cdot CO\cdot CO_2H$	III-64	132.08
5014	amide	oxalan	$C_3H_5O_3N_3$	III-65	131.09
5015	**Oxamaethane**	ethyl oxamate	$NH_2\cdot CO\cdot CO_2C_2H_5$	II-544	117.10

† See also di-iso-butylene.
Orange-III 4328
Orange-GS 4996
Orange-N 4996
Orcin (β) 2380

Oreson 3400
Orexin 5182
Orizabin, cf. glcde.
Orthamine 5256
Orthanilic acid 523

Orthoform new 4112
Ortol, mixt. of 2314 and 4116
Ouabain, cf. glcde.
Oxalacetic ester 2192
Oxalacetone 2939

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
4983	col. cr.	$0.841_{4}^{38^\circ}$	34	235^{6mm}	....	....	....
4984	lq.	0.716^{20°	−102.4	121.3	i.	∞	∞
4985	col. lq.	0.737^{20°	−69	108.2	....	....	....
4986	col. lq.	0.715^{20°	−93.5	101.4	....	....	....
4987	col. lq.	0.743^{20°	....	116.3	....	....	....
4988	col. lq.	0.739^{20°	....	112	....	....	....
4989	lq.	0.737^{20°	....	121	i.	....	....
4990	col. lq.	$0.725_{0}^{20^\circ}$	....	122	i.	....	....
4991	lq.	$0.743_{4}^{25^\circ}$	−79	$131\text{-}2^{762mm}$	....	....	....
4992	col. nd.	$0.854_{4}^{78^\circ}$	14	$285\text{-}6^{100mm}$	i.	∞	∞
4993	nd./aq.	....	150	....	0.25 c.; 1.7 h.	s.	s.
4994	or. red pd.	....	....	....	s.	....	....
4995	or. red pd.	....	....	....	s.	....	....
4996	or. yel. pd.	....	....	....	s.	....	....
4997	brn. cr.	....	....	....	i. chl., CS_2	s.; s. ac.	i.; i. bz.
4998	pr./bz.	1.290^{4°	107-8*	287-90	v. s.	v. s.	v. s.
4999	pr./act.	....	d. >230	....	i.; s. h. ac.	s.; s. alk.	i.; i. bz.
5000	syrup	....	....	....	v. s.	v. s.	sl. s.
5001	cr.	....	176 d. (anh.)	$-H_2O$, 100	s. gly.	v. s.	22^{20°
5002	wh. pd.	....	....	....	v. s.	s.	i.
5003	gn. pr./al.	....	....	....	sl. s. h.	s. h.	....
5004	cr./aq. al.	....	117-9	....	i.; i. pet.	s. h.	s. chl.
5005	nd./aq. al.	....	191-2 d.	....	i. c.; i. bz.; s. a.	s.; i. lg.; s. alk.	i.; i. chl.
5006	col. rhb.	1.90	186-7 d.	subl. > 100	10^{20°; 120^{100°	24^{15° abs.	1.3^{15° abs.
5007	col. mn.	$1.653_{4}^{19^\circ}$	101.5	$-2H_2O$, 100	....	....	....
5008	cr. pd.	....	....	....	3.2^{16°	i.	6.6 h. aq.
5009	mn.	1.667	417-9 d.	....	$0.04^{7\ 3^\circ}$; 0.6^{100°	i.	i.
5010	pl./bz.	....	247-50	>320	i. h.	sl. s. h.	sl. s. h.
5011	col. lq.	$1.488_{4}^{13^\circ}$	−12	$63\text{-}4^{763mm}$	d.	d.	s.
5012	pr.	....	....	....	v. sl. s.; d. h.	sl. s. NH_4OH	....
5013	cr./aq.	....	d. 208-10	....	v. sl. s.; d. h.	i.	i.
5014	cr. ppt.	....	d.	....	i. c.	s. H_2SO_4	s. d. KOH
5015	rhb.	....	114-5	....	s.	v. sl. s. bz.	s.

* Crysts. + $1H_2O$/aq., m. p. 56° ±.

Oxalan 5014
Oxaldiureide dioxime 5005
Oxalic nitrile 1588
Oxalyl chloride 5011
Oxalyl urea 5036
Oxamide 5009
Oxanilide 5010
Oximide 5012
Oximido-mesoxalyl urea 6445
Oxindole 2686
Oxine 3825
Oxy-, cf. also hydroxy-.
Oxyacanthine, cf. alkd.
Oxycaproic acid 3759

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5016	**Oxamic** acid	....	$NH_2 \cdot CO \cdot CO_2H$	II-543	89.05
5017	hydrazide	amino-oxamide	$NH_2 \cdot CO \cdot CO \cdot NH \cdot NH_2$	II-559	103.08
5018	**Oxanilic acid**	....	$C_6H_5NH \cdot CO \cdot CO_2H$	XII-281	165.14
5019	**Oxanthranol**	anthrahydroquinone	$C_6H_4(COCHOH)C_6H_4$	VIII-190	210.22
5020	diacetate	....	$C_{14}H_8(O_2C \cdot CH_3)_2$	VI-1034	294.29
5021	**Oxindol** †	....	$\underbrace{C_6H_4 \cdot CH_2 \cdot CO \cdot NH}$	XXI-282	133.14
5022	**Palmitic** acid	hexadecanoic acid	$CH_3(CH_2)_{14} \cdot CO_2H$	II-370	256.42
5023	aldehyde	hexadecanal	$CH_3(CH_2)_{14} \cdot CHO$	I-717	240.42
5024	aldehyde oxime	....	$C_{15}H_{31} \cdot CH{:}NOH$	I-717	255.43
5025	amide	....	$C_{15}H_{31} \cdot CO \cdot NH_2$	II-374	255.43
5026	anhydride	....	$(C_{15}H_{31}CO)_2O$	II-374	494.82
5027	chloride	palmityl chloride	$C_{15}H_{31} \cdot CO \cdot Cl$	II-374	274.87
5028	nitrile	pentadecyl cyanide	$C_{15}H_{31} \cdot CN$	II-375	237.42
5029	**Palmitolic acid**	....	$CH_3(CH_2)_7C \vdots C \cdot (CH_2)_5 \cdot CO_2H$	II-494	252.38
5030	**Palmitone**	....	$(C_{15}H_{31})_2CO$	I-719	450 81
5031	**Panthesin**	....	$C_{18}H_{32}O_5N_2S$	....	388.51
5032	**Pantocaine**	*p*-butylaminobenzoyl-dimethyl-aminoethanol	$C_4H_9NH \cdot C_6H_4CO_2 \cdot (CH_2)_2N(CH_3)_2HCl$	....	300.82
5033	**Pantothenic** acid (*dl*)	....	$HOCH_2C(CH_3)_2CH \cdot (OH)CONH \cdot (CH_2)_2 \cdot CO_2H$	....	219.23
5034	acid (*d*)	....	$C_9H_{17}O_5N$	....	219.23
5035	Ca salt (*d*)	....	$(C_9H_{16}O_5N)_2Ca$	....	476.53
5036	**Parabanic acid**	oxalyl urea	$C_3H_2O_3N_2$	XXIV-449	114.06
5037	**Paracotoin**	....	$CH_2O_2{:}C_{11}H_6O_2$	....	216.18
5038	**Pararosaniline** base (4,4′,4″)	triamino-triphenyl-carbinol	$HO \cdot C(C_6H_4 \cdot NH_2)_3$	XIII-750	305.37
5039	hydrochloride	parafuchsin	$C_{19}H_{18}N_3Cl \cdot H_2O$	XIII-752	341.83
5040	**Parvoline** (α)	2,4-diEt-pyridine	$C_9H_{13}N$	XX-253	135.20
5041	**Parvoline** (β)	3,4-diEt-pyridine	$C_9H_{13}N$	XX-253	135.20
5042	**Pelargonic** acid	nonanoic acid	$CH_3(CH_2)_7 \cdot CO_2H$	II-352	158.23
5043	aldehyde	nonanal	$CH_3(CH_2)_7 \cdot CHO$	I-708	142.23
5044	aldehyde oxime	....	$C_8H_{17} \cdot CH{:}NOH$	I-708	157.25
5045	amide	nonanamide	$CH_3(CH_2)_7CO \cdot NH_2$	II-353	157.25
5046	chloride	pelargonyl chloride	$CH_3(CH_2)_7 \cdot COCl$	II-353	176.68
5047	nitrile	octyl cyanide	$CH_3(CH_2)_7 \cdot CN$	II-354	139.23
5048	**Penta**-aminobenzene	....	$(NH_2)_5C_6H$	XIII-346	153.19
5048.1	bromoacetone	....	$Br_3C \cdot CO \cdot CHBr_2$	I-659	452.62
5049	bromobenzene	....	Br_5C_6H	V-215	472.65
5050	bromoethane	....	$CHBr_2 \cdot CBr_3$	I-95	424.61
5051	bromophenol	....	$Br_5C_6 \cdot OH$	VI-206	488.65
5052	chloroaniline	....	$Cl_5C_6 \cdot NH_2$	XII-631	265.37
5053	chlorobenzene	....	Cl_5C_6H	V-205	250.35
5054	chloroethane	pentalin	$CHCl_2 \cdot CCl_3$	I-87	202.31
5055	chloroethylbenzene	alkazene-32	$Cl_5C_6 \cdot C_2H_5$	V-355	278.41
5056	chloro-1-keto-1,2,3,4-tetrahydro-naphthalene	2,2,3,4,4-penta-Cl	$C_{10}H_5OCl_5$	VII-370	318.43
5057	chlorophenol	....	$Cl_5C_6 \cdot OH$	VI-194	266.35
5058	cosane	....	$C_{25}H_{52}$	I-175	352.67

† See also No. 2686.

Oxychalcone 3763
Oxydimorphine, cf. alkd.
Oxyjuglon(e) 4477
Oxymethyl-acetamide 3291
Oxyneurine 846
Oxyneurine HCl, cf. alkd.
Oxypurine, cf. alkd.
Palmitin 3431
Palmityl chloride 5027
Papaveraldine, cf. alkd.
Papaverine, cf. alkd.
Parabutyraldehyde 1162, 1165
Paracamphoric acid 1197
Paraconine, cf. alkd.
Paraformaldehyde 3290
Parafuchsine 5039
Parafuchsine carbinol base 5038
Paralactic acid 3939
Paraldehyde 7
Paraldol 170

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5016	cr. pd.	....	214 d.	....	v. sl. s.	i. abs.	i.
5017	col. lf./aq.	....	221-3 d.	....	0.3^{20°	i.; s. a.	i.; s. alk.
5018	nd./bz.	....	150	....	sl. s. h.	v. s.	v. s.
5019	yel. nd.	....	....	....	....	s.	s. alk.
5020	nd./ac.	....	108-9	....	....	s.	s. ac.
5021	col. nd./aq.	....	120	227^{73mm}	s. h.	s.	s.; s. alk.
5022	col. pl.	$0.849^{70^\circ}_{4}$	63-4	271.5^{100mm}	i.; v. sl. s. pet.	9.3^{20° abs.	s.; s. chl.
5023	wh. wax	....	34	$200\text{-}2^{29mm}$	i.	s.	s.
5024	nd./aq. al.	....	88	....	sl. s. bz.	sl. s. pet.	s.; s. chl.
5025	cr. lf.	....	106-7	$235\text{-}6^{12mm}$	i.	v. s.	v. sl. s.
5026	col. cr.	$0.847^{70^\circ}_{4}$	64	....	....	0.2^{20°	s.
5027	col. cr.	....	12	$194\text{-}5^{17mm}$	d.	d.	sl. s.
5028	pl.	$0.822^{31^\circ}_{4}$	31	251.5^{100mm}	i.	s.	s.
5029	nd./aq.	....	42	240^{15mm}	i.	v. s.	v. s.
5030	lf./al.	$0.800^{83^\circ}_{4}$	82.8	....	i.	....	....
5031	wh. pd.	....	157-9	....	33	s.	....
5032	wh. pd.	....	148-50*	....	14	s.	i.
5033	col. syrup	....	....	....	s.	s.	s. act.
5034	syrup	....	....	....	s.	s.	s. act.
5035	col. cr.	....	....	....	s.	s. Me al.	sl. s. act.
5036	mn.	....	243 d.	subl. 100	4.7^{8°	s.	i.
5037	yel. cr.	....	162	....	....	s.	s.; s. chl.
5038	col. lf.	....	205 d.	....	v. sl. s.	s.	i.
5039	gn. met.	....	d. 250	....	0.31^{22°	....	....
5040	lq.	0.934^{0°	....	188	sl. s.	s.	....
5041	lq.	0.916	....	209^{710mm}	....	....	....
5042	col. oil	$0.906^{20^\circ}_{4}$	12.5	253-4	v. sl. s.	s.; s. chl.	s.
5043	lq.	$0.827^{19^\circ}_{19}$	....	185	....	....	....
5044	lf./aq. al.	....	63-4	....	i.	s.	s.
5045	col. cr.	....	99-100	....	i. c.	sl. s.	sl. s.
5046	col. lq.	$0.946^{15^\circ}_{4}$	<-60	215.4^{760mm}	d.	d.	s.
5047	col. lq.	0.786^{16°	....	214-6	i.	s.	s.
5048	salts only	....	....	....	....	....	....
5048.1	rhb. nd./al.	....	79-80(72)	subl.	i. c.	v. s.	v. s.
5049	nd./ac.	....	293	....	i.; s. bz.	sl. s.	sl. s.
5050	mn. pr.	3.312	56-7	210^{300mm} d.	i.	s.	v. s.
5051	mn./al.	....	225-6	subl.	i.	sl. s.	sl. s.
5052	nd./al.	....	232	....	sl. s. lg.	s.	s.
5053	nd./al.	1.834^{17°	85-6	275-7	i.	s. h.	v. s.
5054	col. lq.	$1.671^{25^\circ}_{4}$	-22	162	0.05^{20°	∞	∞
5055	cr./al. bz.	$1.552^{60^\circ}_{25}$	53	305 ±	i.; v. s. bz.	2^{25° Me al.	166^{25°
5056	mn./bz.	....	156-7	d. >200, -HCl	s. h. bz.	v. s.	i.
5057	mn.	1.978^{22°	188-9	309^{754mm} d.	0.003^{50°	v. s.	148^{25°
5058	cr.	0.791^{60°	53.3	$282\text{-}4^{40mm}$	....	s. abs.	5.4^{15° chl.

* Free base, m. p. 153-4°.

Param 2080
Paramorphine, cf. alkd.
Pararosolic acid 593
Parietic acid 2306
Parillin, cf. glcde.
Paris green 3594
Parodyne 565
Paviin, cf. glcde.
P.D.H. 5261
Pear oil 398
Peganine, cf. alkd.
Pelargonamide 5045
Pelargone 2685
Pelargonyl chloride 5046
Pelletierine, cf. alkd.
Pellotine, cf. alkd.
Penta-acetyl glucose 3362-3

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5059	**Penta** decanaldoxime	....	$C_{14}H_{29}\cdot CH:NOH$	I-716	241.41
5060	decane (*n*)	....	$CH_3(CH_2)_{13}\cdot CH_3$	I-172	212.41
5061	decyl acetate (*n*)	....	$CH_3CO_2\cdot C_{15}H_{31}$	II-136	270.44
5062	decyl alcohol (*n*)	pentadecanol-1	$CH_3(CH_2)_{13}\cdot CH_2OH$	I-429	228.41
5063	decyl bromide	1-bromo-pentadecane	$CH_3(CH_2)_{13}\cdot CH_2Br$	I-172	291.31
5064	diene-1,3	piperylene	$CH_3CH:CH\cdot CH:CH_2$	I-251	68.11
5065	diene-2,3	....	$CH_3CH:C:CHCH_3$	I-251	68.11
5066	erythritol	pentaerythrite	$C(CH_2OH)_4$	I-528	136.15
5067	erythritol tetra-acetate	....	$C(CH_2O_2CCH_3)_4$	II-150	304.29
5068	ethylbenzene	....	$(C_2H_5)_5C_6H$	V-471	218.37
5069	glycerol	....	$CH_3\cdot C(CH_2OH)_3$	I-520	120.15
5070	hydroxy benzo-phenone	mori(n)tannic acid; maclurin	$(HO)_2C_6H_3\cdot CO\cdot C_6H_2(OH)_3\cdot H_2O$	VIII-538	280.23
5071	iodobenzene	....	I_5C_6H	V-229	707.67
5072	iodoethane	....	$CHI_2\cdot CI_3$	*I-31	659.63
5073	methyl-amino-benzene	....	$(CH_3)_5C_6\cdot NH_2$	XII-1182	163.25
5074	methyl benzene	....	$(CH_3)_5C_6H$	V-443	148.24
5075	methyl benzoic acid	....	$(CH_3)_5C_6\cdot CO_2H$	IX-569	192.25
5076	methyl para-rosaniline	methyl violet base	$C_{24}H_{29}ON_3$	XIII-755	375.50
5077	methyl pararosani-line chloride	methyl violet dye salt †	$C_{24}H_{28}N_3\cdot Cl$	XIII-755	393.95
5078	methyl phenol	....	$(CH_3)_5C_6\cdot OH$	VI-551	164.24
5079	methylene-tetrazol	metrazol; cardiazol	$\cdot N(CH_2)_5C:(N_3)$	....	138.17
5080	triacontane (*n*)	....	$CH_3(CH_2)_{33}\cdot CH_3$	I-177	492.93
5081	**Pentaldol**	2,2-di Me-propan-3-ol-1-al	$(CH_3)_2C(CHO)\cdot CH_2OH$	I-833	102.13
5083	**Pentane**	*n*-pentane	$(C_2H_5)_2CH_2$	I-130	72.15
5084	**Pentane** (*iso*)	2-methyl-butane	$(CH_3)_2CH\cdot C_2H_5$	I-134	72.15
5085	**Pentane** (*neo*)	2,2-dimethyl-propane	$(CH_3)_4C$	I-141	72.15
5086	**Pentyne**-1	propyl acetylene	$C_2H_5\cdot CH_2\cdot C\vdots CH$	I-250	68.11
5087	**Pentyne**-2	valerylene	$C_2H_5\cdot C\vdots C\cdot CH_3$	I-250	68.11
5088	**Perchloro**-ether	....	$Cl_5C_2\cdot O\cdot C_2Cl_5$	II-210	418.61
5089	methyl mercaptan	....	$Cl_3C\cdot S\cdot Cl$	III-135	185.90
5090	**Perseite** (*d*)	mannoheptitol	$C_7H_{16}O_7$	I-548	212.20
5091	**Phanodorn**	Et-cyclohexenyl-barbituric acid	$(C_2H_5)(C_6H_9):C_4H_2O_3N_2$	....	236.26
5092	**Phellandrene** (*α*)(*d*)	*p*-menthadiene-1,5	$C_{10}H_{16}$	V-129	136.23
5093	**Phellandrene** (*β*)	*p*-menthadiene-2,1(7)	$C_{10}H_{16}$	V-132	136.23
5094	**Phenacyl** acetate	ω-acetoxy-acetophenone	$C_6H_5\cdot CO\cdot CH_2\cdot O\cdot CO\cdot CH_3$	VIII-92	178.18
5095	**Phenanthrene**	....	$(C_6H_4CH)_2$	V-667	178.22
5096	hydroquinone	(9,10)	$C_{14}H_8(OH)_2$	VI-1035	210.22
5097	**Phenanthraqui-none**	phenanthrene quinone	$\underbrace{C_6H_4(CO)_2C_6H_4}$	VII-796	208.20
5098	**Phenanthrol** (2)	....	$C_{14}H_9OH$	VI-704	194.22
5099	**Phenanthrol** (3)	....	$C_{14}H_9OH$	VI-705	194.22

† Commercial dye mostly penta- with some hexa-methyl derivative.

Penta-diazenone 5480
Penta-decanol 5062
Penta-decyl cyanide 5028
Penta-erythrite 5066
Penta-hydroxy-flavone 5806-7
Penta-methylene 1619
Penta-methylene-diamine 1184
Penta-methylene-dibromide 1857
Penta-methylene-dicyanide 5311
Penta-methylene-diiodide 2396
Pentalin 5054
Pentanal 6400
Pentandioic acid 3376
Pentandiolamine 243
Pentane diethylsulfone 5872
Pentanoic acid 6399
Pentanol 404-5, 408
Pentanone 2180, 4355
Pentanpentol 572, 6478
Pentanthiol 467-8
Pentaphen 476

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5059	nd./aq. al.	....	86	....	sl. s. c. pet.	sl. s. c.	v. s.; sl. s. bz.
5060	col. lq.	$0.770^{20°}_{4}$	10	270.5	i.	v. s.	v. s.
5061	wax	....	10-1	$230^{70\text{mm}}$	....	....	....
5062	cr.	....	45-6	....	....	....	....
5063	cr.	....	14-5	....	....	....	....
5064	lq.	$0.676^{20°}$	....	42.3	....	....	....
5065	lq.	$0.66^{20°}$	....	40	....	....	....
5066	cr.	....	262	$276^{30\text{mm}}$	$5.6^{15°}$	v. sl.s.	i.
5067	nd./aq. or bz.	$1.273^{18°}_{4}$	83-4	....	....	....	....
5068	lq.	$0.896^{20°}_{4}$	<-20	277	i.	....	....
5069	nd./abs. al.	....	199	subl.	v. s.	v. s.	i.
5070	yel. pr./aq.	....	200(anh.)	$-H_2O$, 130-40	$0.5^{15°}$	s.	s.
5071	cr./al.	....	172	....	s. h. ac.	sl. s. c.	sl. s.
5072	col./ac.	....	182-4	....	s. ac.	s.	s. bz.
5073	mn./al.	....	151-2	278-80	i. h.	s.	s.
5074	pr./aq. al.	$0.847^{107°}_{4}$	53	230-1	i.	v. s.	v. s. bz.
5075	nd./aq. al.	....	210.5	subl.	v. sl. s.	v. s. h.	....
5076	salts only	....	....	....	....	....	....
5077	red or b. vl.	....	....	....	s.	....	....
5078	nd./al.	....	125	267	0.15 h.	s. h. aq. NaOH	....
5079	wh. cr. pd.	....	57-8	....	s.	s.	s.
5080	cr.	$0.782^{74.7°}_{4}$	α75; β72	$331^{15\text{mm}}$	....	....	....
5081	col. nd./al.	....	96-7	$172\text{-}3^{747\text{mm}}$ d.	5 c.	2.5 c.	s.
5083	col. lq.	$0.626^{20°}$	-129.7	36.1	$0.036^{16°}$	∞	∞
5084	col. lq.	$0.621^{19°}$	-159.9	27.9	i.	∞	∞
5085	lq.	$0.613^{20°}_{4}$	-16.6	9.5	i.	s.	s.
5086	col. lq.	$0.691^{20°}$	-106	40.2	i.	....	s.
5087	lq.	$0.711^{20°}$	-109.3	56.1	i.	....	....
5088	tet.	$1.900^{14.5°}$	69	d.	....	....	....
5089	yel. lq.	$1.695^{17.5°}$	....	149 sl. d.	....	....	....
5090	nd.	1.485	188	....	$6.9^{18°}$	s. h.	$44^{74°}$ aq.
5091	wh. cr. pd.	....	173±	....	sl. s.	22	6
5092	lq.	$0.845^{20°}$	....	175	....	i.	s.
5093	lq.	$0.852^{20°}_{4}$	....	171-2	i.	i.	s.
5094	rhb. pl./et. or lg.	....	48-9	270	i.; s. chl.	s.; sl. s. bz.	s.; sl. s. lg.
5095	pl./al.	$1.179^{25°}$	99-100	340	i.; s. CS_2	$2^{14°}$; 10 h.	v. s.; s. bz.
5096	col. nd.	....	147-8	....	s. h.	v. s.	v. s.; v.s.bz.
5097	or. nd.	$1.405^{4°}$	206.5-7.5	>300; subl.	v. sl. s.	s. h.; s. bz.	sl. s.
5098	lf./aq. al.	....	168-9	....	....	v. s.	v. s.
5099	nd./aq. al.	....	119-22	....	sl. s. h.	v. s.	v. s.

Pentazane 5523
Pentendioic acid 3370
Pentene, cf. amylene.
Pentene 498, 501
Pentenoic acid 190
Pentenol 3189
Pentobarbital 4583
Pentolite 2895
Pentylene, cf. amylene.
Pentylene glycol 503
Perbromo-benzene 3561
Perbromo-ethane 3562
Perbromo-ethylene 5721
Percaine 1025
Perchloro-benzene 3563
Perchloro-ethane 3564
Perchloro-ethylene 5741
Perchloro-propane 4936
Peri acid 4543
Periodo-benzene 3589
Periodo-ethylene 5812
Periplocin, cf. glcde.
Pernoston 1061
Phaseolunatin, cf. glcde.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5100	**Phenanthrol** (9)	phenanthrone	$C_{14}H_9OH$	VI-706	194.22
5101	**Phenanthroline** (*o*)	(1,10)	$C_{12}H_8N_2$	XXIII-227	180.20
5102	**Phenanthroline** (*m*)	(1,5)	$C_{12}H_8N_2 \cdot 2H_2O$	XXIII-227	216.23
5103	**Phenanthroline** (*p*)	(1,8)	$C_{12}H_8N_2 \cdot 4H_2O$	XXIII-228	252.26
5104	**Phenazine**	azophenylene	$C_6H_4:N_2:C_6H_4$	XXIII-223	180.20
5105	**Phenetidine** (*o*)	*o*-aminophenetole	$C_2H_5O \cdot C_6H_4 \cdot NH_2$	XIII-359	137.18
5106	**Phenetidine** (*m*)	....	$C_2H_5O \cdot C_6H_4 \cdot NH_2$	XIII-404	137.18
5107	**Phenetidine** (*p*)	....	$C_2H_5O \cdot C_6H_4 \cdot NH_2$	XIII-436	137.18
5108	citrate	citrophen	$C_8H_{11}ON \cdot C_6H_8O_7$	XIII-437	329.30
5109	hydrochloride	....	$C_8H_{11}ON \cdot HCl$	XIII-437	173.64
5110	tartrate	vinopyrin	$C_8H_{11}ON \cdot C_4H_6O_6$	XIII-437	287.26
5111	**Phenetole**	ethyl-phenyl ether	$C_2H_5 \cdot O \cdot C_6H_5$	VI-140	122.16
5112	**Phenetyl urea** (*p*)	dulcin; sucrol; valzin	$C_2H_5O \cdot C_6H_4 \cdot NH \cdot CO \cdot NH_2$	XIII-480	180.20
5113	**Phenobarbital**	Et-Ph-barbituric acid; luminal; gardenal	$(C_2H_5)(C_6H_5):C_4H_2O_3N_2$	*XXIV-423	232.23
5114	Na salt	"soluble"	$C_{12}H_{11}O_3N_2Na$	....	254.22
5115	**Phenocoll**	glycine-*p*-phenetidide	$C_2H_5O \cdot C_6H_4 \cdot NH \cdot CO \cdot CH_2 \cdot NH_2 \cdot H_2O$	XIII-506	212.24
5116	hydrochloride	phenamine-HCl	$C_{10}H_{14}O_2N_2 \cdot HCl$	XIII-506	230.69
5117	salicylate	salocoll	$C_{10}H_{14}O_2N_2 \cdot C_7H_6O_3$	....	332.35
5118	**Phenol**	carbolic acid	$C_6H_5 \cdot OH$	VI-113	94.11
5119	Na salt	sodium phenoxide	$C_6H_5ONa \cdot 3H_2O$	VI-136	170.15
5120	Na salt	....	$C_6H_5ONa \cdot 2C_6H_5OH$	*VI-78	304.31
5121	phthalein	....	$C_{20}H_{14}O_4$	XVIII-143	318.31
5122	phthalin	phthalin	$C_{20}H_{16}O_4$	X-455	320.33
5123	sulfonic acid (*o*)	....	$HO \cdot C_6H_4 \cdot SO_3H \cdot \frac{3}{4}H_2O$	XI-234	187.68
5124	sulfonic acid (*m*)	....	$HO \cdot C_6H_4 \cdot SO_3H \cdot 2H_2O$	XI-239	210.20
5125	sulfonic acid (*p*)	....	$HO \cdot C_6H_4 \cdot SO_3H$	XI-241	174.17
5126	sulfonic Na (*p*)	Na sulfocarbolate	$C_6H_5O_4SNa \cdot 2H_2O$	XI-241	232.19
5127	sulfonphthalein	phenol red	$C_{19}H_{14}O_5S$	XIX-91	354.36
5128	tricarboxylic acid	(2;1,3,5)	$HOC_6H_2(CO_2H)_3 \cdot aq.$	X-580	226.14
5129	**Phenoxthine**	phenothioxine; dibenzothioxine (1,4)	$\underbrace{C_6H_4 \cdot O \cdot C_6H_4 \cdot S \cdot}$	XIX-45	200.24
5130	**Phenoxy**-acetic acid	....	$C_6H_5O \cdot CH_2 \cdot CO_2H$	VI-161	152.14
5131	acetic amide	phenoxyacetamide	$C_6H_5O \cdot CH_2 \cdot CONH_2$	VI-162	151.16
5132	acetone	ω-acetoanisole	$C_6H_5O \cdot CH_2 \cdot COCH_3$	VI-151	150.17
5133	benzoic acid (*o*)	salicylic phenyl ether	$C_6H_5O \cdot C_6H_4 \cdot CO_2H$	X-65	214.21
5134	butyronitrile (γ)	....	$C_6H_5O \cdot (CH_2)_3 \cdot CN$	VI-164	161.20
5135	β′-chloroethyl ether	(β)	$C_6H_5O \cdot (CH_2)_2 \cdot O \cdot CH_2 \cdot CH_2Cl$	....	200.66
5136	ethyl alcohol	phenyl cellosolve	$C_6H_5O \cdot (CH_2)_2 \cdot OH$	VI-146	138.16
5137	ethyl aniline	(***N***)(β)	$C_6H_5O \cdot (CH_2)_2 \cdot NH \cdot C_6H_5$	....	213.27
5138	**Phenthiazine**	thiodiphenylamine	$\underbrace{C_6H_4 \cdot NH \cdot C_6H_4 \cdot S \cdot}$	XXVII-63	199.26
5139	**Phenyl** acetaldehyde	α-toluylaldehyde	$C_6H_5 \cdot CH_2 \cdot CHO$	VII-292	120.14
5140	acetamide	....	$C_6H_5 \cdot CH_2 \cdot CO \cdot NH_2$	IX-437	135.16

Phenacaine HCl 2910
Phenacetin 25
Phenacyl acetone 52
Phenacyl alcohol 754
Phenacyl amine 239
Phenacyl bromide 887
Phenacyl chloride 1303

Phenanthrene-quinone 5097
Phenanthrone 5100
Phenazone 565
Phenic acid 5118
Phenodin 3499
Phenol propionic acid 3711-3

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5100	col. nd.	....	152-3	....	v. sl. s.	v. s.	v. s.
5101	cr./bz.	....	98-100*	>300	0.3	s.	s.
5102	pl./aq.	....	66; anh. 78	>360	s. h.; i. bz.	v. s.	v. sl. s.
5103	nd./aq.	....	173(anh.)	subl. > 100	s. h.	s.	sl. s.
5104	yel. nd.	....	170-1	>360	v. sl. s.	2 c.; s. h.	s.
5105	oil	....	<-21	228-9	i.	s.	s.
5106	lq.	....	....	$180\text{-}205^{100mm}$	i.	s.	s.
5107	lq.	$1.061^{15°}$	3-4	254-5	i.	s.	s.
5108	wh. cr. pd.	....	186-8	....	2.5	sl. s.	....
5109	col. pl.	....	233-4	subl.	v. s.	....	....
5110	col. lf.	....	168 ±	d. 150-5	v. s.	sl. s.	i.
5111	col. lq.	$0.967^{20°}_{4}$	-30.2	172	i.	∞	∞
5112	lf./aq. al.	....	173-4	....	$0.12^{15°}$; $0.5^{100°}$	4	s.
5113	lf./aq.	....	174 (156; 166)	....	0.1 c.; s. h.	14; s. alk.	10
5114	wh. cr. pd.	....	....	....	100	11	i.; i. chl.
5115	nd.	....	95 ±; 100.5 (anh.)	....	sl. s.	s.	....
5116	wh. cr. pd.	....	....	....	5	s.	sl. s.
5117	wh. nd.	....	....	....	0.5 c.	5 h. aq.	....
5118	col. nd.	$1.071^{25°}_{4}$	42-3	181.4	$8.2^{15°}$; $\infty^{65.3°}$	∞	∞
5119	col. cr.	....	....	d. by CO_2	23.8 c.	$7.4^{100°}$	$0.5^{25°}$
5120	cr.	....	....	....	$80^{25°}$ ±	....	....
5121	col. rhb.	$1.299^{25°}_{4}$	261-2	....	$0.2^{20°}$; s. h.	$10^{25°}$; s. alk.	5.9 c.; v. sl. s. chl.
5122	nd./aq. al.	....	235-7	....	$0.02^{20°}$	....	....
5123	cr.	....	50 d.	....	v. s.	v. s.	....
5124	nd.	....	$-1.5H_2O$, 100	$-2H_2O$, 140	....	....	....
5125	delq. nd.	....	....	....	s.	s.	....
5126	col. mn.	....	....	....	24 c.; 125 h.	0.8 c.; 8 h.	....
5127	red nd./ac.	....	....	....	0.03 h.	0.3	i.; s. alk.
5128	cr./aq.	....	$-H_2O$, 120	d. 180	$0.5^{10°}$	s. h.	sl. s.; i. chl
5129	nd./al.	$1.226^{60°}_{25}$	56-7	$185\text{-}7^{23mm}$	i.; $165^{25°}$ bz.	$7^{25°}$ Me al. $200^{25°}$ act.	$165^{25°}$
5130	nd./aq.	....	98-9	285 sl. d.	$1.2^{10°}$; v. s. h.	s.; s. ac.	$29^{25°}$; $3^{25°}$ bz.
5131	nd./aq.	....	101-2	....	v. sl. s. h.	s. h.	....
5132	col. oil	....	....	229-30	....	....	....
5133	lf./aq. al.	....	113-14.5	355 sl. d.	sl. s. h.	v. s.	v. s.
5134	nd.	....	45-6	$287\text{-}9^{765mm}$	....	....	....
5135	pa. yel. lq.	....	....	$138\text{-}43^{8mm}$	i.	s.	s.
5136	oil	$1.109^{20°}_{20}$	12.5	244.7	$2^{25°}$	∞; s. KOH	∞; ∞ bz.
5137	cr.	$1.070^{60°}_{25}$	44-9	202^{10mm}	i.; v. s. bz.	v. s.; v. s. act.	v. s.; v. s. CCl_4
5138	yel. lf./al.	....	184-5	subl. 371	i.; $3^{25°}$ bz.	$2^{25°}$; $27^{25°}$ act.	$7^{25°}$
5139	lq.	$1.025^{20°}$	....	193-4	v. sl. s.	[illegible]	∞
5140	lf.	....	156-7	d. 280-90	v. sl. s. c.	s.	v. sl. s.

* Crysts. + $1H_2O$/aq., m. p. 92-3°; anh., m. p. 117°.

Phenol red 5127
Phenol-tetrachlorophthalein 5744
Phenoquin 5234
Phenothiazine 5138
Phenothioxine 5129
Phenoval 1008
Phenoxy-acetamide 5131
Phenoxy-ethyl bromide 969
Phenoxy-phenol 3770
Phenyl-, cf. also diphenyl-.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5141	**Phenyl** acetate	acetyl phenol	$C_6H_5\cdot O\cdot CO\cdot CH_3$	VI-152	136.14
5142	acetic acid	*α*-toluic acid	$C_6H_5\cdot CH_2\cdot CO_2H$	IX-431	136.14
5143	acetanilide	phenacetyl-anilide	$C_6H_5CH_2CO\cdot NHC_6H_5$	XII-275	211.25
5144	acetophenone (***p***)	Me-diphenylyl ketone	$C_{12}H_9\cdot CO\cdot CH_3$	VII-443	196.24
5145	acetyl chloride	....	$C_6H_5\cdot CH_2\cdot CO\cdot Cl$	IX-436	154.59
5146	acetylene	....	$C_6H_5\cdot C\vdots CH$	V-511	102.13
5147	acridine (9)	....	$C_6H_5\cdot C_{13}H_8N$	XX-514	255.30
5148	alanine (***dl***)	*α*-amino-*β*-phenyl-propionic acid	$C_6H_5CH_2\cdot CH(NH_2)\cdot CO_2H$	XIV-498	165.19
5149	alanine (***β***)(***l***)	*α*-amino-hydrocinnamic acid	$C_6H_5CH_2\cdot CH(NH_2)\cdot CO_2H$	XIV-495	165.19
5150	alanine (***β,β***)	*β*-amino-hydrocinnamic acid	$C_6H_5\cdot CH(NH_2)\cdot CH_2\cdot CO_2H$	XIV-493	165.19
5151	angelic acid	*α*-ethyl-cinnamic acid	$C_6H_5\cdot CH{:}C(C_2H_5)\cdot CO_2H$	IX-623	176.21
5152	angelic acid (***stereo isomer***)	....	$C_6H_5\cdot CH{:}C(C_2H_5)\cdot CO_2H$	IX-623	176.21
5153	aniline (***o***)	2-amino-diphenyl	$C_6H_5\cdot C_6H_4\cdot NH_2$	XII-1317	169.22
5154	aniline (***m***)	3-amino-diphenyl	$C_6H_5\cdot C_6H_4\cdot NH_2$	XII-1318	169.22
5155	aniline (***p***)	4-amino-diphenyl	$C_6H_5\cdot C_6H_4\cdot NH_2$	XII-1318	169.22
5156	anthracene (9)	....	$C_6H_5\cdot C_{14}H_9$	V-725	254.31
5157	anthranilic acid (***N***)(***o***)	***o***-anilino-benzoic acid	$C_6H_5NH\cdot C_6H_4\cdot CO_2H$	XIV-327	213.23
5158	arsonic acid	Ph-arsinic acid	$C_6H_5\cdot AsO(OH)_2$	XVI-868	202.03
5159	benzoate	....	$C_6H_5\cdot CO_2\cdot C_6H_5$	IX-116	198.21
5160	benzoic acid (***o***)	diPh-carboxylic acid	$C_6H_5\cdot C_6H_4\cdot CO_2H$	IX-669	198.21
5161	benzoic acid (***m***)	....	$C_6H_5\cdot C_6H_4\cdot CO_2H$	IX-671	198.21
5162	benzoic acid (***p***)	....	$C_6H_5\cdot C_6H_4\cdot CO_2H$	IX-671	198.21
5163	benzoylene urea (3)	....	$C_6H_4\cdot NH\cdot CO\cdot N\cdot$ $(C_6H_5)\cdot CO$	XXIV-376	238.24
5164	benzylcarbinol	....	$C_6H_5\cdot CHOH\cdot CH_2\cdot C_6H_5$	VI-683	198.25
5165	benzylurethane	ethyl ***N***-Ph-***N***-benzyl-carbamate	$C_6H_5CH_2(C_6H_5)N\cdot CO_2C_2H_5$	....	255.30
5166	bromoacetate	....	$Br\cdot CH_2\cdot CO_2C_6H_5$	VI-154	215.05
5167	carbamate	"phenyl urethane"	$NH_2\cdot CO_2\cdot C_6H_5$	VI-159	137.13
5168	carbylamine chloride	*iso*-cyanophenyl chloride	$C_6H_5\cdot N{:}CCl_2$	XII-447	174.03
5169	chloroacetate	....	$Cl\cdot CH_2\cdot CO_2C_6H_5$	VI-153	170.59
5170	4-chlorobenzene-sulfonate	....	$Cl\cdot C_6H_4\cdot SO_3\cdot C_6H_5$	....	268.71
5171	cinchonoyl-urethane	fantan	$C_6H_5\cdot C_9H_5N\cdot NH\cdot CO_2C_2H_5$	....	292.32
5172	cinnamic acid (*α*)(***trans***)	....	$C_6H_5\cdot CH{:}C(C_6H_5)\cdot CO_2H$	IX-691	224.25
5173	cinnamic acid (*α*)(***cis***)	....	$C_6H_5\cdot CH{:}C(C_6H_5)\cdot CO_2H$	IX-693	224.25
5174	cinnamic acid (***β***)	....	$(C_6H_5)_2C{:}CH\cdot CO_2H$	IX-699	224.25
5175	crotonic acid (*γ*)(3)	....	$C_{10}H_{10}O_2$	IX-614	162.18

Phenyl-acetanilide 5143
Phenyl-acetone 4146
Phenyl-acetonitrile 800
Phenyl-aceturic acid 110
Phenyl acetylsalicylate 120
Phenyl acid 5208
Phenyl-acrolein 1501
Phenyl-acrylic acid 591, 1497-8, 1500
Phenyl-amine 513
Phenyl-aminophenol 3767-9
Phenyl-azide 6079
Phenyl-benzamide 715
Phenyl-benzene 2695
Phenyl-benzimidazole 690
Phenyl-benzochromone 4479
Phenyl-benzopyrone 3243
Phenyl-benzothiazole 687
Phenyl-benzylamine 786
Phenyl-benzyl ketone 1660
Phenyl bromide 902
Phenyl-butane 1049-52
Phenyl-butyl ketone 1117-8
Phenyl-butyne 3120
Phenyl-carbamide 5253

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5141	col. lq.	$1.073^{25°}_{25}$	....	195.8^{756mm}	v. sl. s.	∞; ∞ chl.	∞
5142	lf.	$1.081^{80°}_{4}$	76-7	265.5	s. h.	v. s.	v. s.
5143	pr./al.	....	117-8	....	i. aq. KOH	s.; i. H_2SO_4	s.
5144	pr./act.	....	121	325-7	....	s.	s. act.
5145	col. lq.	$1.168^{30°}_{4}$	....	170^{250mm}	d.	d.	....
5146	col. lq.	$0.930^{20°}_{4}$	−43	142-3	i.	∞	∞
5147	yel. pr.	....	181	403-4	i.; s. bz.	s. h.	s.
5148	lf./al.	....	271-3 d.	....	sl. s. c.	v. sl. s. h.	i.
5149	cr./aq.	....	d. 275-83	....	$3.1^{25°}$	v. sl. s.	v. sl. s.
5150	cr./aq.	....	231 d.	....	s. h.; s. alk.	s. h.; s. aq. a.	sl. s.
5151	nd./aq.	....	104-5	....	$0.01^{25°}$; s. h.	v. s.	sl. s. pet.
5152	nd./aq.	....	82	....	sl. s. h.	s.	s.; s. bz.
5153	cr./aq. al.	....	45-6	299^{760mm}	sl. s.	s.	....
5154	nd.	....	30	254^{135mm}	sl. s.	s.	s.
5155	lf./aq. al.	....	50-2	302	s. h.	s.	s.
5156	lf./al.	....	152-3	417	s. h. bz.	s. h.	s. h.
5157	nd./al.	....	183-4	d. > 184	v. sl. s. h.	s. h.	v. sl. s.
5158	cr./aq.	1.760	157-8	$-H_2O > 158$	$3.3^{28°}$	$15.5^{26°}$	i. chl.
5159	mn.	$1.235^{31°}$	70-1	314	i.	v. s. h.	v. s. h.
5160	cr./aq. al.	....	113-4	343-4	i. c.	s.	s. bz.
5161	lf./al.	....	160-1	....	sl. s.	s.	s.
5162	nd./al.	....	219-20	subl.	sl. s. h.	s.	s.
5163	nd.	....	282	....	i.	sl. s.	s. NaOH
5164	nd./aq. al.	....	67-8	$167\text{-}70^{10mm}$	0.06 h.	$420^{7°}$	v. s.
5165	col. lq.	....	....	$180\text{-}2^{12mm}$	....	....	....
5166	lf./al.	....	32	140^{20mm}	....	....	....
5167	nd./aq.	$1.078^{63.8°}$	141-3	....	sl. s.	s.	....
5168	lq.	....	....	209-10	sl. d. h.	d.	....
5169	nd./al.	....	44-5	230-5	i.	s.	s.
5170	col. cr.	....	90-1	....	i.	s. h.	s.
5171	yel. wh. cr.	....	173-4	....	i.; s. chl.	sl. s.; sl. s. bz.	sl. s.
5172	wh. nd./aq. al.	....	172	subl.	s. h.	s.	s.
5173	nd.	....	137-8	....	s. h.	....	....
5174	lf./al.	....	162	....	sl. s. h.	s.	s.
5175	pl./bz.	....	65	....	s. bz.	s.; s. CS_2	s.

Phenyl carbinol 782
Phenyl carbonate 2711
Phenyl-carbonimide 5177
Phenyl-carbylamine 5178
Phenyl-catechol 2339
Phenyl cellosolve 5136
Phenyl chloride 1324
Phenyl-chloroform 735
Phenyl-cinchonic acid 5234
Phenyl-cyanamide 1578
Phenyl-*iso*-cyandichloride 5168
Phenyl cyanide 716
Phenyl-diacetamide 1670
Phenyl-dibromopropionic acid 1830
Phenyl-dichlorophosphine 5270
Phenyl-dimethylpyrazolone 565
Phenyl disulfide 2715
Phenyl-ethane 2973
Phenyl-ethanolamine 2930
Phenyl ether 2719
Phenyl-ethylacetic acid 3119
Phenyl-ethyl bromide 937-8
Phenyl-ethyl carbinol 3123
Phenyl-ethyl ether 5111

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5176	**Phenyl** crotonic acid (*iso*)	....	$C_6H_5\cdot CH:CH\cdot CH_2\cdot CO_2H$	IX-612	162.18
5177	*iso*-cyanate	phenyl carbonimide	$C_6H_5\cdot N:CO$	XII-437	119.12
5178	*iso*-cyanide	phenyl carbylamine	$C_6H_5\cdot N:C$	XII-191	103.12
5179	cyclohexane	cyclohexylbenzene	$C_6H_5\cdot CH(CH_2)_4\cdot CH_2\cdot$	V-503	160.25
5180	3,4-dichlorobenzene sulfonate	....	$Cl_2C_6H_3\cdot SO_3\cdot C_6H_5$	....	303.16
5181	diethanolamine	....	$(HO\cdot CH_2\cdot CH_2)_2N\cdot C_6H_5$	XII-183	181.23
5182	dihydroquinazoline	orexin	$C_6H_4\cdot CH_2\cdot N(C_6H_5)\cdot CH:N$	XXIII-137	208.25
5183	ditolylmethane (4,4′)	....	$C_6H_5\cdot CH(C_6H_4\cdot CH_3)_2$	V-712	272.37
5184	di-*o*-xenyl phosphate	phosphen 6	$(C_{12}H_9O)_2:PO\cdot OC_6H_5$	....	478.46
5185	ethyl acetate (*β*)	....	$C_6H_5\cdot C_2H_4\cdot O_2CCH_3$	VI-479	164.20
5186	ethyl alcohol (*α*)	Me-Ph-carbinol	$C_6H_5\cdot CHOH\cdot CH_3$	VI-475	122.16
5187	ethyl alcohol (*β*)	benzyl carbinol	$C_6H_5\cdot CH_2\cdot CH_2OH$	VI-478	122.16
5188	ethylamine (*α*)(*dl*)	....	$C_6H_5\cdot CH(NH_2)\cdot CH_3$	XII-1094	121.18
5189	ethylamine (*β*)	ω-phenyl-ethylamine	$C_6H_5\cdot CH_2\cdot CH_2\cdot NH_2$	XII-1096	121.18
5190	ethyl benzoate (*β*)	....	$C_6H_5CO_2\cdot C_2H_4\cdot C_6H_5$	....	226.26
5191	ethyl chloride (*β*)	β-Cl-ethyl benzene	$C_6H_5\cdot CH_2CH_2Cl$	V-354	140.61
5192	ethyl cinnamate (*β*)	....	$C_6H_5\cdot CH:CH\cdot CO_2\cdot CH_2\cdot CH_2\cdot C_6H_5$	....	252.30
5193	*d*-glucosazone	Ph-*d*-fructosazone	$(C_6H_5NHN)_2C_6H_{10}O_4$	XV-225	358.39
5194	glycine (*N*)	anilino-acetic acid	$C_6H_5\cdot NH\cdot CH_2\cdot CO_2H$	XII-468	151.16
5195	glycine *o*-carboxylic acid	....	$HO_2C\cdot C_6H_4\cdot NHCH_2\cdot CO_2H$	XIV-348	195.17
5196	hydrazine	....	$C_6H_5\cdot NH\cdot NH_2$	XV-67	108.14
5197	hydrazine HCl	....	$C_6H_5N_2H_3\cdot HCl$	XV-108	144.61
5198	hydrazine-*p*-sulfonic acid	....	$H_2N\cdot NH\cdot C_6H_4\cdot SO_3H$	XV-639	188.20
5199	hydrazoquinoline	(*α*)	$C_6H_5(NH)_2C_9H_6N$	XXII-564	235.28
5200	hydroxylamine (*β*)	....	$C_6H_5\cdot NH\cdot OH$	XV-2	109.12
5201	hydroxylamine (*β*)	(oxalate salt)	$2C_6H_5NHOH\cdot H_2C_2O_4$	....	308.28
5202	3-methylpyrazolone	(*N*)	$C_4H_5ON_2\cdot C_6H_5$	XXIV-20	174.20
5203	morpholine (4)	....	$(CH_2)_2\cdot O\cdot (CH_2)_2\cdot N\cdot C_6H_5$	XXVII-6	163.21
5204	naphthalene (*α*)	....	$C_6H_5\cdot C_{10}H_7$	V-687	204.26
5205	naphthalene (*β*)	....	$C_6H_5\cdot C_{10}H_7$	V-687	204.26
5206	*α*-naphthylamine	(*N*)	$C_6H_5\cdot NH\cdot C_{10}H_7$	XII-1224	219.27
5207	*β*-naphthylamine	(*N*)	$C_6H_5\cdot NH\cdot C_{10}H_7$	XII-1275	219.27
5208	1-naphthylamine-8-sulfonic acid	(*N*); phenyl (peri) acid	$C_6H_5\cdot NH\cdot C_{10}H_6\cdot SO_3H$	XIV-753	299.33
5209	*α*-naphthyl carbinol	....	$C_6H_5\cdot CHOH\cdot C_{10}H_7$	VI-710	234.28
5210	*α*-naphthyl ketone	benzoyl-naphthalene	$C_6H_5\cdot CO\cdot C_{10}H_7$	VII-510	232.27
5211	*β*-naphthyl ketone	....	$C_6H_5\cdot CO\cdot C_{10}H_7$	VII-511	232.27
5212	nitroamine	....	$C_6H_5\cdot NH\cdot NO_2$	....	138.12
5213	nitromethane	ω-nitrotoluene	$C_6H_5\cdot CH_2\cdot NO_2$	V-325	137.13

Phenyl-ethyl-hydantoin 3126
Phenyl-ethyl ketone 3129
Phenyl-ethyl sulfide 3132
Phenyl-ethylene 5646
Phenyl-ethylene oxide 5648
Phenyl fluoride 3258
Phenyl-formanilide 3306
Phenyl-fructosazone 5193
Phenyl-glycine ethyl ester 3125
Phenyl-glyoxaloxime 4874
Phenyl-glyoxylic acid 758
Phenyl-hydrocinnamic acid 2739
Phenyl-hydroquinone 2338
Phenyl-hydroxycrotonic acid 637
Phenyl iodide 3879

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5176	nd./aq.	....	88	302 sl. d.	sl. s. h.	v. s.	v. s.
5177	lq.	$1.096^{20^\circ}_{4}$	....	166^{769mm}	d.	d.	v. s.
5178	col. lq.	0.978^{15°	....	78^{40mm}	d.	d.	s.
5179	oil	$0.944^{20^\circ}_{0}$	7-8	239^{745mm}	....	....	....
5180	col. nd.	....	82-5	....	i.	s. h.	v. s.
5181	cr.	....	58-9	>350 sl. d.	5^{25°;23^{25° bz.	v. s.; v. s. act.	29^{25°
5182	pl./et. lg.	1.290^{4°	95	d.	i.	s.	s.
5183	nd./Me al.	....	55-6	....	v. s. bz.	sl. s. c.	v. s.
5184	col. lq.	$1.20^{60^\circ}_{4}$	....	$285\text{-}330^{5mm}$	i.	v. s.	∞ bz.; ∞ CCl_4
5185	lq.	$1.051^{22.5^\circ}$	....	232	....	....	....
5186	lq.	$1.019^{13^\circ}_{4}$	....	203.6^{745mm}	i.	∞	∞
5187	col. oil	$1.023^{13^\circ}_{4}$	....	$219\text{-}21^{750mm}$	1.6^{20°	s. aq. al.	∞
5188	oil	0.940^{15°	....	187.5^{741mm}	4.2^{20°	∞	∞
5189	lq.	$0.958^{24^\circ}_{4}$	....	198	s.	∞	∞
5190	yel. lq.	....	....	$204\text{-}6^{25mm}$	i.	s.	s.
5191	oil	$1.069^{25^\circ}_{4}$	....	190-200 sl. d.	....	....	....
5192	col. cr.	....	57-8	....	i.	sl. s.	v. s.
5193	yel. nd.	....	205 d.	....	i.	0.66 abs.	25 c. pyr.
5194	cr.	....	127	....	s.	s.	sl. s.
5195	nd./Me al.	....	218-20	....	sl. s.	s.	s.; i. bz.
5196	lt. yel. oil	$1.097^{22.7^\circ}_{4}$	19.6*	243.5	sl. s. h.	∞; ∞ chl.	∞; ∞ bz.
5197	lf./al.	....	240-3	....	v. s.	s.	i.
5198	cr./al.	....	286	....	0.6^{12°; 3 h.	sl. s.	....
5199	nd./al.	....	191	....	s. chl.	sl. s.	i.; s. ac.
5200	col. nd.	....	81-2	....	2 c.; 10 h.	v. s.	v. s.; v. sl. s. lg.
5201	col. nd.	....	120-2 d.	....	sl. s.	s.	i.
5202	pr./aq.	....	128	191^{17mm}	1^{20°	v. s. h.	v. sl. s.
5203	cr./al. et.	....	57	270 ±	1.0^{20°	s.	s.
5204	waxy	....	45 ±	336-7	v. s. bz.	v. s.	v. s.
5205	lf./al.	....	102.5	345-6	v. s. bz.	sl. s.	sl. s.
5206	pr./al.	....	62	335^{528mm}	s. bz.	s.; s. ac.	s.; s. chl.
5207	rhb./Me al.	....	107-8	395.5	i.; s. h. bz.	v. s. h.	v. s. h.
5208	lf.	....	....	....	v. sl. s.	....	....
5209	cr./al.	....	88	>360	i.	v. s.	v. s.
5210	rhb./al.	....	75.5	385	i.	2.4^{12° abs.	....
5211	rhb./al.	....	82	398^{754mm}	i.	2^{12° abs.	....
5212	lf./lg.	....	46	expl. 98	sl. s. c.	v. s.	sl. s. lg.
5213	yel. lq.	$1.160^{20^\circ}_{0}$	....	$141\text{-}2^{35}$ sl. d.	....	....	....

* Crysts. + $\frac{1}{2}H_2O$, m. 24° ±.

Phenyl mercaptan 5915
Phenyl-mercuric acetate 4036
Phenyl-mercuric chloride 4037
Phenyl-mercuric nitrate 4038
Phenyl-methyl-, cf. also methyl-phenyl-.
Phenyl-methylamino-propanol, cf. alkd.
Phenyl-methyl carbinol 5186
Phenyl-methyl-hydrazine 4338-40
Phenyl-methyl ketone 51
Phenyl mustard oil 5241
Phenyl-naphthyl-methane 817-8

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5214	**Phenyl** phenacyl bromide	ω-Br-*p*-phenyl-acetophenone	$C_6H_5\cdot C_6H_4\cdot CO\cdot CH_2\cdot Br$	....	275.14
5215	phenacyl chloride	ω-Cl-*p*-phenyl-acetophenone	$C_6H_5\cdot C_6H_4\cdot CO\cdot CH_2\cdot Cl$	VII-443	230.69
5216	phenol (*o*)	2-hydroxy-diphenyl	$C_6H_5\cdot C_6H_4\cdot OH$	VI-672	170.20
5217	phenol (*m*)	3-hydroxy-diphenyl	$C_6H_5\cdot C_6H_4\cdot OH$	VI-673	170.20
5218	phenol (*p*)	4-hydroxy-diphenyl	$C_6H_5\cdot C_6H_4\cdot OH$	VI-674	170.20
5219	phosphine	....	$C_6H_5\cdot PH_2$	XVI-757	110.10
5220	propiolic acid	....	$C_6H_5\cdot C\vdots C\cdot CO_2H$	IX-633	146.14
5221	propionate	....	$C_2H_5\cdot CO_2\cdot C_6H_5$	VI-154	150.17
5222	*n*-propyl bromide	(γ)	$C_6H_5\cdot (CH_2)_3\cdot Br$	V-391	199.09
5223	propylene (α,α)	*iso*-allylbenzene	$C_6H_5\cdot CH{:}CH\cdot CH_3$	V-481	118.17
5224	propylene (β)	α-methyl-styrene	$C_6H_5\cdot C(CH_3){:}CH_2$	V-484	118.17
5225	propylene (γ)	....	$C_6H_5\cdot CH_2\cdot CH{:}CH_2$	V-484	118.17
5226	pyridine (2)(α)	....	$C_6H_5\cdot C_5H_4N$	XX-424	155.19
5227	pyridine (3)(β)	....	$C_6H_5\cdot C_5H_4N$	XX-424	155.19
5228	pyridine (4)(γ)	....	$C_6H_5\cdot C_5H_4N$	XX-424	155.19
5229	pyrrole (*N*)	....	$C_4H_4N\cdot C_6H_5$	XX-164	143.18
5230	quinoline (2)(α)	....	$C_6H_5\cdot C_9H_6N$	XX-481	205.25
5231	quinoline (4)	....	$C_6H_5\cdot C_9H_6N$	XX-483	205.25
5232	quinoline (6)(*p*)	....	$C_6H_5\cdot C_9H_6N$	XX-483	205.25
5233	quinoline (8)(*o*)	....	$C_6H_5\cdot C_9H_6N$	XX-484	205.25
5234	quinoline-4-carboxylic acid (2)	2-Ph-cinchonic acid; atophan	$C_6H_5\cdot C_9H_5N\cdot CO_2H$	XXII-103	249.26
5235	salicylate	salol	$HO\cdot C_6H_4\cdot CO_2\cdot C_6H_5$	X-76	214.21
5236	semicarbazide (1)	....	$C_6H_5NH\cdot NH\cdot CO\cdot NH_2$	XV-287	151.17
5237	semicarbazide (4)	....	$C_6H_5\cdot NH\cdot CO\cdot N_2H_4$	XII-378	151.17
5238	stearate	....	$C_{17}H_{35}CO_2\cdot C_6H_5$	VI-155	360.56
5239	succinic acid (α)	(*dl*)	$C_6H_5\cdot C_2H_3(CO_2H)_2$	IX-865	194.18
5240	thioacetamide	thio-Ph-acetamide	$C_6H_5\cdot CH_2\cdot CS\cdot NH_2$	IX-460	151.22
5241	*iso*-thiocyanate	phenyl mustard oil	$C_6H_5\cdot N{:}C{:}S$	XII-453	135.18
5242	thiohydantoic acid	phenyl-pseudothiohydantoic acid	$C_6H_5N{:}C(NH_2)\cdot S\cdot CH_2\cdot CO_2H$	XII-411	210.25
5243	thiosemicarbazide	(1)	$C_6H_5NH\cdot NH\cdot CS\cdot NH_2$	XV-294	167.23
5244	thiourea	Ph thiocarbamide	$C_6H_5\cdot NH\cdot CS\cdot NH_2$	XII-388	152.21
5245	toluene (*o*)	....	$C_6H_5\cdot C_6H_4\cdot CH_3$	V-596	168.23
5246	toluene (*m*)	....	$C_6H_5\cdot C_6H_4\cdot CH_3$	V-596	168.23
5247	toluene (*p*)	....	$C_6H_5\cdot C_6H_4\cdot CH_3$	V-597	168.23
5248	*p*-toluene sulfonate	....	$CH_3\cdot C_6H_4\cdot SO_3\cdot C_6H_5$	XI-99	248.29
5249	*o*-tolyl ketone	Me benzophenone	$C_6H_5\cdot CO\cdot C_6H_4\cdot CH_3$	VII-439	196.24
5250	*m*-tolyl ketone	....	$C_6H_5\cdot CO\cdot C_6H_4\cdot CH_3$	VII-440	196.24
5251	*p*-tolyl ketone	....	$C_6H_5\cdot CO\cdot C_6H_4\cdot CH_3$	VII-440	196.24
5252	*p*-tolyl sulfone	Me diphenyl sulfone	$C_6H_5\cdot SO_2\cdot C_6H_4\cdot CH_3$	VI-418	232.29
5253	urea	phenyl carbamide	$C_6H_5\cdot NH\cdot CO\cdot NH_2$	XII-346	136.15
5254	urethane†(*N*)	Et-Ph-carbamate	$C_6H_5\cdot NH\cdot CO_2C_2H_5$	XII-320	165.19
5255	xanthydrol (9)	....	$C_6H_5\cdot C_{13}H_8O(OH)$	XVII-138	274.30
5256	**Phenylene** diamine	1,2-diaminobenzene	$NH_2\cdot C_6H_4\cdot NH_2$	XIII-6	108.14
5257	diamine HCl (*o*)	....	$C_6H_4(NH_2)_2\cdot 2HCl$	XIII-14	181.07
5258	diamine (*m*)	1,3-diaminobenzene	$NH_2\cdot C_6H_4\cdot NH_2$	XIII-33	108.14
5259	diamine HCl (*m*)	....	$C_6H_4(NH_2)_2\cdot 2HCl$	XIII-38	181.07
5260	diamine (*p*)	1,4-diaminobenzene	$NH_2\cdot C_6H_4\cdot NH_2$	XIII-61	108.14
5261	diamine HCl (*p*)	....	$C_6H_4(NH_2)_2\cdot 2HCl$	....	181.07
5262	diamine sulfonic acid (*p*)	2,5-diaminobenzene 1-sulfonic acid	$(NH_2)_2C_6H_3\cdot SO_3H\cdot 2H_2O$	XIV-712	224.23

† See also No. 5167.

Phenyl-nitrosohydroxylamine 1574
Phenyl-oxydisulfide 2716
Phenyl-pentane 421-4
Phenyl peri acid 5208
Phenyl-phenol methyl ether 4073-4
Phenyl-phenylenediamine 313-4
Phenyl phosphate 6341
Phenyl phosphite 6343
Phenyl phthalate 2737
Phenyl-phthalimide 5273
Phenyl-propionaldehyde 3706
Phenyl-propionamide 3707
Phenyl-propionic acid 3683, 3704
Phenyl-propionitrile 3709
Phenyl-propionyl chloride 3708
Phenyl-propyl alcohol 3122, 3705
Phenyl-propyl carbinol 5436-7
Phenyl-propyl ketone 5439-40
Phenyl-pyrocatechol 2339
Phenyl succinate 2748
Phenyl-sulfanilic acid 2701

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5214	col. nd.	....	124-5	....	....	$1.3^{25°}$	$6.7^{78°}$ al.
5215	yel. cr. pd.	....	126-7	....	....	v. s. h.	....
5216	nd./pet.	....	56-7	275	i.; s. lg.	s.; s. alk.	s.
5217	nd./aq.	....	75-8	>300	sl. s.	v. s.	s. KOH
5218	nd./aq. al.	....	164-5	305-8	i.; s. alk.	v. s.	v. s.
5219	lq.	$1.001^{15°}$	....	160-1	....	....	....
5220	nd./aq.	....	136-7	subl.	v. sl. s.	v. s.	v. s.
5221	pr.	$1.047_{25}^{25°}$	20	211^{760mm}	....	....	....
5222	col. lq.	....	....	$121\text{-}2^{20mm}$	....	....	s.
5223	col. lq.	$0.914_{4}^{20°}$	....	176-7	i.	s.	s.
5224	col. lq.	$0.911^{20°}$	-23.2	165.4	i.	∞	∞
5225	col. lq.	$0.893_{0}^{20°}$	....	156-7	i.	s.	s.
5226	lq.	>1	....	$269\text{-}70^{749mm}$	i.	s.	s.
5227	oil	>1	....	$269\text{-}70^{749mm}$	i.	s.	s.
5228	lf./aq.	....	77-8	274-5	s. h.	s.	s.
5229	pl.	....	62	234	i.; s. pet.	s.; s. chl.	s.; s. bz.
5230	nd./aq. al.	....	86	363	sl. s.	s. h.	s.
5231	nd./et.	....	61-2	....	i.	v. s.	v. s.
5232	cr./al.	$1.195^{20°}$	110-1	260^{77mm}	v. sl. s.	s.	s.
5233	lq.	....	....	283^{187mm}	s. bz.	s.	s.
5234	nd./Me al.	....	217-9	....	i.; s. alk.; 4 h. Me al.	5 h. abs.; 3 h. act.	s.; s. a.; 0.4 h. bz.
5235	rhb./al.	$1.250_{4}^{20°}$	42-3	$172\text{-}3^{12mm}$	0.015	v. s. h.	s.; 80 bz.
5236	lf./aq.	....	172	....	s. h.	s.; s. act.	sl. s.
5237	rhb./aq.	....	122	d. 140-70	sl. s. h.	s.	i.
5238	cr.	....	52	267^{15mm}	i.	....	....
5239	cr./aq.	....	168	$-H_2O > 168$	s. h.; s. ac.	s.; i. lg.	s.; i. bz.
5240	rhb./al.	....	97-8	d.	v. sl. s. h.	s.	s.
5241	col. lq.	$1.138_{15}^{15°}$	-21	219-20	i.	s.	s.
5242	col. nd.	....	157-8	....	v. sl. s.; s. a.; s. alk.	v. sl. s.; sl. s. CS_2	v. sl. s.; v. sl. s. bz.
5243	pr./al.	....	200-1 d.	....	sl. s.	s. h.	sl. s.
5244	nd./aq.	1.3	154	....	$0.26^{18°}$	s.	$5.9^{100°}$ aq.
5245	lq.	$1.010_{4}^{20°}$	....	261-4	i.	s. abs.	s.
5246	lq.	$1.031^{0°}$	....	272-7	i.	s. abs.	s.
5247	lf./lg.	$1.015^{27°}$	47-8	267	i.	s. abs.	s.
5248	rhb. nd./al.	....	94-5	....	i.; v. s. bz.	v. s.	v. s.
5249	col. lq.	....	< -18	$312\text{-}5^{735mm}$	i.	v. s. 80% al.	v. s.
5250	lq.	$1.088^{17.5°}$	....	321^{761mm}	∞ chl.	∞	∞
5251	mn.	....	59-60(55)	326.5	i.; s. bz.	s.	s.
5252	pl./al.	....	124.5	....	sl. s. ac.	$1.62^{20°}$	sl. s. bz.
5253	mn.	1.302	147	d. 160	s. h.	s.	sl. s.
5254	pl./al.	$1.106_{4}^{30°}$	52-3	237 sl. d.	i. c.	s.	s.
5255	pr./bz. lg.	....	159-60	subl.	sl. s. ac.	s. h.; s. bz.	s.; i. lg.
5256	lf./aq.	....	103-4	256-8	$4.2^{35°}$	v. s.	v. s.
5257	nd.	....	....	....	v. s.	....	....
5258	rhb.	$1.139_{15}^{15°}$	62.8	284-7	v. s.	v. s.	s.
5259	col. nd.	....	....	....	v. s.	s.	....
5260	mn.	....	140	267	$3.8^{24°}$	s.	s.; s. chl.
5261	col. tri.	....	....	....	v. s.	sl. s.	i. HCl
5262	pl./aq.	....	....	....	s.	i.	i.; i. bz.

Phenyl sulfide 2749
Phenyl sulfone 2750
Phenyl-thiocarbamide 5244
Phenyl-tolylamine 4220
Phenyl-tolyl-hydrazine 4271-3
Phenyl-tolyl-methane 842-3
Phenyl-trityl ketone 731
"Phenyl urethane" 5167
Phenylene-cyclotriazine 252
Phenylene-dimercaptan 2820-2822
Phenylene-diphenyl 2703-5
Phenylene-guanidine 263
Phenylene-urea 709
Phillyrin, cf. glcde.
Phillyroside, cf. glcde.
Phloretinic acid 3713
Phloridzin, cf. glcde.
Phlorizin, cf. glcde.
Phloroglucinol 6218-9
Phloroglucinol carboxylic acid 6222
Phlorol 3114
Phlorone 2550
Phlorrhizin, cf. glcde.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Phenylene				
5263	diamine sulfonic acid (*p*) HCl	....	$C_6H_8O_3N_2S\cdot 2HCl$	....	261.13
5264	**Phloretin**	dihydronaringenin	$C_{15}H_{14}O_5$	VIII-498	274.26
5265	**Phloroglucinol** triethyl ether	(1,3,5)	$C_6H_3(OC_2H_5)_3$	VI-1103	210.26
5266	trimethyl ether	(1,3,5)	$C_6H_3(OCH_3)_3$	VI-1101	168.19
5267	trioxime (1,3,5)	....	$C_6H_6(:NOH)_3$	XV-34	171.16
5268	**Phorone**	*sym*-diisopropylidene acetone	$[(CH_3)_2C:CH]_2CO$	I-751	138.20
5269	*iso*-**Phorone**	1,1,3-triMe-cyclohexene-3-one-5	$(CH_3)_3C_6H_5O$	VII-65	138.20
5270	**Phosphenyl chloride**	Ph-diCl-phosphine	$C_6H_5\cdot PCl_2$	XVI-763	178.99
5271	**Phosphobenzene**	....	$C_6H_5\cdot P:P\cdot C_6H_5$	XVI-824	216.16
5272	**Phthalamidic acid** (*o*)	*o*-phthalamic acid	$NH_2\cdot CO\cdot C_6H_4\cdot CO_2H$	IX-809	165.14
5273	**Phthalanil**	*N*-Ph-phthalimide	$C_6H_5\cdot N:C_8H_4O_2$	XXI-464	223.22
5274	**Phthalic** acid (*o*)	phthalic acid	$C_6H_4(CO_2H)_2$	IX-791	166.13
5275	acid Na	(mono Na salt)	$C_8H_5O_4Na\cdot 2H_2O$	IX-796	224.15
5276	acid (*m*)	isophthalic acid	$C_6H_4(CO_2H)_2$	IX-832	166.13
5277	acid (*p*)	terephthalic acid	$C_6H_4(CO_2H)_2$	IX-841	166.13
5278	aldehyde†(*o*)	....	$C_6H_4(CHO)_2$	VII-674	134.13
5279	aldehyde (*m*)	....	$C_6H_4(CHO)_2$	VII-675	134.13
5280	aldehyde (*p*)	....	$C_6H_4(CHO)_2$	VII-675	134.13
5281	amide (*o*)	phthaldiamide	$C_6H_4(CO\cdot NH_2)_2$	IX-814	164.16
5282	anhydride (*o*)	....	$C_6H_4(CO)_2O$	XVII-469	148.11
5283	dichloride (*o*) (*sym*)	phthalyl dichloride	$C_6H_4(COCl)_2$	IX-805	203.03
5284	dichloride (*o*)(*uns*)	phthalyl dichloride	$\underline{C_6H_4\cdot CO\cdot O\cdot C}:Cl_2$	IX-805	203.03
5285	dichloride (*m*)	isophthalyldichloride	$C_6H_4(COCl)_2$	IX-834	203.03
5286	dichloride (*p*)	terephthalyl diCl	$C_6H_4(COCl)_2$	IX-844	203.03
5287	imide (*o*)	*o*-phthalimide	$C_6H_4(CO)_2NH$	XXI-458	147.13
5288	nitrile (*m*)	isophthalic nitrile	$C_6H_4(CN)_2$	IX-836	128.13
5289	nitrile (*p*)	terephthalic nitrile	$C_6H_4(CN)_2$	IX-846	128.13
5290	**Phthalide**	....	$\underline{C_6H_4\cdot CH_2\cdot O\cdot CO}$	XVII-310	134.13
5291	**Phthalonic acid**	(1,2)	$C_6H_4(CO_2H)\cdot CO\cdot CO_2H$	X-857	194.14
5292	**Phthalophenone**	triPh-carbinol-*o*-carboxylic anhyd.	$(C_6H_5)_2\underline{C\cdot C_6H_4\cdot CO\cdot O}$	XVII-391	286.31
5293	**Phytadiene**	....	$C_{20}H_{38}$	I-263	278.50
5294	**Phytane**	....	$C_{20}H_{42}$	I-174	282.54
5295	**Phytanol**	dihydrophytol	$C_{20}H_{41}OH$	I-431	298.54
5296	sodium	....	$C_{20}H_{41}ONa$	....	320.53
5297	**Phytene**	....	$C_{20}H_{40}$	I-227	280.52
5298	**Phytol**	....	$C_{20}H_{39}OH$	I-453	296.52
5299	**Picene**	....	$C_{22}H_{14}$	V-735	278.33
5300	**Picoline** (α)	2-methyl-pyridine	$CH_3\cdot C_5H_4N$	XX-234	93.12
5301	**Picoline** (β)	3-methyl-pyridine	$CH_3\cdot C_5H_4N$	XX-239	93.12

† See also Nos. 162-4.

Phosgene 1247
Phosphen-1 2707
Phosphen-2 1907
Phosphen-3 2713
Phosphen-4 2046
Phosphen-5 2762
Phosphen-7 6120
Phosphen-8 6165
Phosphen-9 6360
Phosphen-11 1146
Photo-glycin 3800
Photol 4117
Phthal alcohol 6497-9
Phthalamic acid 5272

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5263	tan pd.	....	....	....	s.	sl. s.	i.
5264	lf.	....	253-5 d.	....	v. sl. s. h.	∞	0.35^{16° abs.
5265	cr.	....	43	175^{24mm}	i.	v. s.	v. s.
5266	pr./al.	....	52.5	255.5	i.	v. s.	v. s.
5267	pd.	....	expl. 155	....	v. sl. s.	v. sl. s.	sl. s. chl.
5268	yel. gn. pr.	$0.885_{4}^{20^\circ}$	28	197.2^{743mm}	0.1^{50°	s.	s.
5269	lq.	$0.923_{20}^{20^\circ}$	....	215-6	i.	....	....
5270	fum. lq.	1.319^{20°	....	224.6	d.	∞ bz.	∞ CS_2
5271	lt. yel. pd.	....	149-50	....	i. h.	i.	i.; s. h. bz.
5272	pr.	....	148-9	155 d.	s.	s.	sl. s.
5273	nd./al.	....	205	subl.	i.	s.	....
5274	mn./aq.	$1.593_{4}^{20^\circ}$	191* 231†	....	0.54^{14°; 18^{99°	11.7^{18° abs.	0.68^{15°
5275	pr./aq.	....	$-H_2O$, 100	....	10^{25°	....	....
5276	nd./h. aq.	....	347-8	subl.	0.01^{25°; 0.2 h.	s.; s. ac.	i. bz.; i. pet.
5277	cr. or amor.	....	425 *	subl. >300	0.001 c.	sl. s. h.	i.; s. alk.
5278	lt. yel. nd.	....	56	....	1.4 h.	v. s.	v. s.
5279	nd.	....	89-90	....	sl. s.	v. s.	i. pet.
5280	nd./aq.	....	115-6	$245\text{-}8^{771mm}$	1.7 h.	v. s.	s.
5281	cr.	....	219-20 d.	....	v. sl. s. c.	v. sl. s.	i.
5282	rhb.	1.527^{4°	130.8	284.5	v. sl. s.	s.	sl. s.
5283	col. lq.	$1.414_{25}^{25^\circ}$	16	281.1	d.	d.	s.
5284	cr.	....	88-9	275.2^{720mm}	....	....	....
5285	cr.	....	41	276	d.	d.	....
5286	nd.	....	78-9	259	....	....	....
5287	cr./et.	....	238	subl.	0.04^{25°	5; s. alk.	s. h.; i. bz.
5288	nd.	....	161.5	subl.	s. h.; i. lg.	v. s. h.	v. s. h.
5289	nd./bz.	....	222	....	i.; s. h. ac.	sl. s. h.	v. sl. s. h.
5290	nd./aq.	$1.164_{4}^{20^\circ}$	73(65)	290	v. sl. s.	s.	....
5291	pr./bz. al.	....	144.5	....	115^{15°	s.	s.; sl. s. chl.
5292	lf./al.	....	115	419-28 sl. d.	d. h.	s.; s. H_2SO_4	i. c. alk.
5293	lq.	$0.826_{4}^{0^\circ}$	....	$185\text{-}8^{22mm}$	∞ pet.	∞ Me al.	∞ ac.
5294	lq.	$0.803_{4}^{0^\circ}$	....	$169.5^{9.5mm}$	v. sl. s. ac.	v. sl. s.	....
5295	oil	$0.840_{4}^{20^\circ}$	....	202^{10mm}	i.	s.	s.
5296	oil	....	....	....	....	s. pet.	s.
5297	col. oil	$0.817_{4}^{0^\circ}$	....	$177\text{-}8^{10.5mm}$	v. s. pet.	sl. s. h.	sl. s.
5298	col. oil	$0.852_{4}^{20^\circ}$	....	204^{10mm}	i.	∞ Me al.	∞
5299	col. lf.	....	364	518-20	i.	v. sl. s.	v. sl. s.
5300	col. lq.	$0.950_{4}^{15^\circ}$	−70	128.8	v. s.	∞	∞
5301	col. lq.	$0.961_{4}^{15^\circ}$	....	143.5	∞	∞	∞

* Sealed tube.

† Heated rapidly.

Phthaldiamide 5281
Phthalimide 5287
Phthalimino-ethyl bromide 940
Phthalin 5122
Phthalyl dichloride 5283-4
Phthiocol 4275
Phthiocol acetate 4276-7
Phthiocol oxime 4278
Phyllyrin, cf. glcde.
Physostigmine, cf. alkd.
Picein, cf. glcde.
Piceoside, cf. glcde.
Picoline dicarboxylic acid 6398

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5302	**Picoline** (γ)	4-methyl-pyridine	$CH_3 \cdot C_5H_4N$	XX-240	93.12
5303	**Picramic** acid	4,6-diNO_2-2-NH_2-phenol	$HO \cdot C_6H_2(NH_2)\colon(NO_2)_2$	XIII-394	199.12
5304	sodium salt	sodium picramate	$C_6H_4O_5N_3Na \cdot H_2O$	XIII-395	239.13
5305	**Picrolonic acid**	4-NO_2-3-Me-1-*p*-NO_2-phenylpyrazolone-5	$C_{10}H_8O_5N_4$	....	264.20
5306	**Picropodophyllin**	....	$C_{22}H_{22}O_8$	....	414.40
5307	**Picrorocellin**	....	$C_{20}H_{22}O_4N_2$	....	354.39
5308	**Picryl chloride** (1;2,4,6)	....	$Cl \cdot C_6H_2(NO_2)_3$	V-273	247.56
5309	**Pimelic** acid	heptandioic acid	$(CH_2)_5(CO_2H)_2$	II-670	160.17
5310	acid (*iso*)	....	$(C_2H_5)(CH_3)C \cdot CH_2(CO_2H)_2$	II-685	160.17
5311	nitrile	....	$(CH_2)_5(CN)_2$	II-671	122.17
5312	**Pinacol**	2,3-diMe-butandiol-2,3	$[(CH_3)_2C \cdot OH]_2$	I-487	118.17
5313	hydrate	pinacone hydrate	$C_6H_{14}O_2 \cdot 6H_2O$	I-488	226.27
5314	**Pinacoline semicarbazone**	....	$C_5H_{12}C\colon N \cdot NH \cdot CO \cdot NH_2$	III-104	157.21
5315	**Pinacolyl acetate**	....	$CH_3CO_2 \cdot C_6H_{13}$	II-133	144.21
5316	**Pinacyanole**	sensitol red	$C_{23}H_{20}N_2 \cdot C_2H_5I$	XXIII-320	480.39
5317	**Pinane** (*d*)	....	$C_{10}H_{18}$	V-93	138.24
5318	**Pinene** (α)(*dl*)	....	$C_{10}H_{16}$	V-144	136.23
5319	hydrochloride	artificial camphor	$C_{10}H_{16} \cdot HCl$	V-94	172.69
5320	**Pinol** (*dl*)	sobrerone	$C_{10}H_{16}O$	XVII-45	152.23
5321	**Piperic acid**	....	$CH_2O_2\colon C_6H_3 \cdot C_5H_5O_2$	XIX-281	218.20
5322	**Piperidine**	hexazane	$\underline{\vert CH_2(CH_2)_4NH \vert}$	XX-6	85.15
5323	**Piperonal**	heliotropine	$CH_2O_2\colon C_6H_3 \cdot CHO$	XIX-115	150.13
5324	acetophenone	....	$C_8H_6O_2\colon CH \cdot COC_6H_5$	XIX-141	252.26
5325	**Piperonyl** alcohol	....	$CH_2O_2\colon C_6H_3 \cdot CH_2OH$	XIX-67	152.14
5326	phloroglucinol-dimethyl ether	protocotoin; (2,4-diMeO)	$(CH_3O)_2C_{14}H_8O_4$	XIX-242	302.27
5327	**Piperonylic acid**	....	$CH_2O_2\colon C_6H_3 \cdot CO_2H$	XIX-269	166.13
5328	**Proflavine**	3,6-diNH_2-acridine sulfate; trypaflavine	$C_{13}H_{11}N_3 \cdot H_2SO_4 \cdot H_2O$	*XXII-650	325.33
5329	**Pregnan**(e)**diol**	23(α),20(α)	$C_{21}H_{36}O_2$	....	320.50
5330	**Pregnan**(e)**diol**	3(α),20(β)	$C_{21}H_{36}O_2$	....	320.50
5331	**Pregnan**(e)**diol**	3(β),20(α)	$C_{21}H_{36}O_2$	....	320.50
5332	**Pregnan**(e)**diol**	3(β),20(β)	$C_{21}H_{36}O_2$	....	320.50
5333	**Progesterone**(α)	....	$C_{21}H_{30}O_2$	....	314.45
5334	**Progesterone**(β)	progestin; corporin	$C_{21}H_{30}O_2$	....	314.45
5335	**Proline** (*l*–)	pyrrolidine-2-carboxylic acid	$\underline{\vert HN \cdot (CH_2)_3 \cdot CH \vert} \cdot CO_2H$	XXII-2	115.13
5336	**Prominal**	1-Me-5-Et-5-Ph-barbituric acid	$(C_6H_5)(C_2H_5)(CH_3) \cdot C_4HO_3N_2$	....	246.26
5337	**Prontosil** † (4,1;1′,2′,4′)	prontosil red; rubiazol; streptozon	$H_2NSO_2 \cdot C_6H_4 \cdot N\colon N \cdot C_6H_3(NH_2)_2 \cdot HCl$	....	327.79
5338	**Propane**	....	$CH_3 \cdot CH_2 \cdot CH_3$	I-104	44.09
5339	*iso*-**Propanolamine**	α-NH_2-*iso*Pr alcohol	$NH_2 \cdot CH_2CHOH \cdot CH_3$	IV-289	75.11

† *p*-Aminobenzene-sulfonamide also sometimes called "Prontosil."

Picolinic acid 5486
Picramide 6289
Picric acid 6310
Picrocrocin, cf. glcde.
Picryl-hydrazine 6311
Pictol 4117
Pilocarpidine, cf. alkd.
Pilocarpine, cf. alkd.
Pilosine, cf. alkd.
Piloty's acid 674
Pimelin ketone 1606
Pinacolin 4166
Pinacolin alcohol 3627
Pinacolon(e) 4166
Pinacone 5312
Pineapple oil 1534-5
Pinene HCl 864
Pinite 4286
Pinatol 4286
Pipecoline 4345-7
Pipecolyl carbinol 2931
Piperazine 2225
Piperidinic acid 279
Piperine, cf. alkd.
Piperylene 5064
Piria acid 4541
Pitayine, cf. alkd.
Pivalic acid 6245
Pivalic aldehyde 6243

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5302	lq.	$0.957^{15\circ}_{4}$	....	143.1	∞	∞	∞
5303	red nd./al.	....	169	....	$0.14^{22\circ}$; s. ac.	s.; sl. s. chl.	sl. s.; s. bz.
5304	red crust	....	....	....	$2^{16\circ}$	....	....
5305	yel. lf.	....	116.5	d. 125	$0.12^{17\circ}$	sl. s.	....
5306	col. nd./bz.	....	228	....	i.; s. alk.	s.	s. chl.
5307	col. pr./al.	....	190-220	....	i.; s. chl.	s. h.	sl. s.
5308	yel. mn.	$1.797^{20\circ}$	83	....	i.; d. aq. alk.; s.bz.	$4.8^{17\circ}$; s. h. chl.	$7^{17\circ}$; sl. s. pet.
5309	mn./aq.	$1.291^{25\circ}_{4}$	103-5	272^{100mm}	$2.5^{14\circ}$	v. s.	v. s.
5310	rhb./aq.	....	103-4	d. 135	$15.4^{15\circ}$	v. s.	v. s. h.
5311	col. lq.	$0.949^{18\circ}$	....	$175\text{-}6^{14mm}$	i.	∞	∞
5312	col. nd.	lq. $0.967^{15\circ}$	41-3(38)*	$171\text{-}2^{739mm}$	sl. s. c.; s. h.	v. s.	v. s.; sl. s. CS_2
5313	cr./aq.	....	46-7**	d. $-H_2O$	sl. s. c.	s.	s.
5314	nd./aq.	....	157	....	sl. s. c.	s.	v. s.
5315	col. lq.	....	....	143^{757mm}	....	....	....
5316	b. gn./al.	....	276-8	....	sl. s.	s.	s. pyr.
5317	col. lq.	$0.839^{20\circ}_{4}$	−45	169.4	....	....	....
5318	col. lq.	$0.878^{20\circ}_{4}$	−55	154-6	v. sl. s.	∞ abs.	∞
5319	cr. lf.	....	131-2	207-8	i.	33	s.
5320	lq.	$0.953^{20\circ}_{20}$	....	183-4	s. bz.	s.	s.
5321	yel. nd./al.	....	216-7	subl. sl. d.	i.; 2 h.	3.6 c.	s.; sl. s. bz.
5322	lq.	$0.860^{20\circ}_{4}$	−9	106	∞	∞	....
5323	cr./aq.	....	37	263	$0.1^{0\circ}$; $0.66^{78\circ}$	$15^{0\circ}$; $550^{78\circ}$	∞
5324	yel. nd./al.	....	122	....	....	....	....
5325	nd.	....	52-3	d.	s. h.	∞	∞
5326	lt. yel. mn./al.	....	141-2	....	i.; s. alk.; s. ac.	s.; i. alk. carb.	s.; s. bz.; s. chl.
5327	nd./al.	....	228	subl.	v. sl. s. h.	sl. s. h.	sl. s.
5328	red nd.	....	....	....	1 c.	s.	i.; i. chl.
5329	col. cr./act.	....	237-9	....	sl. s.	s.	s.
5330	col. cr./al.	....	232-4	....	sl. s.	s.	s.
5331	col. cr./et.	....	182-4	....	sl. s.	s.	s.
5332	cr./aq. al.	....	174-6	....	sl. s.	s.	s.
5333	pr.	....	128.5	....	i.	s.	s.
5334	nd./pet.	....	121	....	i.	s.	s.
5335	hyg. nd./ al. et.	....	220-2 d.	....	v. s.	$1.6^{19\circ}$	i.
5336	col. cr.	....	176	....	s. h.	s.	....
5337	red cr. pd.	....	247-51	....	0.25	....	....
5338	col. gas	(A)1.562 $0.585^{-44.5\circ}_{4}$	−187.7	−42.1	$6.5^{17.8\circ}$ cc.	$926^{16.6\circ}$ cc.	$1299^{16.6\circ}$ cc.
5339	lq.	$0.973^{18\circ}$	....	160-1	v. s.	s.	i.

* Crysts. + $6H_2O$/aq., m. p. 47°.

** Anhydrous crysts./et., m. p. 38°; b. p. 172-5°.

Planocaine 4935
Poirrier's blue 6344
Polygonin, cf. glcde.
Populin, cf. glcde.
Porphyroxine, cf. alkd.
Potassium myronate, cf. glcde.
Pragmoline 82
Prehnitic acid 680
Prehnitol 5827
Prehnitylic acid 6257
Primulin, cf. glcde.
Procaine 4935
Progestin(e) 5334
Proline-betaine, cf. alkd.
Prontosil album 527
Propadiene 183
Propanal 5352
Propandioic acid 4002
Propandiol 5465, 6286
Propandithiol 6284

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5340	**Propargyl** acetate	....	$CH_3CO_2\cdot CH_2\cdot C\vdots CH$	II-140	98.10
5341	alcohol	propyne-1-ol-3	$HC\vdots C\cdot CH_2OH$	I-454	56.06
5342	bromide	3-bromo-propyne-1	$HC\vdots C\cdot CH_2Br$	I-248	118.97
5343	chloride	chloro-allylene	$HC\vdots C\cdot CH_2Cl$	I-248	74.51
5344	iodide	3-iodo-propyne-1	$HC\vdots C\cdot CH_2I$	I-248	165.97
5345	**Propenyl** chloride†	1-chloro-propene-1	$CH_3\cdot CH:CHCl$	I-198	76.53
5346	chloride (*iso*)	2-chloro-propene-1	$CH_3\cdot CCl:CH_2$	I-198	76.53
5347	guaethol	(4;1,2)	$CH_3\cdot CH:CH\cdot C_6H_3:(OH)(OC_2H_5)$	....	178.22
5348	**Propiolic** acid	propynoic acid	$HC\vdots C\cdot CO_2H$	II-477	70.05
5349	aldehyde	propargyl aldehyde	$HC\vdots C\cdot CHO$	I-750	54.05
5350	**Propionaldol**	....	$C_2H_5\cdot CHOH\cdot CH:(CH_3)CHO$	I-836	116.16
5351	**Propionic** acid	propanoic acid	$CH_3\cdot CH_2\cdot CO_2H$	II-234	74.08
5352	aldehyde	propanal	$CH_3\cdot CH_2\cdot CHO$	I-629	58.08
5353	aldehyde oxime	propionaldoxime	$C_2H_5\cdot CH:NOH$	I-631	73.09
5354	aldehyde semicarbazone (*α*)	....	$C_2H_5\cdot CH:N\cdot NH\cdot CO\cdot NH_2$	III-101	115.14
5355	aldehyde semicarbazone	....	$C_2H_5\cdot CH:N\cdot NH\cdot CO\cdot NH_2$	III-101	115.14
5356	amide	propionamide	$C_2H_5\cdot CO\cdot NH_2$	II-243	73.09
5357	anhydride	....	$(C_2H_5\cdot CO)_2O$	II-242	130.14
5358	anilide	propionanilide	$C_2H_5\cdot CO\cdot NH\cdot C_6H_5$	XII-250	149.19
5359	bromide	propionyl bromide	$C_2H_5\cdot CO\cdot Br$	II-243	136.99
5360	chloride	propionyl chloride	$C_2H_5\cdot CO\cdot Cl$	II-243	92.53
5361	fluoride	propionyl fluoride	$C_2H_5\cdot CO\cdot F$	II-243	76.07
5362	iodide	propionyl iodide	$C_2H_5\cdot CO\cdot I$	II-243	183.99
5363	nitrile	ethyl cyanide	$CH_3\cdot CH_2\cdot CN$	II-245	55.08
5364	**Propyl** acetanilide (*N*)	acetyl *n*-propylaniline	$C_6H_5\cdot N(COCH_3)\cdot CH_2\cdot C_2H_5$	XII-246	177.24
5365	acetate (*n*)	....	$CH_3CO_2\cdot CH_2\cdot C_2H_5$	II-129	102.13
5366	acetate (*iso*)	....	$CH_3CO_2\cdot CH(CH_3)_2$	II-130	102.13
5367	acetoacetate (*iso*)	....	$CH_3COCH_2CO_2C_3H_7$	III-659	144.17
5368	alcohol (*n*)	propanol-1	$CH_3\cdot CH_2\cdot CH_2OH$	I-350	60.09
5369	alcohol (*iso*)	propanol-2	$(CH_3)_2CHOH$	I-360	60.09
5370	allyl barbituric acid (*iso*)	numal; alurate	$(C_3H_5)(C_3H_7):C_4H_2O_3N_2$	....	210.23
5371	amine (*n*)	1-aminopropane	$CH_3\cdot CH_2\cdot CH_2\cdot NH_2$	IV-136	59.11
5372	amine (*iso*)	2-aminopropane	$(CH_3)_2CH\cdot NH_2$	IV-152	59.11
5373	*p*-aminobenzoate	propesine	$NH_2\cdot C_6H_4\cdot CO_2C_3H_7$	XIV-423	179.21
5374	aniline (*n*)(*N*)	....	$C_6H_5\cdot NH\cdot CH_2\cdot C_2H_5$	XII-166	135.20
5375	aniline (*iso*)(*p*)	cumidine	$(CH_3)_2CH\cdot C_6H_4\cdot NH_2$	XII-1147	135.20
5376	arsonic acid (*n*)	....	$C_3H_7\cdot AsO(OH)_2$	IV-615	168.01
5377	benzaldehyde (*iso*) (*p*)	*p*-cuminic aldehyde	$(CH_3)_2CH\cdot C_6H_4\cdot CHO$	VII-318	148.20
5378	benzene (*n*)	....	$C_6H_5\cdot CH_2\cdot C_2H_5$	V-390	120.19
5379	benzene (*iso*)	cumene	$C_6H_5\cdot CH(CH_3)_2$	V-393	120.19
5380	benzoate (*n*)	....	$C_6H_5\cdot CO_2\cdot CH_2\cdot C_2H_5$	IX-112	164.20
5381	benzoate (*iso*)	....	$C_6H_5\cdot CO_2\cdot CH(CH_3)_2$	IX-112	164.20
5382	benzoic acid (*n*)(*o*)	....	$C_3H_7\cdot C_6H_4\cdot CO_2H$	IX-544	164.20
5383	benzoic acid (*iso*) (*o*)	*o*-cuminic acid	$(CH_3)_2CH\cdot C_6H_4\cdot CO_2H$	IX-546	164.20
5384	benzoic acid (*n*)(*p*)	....	$C_3H_7\cdot C_6H_4\cdot CO_2H$	IX-545	164.20

† Properties for trans-; cis, m. p. −134.8°, b. p. 32.8°.

Propanoic acid 5351
Propanol 5368-9
Propanone 56
Propanselenol 5448
Propanthiol 5424-5
Propargyl aldehyde 5349
Propene 5459
Propenoic acid 149
Propenol 193
Propenyl anisole 511
Propenyl bromide (*iso*) 990
Propenyl carbinol (*iso*) 4059
Propenyl cyanide 1563
Propenyl guaiacol 1280, 3223
Propenyl trimethoxybenzene 584
Propesine 5373
Propine 225
Propionamide 5356

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5340	col. lq.	$1.005^{20°}_{4}$	....	124-5	....	s.	s.
5341	col. lq.	$0.972^{20°}_{4}$	−17	114-5	s.	∞	∞
5342	lq.	$1.52^{20°}$	....	88-90	....	....	....
5343	lq.	$1.045^{5°}$	....	65	....	....	....
5344	lq.	$2.018^{0°}$	....	115	....	....	s.
5345	col. lq.	$0.935^{15°}_{25}$	−99	37	i.	∞ ; ∞ act.	∞ ; ∞ bz.
5346	lq.	$0.918^{9°}$	−137.4	22.65	i.	....	....
5347	col. pd.	....	85-7	....	i.	s.	s.
5348	col. lq.	$1.139^{15°}_{15}$	18	102^{200mm}	s.	s.	s.
5349	oil	....	....	59-61	v. s.	....	....
5350	col. lq.	$0.986^{25°}_{4}$	....	$84\text{-}6^{11mm}$	s.	....	....
5351	col. lq.	$0.992^{20°}_{4}$	−22	141.1	∞	∞	∞ ; ∞ chl.
5352	col. lq.	$0.807^{20°}_{4}$	−81	49.5^{740mm}	$20^{20°}$	∞	∞
5353	lq.	$0.926^{20°}_{4}$	21(40?)	130-2	....	....	....
5354	nd./bz. + lg.	....	88-90	....	v. s.	v. s. h. bz.	....
5355	pl./aq.	....	154	less s. bz. than α	....	....	....
5356	rhb. pl.	$1.042^{20°}_{4}$	79-80	213	v. s.	v. s.	v. s.
5357	col. lq.	$1.012^{20°}_{4}$	−45	168.8^{780mm}	d.	d.	....
5358	lf./al.	1.175	104-5	....	$0.4^{24°}$	s.; s. h. aq.	s.
5359	lq.	$1.521^{16.4°}_{4}$	....	103-4	d.	d.	s.
5360	col. lq.	$1.065^{20°}_{4}$	−94	80	d.	d.	s.
5361	col. lq.	$0.972^{15°}$	....	44	d.	d.	....
5362	lq.	....	....	127-8	d.	d.	....
5363	col. lq.	$0.783^{21°}_{4}$	−91.9	97.1	s.	∞	∞
5364	mn. pl./et. or lg.	....	47-8	266^{712mm}	i.	s.	s.
5365	col. lq.	$0.886^{20°}_{4}$	−92.5	101.6	$1.6^{16°}$	∞	∞
5366	col. lq.	$0.874^{20°}_{20}$	−73.4	88.4	$3^{20°}$	∞	∞
5367	col. lq.	....	....	185-7	v. sl. s.	s.	s.
5368	col. lq.	$0.804^{20°}_{4}$	−127	97.8	∞	∞	∞
5369	col. lq.	$0.789^{20°}_{4}$	−85.8	82.5	∞	∞	∞
5370	col. cr., aq.	....	137-8	....	sl. s.	s.	s.
5371	col. lq.	$0.718^{20°}_{20}$	−83	$49\text{-}50^{761mm}$	∞	∞	∞
5372	col. lq.	$0.694^{15°}_{4}$	−101	33-4	∞	∞	∞
5373	col. pr.	....	74-6	....	v. sl. s.	s.; s. chl.	s.; s. bz.
5374	lq.	$0.949^{18°}$	....	222	i.	v. s.	v. s.
5375	lq.	0.953	< −20	225^{761mm}	i.	....	....
5376	col. nd./al.	....	126-7	....	v. s.	v. s.	i.
5377	lq.	$0.978^{20°}_{4}$	....	236-7	i.	s.	s.
5378	col. lq.	$0.862^{20°}_{4}$	−99.5	159.2	i.	∞ ; s. SO_2	∞ ; i. NH_3
5379	col. lq.	$0.862^{20°}_{4}$	−96.0	152.4	i.	∞	∞
5380	col. lq.	$1.021^{25°}_{25}$	−51.6	231	i.	s.	s.
5381	col. lq.	$1.010^{25°}_{25}$	....	218.5	i.	s.	s.
5382	lf./aq. al.	....	58	272^{739mm}	sl. s. h.	s.	....
5383	pr./aq.	....	51	....	sl. s. h.	s.	s.; s. bz.
5384	pr./h. aq.	....	140-1	....	sl. s. h.	s.	s.; s. bz.

Propionanilide 5358
Propionyl bromide 5359
Propionyl chloride 5360
Propionyl fluoride 5361
Propionyl iodide 5362
Propionyl phenol 3810-1
Propiophenone 3129
Proponal 2776
Propyl-, cf. also dipropyl-.
Propyl acetone 4164
Propyl-acetylene 5086
Propyl-acetylene (*iso*) 4168
Propyl adipate 2771

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5385	**Propyl** benzoic acid (*iso*) (*p*)	cuminic acid	$(CH_3)_2CH\cdot C_6H_4\cdot CO_2H$	IX-546	164.20
5386	benzoic amide (*iso*)(*p*)	cuminic amide	$(CH_3)_2CH\cdot C_6H_4\cdot CO\cdot NH_2$	IX-547	163.21
5387	*o*-benzoylbenzoate (*n*)	....	$C_6H_5\cdot CO\cdot C_6H_4\cdot CO_2\cdot CH_2\cdot C_2H_5$	....	268.30
5388	bromide (*n*)	1-bromopropane	$CH_3\cdot CH_2\cdot CH_2Br$	I-108	123.00
5389	bromide (*iso*)	2-bromopropane	$CH_3\cdot CHBr\cdot CH_3$	I-108	123.00
5390	bromopropenyl barbituric acid	nostal; noctal	$(C_3H_7)(CH_3\cdot CBr:CH):C_4H_2O_3N_2$	....	289.14
5391	*iso*-butyl ketone (*n*)	....	$C_2H_5\cdot CH_2\cdot CO\cdot C_4H_9$	I-706	128.21
5392	*n*-butyrate (*n*)	....	$C_3H_7\cdot CO_2\cdot C_3H_7$	II-271	130.18
5393	*iso*-butyrate (*n*)	....	$(CH_3)_2CHCO_2C_3H_7$	II-291	130.18
5394	*n*-butyrate (*iso*)	....	$C_2H_5\cdot CH_2\cdot CO_2\cdot CH:(CH_3)_2$	II-271	130.18
5395	*iso*-butyrate (*iso*)	....	$C_3H_7\cdot CO_2\cdot C_3H_7$	II-291	130.18
5396	caproate (*n*)	....	$C_5H_{11}\cdot CO_2\cdot CH_2\cdot C_2H_5$	II-323	158.23
5397	caprylate (*n*)	....	$C_7H_{15}\cdot CO_2\cdot CH_2\cdot C_2H_5$	II-348	186.29
5398	carbamate (*n*)	....	$NH_2\cdot CO_2\cdot CH_2\cdot C_2H_5$	III-28	103.12
5399	carbonate, ortho-	....	$C(OCH_2\cdot C_2H_5)_4$	III-6	248.35
5400	chloride (*n*)	1-chloropropane	$CH_3\cdot CH_2\cdot CH_2Cl$	I-104	78.54
5401	chloride (*iso*)	2-chloropropane	$CH_3\cdot CHCl\cdot CH_3$	I-105	78.54
5402	chloroformate (*n*)	*n*-Pr chlorocarbonate	$Cl\cdot CO_2\cdot CH_2\cdot C_2H_5$	III-11	122.55
5403	chloroformate (*iso*)	*iso*-Pr chlorocarb.	$Cl\cdot CO_2\cdot CH(CH_3)_2$	III-12	122.55
5404	*iso*-cyanide (*n*)	*n*-propyl carbylamine	$C_2H_5\cdot CH_2\cdot N:C$	IV-141	69.10
5405	*iso*-cyanide (*iso*)	*iso*-Pr carbylamine	$(CH_3)_2CH\cdot N:C$	IV-154	69.10
5406	fluoride (*n*)	1-fluoropropane	$CH_3\cdot CH_2\cdot CH_2F$	I-104	62.09
5407	fluoride (*iso*)	2-fluoropropane	$CH_3\cdot CHF\cdot CH_3$	I-104	62.09
5408	formate (*n*)	....	$H\cdot CO_2\cdot CH_2\cdot C_2H_5$	II-21	88.10
5409	formate (*iso*)	....	$H\cdot CO_2\cdot CH(CH_3)_2$	II-21	88.10
5410	formate, ortho-(*n*)	....	$H\cdot C(O\cdot CH_2\cdot C_2H_5)_3$	II-21	190.28
5411	furoate (*n*)	....	$C_4H_3O\cdot CO_2\cdot C_3H_7$	XVIII-275	154.16
5412	*β*-furylacrylate (*n*)	....	$C_4H_3O\cdot CH:CH\cdot CO_2\cdot CH_2\cdot C_2H_5$	....	180.20
5413	glycolate (*iso*)	....	$HOCH_2\cdot CO_2\cdot C_3H_7$	**III-172	118.13
5414	*n*-hexyl ketone (*n*)	decanone-4	$C_3H_7\cdot CO\cdot C_6H_{13}$	I-711	156.26
5415	*p*-hydroxybenzoate	(*n*); nipasol	$HOC_6H_4CO_2\cdot C_3H_7$	X-160	180.20
5416	hydroxylamine (*β*)	....	$C_2H_5\cdot CH_2\cdot NHOH$	IV-537	75.11
5417	iodide (*n*)	1-iodopropane	$CH_3\cdot CH_2\cdot CH_2I$	I-113	169.99
5418	iodide (*iso*)	2-iodopropane	$CH_3\cdot CHI\cdot CH_3$	I-114	169.99
5419	lactate (*n*)	....	$C_2H_4(OH)CO_2C_3H_7$	III-265	132.16
5420	lactate (*iso*)	....	$C_2H_4(OH)CO_2C_3H_7$	III-282	132.16
5421	levulinate (*n*)	....	$C_4H_7O\cdot CO_2C_3H_7$	III-675	158.19
5422	malonic acid (*n*)	....	$C_3H_7\cdot CH(CO_2H)_2$	II-657	146.14
5423	malonic acid (*iso*)	....	$C_3H_7\cdot CH(CO_2H)_2$	II-669	146.14
5424	mercaptan (*n*)	propanthiol-1	$CH_3\cdot CH_2\cdot CH_2\cdot SH$	I-359	76.15
5425	mercaptan (*iso*)	propanthiol-2	$(CH_3)_2CH\cdot SH$	I-367	76.15
5426	*α*-naphthylamine (*n*)	....	$C_{10}H_7\cdot NH\cdot CH_2\cdot C_2H_5$	XII-1224	185.26
5427	nitrate (*n*)	....	$CH_3\cdot CH_2\cdot CH_2\cdot O\cdot NO_2$	I-355	105.09
5428	nitrite (*n*)	....	$CH_3\cdot CH_2\cdot CH_2\cdot O\cdot NO$	I-355	89.09

Propyl-benzyl alcohol (*iso*) 1571
Propyl-bromobutyramide 4580
Propyl carbinol (*n*) 1034
Propyl carbinol (*iso*) 1036
Propyl carbonate 2780
Propyl carbylamine 5404-5
Propyl chlorocarbonate 5402-3
Propyl cyanide 1175-6
Propyl dibromosuccinate 2781
Propyl disulfide 2782
Propyl ether 2783-5
Propyl-ethylene 498-9
Propyl maleate 2788
Propyl malonate 2789
Propyl mustard oil 5450

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5385	tri.	1.162	116-7	subl.	$0.015^{25°}$	s.; s. conc. H_2SO_4	s.
5386	nd. or pl.	....	155	....	sl. s. h.	∞	sl. s.
5387	col. lq.	....	....	$223\text{-}5^{15mm}$	i.	s.	s.
5388	col. lq.	$1.353^{20°}_{4}$	–109.9	70.8	$0.25^{20°}$	∞	∞
5389	col. lq.	$1.310^{20°}_{4}$	–89	60	$0.32^{20°}$	∞; ∞ chl.	∞; ∞ bz.
5390	col. cr.	....	178	....	sl. s.	s.	sl. s.
5391	lq.	$0.813^{22°}_{0}$	....	155^{750mm}	i.; s. alk.	s.; s. act.	s.; sl. s. chl.
5392	col. lq.	$0.879^{15°}$	–95.2	142.7	$0.17^{17°}$	∞	∞
5393	col. lq.	$0.884^{0°}_{4}$	....	134-5	....	....	....
5394	col. lq.	$0.865^{13°}$	....	128	....	....	....
5395	col. lq.	$0.869^{0°}_{4}$	....	120.8	....	....	....
5396	col. lq.	$0.884^{0°}_{0}$	....	185.5	....	....	....
5397	col. lq.	$0.880^{0°}_{0}$	....	224.7	....	....	....
5398	pr.	....	60-1	200	v. s.	v. s.	v. s.
5399	col. lq.	$0.911^{8°}$	....	224.2	....	....	....
5400	col. lq.	$0.890^{20°}_{4}$	–122.8	46.4	$0.27^{20°}$	∞	∞
5401	col. lq.	$0.859^{20°}$	–117	36.5	$0.31^{20°}$	∞	∞
5402	col. lq.	$1.090^{20°}_{4}$	....	$114\text{-}5^{768mm}$	i.; sl. d.	i.; sl. d.	∞; ∞ bz.
5403	col. lq.	....	....	$103\text{-}5^{721mm}$	i.	v. s.	v. s.
5404	lq.	....	....	99.5	i.	∞	∞
5405	lq.	$0.760^{0°}$	....	87	i.	∞	∞
5406	gas	....	....	–3	....	....	....
5407	gas	....	....	–11	....	....	....
5408	col. lq.	$0.901^{20°}_{4}$	–92.9	81.3	$2.2^{22°}$	∞	∞
5409	lq.	$0.873^{20°}_{4}$	....	$68\text{-}71^{751mm}$	$2.1^{22°}$	....	....
5410	col. lq.	$0.881^{20°}_{4}$	....	196-8	$2.1^{22°}$	....	....
5411	col. lq.	$1.075^{20°}_{4}$	....	211	v. sl. s.	s.	∞
5412	col. lq.	$1.074^{20°}_{4}$	....	119^{7mm}	i.	s.	....
5413	col. lq.	$1.043^{18°}_{4}$	....	164	s.	s.	s.
5414	lq.	$0.824^{21°}_{0}$	–9	206-7	v. sl. s.	∞	∞
5415	col. pr./et.	....	95-6	....	$0.2^{80°}$	$100^{25°}$ Me al.	$50^{25°}$
5416	nd./et.	....	46 ±	....	v. s.	v. s.	sl. s. lg.
5417	lq.	$1.743^{20°}_{4}$	–98.8	102.5	$0.11^{20°}$	∞	∞
5418	lq.	$1.705^{25°}_{25}$	–90 ±	89.5	$0.14^{20°}$	∞; ∞ chl.	∞; ∞ bz.
5419	col. lq.	....	....	$122\text{-}3^{150mm}$	s.	s.	s.
5420	col. lq.	....	....	167.5	s.	s.	s.
5421	lq.	$0.990^{20°}_{4}$	....	221	....	....	....
5422	pl./bz.	....	96	d.	v. s.	v. s.	....
5423	col. pr.	....	87	d. 180	....	v. s.	v. s.
5424	lq.	$0.836^{25°}_{4}$	–112	67-8	v. sl. s.	s.	s.
5425	lq.	$0.809^{25°}_{4}$	–130.7	58-60	sl. s.	∞	∞
5426	lt. yel. oil	....	....	$316\text{-}8^{771mm}$	i.	....	....
5427	lq.	$1.058^{20°}_{4}$	....	110.5	....	s.	s.
5428	lq.	$0.935^{20°}_{4}$	....	57	....	s.	s.

Propyl oxalate 2792-3
Propyl phthalate 2794-5
Propyl-piperidine, cf. alkd.
Propyl-*iso*-propyl carbinol 3536
Propyl succinate 2796-7
Propyl sulfate 2798
Propyl sulfide 2799-2800
Propyl sulfite 2801
Propyl sulfone 2802-3
Propyl tartrate 2804-5
Propyl-toluene (*n*) 4351-2
Propyl-toluene (*iso*) 1622-4
Propylene bromide 1864
Propylene chloride 2051
Propylene iodide 2397

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Propyl				
5429	nitroamine (*n*)	....	$C_2H_5\cdot CH_2\cdot NH\cdot NO_2$	IV-570	104.11
5430	phenol (*o*)(*n*)	....	$C_2H_5\cdot CH_2\cdot C_6H_4\cdot OH$	VI-499	136.19
5431	phenol (*m*)(*n*)	....	$C_2H_5\cdot CH_2\cdot C_6H_4\cdot OH$	VI-499	136.19
5432	phenol (*p*)(*n*)	....	$C_2H_5\cdot CH_2\cdot C_6H_4\cdot OH$	VI-500	136.19
5433	phenol (*o*)(*iso*)	*o*-cumenol	$(CH_3)_2CH\cdot C_6H_4\cdot OH$	VI-504	136.19
5434	phenol (*m*)(*iso*)	*m*-hydroxy-cumene	$(CH_3)_2CH\cdot C_6H_4\cdot OH$	VI-505	136.19
5435	phenol (*p*)(*iso*)	*p*-hydroxy-cumene	$(CH_3)_2CH\cdot C_6H_4\cdot OH$	VI-505	136.19
5436	phenyl carbinol (*n*)	....	$C_3H_7\cdot CHOH\cdot C_6H_5$	VI-522	150.21
5437	phenyl carbinol (*iso*)	....	$C_3H_7\cdot CHOH\cdot C_6H_5$	VI-523	150.21
5438	phenyl ether (*n*)	....	$C_2H_5\cdot CH_2\cdot O\cdot C_6H_5$	VI-142	136.19
5439	phenyl ketone (*n*)	butyrophenone	$C_2H_5\cdot CH_2\cdot CO\cdot C_6H_5$	VII-313	148.20
5440	phenyl ketone (*iso*)	*iso*-butyrophenone	$(CH_3)_2CH\cdot CO\cdot C_6H_5$	VII-316	148.20
5441	propionate (*n*)	....	$C_2H_5\cdot CO_2\cdot CH_2\cdot C_2H_5$	II-240	116.16
5442	propionate (*iso*)	....	$C_2H_5\cdot CO_2\cdot CH(CH_3)_2$	II-241	116.16
5443	pyridine (2)(*α*)(*n*)	conyrine	$C_2H_5\cdot CH_2\cdot C_5H_4N$	XX-247	121.18
5444	pyridine (2)(*α*)(*iso*)	....	$(CH_3)_2CH\cdot C_5H_4N$	XX-247	121.18
5445	pyridine (4)(*γ*)(*iso*)	....	$(CH_3)_2CH\cdot C_5H_4N$	XX-248	121.18
5446	salicylate (*o*)(*n*)	....	$HO\cdot C_6H_4\cdot CO_2\cdot C_3H_7$	X-75	180.20
5447	salicylate (*o*)(*iso*)	....	$HO\cdot C_6H_4\cdot CO_2\cdot C_3H_7$	....	180.20
5448	selenomercaptan	propanselenol-1	$CH_3\cdot CH_2\cdot CH_2\cdot SeH$	I-360	123.05
5449	succinic acid (*n*)	....	$C_3H_7\cdot C_2H_3(CO_2H)_2$	II-675	160.17
5450	*iso*-thiocyanate (*n*)	*n*-propyl mustard oil	$CH_3\cdot CH_2\cdot CH_2\cdot N{:}CS$	IV-145	101.16
5451	thiocyanate (*iso*)	....	$(CH_3)_2CH\cdot S\cdot CN$	III-177	101.16
5452	*p*-toluene sulfonate	(*n*)	$CH_3C_6H_4SO_3C_3H_7$	....	214.27
5453	urea (*n*)	....	$C_3H_7\cdot NH\cdot CO\cdot NH_2$	IV-142	102.14
5454	urethane (*n*)	....	$C_3H_7\cdot NH\cdot CO_2\cdot C_2H_5$	IV-143	131.17
5455	*n*-valerate (*n*)	....	$C_4H_9CO_2\cdot C_3H_7$	II-301	144.21
5456	*iso*-valerate (*n*)	....	$C_4H_9CO_2\cdot CH_2\cdot C_2H_5$	II-312	144.21
5457	*iso*-valerate (*iso*)	....	$C_4H_9CO_2\cdot CH(CH_3)_2$	II-312	144.21
5458	**Propylal** (*n*)	methylene diPr ether	$CH_2(OCH_2\cdot C_2H_5)_2$	I-575	132.20
5459	**Propylene**	propene	$CH_3\cdot CH{:}CH_2$	I-196	42.08
5460	bromohydrin (*prim*)	*β*-Br-propyl alcohol	$CH_3\cdot CHBr\cdot CH_2OH$	*I-181	139.00
5461	chlorohydrin (*prim*)	2-chloro-propanol-1	$CH_3\cdot CHCl\cdot CH_2OH$	I-356	94.54
5462	chlorohydrin (*sec*)	1-chloro-propanol-2	$CH_3\cdot CHOH\cdot CH_2Cl$	I-363	94.54
5463	cyanide	....	$CH_3\cdot CH(CN)\cdot CH_2\cdot CN$	II-640	94.11
5464	diamine (*dl*)	1,2-diamino-propane	$CH_3\cdot CH(NH_2)\cdot CH_2\cdot NH_2$	IV-257	74.13
5465	glycol (*α*)	propandiol-1,2	$CH_3\cdot CHOH\cdot CH_2OH$	I-472	76.09
5466	glycol acetate, di-	....	$(CH_3CO_2)_2CH_2\cdot CH(CH_3)$	II-142	160.17
5467	glycol acetate, mono-(*α*)	....	$CH_3CO_2\cdot CH_2\cdot CHOH\cdot CH_3$	II-142	118.13
5468	oxide (1,2)	....	$CH_3\cdot \underbrace{CH\cdot CH_2\cdot O}$	XVII-6	58.08
5469	oxide (1,3)	trimethylene oxide	$\underbrace{CH_2\cdot CH_2\cdot CH_2\cdot O}$	XVII-6	58.08
5470	**Prostigmine bromide**	(1,3)	$Br(CH_3)_3N\cdot C_6H_4\cdot O_2C\cdot N(CH_3)_2$	....	303.20

Propylidene dibromide 1863
Propylidene dichloride 2050
Propylidene dichloride (*iso*) 2053
Propyne 225
Propynoic acid 5348

Propynol 5341
Protagon 3960
Protocatechuic acid 2319
Protocatechuic aldehyde 2311
Protocatechuic aldehyde ethyl ether 3188

Protocotoin 5326
Protopine, cf. alkd.
Protoveratrine, cf. alkd.
Prulaurasin, cf. glcde.
Prussic acid 3715

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5429	col. lq.	$1.104^{15°}$	−22	128-9^{40mm}	sl. s.	∞	∞
5430	lq.	$1.015^{0°}$	....	221-6	v. sl. s.	s.	s.
5431	lq.	....	26	228	v. sl. s.	s.	....
5432	cr.	$1.009^{0°}$	21-2	230-2	v. sl. s.	s.	....
5433	lq.	$1.012^{20°}$	15-6	214-5	v. sl. s.	∞	∞
5434	cr.	....	26	228	v. sl. s.	....	....
5435	nd.	$0.990^{20°}$	61	228.2-9.2	v. sl. s.	$316^{25°}$	$350^{25°}$
5436	oil	$1.021^{18°}_{4}$	....	168-70^{100mm}	....	....	....
5437	oil	$0.987^{13.7°}_{4}$	....	218-21	....	....	....
5438	col. lq.	$0.953^{15°}_{15}$	....	189-90	....	....	....
5439	lq.	$0.990^{18°}_{1}$	11	231^{727mm}	i.	∞	∞
5440	lq.	$0.985^{20°}_{20}$	....	220^{746mm}	i.	s.	s.
5441	col. lq.	$0.883^{20°}_{4}$	−76	122-3	$0.56^{25°}$	∞	∞
5442	col. lq.	$0.893^{0°}$	....	109-11^{750mm}	$0.6^{25°}$	....	....
5443	lq.	<1	....	165-8	....	....	....
5444	lq.	$0.934^{0°}$	....	158-9	sl. s.	....	....
5445	lq.	$0.944^{0°}$	....	177-8	....	sl. s.	....
5446	col. lq.	$1.099^{15°}$	....	238-40	v. sl. s.	∞	∞
5447	col. lq.	$1.010^{25°}$	....	120-2^{18mm}	....	....	....
5448	oil	$1.302^{20°}_{4}$	....	84	....	....	....
5449	col. cr.	....	92-3	....	s.	2.8 c. chl.	....
5450	lq.	$0.978^{16°}_{4}$	....	152.7^{743mm}	....	....	....
5451	lq.	$0.963^{20°}$	....	152-3^{754mm}	i.	∞	∞
5452	col. lq.	....	....	164-6^{10mm}	i.	s.	s.
5453	cr.	....	107	....	s.	....	....
5454	lq.	....	....	192-3	....	....	....
5455	lq.	$0.874^{15°}$	−70.7	167.5	i.	∞	∞
5456	col. lq.	$0.863^{20°}_{4}$	....	155.9	i.	∞; ∞ chl.	∞
5457	col. lq.	$0.854^{17°}$	....	142^{756mm}	....	....	....
5458	lq.	$0.834^{20°}$	−97	137-8	....	....	....
5459	col. gas	(A)1.498 $0.609^{-47°}_{4}$	−185.3	−47.7	44.6 cc.	1200 cc.	500 cc. ac.
5460	lq.	....	....	52-3^{16mm}	....	....	....
5461	col. lq.	$1.103^{20°}$	....	133-4	s.	s.	s.
5462	col. lq.	$1.115^{20°}_{20}$	....	126-7^{762mm}	∞	∞	....
5463	col. lq.	....	12	252-4	....	....	....
5464	col. lq.	$0.878^{15°}$	....	119-20	∞	....	....
5465	col. oil	$1.040^{19.4°}$	....	188-9	∞	∞	8
5466	col. lq.	....	−31	190.2	10	....	....
5467	col. lq	$1.055^{20°}$	....	182-3	s.	....	....
5468	col. lq.	$0.831^{20°}_{20}$	....	35	$33^{30°}$	∞	∞
5469	lq.	....	....	50	∞	....	....
5470	wh. cr. pd	....	176 d.	....	v. s.	....	....

PS (puking stuff) gas 4697
Pseudoaconitine, cf. alkd.
Pseudochlorogenin 1478
Pseudocinchonine, cf. alkd.
Pseudocumene 6254
Pseudocumidine 6250
Pseudocumene 6254
Pseudocumenol 6265
Pseudoephedrine 2878
Pseudomorphine. cf. alkd.
Pseudopelletierine, cf. alkd.
Pseudopunicine, cf. alkd.
Pseudosarsasapogenin 5602
Pseudotropine, cf. alkd.
Pukateine, cf. alkd.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5471	**Pulegol** (*iso*)(*d*)	....	$C_{10}H_{17}OH$	VI-65	154.24
5472	**Pulegone**	....	$C_{10}H_{16}O$	VII-81	152.23
5473	**Purine**	....	$C_5H_4N_4$	XXVI-354	120.11
5474	**Putrescine**	....	$NH_2\cdot(CH_2)_4\cdot NH_2$	IV-264	88.15
5475	hydrochloride	....	$C_4H_{12}N_2\cdot 2HCl$	IV-264	161.08
5476	**Pyrantin**	*p*-ethoxyphenyl-succinimide	$C_2H_5O\cdot C_6H_4\cdot N(COCH_2)_2$	XXI-377	219.23
5477	**Pyrazine**	1,4-diazine	$\underline{N{:}CH\cdot CH{:}N\cdot CH{:}CH}$	XXIII-91	80.09
5478	**Pyrazole**	....	$\underline{N{:}CH\cdot CH{:}CH\cdot NH}$	XXIII-39	68.08
5479	**Pyrazoline**	....	$\underline{N{:}CH\cdot CH_2\cdot CH_2\cdot NH}$	XXIII-28	70.09
5480	**Pyrazolone** (5)	1,2-pentadiazenone	$\underline{CO\cdot CH_2\cdot CH{:}N\cdot NH}$	XXIV-13	84.08
5481	**Pyrene**	....	$C_{16}H_{10}$	V-693	202.24
5482	**Pyridazine**	1,2-diazine	$\underline{N{:}CH\cdot CH{:}CH\cdot CH{:}N}$	XXIII-89	80.09
5483	**Pyridine**	....	C_5H_5N	XX-181	79.10
5484	hydrochloride	....	$C_5H_5N\cdot HCl$	XX-189	115.56
5485	hydrochloride	....	$C_5H_5N\cdot 2HCl$	XX-189	152.03
5486	carboxylic acid (2)	picolinic acid (2)(α)	$C_5H_4N\cdot CO_2H$	XXII-33	123.11
5487	carboxylic HCl (2)	α-picolinic HCl	$C_5H_4N\cdot CO_2H\cdot HCl$	XXII-34	159.57
5488	carboxylic acid (3)	nicotinic acid (3)(β)	$C_5H_4N\cdot CO_2H$	XXII-38	123.11
5489	carboxylic HCl (3)	nicotinic HCl	$C_5H_4N\cdot CO_2H\cdot HCl$	XXII-39	159.57
5490	carboxylic HNO_3	nicotinic nitrate	$C_5H_4N\cdot CO_2H\cdot HNO_3\cdot H_2O$	XXII-39	204.14
5491	3-carboxylic acid flavianate	nicotinic flavianate	$C_6H_5O_2N\cdot C_{10}H_6O_8N_2S$	....	437.33
5492	3-carboxylic acid picrate	nicotinic acid picrate	$C_6H_5O_2N\cdot C_6H_3O_7N_3$	*XXII-503	352.22
5493	3-carboxylic amide	nicotin(ic)amide	$C_5H_4N\cdot CONH_2$	XXII-40	122.12
5494	3-carboxylic amide flavianate	nicotinamide flavianate	$C_6H_6ON_2\cdot C_{10}H_6O_8N_2S$	....	436.35
5495	3-carboxylic amide picrate	nicotinamide picrate	$C_6H_6ON_2\cdot C_6H_3O_7N_3$	....	351.23
5496	carboxylic acid (4)	*iso*-nicotinic acid (4)	$C_5H_4N\cdot CO_2H$	XXII-45	123.11
5497	dicarboxylic acid (2,3)	quinolinic acid	$C_5H_3N(CO_2H)_2$	XXII-150	167.12
5498	dicarboxylic acid (2,4)	lutidinic acid (2,4)	$C_5H_3N(CO_2H)_2\cdot H_2O$	XXII-153	185.13
5499	dicarboxylic acid (2,5)	*iso*-cinchomeronic acid	$C_5H_3N(CO_2H)_2\cdot H_2O$	XXII-153	185.13
5500	dicarboxylic acid (2,6)	dipicolinic acid	$C_5H_3N(CO_2H)_2\cdot 1\frac{1}{2}H_2O$	XXII-154	194.14
5501	dicarboxylic acid (3,4)	cinchomeronic acid	$C_5H_3N(CO_2H)_2$	XXII-155	167.12
5502	dicarboxylic acid (3,5)	dinicotinic acid	$C_5H_3N(CO_2H)_2$	XXII-160	167.12
5503	pentacarboxylic acid	....	$C_5N(CO_2H)_5\cdot 2H_2O$	XXII-190	335.18
5504	pentacarboxylic acid	....	$C_5N(CO_2H)_5\cdot 3H_2O$	XXII-190	353.20
5505	sulfonic acid (3)	....	$C_5H_4N\cdot SO_3H$	XXII-387	159.16

Puking stuff gas 4697
Pulegomenthol 4025
Pulsatilla camphor 510
Punicine, cf. alkd.
Purpurin 6213-4
Purpuroxanthin 2298
Purpuroxanthin carboxylic acid 2305
Pyracetosalyl 566
Pyramidon 363
Pyrantone-A 1663
Pyridone 3812-4
Pyridyl-methyl-pyrrolidine, cf. alkd.
Pyridyl-piperidine, cf. alkd.
Pyro alcohol 4100

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5471	col. lq.	$0.911_{4}^{20^\circ}$	....	86-9$^{10\text{mm}}$	v. sl. s.	....	....
5472	col. lq.	$0.932_{20}^{20^\circ}$	....	224$^{754\text{mm}}$	i.	∞	∞
5473	cr./al.	....	217	d.	s.	s. h.	s. toluene
5474	cr.	....	27-8	158-60	v. s.	....	....
5475	nd./aq.	$0.877_{4}^{25^\circ}$	>290	....	v. s.	i. Me al.	....
5476	pr./al.	....	155-8	....	0.08^{17°; 1.2^{100°	s. h.	i.
5477	pr./aq.	$1.031_{4}^{61^\circ}$	52-3	118$^{768\text{mm}}$	∞	s.	s.; s. HCl
5478	nd./et.	....	70	186-8	s.	s.	s.; s. bz.
5479	lq.	....	....	144	∞	∞	sl. s.
5480	nd./toluene	....	165	subl. d.	s.	v. s.	v. sl. s.
5481	lt. yel. pr.	$1.277_{4}^{0^\circ}$	149-50	>360	i.	3.1 h. abs.	v. s.
5482	lq.	$1.107_{4}^{20^\circ}$	−8	208	∞; s. HCl	s.; i. lg.	s.; s. bz.
5483	col. lq.	$0.982_{4}^{20^\circ}$	−42	115-6*	∞	∞	s.
5484	hyg. pl./al.	....	82	218-9	s.	s.	i.; s. chl.
5485	pr.	....	46-7	d. > 55	....	....	i.
5486	nd./al.	....	137-9	d. −CO_2	v. s.	v. s.	v. sl. s.
5487	rhb.	....	210-25 d.	....	....	....	....
5488	nd./al.	....	235.2	subl.	s. h.	s. h.	v. sl. s.
5489	pr./aq.	....	274-5	....	....	s.	....
5490	lf. or pr./aq.	....	192-4	....	....	....	....
5491	yel. pl./al.	....	249-50	....	s. h.	sl. s. abs.	i.
5492	pa. yel. pl. or nd./aq.	....	225-7 d.	....	s. h.	sl. s. abs.	i.
5493	col. nd./bz.	....	133	....	100	66.6	v. sl. s.
5494	pa. yel. cr./75% al.	....	269-70 d.	....	s.	sl. s. abs.	i.
5495	yel. pl. or nd.	....	193	....	s. h.	sl. s. abs.	i.
5496	nd./aq.	....	317**	d.	s. h.	sl. s. h.	v. sl. s.
5497	col. mn./aq.	....	d. 110 (slow)	d. > 190 (rapid)	0.6^{7°; s. h.	sl. s.; s. alk.	0.02; i. bz.
5498	pl./aq.	0.942	248-50	....	v. s. h.	s. h.	i.
5499	cr./aq.	....	236-7 (anh.)	subl. d.	sl. s. h.; s. h. HCl	v. sl. s.	v. sl. s.
5500	nd./aq.	....	226 d. (anh.)	....	sl. s. c.	v. sl. s.	v. sl. s.
5501	cr./HCl	....	258-9 d.	subl. d.	sl. s. h.	sl. s.	i.; i. chl.
5502	cr.	....	323 d.	subl. sl. d.	v. sl. s.	v. sl. s.	v. sl. s.; s. HCl
5503	cr./et.	....	−H_2O, 100	d.	s.	....	v. sl. s.
5504	cr./aq.	....	d. 220 (anh.)	....	s.	....	v. sl. s.
5505	nd. or lf.	....	d.	....	v. s.	v. sl. s.	i.

* Liquid + $3H_2O$, b. p. 92-3°.

** Sealed tube.

Pyrocatechin 2312
Pyrocatechol 2312
Pyrocatechol ethyl ether 2927
Pyrocatechuic acid 2312
Pyrodin 111
Pyrogallic acid 6216
Pyrogallol 6216
Pyrogallol carboxylic acid 6220, 6223
Pyroligneous spirit 4100
Pyromellitic acid 682
Pyromucic acid 3340
Pyromuc(ic)amide 3341
Pyromucic anhydride 3343

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5506	**Pyridine** tricarboxylic acid (2,3,4)	α-carbocinchomeronic acid	$C_5H_2N(CO_2H)_3 \cdot 1\frac{1}{2}H_2O$	XXII-182	238.15
5507	tricarboxylic acid (2,4,5)	berberonic acid	$C_5H_2N(CO_2H)_3 \cdot 2H_2O$	XXII-185	247.16
5508	tricarboxylic acid (2,4,6)	trimesitinic acid	$C_5H_2N(CO_2H)_3 \cdot 2H_2O$	XXII-185	247.16
5509	tricarboxylic acid (3,4,5)	β-carbocinchomeronic acid	$C_5H_2N(CO_2H)_3 \cdot 3H_2O$	XXII-186	265.18
5510	**Pyridoxin**	2-Me-3-OH-4.5-di-(hydroxymethyl)-pyridine	$C_8H_{11}O_3N$	....	169.18
5511	hydrochloride	....	$C_8H_{11}O_3N \cdot HCl$	....	205.64
5512	3-methyl ether	....	$CH_3O \cdot C_8H_{10}O_2N$	....	183.20
5513	**Pyrimidine**	*m*-diazine (1,3)	$\underbracket{CH:CH \cdot CH:N \cdot CH:N}$	XXIII-89	80.09
5514	**Pyrocoll**	....	$C_4H_3 \cdot N:(CO)_2:N \cdot C_4H_3$	XXIV-403	186.16
5515	**Pyrogallol** dimethyl ether (1,3;2)	2,6-diMeO-phenol	$(CH_3O)_2C_6H_3 \cdot OH$	VI-1081	154.16
5516	triacetate (1,2,3)	lenigallol	$C_6H_3(O_2CCH_3)_3$	VI-1083	252.22
5517	trimethyl ether	(1,2,3)	$C_6H_3(OCH_3)_3$	VI-1081	168.19
5518	**Pyrone** (1,4)	....	$C_5H_4O_2$	XVII-271	96.08
5519	**Pyronine**	....	$C_{17}H_{19}ON_2 \cdot Cl$	XVIII-596	302.80
5520	**Pyrotartaric acid** (*dl*)	methyl succinic acid	$HO_2C(CH_3)CH \cdot CH_2 \cdot CO_2H$	II-636	132.11
5521	**Pyrrole**	....	$(\cdot CH:CH)_2:NH$	XX-159	67.09
5522	carboxylic acid (α)	(2)	$C_4H_3NH(CO_2H)$	XXII-22	111.10
5523	**Pyrrolidine**	tetrahydropyrrole	$(CH_2)_4:NH$	XX-4	71.12
5524	**Pyrroline**	dihydropyrrole	$\underbracket{CH_2 \cdot CH_2 \cdot NH \cdot CH:CH}$	XX-133	69.10
5525	**Pyruvic** acid	pyro-racemic acid	$CH_3 \cdot CO \cdot CO_2H$	III-608	88.06
5526	amide	....	$CH_3 \cdot CO \cdot CO \cdot NH_2$	III-620	87.08
5527	nitrile	acetyl cyanide	$CH_3 \cdot CO \cdot CN$	III-620	69.06
5528	**Quinaldine** carboxylic acid (3)	2-Me-quinoline-3-carboxylic acid	$CH_3 \cdot C_9H_5N \cdot CO_2H$	XXII-83	187.19
5529	4-carboxylic acid	aniluvitonic acid	$CH_3 \cdot C_9H_5N \cdot CO_2H \cdot aq.$	XXII-85	187.19
5530	5-carboxylic acid	(2;5)	$CH_3 \cdot C_9H_5N \cdot CO_2H$	XXII-86	187.19
5531	6-carboxylic acid	(2;6)	$CH_3 \cdot C_9H_5N \cdot CO_2H$	XXII-87	187.19
5532	8-carboxylic acid	(2;8	$CH_3 \cdot C_9H_5N \cdot CO_2H \cdot 1\frac{1}{2}H_2O$	XXII-87	214.21
5533	**Quinaldinic acid**	quinoline-2-carboxylic acid	$C_9H_6N \cdot CO_2H \cdot 2H_2O$	XXII-71	209.20
5534	**Quinazoline**	....	$C_6H_4 \cdot \underbracket{CH:N \cdot CH:N}$	XXIII-175	130.14
5535	**Quinhydrone**	....	$C_6H_4O_2 \cdot C_6H_4(OH)_2$	VII-617	218.20
5536	**Quinic acid** (*l*)	....	$(HO)_4C_6H_7 \cdot CO_2H$	X-535	192.17
5537	**Quininic acid** (6;4)	6-MeO-cinchoninic acid	$CH_3O \cdot C_9H_5N \cdot CO_2H$	XXII-234	203.19
5538	**Quinoline**	leucoline	C_9H_7N	XX-339	129.15
5539	ethiodide	....	$C_9H_7N \cdot (C_2H_5I)$	XX-353	285.13
5540	**Quinoline** (*iso*)	....	C_9H_7N	XX-380	129.15

Pyromucyl chloride 3344
Pyroracemic acid 5525
Pyroracemic aldoxime 4873
Pyrosal 566
Pyrotritaric acid 6396

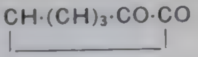
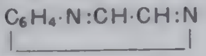
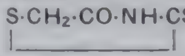
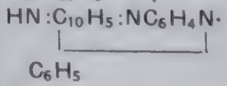
Pyroxanthin 2258
Pyrrodiazole 6080
Pyrrolidine carboxylic acid 5335
Pyrrolidone 3936
Quebrachine, cf. alkd.

Quercetin 5807
Quercetin methyl ether 5556
Quercimelin, cf. glcde.
Quercitol 1608
Quercetrin, cf. glcde.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5506	rhb./aq.	....	249-50 d. (anh.)	$-H_2O$, 115-20	$18^{°}$; s. h.	sl. s.	i.; i. bz.
5507	tri.	....	243	....	s. aq. a.	sl. s. h.	i.; i. bz.
5508	pl./aq. H_2SO_4	....	227 d. (anh.)	subl. d.	v. sl. s.	sl. s.	sl. s.
5509	pl. or lf.	....	d. 261 (anh.)	$-H_2O$, 115	s. h.	....	....
5510	col. nd.	....	160 d.	subl. in vac.	s.; s. act.	s.; sl. s. $CHCl_3$	sl. s.
5511	col. pr.	....	209-10 d.	subl. in vac.	22	1.1	sl. s.; sl. s. act.
5512	cr./chl. lg.	....	103-5	....	s.	s.	s.
5513	cr.	....	20-2	123-4	∞	s.	s.
5514	yel. mn.	....	268-9*	subl.	i.; s. c. H_2SO_4	v. sl. s. c.	v. sl. s.; s. ac.
5515	mn./aq.	....	55-6	262.7	$1.8^{13°}$	s.	s.
5516	wh. cr. pd.	....	164-5	....	i.	s.	d. aq. alk.
5517	rhb.	$1.099^{75°}_{75}$	47	241	s. bz.	v. s.	v. s.
5518	cr.	$1.190^{40.3°}$	32.5	215-7	v. sl. s.	s.	v. s.
5519	gn. pd.	....	....	....	s.	sl. s.	i.
5520	tri.	1.411	111-2	....	$66^{20°}$	v. s.	v. s.
5521	lq.	$0.948^{20°}_{4}$	....	131	i.; i. alk.	s.; s. bz.	s.
5522	mn.	....	192 sl. d.	d. 208.5	s.	s.	s.
5523	lq.	$0.852^{22.5°}$	....	87.5-8.5	∞	∞; ∞ chl.	∞
5524	lq.	$0.910^{20°}_{4}$	....	90-1	v. s.	∞	∞
5525	col. lq.	$1.267^{20°}_{4}$	13.6 ±	165 sl. d.	∞	∞	∞
5526	pl./al.	....	124-5	subl. 100	v. s.	s.	sl. s. c. bz.
5527	lq.	$0.975^{20°}_{4}$	....	93	....	....	....
5528	nd./al. or bz.	....	235-8 d.	....	i.	v. sl. s.	v. sl. s.
5529	yel. nd./aq.	....	244-6 d.	subl. d.	sl. s.; s. h. ac.	sl. s.; i. h. chl.; s. a.	sl. s.; i. pet.
5530	nd./al.	....	285 d.	subl. d.	v. sl. s.	s.; s. h. a.	i.; i. bz.
5531	nd./al.	....	259-61	subl. d.	v. sl. s. h.	s. h.	....
5532	nd./aq.	....	151	....	v. s. h.	s.; s. a.	s. alk.
5533	nd./aq.	....	156 (anh.)	$-H_2O$, 100	s. h.; s. alk.	s.	s. h. bz.
5534	pl./pet.	....	48.0-8.5	243^{773mm}	v. s.	s.	s.
5535	red brn. rhb.	$1.401^{20°}$	171	subl. sl. d.	s. h.; s. NH_4OH	s.	s.; d. chl.
5536	mn./aq.	1.637	162-3	d.	$40^{9°}$	s.; s. ac.	v. sl. s.
5537	yel. pr./aq. HCl	....	280 d.	....	v. sl. s. c.; s. alk.	1.2 h. abs.; s. a.	v. sl. s.; v. sl. s. bz.
5538	hyg. lq.	$1.095^{20°}$	−15	237.1^{747mm}	6	∞	∞; s. CS_2
5539	yel. mn./al.	....	159-60	....	$301^{25°}$	$1.8^{25°}$ chl.	i.; s. al.
5540	pl.	$1.099^{21°}_{4}$	24.6	240.5^{763mm}	sl. s.	....	s. a.

* Sealed tube.

Quercitrinic acid, cf. glcde.
Quinaldic acid 5533
Quinaldine 4367
Quinaldine ethiodide 4368
Quinalizarin 5801
Quinanisole 4083
Quinazine 5548
Quinicine, cf. alkd.
Quinidine, cf. alkd.
Quinine, cf. alkd.
Quinizarin 2299
Quinizarin amide 327
Quinoform, cf. alkd.
Quinol 2314
Quinoline blue 1580
Quinoline carboxylic acid 5533
Quinolinic acid 5497

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5541	**Quinone** (*o*)	*o*-benzoquinone	 $CH\cdot(CH)_3\cdot CO\cdot CO$	VII-600	108.09
5542	**Quinone** (*p*)	quinone	$CO:(CH:CH)_2:CO$	VII-609	108.09
5543	chlorimide (1,4)	....	$O:C_6H_4:N\cdot Cl$	VII-619	141.56
5544	dichlordiimide (*p*)	....	$Cl\cdot N:C_6H_4:N\cdot Cl$	VII-621	175.02
5545	dioxime (*p*)	....	$HO\cdot N:C_6H_4:N\cdot OH$	VII-627	138.12
5546	monoxime (*p*)	*p*-nitrosophenol tautomer	$O:C_6H_4:N\cdot OH$ or $HO\cdot C_6H_4\cdot NO$	VII-622	123.11
5547	monoxime Na	(sodium salt)	$NaO\cdot C_6H_4\cdot NO\cdot 2H_2O$	VII-624	145.10
5548	**Quinoxaline**	quinazine	 $C_6H_4\cdot N:CH\cdot CH:N$	XXIII-176	130.14
5549	**Raffinose**	melitose	$C_{18}H_{32}O_{16}\cdot 5H_2O$	....	594.52
5550	**Resacetophenone**	2,4-diOH-acetophenone	$(HO)_2C_6H_3\cdot COCH_3$	VIII-266	152.14
5551	**Resazurin**	"azoresorcin"	$C_{12}H_7O_4N$	XXVII-128	229.18
5552	**Resorcinol** diacetate	(1,3)	$C_6H_4(O_2C\cdot CH_3)_2$	VI-816	194.18
5553	dibenzoate	(1,3)	$C_6H_4(O_2C\cdot C_6H_5)_2$	IX-131	318.31
5554	**Resorufin**	9-OH-isophenoxazone	$HO\cdot C_{12}H_6ON:O$	XXVII-128	213.18
5555	**Retene**	1-Me-7-isoPr-phenanthrene	$C_{18}H_{18}$	V-683	234.32
5556	**Rhamnetin**	quercetin-7-Me-ether	$C_{16}H_{12}O_7$	XVIII-245	316.26
5557	**Rhamnitol**	rhamnite	$CH_3\cdot C_5H_{11}O_5$	I-532	166.17
5558	**Rhamnose** (*β*)	isodulcite	$C_6H_{12}O_5\cdot H_2O$	I-870	182.17
5559	phenylhydrazone	....	$C_6H_{12}O_4:N\cdot NHC_6H_5$	XV-216	254.28
5560	**Rhodanine**	rhodanic acid	 $S\cdot CH_2\cdot CO\cdot NH\cdot CS$	XXVII-242	133.18
5561	**Rhodeose**	....	$C_5H_{11}O_4\cdot CHO$	I-876	164.16
5562	**Rhodoxanthin**	....	$C_{40}H_{50}O_2$	XXX-101	562.80
5563	**Riboflavin**	vitamin B_2 or G	$C_{17}H_{20}O_6N_4$	....	376.36
5564	**Ribose** (*d*)	....	$C_4H_9O_4\cdot CHO$	I-859	150.13
5565	phenylhydrazone (*l*)	....	$C_5H_{10}O_4:N\cdot NHC_6H_5$	XV-215	240.25
5566	**Ricinelaidic** acid	....	$C_{18}H_{34}O_3$	III-388	298.45
5567	sodium salt†	....	$C_{17}H_{33}O\cdot CO_2Na$	....	320.44
5568	**Ricinoleic acid**	....	$C_{18}H_{34}O_3$	III-385	298.45
5569	**Ricinstearolic acid**	....	$C_6H_{13}CHOHCH_2C\vdots C\cdot C_7H_{14}CO_2H$	III-391	296.44
5570	**Rosaniline** (3-Me; 4,4′,4″-NH_2)	fuchsine carbinol base	$(CH_3\cdot C_6H_3NH_2)\cdot COH(C_6H_4NH_2)_2$	XIII-763	319.39
5571	hydrochloride	fuchsine	$C_{20}H_{20}N_3Cl\cdot aq.$	XIII-765	337.84
5572	**Rosinduline**	....	 $HN:C_{10}H_5:NC_6H_4N\cdot C_6H_5$	XXV-348	321.36
5573	**Rosolic acid**‡	4,4′-diOH-3-Me-fuchsone	$C_{20}H_{16}O_3$	VIII-365	304.33

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† Usually a mixture of salts of fatty acids from castor oil. ‡ See also No. 593.

Quinone-imide-oxime 4875
Quinophan 5234
Quinophenol 3825
Quinosol 3827
Quinotol 1386
Quinotoxine, cf. alkd.
R acid 4491
Racemic acid 5690
Ratanhin 4405
Redoxon 586
Resazoin 5551
Resorcin yellow 2308
Resorcine 2313
Resorcinol 2313
Resorcinol blue 3938
Resorcinol diethyl ether 2092
Resorcinol dimethyl ether 2407
Resorcinol ethyl ether 2928
Resorcinol methyl ether 4080
Resorcinol monacetate 114
Resorcinol phthalein 3250
Resorcinol phthalin 3254
Resorcyl aldehyde (*β*) 2310
Resorcylic acid 2316, 2318, 2320

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5541	red pr.	....	d. 60-70	....	v. s. act.	i. pet.	sl. s.
5542	yel. mn./aq.	$1.318^{20^\circ}_{4}$	115.7	subl.	v. sl. s. c.	s.; s. h. lg.	s.
5543	yel. lq.	....	85-6	expl.	s. h.	s.	s.; s. a.
5544	nd./aq.	....	126 d.	....	v. sl. s. h.	v. s. h.	v. s.
5545	col. or yel.	....	d. 240 ±	....	v. sl. s. aq. NH_4OH	s. conc. NH_4OH	....
5546	lt. yel. rhb.	....	124-6	d. 144	s. h.	v. s.	v. s.
5547	red nd./al.	....	$-2H_2O$, 100	....	v. s.	s.; s. act.	i.
5548	cr.	$1.133^{48^\circ}_{4}$	29-30	225-6	s. c.; sl. s. h.	∞	∞; ∞ bz.
5549	cr./aq.	1.465^{0°	87 partly; 118-9 (anh.)	$-H_2O$, 110	14.3^{20°; ∞ h.	0.1^{20°	....
5550	col. cr.	1.18^{141°	144-6	d.	i.; s. pyr.	s. h.; s. ac.	i.; i. bz.
5551	gn. red/ac.	....	d.	....	i.	sl. s.	i.; i. alk.
5552	lq.	....	....	278 sl. d.	....	....	....
5553	pl./al.	....	117	....	....	5^{18° abs.	....
5554	brn./HCl	....	....	....	i.; s. alk.	v. sl. s.	i.
5555	lf./al.	1.13^{16°	98-9	390-4	i.; s. bz.	69 h.; s. CS_2	v. s. h.
5556	yel. n.d/al.	....	>300	....	v. sl. s. h.	s. h.	s. alk.
5557	tri.	....	121	....	v. s.; sl. s. act.	v. s.; sl. s. chl.	v. sl. s.
5558	col. mn.	$1.471^{20^\circ}_{4}$	126	....	60.8^{21°	54 Me al.	i.
5559	col. lf.	....	159	....	1.25^{15°	....	i.
5560	pa. yel. pr./al.	....	168-70 d.	....	0.2^{25°; s. h.; s.alk.	v. s.; s. NH_4OH	v. s.
5561	nd.	....	144	....	v. s.	v. sl. s.	....
5562	b. bl. lf./bz. Me al.	....	219	....	i.; sl. s. bz.	v. sl. s.; sl. s. chl.	s. pyr.; i. pet.
5563	or. yel. nd.	....	286 d.	....	0.3^{25°	i. abs.	i.; s. pyr.
5564	pl./abs. al.	....	87	....	s.	sl. s.	....
5565	col. cr.	....	154-5 sl. d.	....	v. s.	....	....
5566	nd./al.	....	53	$240\text{-}2^{10mm}$	....	v. s.	v. sl. s. pet.
5567	wh. yel. pd.	....	....	....	s.	s.	....
5568	lq.	0.954^{16°	4-5	$226\text{-}8^{10mm}$	i.	∞; ∞ chl.	∞
5569	nd./al.	....	53	260^{10mm}	....	s.	s.
5570	col. nd./aq.	....	186 d.	....	v. sl. s.; s. a.	sl. s.	i.
5571	gn. red	1.22	d. > 200	....	0.3	s.	i.; s. HCl
5572	brn. nd./et.	....	198-9	....	i.	s.	s.; s. bz.
5573	red lf.	....	308-10 d.	d.	0.12^{25°	v. s. h.	sl. s.; s. alk.

Rhamnin, cf. glcde.
Rhamnite 5557
Rhamnocitrin (β) 5556
Rhamnoxanthin, cf. glcde.
Rheadin, cf. alkd.
Rheic acid 2306
Rhein 2306
Rho acid 553
Rhodalline 221
Rhodamine-B 5766
Rhodanic acid 5560
Rhodeoretin, cf. glcde.
Rhodinal 1518
Rhodinol 1519
Rhodol 4117
Rhoeadine, cf. alkd.
Rhubard yellow 2306
Ricidine, cf. alkd.
Ricinine, cf. alkd.
Robinin, cf. glcde.
Rodinal 349
Rongalite-C 3295
Rosolic acid (*p*) 593
Rubeanic acid 2821
Ruberythric acid, cf. glcde.
Rubiadin glucoside, cf. glcde.
Rubianic acid, cf. glcde.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5574	**Rotenone**	....	$C_{23}H_{22}O_6$	....	394.41
5575	**Rufigallic acid**	1,2,3,5,6,7-hexa-OH-anthraquinone	$C_{14}H_2O_2(OH)_6$	VIII-567	304.20
5576	**Sabinene**	....	$C_{10}H_{16}$	V-143	136.23
5577	**Saccharic acid** (*d* or *l*)	....	$(CHOH)_4(CO_2H)_2$	III-577	210.14
5578	***iso*-Saccharic acid**	....	$(CHOH\cdot CH\cdot CO_2H)_2O$	....	192.12
5579	**Saccharin**	*o*-benzoyl sulfimide	$\underbrace{C_6H_4\cdot CO\cdot NH\cdot SO_2}$	XXVII-168	183.18
5580	soluble	(sodium salt)†	$C_7H_4O_3NSNa\cdot 2H_2O$	XXVII-170	241.20
5581	**Safrole**	3,4-methylenedioxy-allylbenzene	$CH_2O_2{:}C_6H_3\cdot CH_2\cdot CH{:}CH_2$	XIX-39	162.18
5582	***iso*-Safrole**	3,4-methylenedioxy-propenylbenzene	$CH_2O_2{:}C_6H_3\cdot CH{:}CH\cdot CH_3$	XIX-35	162.18
5583	**Salicyl-**acetic acid	....	$C_6H_4(OCH_2CO_2H)\cdot CO_2H$	X-69	196.15
5584	aldehyde triacetate	acetylsalicylaldehyde diacetate	$C_6H_4CH{:}(O_2CCH_3)_2\cdot O_2C\cdot CH_3$	VIII-45	266.24
5585	salicylic acid	disalicylic acid; salysal; diplosal	$HO\cdot C_6H_4\cdot CO_2\cdot C_6H_4\cdot CO_2H$	X-84	258.22
5586	**Salicylidene-**acetamide	....	$HO\cdot C_6H_4\cdot CH{:}N\cdot CO\cdot CH_3$	VIII-47	163.17
5587	benzamide	....	$HO\cdot C_6H_4\cdot CH{:}N\cdot CO\cdot C_6H_5$	IX-212	225.24
5588	*p*-phenetidine	malakin	$HO\cdot C_6H_4\cdot CH{:}N\cdot C_6H_4\cdot OC_2H_5$	XIII-458	241.28
5589	2-thiohydantoin	5-(2-hydroxybenzal)-2-thiohydantoin	$HO\cdot C_6H_4\cdot CH{:}C_3H_2ON_2S$	*XXV-502	220.24
5590	**Salipyrine**	antipyrene salicylate	$C_{18}H_{18}O_4N_2$	XXIV-32	326.34
5591	**Salyrgan**	mersalyl	$C_{13}H_{16}O_6NHgNa$	....	505.87
5592	**Salvarsan** (1-As;3-NH_2; 4-OH)	arsphenamine; "606"	$({:}As\cdot C_6H_3(OH)NH_2\cdot HCl)_2\cdot 2H_2O$	*XVI-507	475.01
5593	**Salvarsan** (neo)	neoarsphenamine; novarsenobenzol	$NH_2(OH)C_6H_3As{:}As\cdot C_6H_3(OH)NH\cdot CH_2OSONa$‡	*XVI-508	466.13
5594	**Santalic acid**	....	$C_{15}H_{14}O_5$	....	274.26
5595	**Santalol** (α)	arheol	$C_{15}H_{24}O$	VI-558	220.34
5596	**Santylyl salicylate**	santyl	$HO\cdot C_6H_4\cdot CO_2\cdot C_{15}H_{23}$	X-80	340.44
5597	**Santonic acid**	....	$C_{15}H_{20}O_4$	X-804	264.31
5598	**Santonin**	santoninic anhydride	$C_{15}H_{18}O_3$	XVII-499	246.29
5599	**Santoninic acid**	....	$C_{15}H_{20}O_4$	X-962	264.31
5600	**Sarcosine**	*N*-methyl glycine	$CH_3NH\cdot CH_2\cdot CO_2H$	IV-345	89.09
5601	hydrochloride	....	$C_3H_7O_2N\cdot HCl$	IV-345	125.56
5602	**Sarsasapogenin,** pseudo	pseudo-smilagenin	$C_{27}H_{44}O_3$	....	416.62
5603	**Schonberg's reagent**	benzylimido-di-(4-methoxyphenyl) methane	$(CH_3O\cdot C_6H_4)_2C{:}N\cdot CH_2\cdot C_6H_5$	....	331.40

† Usually with 5% H_2O. ‡ Contains also solvent and inorganic salts.

Rubiazol 5337
Rufiopin 5799
Rufol 2293
Rumpff acid 4512
Rutaecarpine, cf. alkd.
Rutin, cf. glcde.
Rutylidene 6382

S acid 339, 344
Sα acid 4533
Sacchar(in)ol 5579
Saccharinose 5579
Safranone 670
Salamid 3738
Salazolon 5590

Salicin, cf. glcde.
Salicoyl-phenol 2323-5
Salicoyl-resorcinol 6225
Salicyl-acetophenone 3763
Salicyl alcohol 3750
Salicyl aldehyde 3733
Salicyl-aldehyde ethyl ether 2914

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5574	pl./al.	....	163	....	i.; s. chl.	sl. s.; s. act.	sl. s.; v. s. pet.
5575	red cr.	....	subl. sl. d.	....	i.; s. H_2SO_4	v. sl. s.; s. alk.	v. sl. s.
5576	lq.	$0.848^{15°}_{15}$	....	164-5	i.	∞	∞
5577	nd./al.	....	125-6	d. lactone	v. s.	v. s.	i.
5578	rhb.	....	185	d.	s.	s.	v. sl. s.
5579	mn./act.	....	225-8 sl. d.	subl. 300 in vac.	$0.4^{25°}$; sl. s. h.	3.1 c.; sl. s. chl.	1.05 c.; s. alk. carb.
5580	col. pd.	....	....	....	83	2.2	....
5581	col. mn.	$1.100^{20°}_{4}$	11.2	233-4	i.	s.	∞; ∞ chl.
5582	col. lq.	$1.122^{20°}_{4}$	6-7	252-3	i.	∞	∞; ∞ bz.
5583	nd./aq.	....	191-2	....	s. h.	s.; s. act.	s.; s. ac.
5584	nd. or pl./al.	....	103-4	....	i.	s. h.; s. CCl_4	s.; s. bz.
5585	col. cr./bz. or chl.	....	148-9	d.	i.; $1^{25°}$ bz.	$45^{25°}$; $66^{25°}$ act.	$28^{25°}$; v. s. CCl_4
5586	yel. pd.	....	d. > 150	....	i.; i. alk. carb.	i. alk.	s. conc. H_2SO_4
5587	yel. pd.	....	d. 190	....	v. s. act.*	s.; s. alk.	i.; v. sl. s. bz.
5588	pa. yel. cr./al.	....	91-2	....	i.	s. h.	s.; s. bz
5589	nd./ac.	....	251-3	....	....	....	....
5590	cr. pd.	....	91-2	....	$0.5^{15°}$; $4^{100°}$	s.; v. s. chl.	sl. s.
5591	delq. wh.	....	....	....	100	35	i.
5592	yel. pd.	....	....	....	s.	sl. s.	v. sl. s.
5593	yel. pd.	....	....	....	s.; d. by heat, air, light.	sl. s.; v. s. gly.	i.; i. chl.; sl. s. act.
5594	red pr.	....	104	....	i.; s. alk.	∞ abs.	s.
5595	col. oil	$0.977^{25°}_{25}$	....	300 ±	i.	s.	....
5596	yel. oil	1.07	....	126.6^{20mm}	i.	s.	s.
5597	col. rhb./aq.	$1.251^{20°}_{4}$	170-2	285^{15mm}	$0.56^{17°}$	s.	s.; s. chl.
5598	col. pr.	1.187	169-70	....	$0.02^{17.5°}$; $0.4^{100°}$	$2.3^{22.5°}$; $37^{80°}$	$1.3^{17.5°}$; $2.4^{40°}$
5599	rhb. pl./al.	....	$-H_2O$, 120	....	s. h.	s.; s. chl.	sl. s.
5600	rhb.	....	210-5 d.	....	v. s.	sl. s.	....
5601	nd./al.	....	170-2	....	v. s.	v. sl. s.	v. sl. s.
5602	nd./act.	....	171-3	....	sl. s.	s.	s.; s. ac.
5603	pa. yel. cr./abs. al.	....	93	....	i.; sl. s. pet.	s. h.	sl. s.

* Also a modification insoluble in act.

Salicyl-aldehyde glucose, cf. glcde.
Salicyl-aldoxime 3736
Salicyl-amide 3738
Salicyl-anilide 3741
Salicyl-phenol 2323-5
Salicylic acid 3742
Salicylic methyl ether 4067
Salicylic nitrile 3748
Salicylic phenyl ether 5133
Salicylic sulfonic acid 5681
Salicylide 3747
Salicyl(oyl)-resorcinol 6225
Saliformin 3602
Saligenin 3750
Saligenin methyl ether 4072
Saligenol 3750
Salimenthol 4031
Salinigrin, cf. glcde.
Salipyrazolon 5590
Salit 866
Salmester 4078
Salocol 5117
Salol 5235

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5604	**Scopoletin**	7-OH-6-MeO-coumarin	$C_{10}H_8O_4$	XVIII-99	192.16
5605	**Sebacic** acid	decandioic acid	$(CH_2)_8(CO_2H)_2$	II-718	202.24
5606	nitrile	....	$(CH_2)_8(CN)_2$	II-720	164.24
5607	**Seleno**-phenol	....	$C_6H_5\cdot SeH$	VI-345	157.07
5608	urea	....	$NH_2\cdot CSe\cdot NH_2$	III-227	123.02
5609	**Semicarbazide**	....	$NH_2\cdot NH\cdot CO\cdot NH_2$	III-98	75.07
5610	hydrochloride	....	$NH_2CON_2H_3\cdot HCl$	III-100	111.54
5611	**Serine** (*dl*)	....	$HO\cdot CH_2\cdot CHNH_2\cdot CO_2H$	IV-512	105.09
5612	**Serine** (*d* or *l*)	....	$C_3H_7O_3N$	IV-505	105.09
5613	*iso*-**Serine** (*dl*)	....	$NH_2\cdot CH_2\cdot CHOH\cdot CO_2H$	IV-503	105.09
5614	*iso*-**Serine** (*d* or *l*)	....	$C_3H_7O_3N$	IV-503	105.09
5615	**Silico**-acetic acid	....	$CH_3\cdot SiO\cdot OH$	IV-629	76.10
5616	benzoic acid	....	$C_6H_5\cdot SiO\cdot OH$	XVI-911	138.17
5617	**Silicon** methyl	....	$(CH_3)_4Si$	IV-625	88.20
5618	phenyl trichloride	....	$C_6H_5\cdot SiCl_3$	....	211.53
5619	tetraethyl	siliconane	$(C_2H_5)_4Si$	IV-625	144.30
5620	**Silver** † fulminate	....	$Ag_2C_2O_2N_2$	I-722	299.80
5621	**Sodium** † acetanilide	....	$CH_3CON(Na)\cdot C_6H_5$	XII-237	157.15
5622	ethyl	....	$C_2H_5\cdot Na$	*IV-618	52.06
5623	glycerolate	....	$NaC_3H_7O_3$	I-511	114.08
5624	mercaptide	....	$C_2H_5\cdot S\cdot Na$	I-341	84.12
5625	**Sorbic acid**	hexadienoic acid	$CH_3(CH:CH)_2CO_2H$	II-483	112.12
5626	**Sozoiodolic** acid	2,6-diiodophenol-4-sulfonic acid	$I_2(OH)C_6H_2\cdot SO_3H\cdot 3H_2O$	XI-245	480.04
5627	Na salt	sozoiodol-sodium	$C_6H_3O_4I_2SNa\cdot 2H_2O$	XI-245	484.01
5628	Hg salt	....	$C_6H_2O_4I_2SHg$	*XI-56	624.59
5629	Zn salt	....	$(C_6H_3O_4I_2S)_2Zn\cdot 6H_2O$	XI-245	1023.44
5630	**Starch** ‡	....	$(C_6H_{10}O_5)_x$	....	(162.14)
5631	**Stearic** acid	octadecanoic acid	$CH_3(CH_2)_{16}CO_2H$	II-377	284.47
5632	ammonium salt	amm. stearate	$C_{17}H_{35}CO_2NH_4$	*II-171	301.50
5633	aldehyde	octadecanal	$CH_3(CH_2)_{16}CHO$	I-718	268.47
5634	amide	stearamide	$C_{17}H_{35}\cdot CO\cdot NH_2$	II-384	283.48
5635	anhydride	....	$(C_{17}H_{35}CO)_2O$	II-384	550.92
5636	anilide	stearanilide	$C_{17}H_{35}CO\cdot NHC_6H_5$	XII-257	359.58
5637	chloride	stearyl chloride	$C_{17}H_{35}\cdot CO\cdot Cl$	II-384	302.92
5638	nitrile	heptadecyl cyanide	$C_{17}H_{35}\cdot CN$	II-384	265.47
5639	**Stearolic acid**	octadecynoic acid	$C_8H_{17}C\vdots C(CH_2)_7\cdot CO_2H$	II-495	280.44
5640	**Stearone**	....	$C_{35}H_{70}O$	I-720	506.91
5641	**Stearoxylic acid**	....	$CH_3(CH_2)_7(CO)_2\cdot (CH_2)_7CO_2H$	III-761	312.44
5642	**Stilbene** (*trans*)	diPh-ethylene	$C_6H_5\cdot CH:CH\cdot C_6H_5$	V-630	180.24
5643	**Stilbene** (*cis*)	diPh-ethylene	$C_6H_5\cdot CH:CH\cdot C_6H_5$	V-633	180.24
5644	**Stovaine** §	benzoyl-EtdiMe-amino-*iso*-propanol HCl	$C_6H_5CO_2C(C_2H_5)\cdot (CH_3)CH_2N(CH_3)_2\cdot HCl$	IX-175	271.78
5645	**Strophanthidin**	....	$C_{23}H_{32}O_6\cdot 2H_2O$	....	440.52
5646	**Styrene**	phenyl-ethylene	$C_6H_5\cdot CH:CH_2$	V-474	104.14

† See also inorganic compounds.

‡ See also No. 3443.

§ Free base, liquid, b. p. 149^{25mm}, s. organic solvents.

Salt of amber 5653
Salysal 5585
Sandoptal 1038
Santoninic anhydride 5598
Santyl 5596
Saponin. cf. glcde.
Saporubrin, cf. glcde.
Sapotoxin, cf. glcde.
Sarcine, cf. alkd.
Sarcolactic acid 3939
Sarsasaponin, cf. glcde.
Satrapol 4117
Saxin 5579
Scammonin, cf. glcde.
Schaeffer acid 4498, 4507
Schollkopf's acid 4543
Scopolamine, cf. alkd.
Secaline, cf. alkd.
Sedatine 565
Sedormid 217
Selenium diphenyl 2749

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5604	nd. or pr.	....	204	subl.	v. sl. s.	s. h.; i. bz.	s. h. ac.
5605	pr./HNO_3	$1.207_{4}^{25^\circ}$	134.5	$294.5^{100\text{mm}}$	0.1 c.; 2 h.	v. s.	v. s.
5606	col. lq.	....	....	$199\text{-}200^{15\text{mm}}$	....	....	....
5607	oil	1.487^{15°	....	183.6	v. sl. s.	v. s. CCl_4	v. s.
5608	pr./aq.	....	200 ± d.	....	10^{19°	3^{18°	0.6^{18°
5609	pr./al.	....	96	....	v. s.	v. s.	i.
5610	pr./aq. al.	....	173 d.	....	v. s.	i. abs.	i.
5611	pr./aq.	....	246 d.	....	4^{20°	i.	i.
5612	col. pr.	....	228 d.	....	33^{25°	i.	....
5613	mn.	....	248	....	1.5^{20° s. h. aq.	v. sl. s.	v. sl. s.
5614	col. cr./aq.	....	199-200 d.	....	25^{0°	....	....
5615	amor. pd.	....	....	....	i.	i. h. aq. Na_2CO_3	s. conc. KOH
5616	glass/et.	....	92	....	i.	s. KOH	s.
5617	lq.	$0.648_{4}^{19^\circ}$	ign. in air	$26\text{-}7^{761\text{mm}}$	i. H_2SO_4	....	....
5618	lq.	$1.326_{4}^{18.8^\circ}$	....	201.5	d.	d.; s. chl.	s.
5619	col. lq.	$0.768_{4}^{22^\circ}$	....	154.7	i.	....	....
5620	wh. nd./aq.	....	....	expl.	0.02^{30°	s.	i. HNO_3
5621	cr. pd.	....	....	....	d. h.	....	....
5622	wh. pd.	....	ign. in air	....	d.	i. bz.	....
5623	wh. pd.	....	d. 245	....	d.	s.	i.; i. CS_2
5624	cr./al.	....	....	....	v. s.; d. h.	v. s.; d. h.	....
5625	nd./aq.	....	134.5	228 d.	s. h.	v. s.	v. s.
5626	col. mn. pr.	....	120 (anh.); d. 190	$-3H_2O$, 100	s.	s.	s.
5627	col. cr.	....	....	....	16	6	i.
5628	or. pd.	....	....	....	0.05^{20°	i.; 13.3 aq. 15% NaCl	i.; s. aq. KI
5629	col. nd.	....	....	....	5	30	i.
5630	wh. amor.	1.50^{21°	d.	....	i.	i.	i.
5631	mn./CS_2	$0.847^{69.3^\circ}$	70-1	$291^{110\text{mm}}$	0.03^{25°; s. bz.; s. act.	2^{20°; 100^{50°	6^{15°; s. CCl_4
5632	waxy	0.89	73-5	d.	v. sl. s.	s. h.	i.; i. bz.
5633	lf.	....	38	$251\text{-}2^{100\text{mm}}$	....	....	s.
5634	col. cr.	....	108-9	$250\text{-}1^{12}$ sl. d.	i.	s. h.	s. h.
5635	col. cr.	$0.855_{4}^{80^\circ}$	72	....	i.; s. chl.	0.02^{20°abs.	0.2^{15°
5636	nd./al.	....	94-5	$153.5^{10\text{mm}}$	i.; s. act.	s.; s. chl.	v. s.; s. bz.
5637	col. cr.	....	23	215^{15} sl. d.	....	....	....
5638	col. cr.	$0.818_{4}^{41^\circ}$	41	$274.5^{100\text{mm}}$	i.	....	....
5639	pr./al.	....	48	260	i.	s. h.	s.
5640	lf./lg.	$0.798_{4}^{89^\circ}$	88.4	$345^{12\text{mm}}$	i.	sl. s. h.	sl. s. h.
5641	yel. pl.	....	86	....	sl. s. lg.	s. h.	s.
5642	mn./al.	$0.970_{13}^{125^\circ}$	124	306-7	i.	0.9^{17° abs.	7.9^{14°
5643	yel. oil	....	1	$145^{13\text{mm}}$	....	....	....
5644	nd./al.	....	175	....	50; 2 chl.	22 abs.	i.; i. act.
5645	lf./aq.	....	170-5*	....	sl. s.; s. bz.	s.; s. chl.	s.; i. pet.
5646	col. lq.	0.906^{20°	−30.6	145.2	v. sl. s.	∞	∞

* Anhyd., m. p. 235°.

Selenium ethyl 2207
Selenium methyl 2553
Semi-naphthalidam 4573
Seminose 3619
Semi-oxamazide 5017
Sennite 4286
Sensitol red 5316
Sheibley's reagent 1967
Siliconenane 5619
Sinalbine, cf. glcde.
Sinapine, cf. alkd.
Sinigrin, cf. glcde.
Sinigroside, cf. glcde.
Six-O-six 5592
Skatole 4284
Skatole-acetic acid 3867
Skatole-carboxylic acid 3865
Smilacin, cf. glcde.
Smilagenin (pseudo) 5602
Sneezing gas 2712
Sobrerone 5320
Sodium acetone bisulfite 64
Solanidine, cf. alkd.
Solanine, cf. alkd.
Solid green base 5762
Solid violet 3353

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5647	**Styrene** dibromide	α,β-diBr-ethylbenzene	$C_6H_5CHBr{\cdot}CH_2Br$	V-356	263.98
5648	oxide	phenylethylene oxide	$C_6H_5{\cdot}\underbrace{CH{\cdot}O{\cdot}CH_2}$	XVII-49	120.14
5649	**Suberic** acid	octandioic acid	$(CH_2)_6(CO_2H)_2$	II-691	174.19
5650	aldehyde	octandial	$(CH_2)_6(CHO)_2$	I-795	142.19
5651	**Succinamic acid**	....	$NH_2{\cdot}CO{\cdot}C_2H_4{\cdot}CO_2H$	II-613	117.10
5652	***iso*-Succinic acid**	methyl-malonic acid	$CH_3{\cdot}CH(CO_2H)_2$	II-627	118.09
5653	**Succinic** acid	butandioic acid	$(CH_2{\cdot}CO_2H)_2$	II-601	118.09
5654	sodium salt	sodium succinate	$C_4H_4O_4Na_2{\cdot}6H_2O$	*II-262	270.16
5655	aldehyde	succinic dialdehyde	$(CH_2{\cdot}CHO)_2$	I-767	86.09
5656	amide	succinamide	$(CH_2{\cdot}CO{\cdot}NH_2)_2$	II-614	116.12
5657	anhydride	....	$(CH_2{\cdot}CO)_2O$	XVII-407	100.07
5658	chloride	succinyl chloride	$(CH_2{\cdot}COCl)_2$	II-613	154.99
5659	*N*-chloroimide	succinchlorimide	$(CH_2{\cdot}CO)_2N{\cdot}Cl$	XXI-380	133.54
5660	imide	succinimide	$(CH_2{\cdot}CO)_2NH$	XXI-369	99.09
5661	nitrile	ethylene dicyanide	$(CH_2{\cdot}CN)_2$	II-615	80.09
5662	peroxide	succinyl peroxide	$(HO_2C{\cdot}C_2H_4{\cdot}CO)_2O_2$	II-613	234.16
5663	**Sucrose**	cane sugar; beet sugar	$C_{12}H_{22}O_{11}$	....	342.30
5664	**Sudan III**	benzene-azo-*p*-benzene-azo-*β*-naphthol	$C_6H_5{\cdot}N{:}N{\cdot}C_6H_4{\cdot}N{:}N{\cdot}C_{10}H_6OH$	XVI-171	352.38
5665	**Sulfa**-diazine	2-sulfanilamido-pyrimidine	$H_2N{\cdot}C_6H_4{\cdot}SO_2{\cdot}NH{\cdot}C_4H_3N_2$	....	250.27
5666	guanidine	sulfanilyl-guanidine	$H_2N{\cdot}C_6H_4{\cdot}SO_2{\cdot}NH{\cdot}C({:}NH){\cdot}NH_2$	....	214.24
5667	pyrazine	2-sulfanilamido-pyrazine	$H_2N{\cdot}C_6H_4{\cdot}SO_2{\cdot}NH{\cdot}C_4H_3N_2$	....	250.27
5668	pyridine	2-sulfanilamido-pyridine	$H_2N{\cdot}C_6H_4{\cdot}SO_2{\cdot}NH{\cdot}C_5H_4N$	....	249.28
5669	pyridine sodium	....	$C_{11}H_{10}O_2N_3SNa$	....	271.27
5670	thiazole	2-sulfanilamido-thiazole	$H_2N{\cdot}C_6H_4{\cdot}SO_2{\cdot}NH{\cdot}C_3H_2NS$	....	255.31
5671	**Sulfamino**-benzoic acid (*o*)	benzoic acid-(*o*)-sulfamide	$NH_2{\cdot}SO_2{\cdot}C_6H_4{\cdot}CO_2H$	XI-376	201.19
5672	benzoic acid (*m*)	....	$NH_2{\cdot}SO_2{\cdot}C_6H_4{\cdot}CO_2H$	XI-386	201.19
5673	benzoic acid (*p*)	....	$NH_2{\cdot}SO_2{\cdot}C_6H_4{\cdot}CO_2H$	XI-390	201.19
5674	**Sulfarsphenamine**	diNa-3,3′-diNH₂-4,4′-diOH-arseno-benzene-*N*-di-methylenesulfonate	$[NaSO_3{\cdot}CH_2{\cdot}HN(OH){\cdot}C_6H_3{\cdot}As{:}]_2$	*XVI-509	598.20
5675	**Sulfo**-acetic acid	....	$HO_3S{\cdot}CH_2CO_2H{\cdot}H_2O$	IV-21	158.13
5676	benzoic acid (*o*)	....	$HO_3S{\cdot}C_6H_4{\cdot}CO_2H{\cdot}3H_2O$	XI-369	256.23
5677	benzoic acid (*m*)	....	$HO_3S{\cdot}C_6H_4{\cdot}CO_2H{\cdot}2H_2O$	XI-384	238.21
5678	benzoic acid (*p*)	....	$HO_3S{\cdot}C_6H_4{\cdot}CO_2H{\cdot}3H_2O$	XI-389	256.23
5679	benzoic anhydride	(1,2)	$C_6H_4(CO)(SO_2){:}O$	XIX-110	184.16
5680	phenyl-3-methyl-5-pyrazolone	(1-*p*-sulfophenyl)	$HO_3S{\cdot}C_6H_4{\cdot}N{\cdot}C_4H_5ON{\cdot}H_2O$	XXIV-44	272.27

Soluble indigo 3858
Solvent-GC 3446
Sonneryl 2999
Sophoretin 5807
Sophorin, cf. glcde.
Sophorine, cf. alkd.
Sorbinose 3620
Sorbite 3611
Sorbitol 3611
Sorbitol hexaacetate 3612
Sorbose 3620
Sozoiodol 5627
Sparteine, cf. alkd.
Spasmine 1790
Spasmodine 789
Spirit blue 516
Spirocid 128
Spiroform 120
Spirosal 3466
Spruce turpentine 1624
Stachydrine, cf. alkd.
Starch, animal 3443
Starch gum 1661
Stearamide 5634
Stearanilide 5636
Stearin 3433
Stearyl alcohol 4939
Stearyl chloride 5637
Stovarsol 128
Stramid 527
Streptocid 527
Streptozon 5337

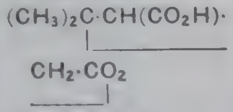
No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5647	cr./al.	....	74-5	$139\text{-}41^{15\text{mm}}$	i.; s. lg.	s.; s. bz.	v. s.
5648	lq.	$1.052_{4}^{16^\circ}$	....	191-2	....	....	s.
5649	nd./aq.	$1.266_{4}^{25^\circ}$	140-4	$279^{100\text{mm}}$	0.14^{16°	s.; i. chl.	0.8^{15°
5650	oil	....	....	230-40 sl. d.	v. s.	....	....
5651	col. nd.	....	157	....	sl. s.	v. sl. s. abs.	i. bz.
5652	col. nd.	1.455	d. 120-35	....	66^{20°	v. s.	v. s.
5653	col. mn.	$1.572_{4}^{25^\circ}$	189-90	$235(-H_2O)$	6.8^{20°; 121^{100°	9.9^{15°	1.2^{15°
5654	wh. pd.	....	$-6H_2O$, 120	....	2 c.	v. sl. s.	87^{75° aq.
5655	lq.	$1.069_{4}^{18^\circ}$	....	169-70 sl. d.	s.	s.	s.
5656	col. nd.	....	242-3	....	0.5^{15°; 11^{100°	i. abs.	i.
5657	col. cr.	1.503	119.6	261	v. sl. s.	v. sl. s. pet.	sl. s.
5658	col. cr.	$1.395_{4}^{20^\circ}$	18.5	192-3	d.	d.; s. bz.	i. pet.
5659	rhb./bz.	1.65	148	....	s. d.	0.9	sl. s.
5660	cr./act.	1.412^{16°	125-6	287-8	v. s.	s.; i. chl.	v. sl. s.
5661	col.	$0.985_{4}^{63^\circ}$	54.5	265-7	v. s.	v. s.	sl. s.
5662	col. pl.	....	128 d.	....	33	s.; s. act.	sl. s.; i. bz.
5663	col. mn.	1.588^{15°	170-86 d.	....	$*179^{0^\circ}$	0.9	i.
5664	brn. lf./ac.	....	195	....	i.; i. alk.; s. xylene	sl. s.; s. H_2SO_4	s.; s. oil; s. chl.
5665	col. mn./aq.	....	255-6	....	0.012^{37°	sl. s.	i.
5666	col. mn./aq.	....	189-90	....	0.19^{37°	sl. s.	i.
5667	col. cr.	....	255-7 d.	....	$\dagger 0.005^{17^\circ}$	....	....
5668	col. pr./aq.	....	191-2	....	<0.03 c.; 0.05^{37°	25; v. s. aq. HCl	sl. s.; v. s. alk.
5669	col. cr./al.	....	317 d.	....	63^{25°	11	....
5670	brn./75% al.	....	201-2	....	0.09^{37°	....	....
5671	rhb./al.	....	165-7	....	s.	s.	s.
5672	pl./aq.	....	237-8	....	v. sl. s. c.	s.	sl. s.
5673	pr./aq.	....	d. 280	....	sl. s. h.	v. sl. s. bz.	....
5674	yel. pd.	....	....	....	v. s.	v. sl. s.	....
5675	hyg. cr.	....	84-6	245 d.	s.	s.; i. chl.	i. abs.
5676	cr./aq.	....	68-9‡	$-3H_2O$, 105	v. s.	v. s.	i.
5677	delq. cr.	....	98‡	....	s.	s.; i. bz.	anh. s.
5678	nd./aq.	....	94	m. anh. 260	s.	s.	anh. s.
5679	col. cr./bz.	....	128-9	$184\text{-}6^{18\text{mm}}$	s. h.	s. chl.	s.; s. bz.
5680	nd./aq.	....	d. 320	$-H_2O$, 120	0.5^{20°	v. sl. s. abs.	i.; v. s. alk.

* See also special table of solubility in water.

† Sodium salt very soluble in aq.

‡ Anhydrous crysts., m. p. 141°.

Strophanthin, cf. glcde.
Strychnine, cf. alkd.
Styphnic acid 6312
Stypticin, cf. alkd.
Styptol, cf. alkd.
Styracin 1508
Styracol 3485
Styrone 1507
Styryl carbinol 1507
Suberane 1596
Suberene 1598
Suberone 1597
Succinamide 5656
Succinimide 5660
Succin-chlorimide 5659
Succinyl chloride 5658
Succinyl peroxide 5662
Sucrol 5112

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Sulfo				
5681	salicylic acid (5)	. . . .	$HO_3S{\cdot}C_6H_3(OH)CO_2H$	XI-411	218.18
5682	salicylic Na	(Na acid salt)	$C_7H_5O_6SNa{\cdot}2H_2O$	XI-412	276.20
5683	**Sulfonal**	acetone diethyl-sulfone	$(CH_3)_2C(SO_2{\cdot}C_2H_5)_2$	I-662	228.32
5684	**Sylvestrine** (*d* or *l*)	. . . .	$C_{10}H_{16}$	V-125	136.23
5685	**Synthalin**	decamethylene-di-guanidine di-HCl	$[H_2N{\cdot}C(:NH)NH{\cdot}(CH_2)_5]_2{\cdot}2HCl$	**IV-712	329.32
5686	**Syringic acid**	gallic acid-3,5-dimethyl ether	$HO(CH_3O)_2{\cdot}C_6H_2{\cdot}CO_2H$	X-480	198.17
5687	**Tannin**	digallic acid	$(HO)_3C_6H_2{\cdot}CO_2{\cdot}C_6H_2(OH)_2CO_2H$	. . . .	322.22
5688	**Tartaric** acid (meso)	*i*-tartaric acid	$(CHOH{\cdot}CO_2H)_2$	III-528	150.09
5689	Ca salt (meso)	Ca meso-tartrate	$C_4H_4O_6Ca{\cdot}3H_2O$	III-529	242.20
5690	acid (*racemic*) (*dl*)	"traubensaure"	$(CHOH{\cdot}CO_2H)_2{\cdot}H_2O$	III-522	168.10
5691	acid (*d* or *l*)	"weinsaure"	$(CHOH{\cdot}CO_2H)_2$	III-481	150.09
5692	amide (*d*)	tartramide	$(CHOH{\cdot}CONH_2)_2$	III-520	148.12
5693	**Tartramidic acid**	. . . .	$NH_2{\cdot}CO{\cdot}(CHOH)_2{\cdot}CO_2H$	III-520	149.10
5694	**Tartrazine**	hydrazine yellow	$C_{16}H_9O_9N_4S_2Na_3$	XXV-252	534.38
5695	**Tartronic acid**	hydroxymalonic acid	$HO{\cdot}CH(CO_2H)_2{\cdot}\frac{1}{2}H_2O$	III-415	129.07
5696	**Taurine**	. . . .	$NH_2{\cdot}CH_2{\cdot}CH_2{\cdot}SO_3H$	IV-528	125.14
5697	**Taurocholic acid**	cholaic acid	$C_{26}H_{45}O_7NS{\cdot}H_2O$	. . . .	533.70
5698	Na salt	. . . .	$C_{26}H_{44}O_7NSNa$	. . . .	537.68
5699	**Tephrosin**	hydroxy-deguelin	$C_{23}H_{22}O_7$	. . . .	410.41
5700	**Teraconic acid**	γ-di Me-itaconic acid	$(CH_3)_2C{:}C(CO_2H){\cdot}CH_2{\cdot}CO_2H$	II-786	158.15
5701	**Terebic acid**	terebinic acid	 $(CH_3)_2C{\cdot}CH(CO_2H){\cdot}CH_2{\cdot}CO_2$	XVIII-377	158.15
5702	**Terpenylic acid** (*dl*)	terpenolic acid	$C_8H_{12}O_4{\cdot}H_2O$	XVIII-385	190.19
5703	**Terpin hydrate** (*cis*)	. . . .	$C_{10}H_{20}O_2{\cdot}H_2O$	VI-745	190.28
5704	**Terpinene** (α)	*p*-menthadiene (1,3)	$C_{10}H_{16}$	V-126	136.23
5705	**Terpinene** (β)	*p*-menthadiene (3,1)(7)	$C_{10}H_{16}$	V-132	136.23
5706	**Terpinenol**-4 (*d*)	terpenol	$C_{10}H_{18}O$	VI-55	154.24
5707	**Terpineol** (α)(*d* or *l*)	. . . .	$C_{10}H_{18}O$	VI-56	154.24
5708	**Terpineol** (α)(*dl*)	. . . .	$C_{10}H_{18}O$	VI-58	154.24
5709	**Terpinolene**	*p*-menthadiene (1,4)(8)	$C_{10}H_{16}$	V-133	136.23
5710	**Terpinyl acetate** (α)	(*dl*)	$C_{10}H_{17}{\cdot}O_2C{\cdot}CH_3$	VI-60	196.28
5711	**Testerone** (*trans*)	. . . .	$C_{19}H_{28}O_2$	. . . .	288.41
5712	**Testerone** (*cis*)	. . . .	$C_{19}H_{28}O_2$	. . . .	288.41
5713	**Tetraamino**-3,3′-**dimethyl-diphenylmethane**	(4,6,4′,6′-tetraNH₂)	$[CH_3(NH_2)_2C_6H_2]_2{:}CH_2$	XIII-342	256.34
5714	**Tetrabromo**-aniline	(2,3,4,6)	$Br_4C_6H{\cdot}NH_2$	XII-668	408.76
5715	benzene (1,2,3,5)	. . . .	$Br_4C_6H_2$	V-214	393.74

Sudan-G 662 or 5664
Sugar 1602-3, 1608, 3616-20, 3947, 4007, 5549, 5558, 5561, 5663-4, 6054, 6480
Sugar, acid of 5006-7
Sulamidyl 527
Sulfaldehyde 5879-81
Sulfanilamide 527
Sulfanilamido-pyrazine 5667
Sulfanilamido-pyrimidine 5665
Sulfanilamido-thiazole 5670
Sulfanilic acid 525
β-Sulfanilic acid 559
Sulfanilic acid diazide 1771
Sulfanilyl-aminopyridine 5668

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5681	hyg.nd./aq.	....	120d.(anh.)	....	s.	s.	s.
5682	col. cr.	....	....	....	3.3	i.	....
5683	pr./al.	$1.183^{132°}_{4}$	127-8	300 sl. d.	$0.2^{15°}$	$1.5^{15°}$; s. bz.	$0.7^{15°}$; s. chl.
5684	lq.	$0.863^{20°}_{4}$	....	176-7	....	....	....
5685	cr./al. et.	....	193	....	s.	....	....
5686	nd./aq. or et.	....	204-5	....	v. sl. s.	s.; s. chl.	s.
5687	amor. pd.	....	200 d.	....	s.	sl. s. abs.	i. abs.
5688	cr.	**1.737**	159-60	....	$120^{15°}$	....	....
5689	cr./aq.	....	$-3H_2O$, 170	....	0.17 h.	0.03^{18} ac.	$0.09^{100°}$ ac.
5690	tri.	$1.697^{20°}_{4}$	205-6	$-H_2O$, 100	$20.6^{20°}$; $185^{100°}$	$2^{0°}$	0.09
5691	mn.	$1.760^{20°}_{4}$	168-70	d.	$139^{20°}$; $343^{100°}$	$25^{15°}$ abs.	$0.4^{15°}$
5692	rhb.	....	195 d.	....	i. bz.	$0.04^{12°}$	i.
5693	rhb./aq.	....	171-2	....	....	....	....
5694	or. yel. pd.	....	....	....	v. s.	i.	....
5695	col. pr./aq.	....	d. 155-8; $-\frac{1}{2}H_2O$,60	subl. 110	v. s.	v. s.	i.; anh. s.
5696	....	....	>240 d.*	....	$6.4^{12°}$	$0.004^{17°}$	i.
5697	delq. nd.	....	125 ±, d.	....	d. h.	s.	v. sl. s.
5698	yel. pd.	....	....	....	v. s.	v. s. h.	sl. s.
5699	col. pr.	....	198	....	i.	s. act.	s.; s. chl.
5700	tri./et.	....	160-1 d.	....	v. s. h.	v. s.	sl. s.; v. sl. s. bz.
5701	mn./al.	$0.815^{24°}_{4}$	174-5	....	s. h.	s.	$1.7^{10°}$
5702	col. cr./aq.	....	56; 90 (anh.)	subl. 130	s. h.	....	....
5703	rhb.	....	$-H_2O$ > 117	....	$0.4^{15°}$; 3.3 h.	$10^{15°}$; 50 h.	$1^{15°}$; $0.5^{15°}$ chl.
5704	lq.	$0.834^{20°}_{4}$	....	181.5	i.	∞	∞
5705	lq.	$0.838^{22°}$	....	173-4	i.	∞	∞
5706	cr.	$0.936^{15°}$	38-40	$219\text{-}21^{760mm}$	i.	v. s.	v. s.
5707	col. cr.	$0.935^{15°}$	38-40	219-21	i.	v. s.	v. s.
5708	col. cr.	$0.935^{20°}_{20}$	35	$218\text{-}9^{752mm}$	i.	v. s.	v. s.
5709	lq.	$0.862^{20°}_{4}$	....	186-7	i.	∞	∞
5710	lq.	$0.966^{20°}_{4}$	<-50	220 d.	i.	20	....
5711	col.nd./act.	....	154-5	....	i.	s.	s.
5712	cr.	....	220-1	....	i.	s.	s.
5713	lf./aq.	....	203-4	....	v. sl. s.	v. sl. s.	....
5714	nd.	....	116-7	....	....	v. s.	v. s.
5715	nd./al.	....	98.5	329	i.	s. h.	v.s.; v.s.bz.

* The sulfonimide, m. p. 88°.

Sulfanilyl-guanidine 5666
Sulfarsenol 5674
Sulfenazoxine 679
Sulfenthal 5127
Sulfhydryl-benzoic acid 5918
Sulfo-anthraquinone 559
Sulfo-benzide 2750
Sulfo-cyanic acid 5897
Sulfon-ethylmethane 6326
Sulfon-methane 5683
Sulfur yellow-S 3241
Sulfuric ether 2911
Superpalite 6159
Suprarenine 157

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Tetrabromo				
5716	benzene (1,2,4,5)	....	$Br_4C_6H_2$	V-214	393.74
5717	*o*-cresol	....	$Br_4C_6(OH){\cdot}CH_3$	VI-362	423.77
5718	*m*-cresol-sulfonphthalein	brom cresol green	$C_{21}H_{14}O_5Br_4S$	....	698.05
5719	ethane (1,1,2,2) (*sym*)	acetylene tetrabromide	$Br_2CH{\cdot}CHBr_2$	I-94	345.70
5720	ethane (1,1,1,2)	(*uns*)	$Br_3C{\cdot}CH_2Br$	I-94	345.70
5721	ethylene	ethylene tetraBr	$Br_2C{:}CBr_2$	I-192	343.68
5722	phenolphthalein	(3′,5′,3″,5″)	$C_{20}H_{10}O_4Br_4$	XVIII-149	633.94
5723	phenolphthalein	(sodium salt)	$C_{20}H_8O_4Br_4Na_2$	....	677.92
5724	phenolsulfonphthalein	brom phenol blue	$C_{19}H_{10}O_5Br_4S$	*XIX-649	669.99
5725	phthalic anhydride	....	$\underline{C_6Br_4{\cdot}CO{\cdot}O{\cdot}CO}$	XVII-485	463.74
5726	quinone	bromanil	$O{:}C_6Br_4{:}O$	VII-642	423.72
5727	**Tetrabutylammonium iodide** (*n*)	....	$(C_4H_9)_4N{\cdot}I$	IV-157	369.38
5728	**Tetrachloro**-acetone	(*sym*)	$(Cl_2CH)_2CO{\cdot}4H_2O$	I-656	267.94
5729	acetone (*sym*)	....	$(Cl_2CH)_2CO$	I-656	195.87
5730	aniline (2,3,4,5)	....	$Cl_4C_6H{\cdot}NH_2$	XII-630	230.92
5731	aniline (2,3,5,6)	....	$Cl_4C_6H{\cdot}NH_2$	....	230.92
5732	aniline (2,3,4,6)	....	$Cl_4C_6H{\cdot}NH_2$	XII-630	230.92
5733	benzene (1,2,3,4)	....	$Cl_4C_6H_2$	V-204	215.90
5734	benzene (1,2,3,5)	....	$Cl_4C_6H_2$	V-204	215.90
5735	benzene (1,2,4,5)	....	$Cl_4C_6H_2$	V-205	215.90
5736	1,2-dibromoethane	(1,1,2,2)	$Cl_2BrC{\cdot}CBrCl_2$	I-93	325.68
5737	1,1-dibromoethane	(1,2,2,2)	$Cl_3C{\cdot}CClBr_2$	I-93	325.68
5738	diphenyl (2,4,2′,4′)	....	$(C_6H_3Cl_2)_2$	V-579	292.00
5739	ethane (*sym*)	acetylene tetraCl	$Cl_2CH{\cdot}CHCl_2$	I-86	167.86
5740	ethane (*uns*)	(1,1,1,2-tetraCl)	$Cl_3C{\cdot}CH_2Cl$	I-86	167.86
5741	ethylene	ethylene tetraCl	$Cl_2C{:}CCl_2$	I-187	165.85
5742	hydroquinone	....	$(HO)_2C_6Cl_4$	VI-851	247.90
5743	phenol (2,3,4,6)	....	$HO{\cdot}C_6HCl_4$	VI-193	231.90
5744	phenolphthalein	(4,5,6,7)	$C_{20}H_{10}O_4Cl_4$	XVIII-148	456.11
5745	*o*-phthalic acid	....	$Cl_4C_6(CO_2H)_2{\cdot}\frac{1}{2}H_2O$	IX-819	312.93
5746	quinone	chloranil	$O{:}C_6Cl_4{:}O$	VII-636	245.89
5747	**Tetracosane** (*n*)	....	$CH_3{\cdot}(CH_2)_{22}{\cdot}CH_3$	I-175	338.64
5748	**Tetradecane** (*n*)	....	$CH_3{\cdot}(CH_2)_{12}{\cdot}CH_3$	I-171	198.38
5749	**Tetradecyl** acetate	(*n*)	$CH_3CO_2{\cdot}C_{14}H_{29}$	II-136	256.42
5750	alcohol (*n*)	tetradecanol-1	$CH_3(CH_2)_{12}CH_2OH$	I-428	214.38
5751	**Tetradecylene** (α)	tetradecene-1	$CH_3(CH_2)_{11}CH{:}CH_2$	I-226	196.36
5752	**Tetradecyne**-2	....	$CH_3(CH_2)_{10}C{\vdots}C{\cdot}CH_3$	I-262	194.35
5753	**Tetraethanolammonium hydroxide**	....	$(HO{\cdot}CH_2CH_2)_4NOH$	IV-285	211.26
5754	**Tetraethylammonium** bromide	....	$(C_2H_5)_4NBr$	IV-104	210.16
5755	chloride	....	$(C_2H_5)_4NCl{\cdot}4H_2O$	IV-104	165.71

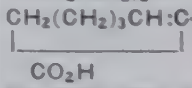
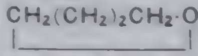
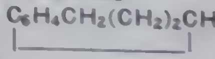
Surinamin 4405
Sylvane 4245
Sylvic acid 1
Syringin, cf. glcde.
Tamasol-J 1031
Tampicin, cf. glcde.
Tanacetone 5936
Tannic acid, cf. glcde.
Tartramide 5692
Tartronyl urea 1686
Telepathine, cf. alkd.
Tellurium ethyl 2219
Tellurium methyl 2566
Terebinic acid 5701
Terephthalic, cf. also phthalic.
Terephthalic acid 5277
Terephthalyl dichloride 5286
Terpane 3579
Terpenol 5706

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5716	mn./CS_2	3.027$^{20°}$	178-80	....	i.	....	....
5717	nd./ac.	....	207-8	....	sl. s. ac.	s.; s. alk.	s.
5718	lt. yel. pd.	....	....	....	sl. s.	s.; s. alk.	i.
5719	col. lq.	$2.964_{4}^{20°}$	−1.0; d. >190	151$^{54\text{mm}}$	i.; ∞ ac.	∞; ∞ chl.	∞; ∞ aniline
5720	col. lq.	$2.875_{4}^{20°}$	0; d. 175	103.5$^{13.5\text{mm}}$	....	s.	....
5721	cr. pl.	....	56-7	226-7	....	....	....
5722	col. nd./al.	....	280-5 d.	....	i.; s. alk.	v. sl. s.	s.
5723	b. pd.	....	....	....	v. s.	sl. s.	i.
5724	cr./ac. act.	....	270-1 d.	....	0.07	sl. s.	i.; s. alk.
5725	cr./ac. + xylene	....	275-80	....	v. sl. s. ac.	v. sl. s. bz.	s. $PhNO_2$
5726	yel. mn./bz.	....	300	subl.	i.	s. h.	sl. s.
5727	lf./bz.	....	144-5	....	sl. s.	s.	s.
5728	tri.	....	48-9	....	....	....	....
5729	lq.	....	....	180-2 sl. d.	v. s. bz.	v. s.	v. s.
5730	nd./al.	....	118-20	....	s. bz.	s.; s. ac.	s.
5731	cr.	....	90	....	i.	s.	....
5732	nd./lg.	....	88	....	s. CS_2	s.	s. lg.
5733	nd.	....	46-7	254$^{761\text{mm}}$	i.	sl. s.	v. s.
5734	nd./al.	....	54-5	246	i.	sl. s. c.	v. s. CS_2
5735	nd./et.	1.858$^{22°}$	138-40	240-6	i.	s. c.	s. bz.
5736	rhb.	2.713	200-5 d.	....	....	....	....
5737	rhb.	2.794	subl.	....	....	s. h.	s.
5738	cr.	....	83	....	0.29$^{20°}$	v. s. h.	sl. s. lg.
5739	col. lq.	$1.600_{4}^{20°}$	−36	146.3	0.29$^{20°}$	∞	∞
5740	lq.	$1.588_{4}^{20°}$	....	129-30	0.02$^{20°}$	∞	∞
5741	col. lq.	$1.624_{4}^{15°}$	−19	120.8	i.	∞; ∞ chl.	∞; ∞ bz.
5742	mn.	....	234-6	subl.	i.; s. act.	20$^{25°}$	20$^{25°}$
5743	nd./lg.	$1.6_{4}^{80°}$	69-70	164$^{23\text{mm}}$	v. sl. s.	v. s.	v. s.
5744	pl./Me al.	....	>300	....	i.; s. alk.	s.; i. chl.	s.; i. bz.
5745	cr./aq.	....	d. $-1\frac{1}{2}H_2O$*	....	0.6$^{14°}$; 3.0$^{99°}$	s.	s.; v. s. act.
5746	yel.mn./bz.	....	290**	subl. 80°	i. bz.$^{25°}$	i. c.; sl. s. h.	i. c.; sl. s. CCl_4
5747	cr.	$0.779_{4}^{51°}$	51.1	324	....	8.4$^{15°}$ chl.	s.
5748	col. lq.	$0.765_{4}^{20°}$	5.5	252.5	i.	v. s.	v. s.
5749	col. cr.	....	12-3	176-7$^{15\text{mm}}$	....	....	....
5750	cr.	$0.824_{4}^{38°}$	38	167-70$^{15\text{mm}}$	<0.02	sl. s.	s.
5751	lq.	$0.775_{4}^{15°}$	−12	127$^{15\text{mm}}$	....	....	....
5752	cr.	$0.800_{4}^{15°}$	6.5	134$^{15\text{mm}}$	....	....	....
5753	....	....	....	....	∞	....	....
5754	cr. /abs. al.	....	....	....	....	v. s.	s. chl.
5755	mn	$1.112_{4}^{25°}$	37.5	....	141$^{25°}$	8.2$^{25°}$ chl.	....

* Anhydride, m. p. 255°.

** Sealed tube.

Terpenolic acid 5702
Terphenyl 2705
Tetbrothalein 5722
Tetraacetyl-glucosyl chloride 44
Tetraanhydro-berberine, cf. alkd.
Tetrabase 5834
Tebrabromo-fluorescein 2875-6
Tetrabromo-methane 1242
Tetracaine 5032
Tetrachloro-methane 1243
Tetradecanol 4451
Tetradecanoic acid 4450
Tetradecanol 5750

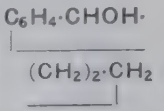
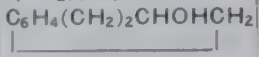
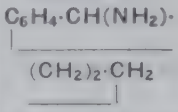
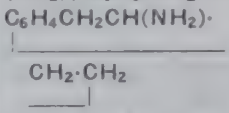
No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5756	**Tetraethylammonium** hydroxide	....	$(C_2H_5)_4NOH$	IV-103	147.26
5757	iodide	....	$(C_2H_5)_4NI$	IV-104	257.17
5758	**Tetraethyl**-benzene	(1,2,4,5)	$(C_2H_5)_4C_6H_2$	V-455	190.32
5759	benzene (1,2,3,4)	....	$(C_2H_5)_4C_6H_2$	V-455	190.32
5760	diaminobenzophenone	(4,4′)	$[(C_2H_5)_2N{\cdot}C_6H_4]_2CO$	XIV-98	324.45
5761	diaminodiphenylmethane	(4,4′)	$[(C_2H_5)_2N{\cdot}C_6H_4]_2CH_2$	XIII-242	310.47
5762	diaminotriphenyl carbinol	brilliant green base	$[(C_2H_5)_2N{\cdot}C_6H_4]_2{\cdot}C(OH){\cdot}C_6H_5$	XIII-746	402.56
5763	diaminotriphenyl carbinol sulfate	brilliant green dye salt	$(C_{27}H_{33}N_2){\cdot}HSO_4$	XIII-746	482.62
5764	ethanetetracarboxylate (*sym*)	....	$[(C_2H_5O_2C)_2CH]_2$	II-858	318.32
5765	propanetetracarboxylate	$(\alpha,\alpha,\beta,\gamma)$	$(CH_2{\cdot}CH{\cdot}CH){\cdot}(CO_2{\cdot}C_2H_5)_4$	II-859	332.34
5766	rhodamine	rhodamine B	$C_{28}H_{31}O_3N_2Cl$	XIX-346	479.00
5767	urea	....	$[(C_2H_5)_2N]_2CO$	IV-120	172.27
5768	**Tetraethylene** glycol	....	$({\cdot}CH_2OCH_2{\cdot})_3{:}({\cdot}CH_2OH)_2$	I-468	194.22
5769	glycol dimethyl ether	di MeO-tetraglycol	$(CH_3O{\cdot}CH_2{\cdot}CH_2{\cdot}O{\cdot}CH_2{\cdot}CH_2)_2O$	....	222.28
5770	pentamine	....	$NH_2{\cdot}(CH_2CH_2NH)_3{\cdot}CH_2{\cdot}CH_2{\cdot}NH_2$	....	189.30
5771	**Tetraglycol dichloride**	....	$(Cl{\cdot}CH_2{\cdot}CH_2{\cdot}O{\cdot}CH_2{\cdot}CH_2)_2O$	....	231.12
5772	**Tetrahydro**-benzoic acid (Δ_1)	....	 $CH_2(CH_2)_3CH{:}C{\cdot}CO_2H$	IX-41	126.15
5773	furan	tetramethylene oxide	 $CH_2(CH_2)_2CH_2{\cdot}O$	XVII-10	72.10
5774	furfuryl acetate	....	$CH_3CO_2{\cdot}CH_2{\cdot}C_4H_7O$	....	144.17
5775	furfuryl alcohol	....	$C_4H_7O{\cdot}CH_2OH$	....	102.13
5776	furfuryl benzoate	....	$C_6H_5CO_2{\cdot}CH_2{\cdot}C_4H_7O$	....	206.23
5777	furfuryl butyrate	....	$C_3H_7CO_2{\cdot}CH_2{\cdot}C_4H_7O$	....	172.22
5778	furfuryl *n*-caproate	....	$C_5H_{11}CO_2{\cdot}CH_2{\cdot}C_4H_7O$	....	200.27
5779	furfuryl lactate	....	$CH_3{\cdot}CHOH{\cdot}CO_2{\cdot}CH_2{\cdot}C_4H_7O$	....	174.19
5780	furfuryl laurate	....	$C_{11}H_{23}CO_2{\cdot}CH_2{\cdot}C_4H_7O$	....	284.43
5781	furfuryl maleate	....	$({:}CH{\cdot}CO_2{\cdot}CH_2{\cdot}C_4H_7O)_2$	....	284.30
5782	furfuryl palmitate	....	$C_{15}H_{31}CO_2{\cdot}CH_2{\cdot}C_4H_7O$	....	340.53
5783	furfuryl propionate	....	$C_2H_5CO_2{\cdot}CH_2{\cdot}C_4H_7O$	....	158.19
5784	furfuryl salicylate	....	$HO{\cdot}C_6H_4CO_2{\cdot}CH_2{\cdot}C_4H_7O$	....	222.23
5785	furfuryl succinate	....	$({\cdot}CH_2{\cdot}CO_2{\cdot}CH_2{\cdot}C_4H_7O)_2$	....	286.32
5786	naphthalene (1,2,3,4)	"Tetralin"	 $C_6H_4CH_2(CH_2)_2CH_2$	V-491	132.20

Tetradecanone 3182
Tetradecene 5751
Tetraethyl germanium 3357
Tetraethyl lead 3957
Tetraethyl silicon 5619
Tetraethyl tin 5950
Tetrafluoro-methane 1244
Tetrahydro-benzene 1609

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5756	only in solns.*	....	*	d.	s.	....	....
5757	col. cr./aq.	1.559^{4°	>200	....	45^{25°	1.6^{25° chl.	i.; s. al.
5758	lq.	$0.888_{4}^{16^\circ}$	13	250	i.	s. abs.	v. s.
5759	lq.	$0.887_{4}^{20^\circ}$	11.6	248	i.	s. abs.	v. s.
5760	lf./al.	....	95-6	....	....	....	....
5761	cr./al.	....	41-2	253^{10mm}	....	....	....
5762	red brn.	....	....	....	v. sl. s.	s.	s. aq. a.
5763	rhb. gold nd.	....	....	....	v. s.	v. s.	....
5764	tet. pr.	$1.064^{79.5^\circ}$	76	305 d.	i. pet. ..	s.	s.
5765	oil	$1.118_{4}^{20^\circ}$	....	$200\text{-}1^{14mm}$	....	....	....
5766	lf./HCl	....	....	....	v. s.	v. s.	sl. s. alk.
5767	lq.	$0.886_{4}^{20^\circ}$	....	210-5	i.	s. a.	i. alk.
5768	lq.	$1.125_{20}^{20^\circ}$	....	327-8	∞	....	....
5769	lq.	$1.013_{20}^{20^\circ}$	....	275.8	∞	....	....
5770	lq.	$0.999_{20}^{20^\circ}$	....	333	∞	....	....
5771	lq.	$1.186_{20}^{20^\circ}$	....	114^{2mm}	sl. s.	....	....
5772	cr.	$1.072_{4}^{47^\circ}$	29	240-3	0.7^{20°	....	....
5773	col. lq.	$0.888_{4}^{21^\circ}$	−65	65-6	s.	s.	s.
5774	col. lq.	$1.062_{4}^{25^\circ}$	....	$192\text{-}4^{740mm}$	sl. s.	s.	s.
5775	col. lq.	$1.050_{4}^{20^\circ}$	....	$177\text{-}8^{743mm}$	∞	∞	∞
5776	lq.	$1.137_{0}^{20^\circ}$	....	$300\text{-}2^{750mm}$	....	....	....
5777	lq.	$1.012_{0}^{20^\circ}$	....	225-7	....	....	....
5778	col. lq.	....	....	$141\text{-}3^{19mm}$	i.	s.	s.
5779	yel. lq.	....	....	$146\text{-}9^{18mm}$	s.	s.	s.
5780	pa. yel. lq.	....	....	$184\text{-}6^{6mm}$	i.	s.	s.
5781	yel. viscous lq.	....	....	$190\text{-}3^{2mm}$	sl. s.	s.	s.
5782	pa. yel. lq.	....	....	$195\text{-}8^{1.5mm}$	i.	s.	s.
5783	lq.	$1.044_{4}^{20^\circ}$	....	$204\text{-}7^{756mm}$	....	....	....
5784	pa. yel. lq.	....	....	$131\text{-}3^{2mm}$	i.	s.	s.
5785	pa. yel. lq.	....	....	$219\text{-}21^{9mm}$	i.	s.	s.
5786	col. lq.	$0.973_{4}^{18^\circ}$	−31	$206\text{-}7^{764mm}$	i.; ∞ bz.	s.; ∞ act.	s.

* Crysts. + $4H_2O$, m. p. 49-50°; + $6H_2O$, m. p. 55°.

Tetrahydro-nicotinic acid, cf. alkd.
Tetrahydro-pyrrole 5523
Tetrahydro-toluene 4207-8
Tetrahydroxy-flavanone 2891
Tetraiodo-fluorescein 2896
Tetraiodo-methane 1245

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Tetrahydro				
5787	α-naphthol (*ac.*)	....	 $C_6H_4\cdot CHOH\cdot$ $(CH_2)_2\cdot CH_2$	....	148.20
5788	α-naphthol (*ar.*)	....	$(CH_2)_4:C_6H_3OH$	VI-578	148.20
5789	β-naphthol (*ac.*)	....	 $C_6H_4(CH_2)_2CHOHCH_2$	VI-579	148.20
5790	β-naphthol (*ar.*)	....	$(CH_2)_4:C_6H_3OH$	VI-579	148.20
5791	β-naphthoylacetonitrile (*ar.*)	....	$(CH_2)_4:C_6H_3\cdot CO\cdot CH_2\cdot CN$	....	199.24
5792	α-naphthylamine (*ac.*)	....	 $C_6H_4\cdot CH(NH_2)\cdot$ $(CH_2)_2\cdot CH_2$	XII-1200	147.21
5793	α-naphthylamine	(*ar.*)	$(CH_2)_4:C_6H_3\cdot NH_2$	XII-1197	147.21
5794	β-naphthylamine (*ac.*)(*dl*)	....	 $C_6H_4CH_2CH(NH_2)\cdot$ $CH_2\cdot CH_2$	XII-1200	147.21
5795	β-naphthylamine	(*ar.*)	$(CH_2)_4:C_6H_3\cdot NH_2$	XII-1198	147.21
5796	*o*-phthalic acid (Δ_1)	....	$C_8H_{10}O_4$	IX-770	170.16
5797	quinoline (1,2,3,4)	....	$C_9H_{10}NH$	XX-262	133.19
5798	quinone (*p*)	....	$OC:(CH_2)_4:CO$	VII-556	112.12
5799	**Tetrahydroxy-**anthraquinone	rufiopin (1,2,5,6)	$C_{14}H_4O_2(OH)_4$	VIII-549	272.20
5800	anthraquinone (1,3,5,7)	anthrachryson	$C_{14}H_4O_2(OH)_4\cdot 2H_2O$	VIII-551	308.24
5801	anthraquinone (1,2,5,8)	quinalizarin; alizarin bordeaux	$C_{14}H_4O_2(OH)_4$	VIII-549	272.20
5802	benzene (1,2,4,5)	....	$(HO)_4C_6H_2$	VI-1155	142.11
5803	benzene (1,2,3,5)	....	$(HO)_4C_6H_2$	VI-1154	142.11
5804	3,6-diaminobenzene HCl	(1,2,4,5)	$(HO)_4C_6(NH_2)_2\cdot 2HCl$	XIII-842	245.07
5805	flavone (3,7,3′,4′)	fisetin	$(HO)_2C_9H_3O_2\cdot C_6H_3:(OH)_2$	XVIII-221	286.23
5806	flavanol (5,7,2′,4′)	morin; 3,5,7,2′,4′-pentaOH-flavone	$C_{15}H_{10}O_7\cdot 2H_2O$	XVIII-239	338.26
5807	flavanol (5,7,3′,4′)	quercetin	$C_{15}H_{10}O_7\cdot 2H_2O$	XVIII-242	338.26
5808	quinone	....	$(HO)_4C_6O_2$	VIII-534	172.09
5809	**Tetraiodo-**benzene	(1,2,3,4)	$I_4C_6H_2$	V-229	581.76
5810	benzene (1,2,3,5)	....	$I_4C_6H_2$	V-229	581.76
5811	benzene (1,2,4,5)	....	$I_4C_6H_2$	V-229	581.76
5812	ethylene	periodo-ethene	$I_2C:CI_2$	I-195	531.70
5813	phenolphthalein	nosophen; iodophen	$C_{20}H_{10}O_4I_4$	XVIII-151	821.96
5814	phenolphthalein	(Na salt); iodeikon	$C_{20}H_8O_4I_4Na_2\cdot 3H_2O$	XVIII-151	919.99
5815	phenolsulfonphthalein	....	$C_{19}H_{10}O_5I_4S$	....	858.01
5816	phthalic anhydride	....	$I_4C_6:(CO)_2O$	XVII-486	651.76
5817	pyrrole	iodol	I_4C_4NH	XX-168	570.74

Tetralin 5786
Tetralite 5873
Tetramethyl-alloxantin 232
Tetramethyl-aniline 5818

Tetramethyl-diaminobenzophenone 4436
Tetramethyl-diaminodiphenyl carbinol 4435
Tetramethyl-diaminotriphenyl methane 3964
Tetramethyl-ethylene 3658

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts: Water	Alcohol	Ether
5787	crl. lq.	1.090	....	140^{17mm}	....	....	....
5788	mn.	....	68.5-9.0	$264\text{-}5^{705mm}$	sl. s. h.	v. s.	v. s.
5789	oil	$1.071^{20°}_{4}$	....	264^{716mm}	v. sl. s.	v. s.	v. s.
5790	nd./lg.	....	58-9	275-6	v. sl. s.	v. s.	v. s.
5791	pa. yel. cr.	....	98-100	....	i.	sl. s.	s.
5792	oil	....	....	246.5^{714mm}	s. h.	s.	s.
5793	oil	$1.067^{15°}_{15}$	....	275^{12mm}	v. sl. s.	s.	s.
5794	lq.	$1.034^{15°}_{15}$	....	250^{710} sl. d.	sl. s. h.	s.	s.
5795	nd./lg.	$1.029^{22°}_{4}$	38	$275\text{-}7^{713mm}$	....	s.	s.
5796	lf.	....	120($-H_2O$)	....	v. s.	....	....
5797	cr.	$1.070^{4°}$	20 ±	251	s.	∞	∞
5798	mn./aq.	....	78	subl. 100	s.	s.	s.
5799	yel. red	....	subl. d.	....	sl. s. h.; s. H_2SO_4	s.; s. h. ac.	v. sl. s.
5800	yel. nd.	....	>360	$-H_2O$, 150	i.; i. CS_2	sl. s.; s. ac.	v. sl. s.
5801	red nd./ $PhNO_2$	....	>275	subl.	s. alk.; s. H_2SO_4	....	....
5802	lf./ac.	....	215-20	....	v. s.; sl. s. HCl	v. s.	v. s.
5803	nd./aq.	....	165	....	v. s.	v. s.	i. chl., bz.
5804	nd.	....	....	....	v. s.	i. HCl	....
5805	yel. nd.	....	>360 d.	....	i. c.; s. alk.	s.; s. act.; sl. s. pet.	sl. s.; sl. s. bz., chl.
5806	yel. nd./al.	....	285 (anh.)	....	$0.03^{20°}$; $0.1^{100°}$	s.; i. CS_2	sl. s.; s. alk.
5807	yel. nd.	....	313-4 (anh.)	....	i. c.; v. sl. s. h.	0.4 c.; 5.5 h.	v. sl. s.; s. alk.
5808	b. bl.	....	....	....	v. s. h.	v. s.	sl. s.
5809	pr./CS_2	....	136	subl.	s. chl.	s.	s.
5810	pr./et.	....	148	subl.	v. s. h. ac.	sl. s.	sl. s.
5811	nd./et.	....	254	subl. in vac.	v. s. CS_2	v. sl. s.	v. sl. s.
5812	yel. mn.	$2.983^{20°}$	187-92	subl. in vac.	v. s. CS_2	v. sl. s. c.	s. ac., bz.
5813	amor. pd.	....	d. 220 ±	....	i.; s. alk.	sl. s.	s.; s. chl.
5814	pa. b. hyg.	....	d. by CO_2	....	14	sl. s.	....
5815	col. amor.	....	....	....	i.	i.	i.
5816	yel. cr./ac.	....	320-5	subl.	s. PhOH	s. $PhNO_2$	i.
5817	yel./aq. al.	....	d. 140-50	....	0.02	$5.8^{15°}$; s. h.	50

Tetramethyl-ethylene glycol 5312
Tetramethyl-hydracrylic acid 3762
Tetramethyl lead 3958
Tetramethyl-*p*-leucaniline 5844
Tetramethyl-methane 5085
Tetramethyl-piperidone 6056
Tetramethyl-*iso*-propyl alcohol 3531
Tetramethyl silicon 5617

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5818	**Tetramethyl-**aminobenzene	2,3,4,5-tetramethylaniline	$(CH_3)_4C_6H\cdot NH_2$	XII-1175	149.23
5819	aminobenzene	(2,3,5,6); duridine	$(CH_3)_4C_6H\cdot NH_2$	XII-1177	149.23
5820	aminobenzene	(2,3,4,6); ***iso*-**duridine	$(CH_3)_4C_6H\cdot NH_2$	XII-1175	149.23
5821	ammonium bromide	....	$(CH_3)_4N\cdot Br$	IV-51	154.06
5822	ammonium chloride	....	$(CH_3)_4N\cdot Cl$	IV-51	109.60
5823	ammonium hydroxide	....	$(CH_3)_4NOH\cdot 5H_2O$	IV-50	181.23
5824	amm. hydroxide	....	$(CH_3)_4NOH\cdot 3H_2O$	IV-50	145.20
5825	amm. hydroxide	....	$(CH_3)_4NOH\cdot H_2O$	IV-50	109.17
5826	ammonium iodide	....	$(CH_3)_4N\cdot I$	IV-51	201.06
5827	benzene (1,2,3,4)	prehnitol	$(CH_3)_4C_6H_2$	V-430	134.21
5828	benzene (1,2,3,5)	isodurene	$(CH_3)_4C_6H_2$	V-430	134.21
5829	benzene (1,2,4,5)	durene	$(CH_3)_4C_6H_2$	V-431	134.21
5830	benzidine	....	$[(CH_3)_2N\cdot C_6H_4\cdot]_2$	XIII-221	240.34
5831	benzoquinone	duroquinone	$(CH_3)_4C_6O_2$	VII-669	164.20
5832	diaminobutane(α,δ)	....	$[(CH_3)_2N\cdot CH_2CH_2\cdot]_2$	IV-265	144.26
5833	diaminodiphenylamine (*p*)	Bindschedler's green leuco base	$[(CH_3)_2N\cdot C_6H_4]_2NH$	XIII-112	255.35
5834	diaminodiphenyl methane (*p,p′*)	Michler's hydride	$[(CH_3)_2N\cdot C_6H_4]_2CH_2$	XIII-239	254.36
5835	diamino-4″-hydroxy-triphenylmethane	(4,4′)	$[(CH_3)_2N\cdot C_6H_4]_2CH\cdot C_6H_4\cdot OH$	XIII-737	346.45
5836	diamino-4″-dimethoxy-triphenylmethane	(4,4′)	$[(CH_3)_2N\cdot C_6H_4]_2CH\cdot C_6H_4\cdot OCH_3$	XIII-737	360.48
5837	diamino-4″-methyl-triphenylmethane	(4,4′)	$[(CH_3)_2N\cdot C_6H_4]_2CH\cdot C_6H_4\cdot CH_3$	XIII-282	344.48
5838	diamino-3″-nitro-triphenylmethane	(4,4′)	$[(CH_3)_2N\cdot C_6H_4]_2CH\cdot C_6H_4\cdot NO_2$	XIII-279	375.45
5839	*p*-phenylenediamine	....	$(CH_3)_2N\cdot C_6H_4\cdot N(CH_3)_2$	XIII-74	164.24
5840	*p*-phenylenediamine	(HCl); Wurster's reagent	$C_{10}H_{16}N_2\cdot 2HCl$	XIII-74	237.17
5841	pyromellitate	(1,2,4,5)	$C_6H_2(CO_2CH_3)_4$	IX-998	310.25
5842	succinic acid	....	$[(CH_3)_2C\cdot CO_2H]_2$	II-706	174.19
5843	thiouram disulfide	....	$[(CH_3)_2N\cdot CS\cdot S\cdot]_2$	IV-76	240.41
5844	triaminotriphenylmethane	tetramethyl-*p*-leucaniline	$[(CH_3)_2N\cdot C_6H_4]_2CH\cdot C_6H_4\cdot NH_2$	XIII-314	345.47
5845	urea	....	$[(CH_3)_2N]_2CO$	IV-74	116.16
5846	**Tetranitro-**diphenol	(3,x,3′,x;4,4′)	$[(NO_2)_2C_6H_2\cdot OH]_2$	VI-992	366.20
5847	diphenyl (2,4,2′,4′)	....	$C_{12}H_6(NO_2)_4$	V-585	334.20
5848	diphenyl (3,4,3′,4′)	....	$C_{12}H_6(NO_2)_4$	V-585	334.20
5849	diphenyl (2,6,2′,6′)	....	$C_{12}H_6(NO_2)_4$	*V-274	334.20
5850	diphenyldisulfide	(2,2′,4,4′)	$[(NO_2)_2C_6H_3\cdot S\cdot]_2$	VI-344	398.32
5851	diphenyl ether	(2,4,2′,4′)	$[C_6H_3(NO_2)_2]_2O$	VI-255	350.20
5852	diphenylmethane	(2,4,2′,4′)	$C_{13}H_8(NO_2)_4$	V-596	348.23
5853	methane	....	$C(NO_2)_4$	I-80	196.04

Tetramethyl thionine 4426
Tetramethyl tin 5951
Tetramethylene 1595
Tetramethylene-diamine 5474

Tetramethylene dibromide 1823
Tetramethylene dichloride 1973
Tetramethylene dicyanide 155
Tetramethylene diiodide 2389

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5818	lf./bz.	....	70	259-60	sl. s. h.	s.	s.; s. pet.
5819	pr./h. aq.	....	75	261-2	v. sl. s. c.	s.	s.
5820	cr.	$0.978^{24°}$	23-4	253-5	....	....	....
5821	cr.	1.56	d. > 230	subl. > 360	$55^{15°}$	sl. s. abs.	i.; s. SO_2
5822	col. cr.	1.169	425±*	subl. >300	s.	s. h.	i.; i. chl.
5823	hyg. nd.	....	62-3	d.	$151^{0°}$	$\infty^{63°}$ aq.	....
5824	....	....	59-60	....	....	....	....
5825	....	....	d. 130-5	....	....	....	....
5826	col. pr.	1.84	d. > 230	....	sl. s. c.	0.1 h.	i.; s. SO_2
5827	lq.	$0.905^{20°}_{4}$	−6.3	205.0	....	....	....
5828	lq.	$0.890^{20°}_{4}$	−24	197.9	i.	s.	....
5829	mn.	$0.838^{51°}_{4}$	79.3	196	i.; s. bz.	s.	s.
5830	nd./bz. pet.	....	193-4	>360	s. h. bz.	v. sl. s.	sl. s.
5831	yel. nd./lg.	....	111	subl. 100	i.; s. bz.	v. s.	v. s.
5832	col. lq.	$0.804^{19°}_{4}$	....	169	∞	s.	s.
5833	pl.	....	119	....	....	s.	....
5834	lf./al.	....	90-1; subl.	300	i.; s. bz.	s. h.; s. ac.	s.; s. chl.
5835	cr./al.	....	163-5	....	i.; s. dil. alk.	v. sl. s. lg.	s. bz.
5836	nd./al.	....	105-6	....	v. s. lg.; v. s. chl.	s.; v. s. CS_2	v. s.
5837	nd./al.	....	94-5	....	i.	s.	s.
5838	yel. pr./al.	....	152	....	i.; s. bz.	sl. s.; sl. s. lg.	sl. s.
5839	lf./aq. al.	....	51	260	sl. s. h.	v. s.; v. s. lg.	v. s.; v. s. chl.
5840	cr.	....	....	....	s.	....	....
5841	lf./Me al.	....	141.5	....	....	sl. s. h.	....
5842	cr.	....	190-200 d.	....	$0.48^{13.5°}$	s.	s.; i. lg.
5843	cr./al. chl.	$1.29^{20°}_{4}$	146	....	i.; s. chl.	v. sl. s.	v. sl. s.
5844	cr./al.	....	151-2	....	....	sl. s.	....
5845	lq.	$0.972^{15°}$	....	177.5	....	v. s.	v. s.
5846	yel. nd.	....	220-5	....	i.	s.	....
5847	yel. pr./bz.	....	165-6	d.	s. bz.; s. ac.	sl. s.	sl. s.
5848	yel. pr.	....	186	....	s. bz.	v. sl. s. lg.	s. ac.
5849	yel. nd./ac.	....	217-8	....	....	....	....
5850	yel. nd.	....	expl. > 280	....	i.; s. pyr.	i.; s. $PhNO_2$	i.; s. $PhNH_2$
5851	cr.	....	195±	....	i.; s. h. bz.	v. sl. s.	sl. s.
5852	lt. yel./ac.	....	172	....	sl. s. bz.	i.	i.
5853	col. lq.	$1.650^{13°}_{4}$	13	125.7 sl. d.	i.	v. s.	v. s.

Tetramethylene-glycol diacetate 2224
Tetramethylene oxide 5773
Tetranitro-chrysazine 1491
Tetraphenyl lead 3959
Tetraphenyl-pyrazine 234
Tetraphenyl tin 5952
Thebaine, cf. alkd.
Theelin 2903

*Sealed tube.

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Tetranitro				
5854	naphthalene (γ)	(1,3,5,8)	$C_{10}H_4(NO_2)_4$	V-564	308.16
5855	naphthalene (β)	(1,3,6,8)	$C_{10}H_4(NO_2)_4$	V-564	308.16
5856	naphthalene (α)	(1,5,x,x)	$C_{10}H_4(NO_2)_4$	V-564	308.16
5857	phenol (2,3,4,6)	....	$HO\cdot C_6H(NO_2)_4$	VI-292	274.11
5858	phenolsulfonphthalein	....	$C_{19}H_{10}O_{13}N_4S$	*XIX-650	534.36
5859	**Tetraphenyl-**arsonium bromide	....	$(C_6H_5)_4AsBr\cdot 2H_2O$	....	499.26
5860	ethane (*sym*)	....	$[(C_6H_5)_2CH\cdot]_2$	V-738	334.44
5861	ethylene	....	$(C_6H_5)_2C:C(C_6H_5)_2$	V-743	332.42
5862	guanidine	....	$HN:C[N(C_6H_5)_2]_2$	XII-430	363.44
5863	hydrazine	....	$(C_6H_5)_2N\cdot N(C_6H_5)_2$	XV-125	336.42
5864	methane	....	$(C_6H_5)_4C$	V-739	320.41
5865	urea	....	$[(C_6H_5)_2N]_2CO$	XII-429	364.43
5866	**Tetrapropyl-**ammonium iodide (*n*)	....	$(C_2H_5\cdot CH_2)_4NI$	IV-140	313.27
5867	benzene (*iso*)	(1,2,4,5)	$[(CH_3)_2CH]_4C_6H_2$	**V-358	246.42
5868	**Tetratriacontane** (*n*)	....	$CH_3(CH_2)_{32}CH_3$	I-177	478.90
5869	**Tetrazine** (1,2,4,5)	....	$(:N\cdot CH\cdot N)_2$	XXVI-353	82.07
5870	**Tetrazole**	....	$\underbrace{CH:N\cdot NH\cdot N:N}$	XXVI-346	70.06
5871	**Tetrolic acid**	butynoic acid	$CH_3\cdot C\vdots C\cdot CO_2H$	II-479	84.07
5872	**Tetronal**	pentane-3,3-diethyl-sulfone	$(C_2H_5)_2C(SO_2C_2H_5)_2$	I-681	256.37
5873	**Tetryl** (2,4,6)	tri-NO_2-phenylmethylnitramine	$(NO_2)_3C_6H_2\cdot N(CH_3)NO_2$	XII-770	287.15
5874	**Thallin**	6-methoxy-tetrahydroquinoline	$CH_3O\cdot C_9H_{10}N$	XXI-61	163.21
5875	**Thialdine**	....	$(CH_3)_3C_3H_4S_2N$	XXVII-461	163.29
5876	**Thiamin chloride**	vitamin B_1	$C_{12}H_{17}ON_4ClS\cdot HCl$	....	337.27
5877	**Thianthrene**	diphenylene disulfide	$(C_6H_4)_2S_2$	XIX-45	216.30
5878	**Thiazole**	....	C_3H_3NS	XXVII-15	85.12
5879	**Thio-**acetaldehyde (α)	sulfaldehyde	$(CH_3\cdot CHS)_3$	XIX-387	180.34
5880	acetaldehyde (β)	sulfaldehyde	$(CH_3\cdot CHS)_3$	XIX-387	180.34
5881	acetaldehyde (γ)	sulfaldehyde	$(CH_3\cdot CHS)_3$	....	180.34
5882	acetamide	aceto-thioamide	$CH_3\cdot CS\cdot NH_2$	II-232	75.13
5883	acetanilide	....	$C_6H_5\cdot NH\cdot CS\cdot CH_3$	XII-245	151.22
5884	acetdimethylamide	....	$CH_3\cdot CS\cdot N(CH_3)_2$	*IV-329	103.18
5885	acetic acid	....	$CH_3\cdot CO\cdot SH$	II-230	76.11
5886	aniline (4,4′)	diNH_2-diPH-sulfide	$(NH_2\cdot C_6H_4)_2S$	XIII-535	216.29
5887	barbituric acid	malonyl thiourea	$C_4H_4O_2N_2S$	XXIV-476	144.15
5888	benzaldehyde (α)	....	$(C_6H_5\cdot CHS)_3$	XIX-396	366.53
5889	benzaldehyde (β)	....	$(C_6H_5\cdot CHS)_3$	XIX-397	366.53
5890	benzanilide	....	$C_6H_5\cdot NH\cdot CS\cdot C_6H_5$	XII-269	213.29
5891	benzoic acid	....	$C_6H_5\cdot CO\cdot SH$	IX-419	138.18
5892	carbanilide	diphenyl thiourea	$(C_6H_5\cdot NH)_2CS$	XII-394	228.30
5893	chrome	....	$C_{12}H_{14}ON_4S$	....	262.32
5894	cresol (*o*)	*o*-tolyl mercaptan	$CH_3\cdot C_6H_4\cdot SH$	VI-370	124.19
5895	cresol (*m*)	*m*-tolyl mercaptan	$CH_3\cdot C_6H_4\cdot SH$	VI-388	124.19
5896	cresol (*p*)	*p*-tolyl mercaptan	$CH_3\cdot C_6H_4\cdot SH$	VI-416	124.19

Theelol 2902
Theine, cf. alkd.
Theobromine, cf. alkd.
Theocine, cf. alkd.
Theophylline, cf. alkd.
Thevetin, cf. glcde.
Thienyl alcohol 5924
Thio-, cf. also sulfo-.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5854	yel./act.	....	194-5	....	s. HNO_3	sl. s.	s. act.
5855	nd./al.	....	203	expl.	i.	....	....
5856	lt. yel./chl.	....	259	expl.	i.	v. sl. s.	....
5857	lt. yel./chl.	....	140	expl.	d. h.	v. sl. s. bz.	v. sl. s. lg.
5858	yel. nd./ ac. act.	....	>200	....	s.	s.	i.
5859	col. cr.	....	281-4 (anh.)	$-2H_2O >$ 100	1.6	s.	sl. s. act.
5860	rhb.	1.182	209-11	379-83	14 h. bz.	0.8 h.	5 h. ac.
5861	tri. or mn.	$1.155^{0^\circ}_{4}$...	221-3	415-25	s. h. bz.	sl. s.	sl. s.
5862	rhb./lg.	....	130-1	....	i.; v. s. bz.	v. s.	v. s.
5863	rhb./al. chl.	....	147-9	....	s. bz.	v. sl. s. h.	s. act.
5864	rhb./bz.	....	285	431	i. lg.	i.; s. h. bz.	i.; i. ac.
5865	rhb.	1.222	183	....	i.	s. h.	....
5866	rhb.	$1.314^{25^\circ}_{4}$	d. 280±	....	18.6^{25°	55^{25° chl.	....
5867	cr./al.	....	117	260^{775mm}	i.	1^{25°	85^{25°
5868	cr.	lq. 0.781^{73°	α73;β77(?)	$255^{1.0mm}$	....	....	....
5869	red pr.	....	99	....	s.	s.	s.
5870	lf./al.	....	155	subl.	s.; s. ac.	s.; sl. s. bz.	sl. s.
5871	pl./et.	....	77-8	203	v. s.	v. s.	v. s.
5872	pl./aq.	....	85	....	0.22 c.	5.4^{15° abs.	10^{15°
5873	yel. mn./al.	1.57^{19°	129	expl. 187	i.; s. bz.	s. h.	s.; s. ac.
5874	pr.	....	42-3	283^{735mm}	sl. s. c.	v. s.; v. s. bz.	v. s.
5875	mn.	1.191^{18°	43	d.	v. sl. s.	s.	v. s.
5876	hyg. pr.	....	252 sl. d.	....	100	0.1	i.; i. bz.
5877	mn./al.	$1.706^{18^\circ}_{4}$	158-60	364-6	i.	0.25 c.	s. h.
5878	lq.	$1.200^{17^\circ}_{4}$	....	116.8	sl. s.	s.	s.
5879	cr./al.	....	101	246-7	i.; s. bz.	3.86^{25°	15.6^{25°
5880	cr./al.	....	125-6	246-7	i.; s. chl.	3.97^{25°	13.7^{25°
5881	cr.	....	81	100	....	....	....
5882	mn.	....	115-6	....	v. s.	s.; sl. s.	sl. s.
5883	nd./aq.	....	75-6	d.	i.	i. a.	s. alk.
5884	col. cr.	....	114-6	....	sl. s.	s.	v. s.
5885	yel. lq.	1.074^{10°	<-17	93	s.	∞	∞
5886	nd./aq.	....	108	....	sl. s. h.	s.	s.; s. h. bz.
5887	lf./aq.	....	235 d.	....	sl. s.	s.; s. alk.	s. alk. carb.
5888	nd./bz. al.	....	166-7	....	i.	0.2^{25°	1.1^{25°
5889	nd./bz.	....	225-6 d.	....	s. h. ac.	0.04^{25°	0.4^{25°
5890	yel. pr./al.	....	101-2	....	i.	s.	v. s.
5891	yel. oil	....	24	d.	i.	v. s.	∞
5892	rhb./al.	1.3^{24°	154	d.	i.	v. s.	v. s.
5893	yel. pr./chl.	....	227-8*	....	s.	sl. s.	sl. s.
5894	lf.	....	15	194.3	i.	s.	s.
5895	lq.	$1.052^{12^\circ}_{4}$	<-20	195.4	i.	s.	s.
5896	lf./al.	....	43-4	195	i.	sl. s.	v. s.

* HCl salt, m. p. 217-21°.

Thio-allyl ether 1684
Thio-benzyl alcohol 816
Thio-carbamide 5920
Thio-carbonyl chloride 5916
Thio-cresol methyl ether 4402

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5897	**Thio** cyanic acid	sulfocyanic acid	$HS\cdot CN$	III-143	59.09
5898	cyanic acid, per-	3,5-dimercapto-1,2,4-thiodiazol	$CS\cdot NH\cdot CS\cdot NH\cdot S$	XXVII-665	150.23
5899	cyanuric acid	....	$C_3H_3N_3S_3$	XXVI-259	177.26
5900	diglycol (*β*)	*β*,*β*′diOH-diEt sulfide	$(HO\cdot CH_2CH_2)_2S$	I-470	122.18
5901	formamide	....	$H\cdot CS\cdot NH_2$	II-95	61.10
5902	formanilide	....	$C_6H_5\cdot NH\cdot CH:S$	XII-233	137.19
5903	glycerol (1)	....	$HS\cdot CH_2\cdot C_2H_3(OH)_2$	I-519	108.15
5904	glycol, mono-	ethanol-1-thiol-2	$HO\cdot CH_2\cdot CH_2\cdot SH$	I-470	78.13
5905	glycolic acid	....	$HS\cdot CH_2\cdot CO_2H$	III-245	92.11
5906	glycolic-*β*-amino-naphthalide	thionalide	$C_{10}H_7\cdot NH\cdot CO\cdot CH_2\cdot SH$	....	217.28
5907	hydantoin	glycolyl thiourea	$C_3H_4ON_2S$	XXIV-260	116.14
5908	hydracrylic acid	....	$HS\cdot CH_2CH_2CO_2H$	III-299	106.14
5909	hydroquinone, mono-	(1,4)	$HS\cdot C_6H_4\cdot OH$	VI-859	126.17
5910	lactic acid	....	$CH_3\cdot CH(SH)\cdot CO_2H$	III-289	106.14
5911	malic acid (*dl*)	mercaptosuccinic	$(HS\cdot C_2H_3)(CO_2H)_2$	III-439	150.15
5912	naphthene	benzothiophene	C_8H_6S	XVII-59	134.19
5913	naphthol (*α*)	*α*-naphthyl mercaptan	$C_{10}H_7\cdot SH$	VI-621	160.22
5914	naphthol (*β*)	*β*-naphthyl mercaptan	$C_{10}H_7\cdot SH$	VI-657	160.22
5915	phenol	phenyl mercaptan	$C_6H_5\cdot SH$	VI-294	110.17
5916	phosgene	thiocarbonyl chloride	$Cl_2C:S$	III-134	114.98
5917	propionamide	....	$C_2H_5\cdot CS\cdot NH_2$	II-264	89.15
5918	salicylic acid (*o*)	sulfhydryl benzoic	$HS\cdot C_6H_4\cdot CO_2H$	X-125	154.18
5919	semicarbazide	....	$NH_2\cdot CS\cdot NH\cdot NH_2$	III-195	91.13
5920	urea	thiocarbamide	$NH_2\cdot CS\cdot NH_2$	III-180	76.12
5921	urethane	ethyl thiourethane	$NH_2\cdot CO\cdot SC_2H_5$	III-138	105.15
5922	**Thionin**	Lauth's violet	$C_{12}H_9N_3S$	XXVII-391	227.28
5923	**Thiophene**	....	C_4H_4S	XVII-29	84.13
5924	alcohol (*α*)	thienyl alcohol	$C_4H_3S\cdot CH_2OH$	XVII-113	114.16
5925	aldehyde (*α*)(2)	....	$C_4H_3S\cdot CHO$	XVII-285	112.14
5926	carboxylic acid (*α*)	(1,2)	$C_4H_3S\cdot CO_2H$	XVIII-289	128.14
5927	carboxylic acid (*β*)	(1,3)	$C_4H_3S\cdot CO_2H$	XVIII-292	128.14
5928	**Thioxene** (*o*)	2,5-diMe-thiophene	$(CH_3)_2C_4H_2S$	XVII-41	112.18
5929	**Thioxene** (*o*)	2,3-diMe-thiophene	$(CH_3)_2C_4H_2S$	XVII-40	112.18
5930	**Thioxene** (*m*)	2,4-diMe-thiophene	$(CH_3)_2C_4H_2S$	XVII-41	112.18
5931	**Thioxene** (*m*)	3,4-diMe-thiophene	$(CH_3)_2C_4H_2S$	XVII-42	112.18
5932	**Threonine** (*dl*)	*α*-amino-*β*-hydroxy-butyric acid	$CH_3\cdot CHOH\cdot CH:(NH_2)CO_2H$	....	119.12
5933	**Threonine** (*d*–)	....	$C_4H_9O_3N$	IV-514	119.12
5934	**Threonine, allo-**	(*dl*)	$C_4H_9O_3N$	....	119.12
5935	**Thujone** (*α*)	....	$C_{10}H_{16}O$	VII-93	152.23
5936	**Thujone** (*β*)	tanacetone	$C_{10}H_{16}O$	VII-93	152.23
5937	**Thymohydroquinone**	....	$C_{10}H_{14}O_2$	VI-945	166.21
5938	**Thymol**	5-Me-2-isoPr-phenol	$(CH_3)(C_3H_7)C_6H_3OH$	VI-532	150.21
5939	chloride	(3,6;1,4)	$(CH_3)(C_3H_7)C_6H_2:(OH)Cl$	VI-539	184.66
5940	iodide	4-iodothymol	$C_{10}H_{13}OI$	VI-541	276.12
5941	phthalein	....	$C_{28}H_{30}O_4$	*XVIII-381	430.52

Thio-diphenylamine 5138
Thio-histidine betaine 2890
Thio-phenetole 3132
Thio-phenine 378
Thio-phenylacetamide 5240
Thio-sinamine 221
Thio-trimethylacetamide 6275
Thiols, cf. mercaptans.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5897	col. lq.	....	5 ±	d.	∞, d.	v. s.	v. s.
5898	not known; salts only	....	....	....	....	....	....
5899	cr.	....	d. 200	....	sl. s. h.	sl. s.	sl. s.
5900	syrup	$1.221^{20^\circ}_{20}$	....	164-6^{20mm}	∞	s. chl.	....
5901	col. cr.	....	28-9	....	s.; i. bz.	s.; s. act.	s.; s. CS_2
5902	nd./aq.	....	138	....	i. aq. HCl	s.	v. s.
5903	yel. lq.	$1.295^{14.4^\circ}$	....	d.	v. sl. s.	∞	i.
5904	lq.	$1.114^{20^\circ}_{4}$	....	55-6^{9mm}	v. s.	v. s.	v.s.; ∞ bz.
5905	col. lq.	1.325^{20°	−16.5	123^{29mm}	....	....	....
5906	col. nd.	....	111-2	....	....	s.	s.
5907	nd./aq.	....	d. 200 ±	....	sl. s.	i.	i.
5908	col. cr.	1.218^{21°	16.8	111-2^{15mm}	∞	∞	∞
5909	cr.	....	32-4	166-8^{45mm}	s.	s. H_2SO_4	....
5910	oil	....	10 ±	98-9^{14mm}	∞	∞	∞
5911	col. cr.	....	149-50	....	s.; s. act.	s.; sl. s. bz.	sl. s.
5912	lf.	$1.165^{20^\circ}_{4}$	31-2	220-1	....	....	....
5913	lq.	$1.155^{23^\circ}_{4}$	....	208.5^{200mm}	sl. s.	v. s.	v. s.
5914	cr./al.	....	81	286-8	v. sl. s.	v. s.	v. s.
5915	col. lq.	$1.074^{23^\circ}_{4}$	....	168-9	v. sl. s.	v. s.; ∞ bz.	∞; s. CS_2
5916	red lq.	1.509^{15°	....	73.5	d.	d.	s.
5917	lf./bz.	....	41-3	....	v. sl. s.	v. sl. s.	s.; s. bz.
5918	lt. yel. nd.	....	164	subl.	sl. s. h.	s.	s. ac.
5919	nd./aq.	....	181-3 d.	....	s.	s.	....
5920	rhb./al.	$1.405^{20^\circ}_{4}$	180-2	d.	9.2$^{13^\circ}$	s.	sl. s.
5921	lf.	....	108-9	subl. sl. d.	s. h.	s.	sl. s.
5922	brn. bl. lf.	....	....	....	i. c.; i. lg.	sl. s.; s. chl.	sl. s.
5923	col. lq.	$1.070^{15^\circ}_{4}$	−30	84	i.; s. bz.	s.	s. H_2SO_4
5924	lq.	....	....	207	....	....	....
5925	oil	1.215^{21°	....	198	....	....	s.
5926	nd./aq.	....	126.5	260 sl. d.	v. s. h.	v. s.	s.; sl. s. lg.
5927	mn. nd.	....	136	subl.	0.43$^{25^\circ}$	....	....
5928	lq.	$0.976^{17.5^\circ}$	....	136.5-7.5	i.	s.	s.
5929	lq.	0.994^{21°	....	136-7	....	....	....
5930	lq.	0.996^{20°	....	137-8	i.	s.	s.
5931	lq.	$1.008^{23^\circ}_{22}$	....	144-6	....	....	....
5932	col. cr.	....	228-9 d.	....	20$^{25^\circ}$	....	....
5933	hex. pl.	....	225-7 d.	....	s.	....	....
5934	col. cr.	....	250-2	....	s. h.	....	....
5935	col. lq.	0.912	....	200-1	i.	s.	....
5936	col. lq.	$0.916^{20^\circ}_{4}$	....	201-3	i.	s.	....
5937	pr.	....	140-3	290	s. h.	v. s.	v. s.
5938	cr./act.	$0.972^{25^\circ}_{25}$	51.5	232-3^{752mm}	0.09$^{19^\circ}$; 0.11$^{100^\circ}$	v. s.; v. s. chl.	v. s.; s. alk.
5939	col. pl./lg.	....	59-61	....	0.1; s. dil. alk.	222; 60 bz.	83
5940	nd.	....	68-9	....	sl. s. h.	sl. s.	s.; s. chl.
5941	col. nd./al.	....	252-3	....	i.; s. H_2SO_4	s.; s. act.	s. dil. alk.

Thionalid 5906
Thujin, cf. glcde.
Thymine 4413
Thymiode 5940
Thymiodol 5940
Thymodin 5940
Thymol-hexahydride 4024

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5942	**Thymol** sulfonic acid (*α*)	(3,6;1,4)	$(CH_3)(C_3H_7)C_6H_2:(OH)SO_3H\cdot H_2O$	....	248.29
5943	**Thymoquinone**	....	$O:C_6H_2(CH_3)\cdot(C_3H_7):O$	VII-662	164.20
5944	**Thymotic acid** (*o*)	(1,4;3,2)	$(CH_3)(C_3H_7)C_6H_2:(OH)CO_2H$	X-280	194.22
5945	**Thymyl**-acetate	acetyl thymol	$C_{10}H_{13}\cdot O_2C\cdot CH_3$	VI-537	192.25
5946	amine (1,3;4)	....	$CH_3(NH_2)C_6H_3\cdot C_3H_7$	XII-1171	149.23
5947	**Thyroxine** (*l*)	....	$C_{15}H_{11}O_4NI_4$	*XIV-671	776.93
5948	**Tin** chloride triphenyl	triphenyltin chloride	$(C_6H_5)_3SnCl$	*XVI-540	385.46
5949	diethyl	diethyl tin	$(C_2H_5)_2Sn$	IV-631	176.82
5950	tetraethyl	tetraethyl tin	$(C_2H_5)_4Sn$	IV-632	234.94
5951	tetramethyl	tetramethyl tin	$(CH_3)_4Sn$	IV-632	178.84
5952	tetraphenyl	tetraphenyl tin	$(C_6H_5)_4Sn$	XVI-914	427.10
5953	triethyl	triethyl tin	$[(C_2H_5)_3Sn\cdot]_2$	IV-638	411.76
5954	**Tolane**	diphenyl-acetylene	$C_6H_5\cdot C\vdots C\cdot C_6H_5$	V-656	178.22
5955	**Tolidine** (*o*)	3,3′-diMe-benzidine	$(CH_3\cdot C_6H_3\cdot NH_2)_2$	XIII-256	212.28
5956	hydrochloride	....	$C_{14}H_{16}N_2\cdot 2HCl$	XIII-257	285.21
5957	sulfate	....	$C_{14}H_{16}N_2\cdot H_2SO_4$	XIII-257	310.36
5958	disulfonic acid	(3,4;6)	$[(CH_3)(NH_2)C_6H_2\cdot SO_3H]_2\cdot 1\frac{1}{2}H_2O$	XIV-796	399.43
5959	**Tolidine** (*m*)	2,2′-diMe-benzidine	$(CH_3\cdot C_6H_3\cdot NH_2)_2$	XIII-255	212.28
5960	**Toluene**	methyl-benzene	$CH_3\cdot C_6H_5$	V-280	92.13
5961	azo-1-naphthyl-amine-2 (*o*)	(2,1;1′,2′); yellow OB	$CH_3\cdot C_6H_4\cdot N:N\cdot C_{10}H_6\cdot NH_2$	XVI-373	261.31
5962	disulfonic acid	(2,4)	$CH_3\cdot C_6H_3(SO_3H)_2$	XI-204	252.25
5963	disulfonic Na	(2,4); (Na salt)	$C_7H_6O_6S_2Na_2\cdot 7H_2O$	XI-204	422.34
5964	sulfinic acid (*p*)	....	$CH_3\cdot C_6H_4\cdot SO_2H$	XI-9	156.19
5965	sulfinic Na (*p*)	(sodium salt)	$C_7H_7O_2SNa\cdot 2H_2O$	XI-9	214.22
5966	sulfonic acid (*o*)	....	$CH_3\cdot C_6H_4\cdot SO_3H\cdot 2H_2O$	XI-83	208.23
5967	sulfonic acid (*m*)	....	$CH_3\cdot C_6H_4\cdot SO_3H\cdot aq.$	XI-94	172.19
5968	sulfonic acid (*p*)	....	$CH_3\cdot C_6H_4\cdot SO_3H\cdot H_2O$	XI-97	190.21
5969	sulfonic Na (*p*)	(sodium salt)	$C_7H_7O_3SNa\cdot 2H_2O$	XI-97	230.22
5970	**Toluenesulfonyl-** amide (*o*)	toluenesulfonamide	$CH_3\cdot C_6H_4\cdot SO_2\cdot NH_2$	XI-86	171.21
5971	amide (*p*)	....	$CH_3\cdot C_6H_4\cdot SO_2\cdot NH_2$	XI-104	171.21
5972	anilide (*p*)	toluene-sulfonanilide	$CH_3\cdot C_6H_4\cdot SO_2\cdot NH\cdot C_6H_5$	XII-567	247.30
5973	*n*-butylamide (*p*)	....	$CH_3\cdot C_6H_4\cdot SO_2\cdot NH\cdot C_4H_9$	....	227.31
5974	chloride (*o*)	toluene sulfon-chloride	$CH_3\cdot C_6H_4\cdot SO_2Cl$	XI-86	190.64
5975	chloride (*p*)	....	$CH_3\cdot C_6H_4\cdot SO_2Cl$	XI-103	190.64
5976	di-*n*-butylamide	(*p*)	$CH_3\cdot C_6H_4\cdot SO_2\cdot N:(C_4H_9)_2$	....	283.42
5977	dimethylamide (*p*)	....	$CH_3\cdot C_6H_4\cdot SO_2\cdot N:(CH_3)_2$	....	199.26
5978	ethylamide (*p*)	....	$CH_3\cdot C_6H_4\cdot SO_2\cdot NH\cdot C_2H_5$	XI-105	199.26
5979	methylamide	....	$CH_3\cdot C_6H_4\cdot SO_2\cdot NH\cdot CH_3$	XI-105	185.24
5980	methylanilide	....	$CH_3\cdot C_6H_4\cdot SO_2\cdot N:(CH_3)(C_6H_5)$	XII-575	261.33

Tiglic acid 2426
Tiglic aldehyde 2427
T N T 6316
Tobias' acid 4505, 4549
Tolamine 1290

Tolazine 4334
Toliminazole 4137
Tolualdehyde 5985-7
Toluamide 5988-90
Tolubenzyl acetate 6481

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5942	col. pl.	....	115-6	....	v. s.	....	....
5943	yel. tri.	....	46-7	232	v. sl. s.	s.	s.
5944	mn./aq.	....	127	subl.	0.01 c.	s.	s.; s. bz.
5945	lq.	$1.009^{0°}$	....	245^{757mm}	i.; ∞ chl.	∞; ∞ bz.	∞
5946	oil	....	....	230	v. sl. s.	s.	s.
5947	col. nd.	....	232 d.	....	i.; s. alk.	i.	i.
5948	col. cr./al.	....	112-3	$240^{13.5mm}$	i.	s.	s.
5949	yel. oil	$1.558^{15°}$	....	d.	i.	s.	s.
5950	col. lq.	$1.199_{4}^{20°}$	−112	181	i.	....	s.
5951	lq.	$1.291_{4}^{26°}$	....	78	i.	....	....
5952	tet. pr./chl.	$1.490_{4}^{0°}$	226	>420	i.; s. pyr.	v. sl. s.	v. sl. s.
5953	lq.	$1.412^{0°}$	....	265-70	i.	i. aq. al.	s. bz.
5954	mn. pr.	$0.966_{4}^{100°}$	60-2	300	i.	v. s. h.	v. s.
5955	lf.	....	128-9	....	v. sl. s.	s.	s.; s. ac.
5956	scales	....	d. > 340	....	$0.9^{12°}$	....	....
5957	gray	....	d.	....	0.1c.; d.h.	v. sl. s.	s. dil. a.
5958	nd.	....	$-H_2O$, 150	....	$0.2^{18°}$ (anh.)	i.; i. ac.	i.
5959	pr./aq.	....	107-8	....	sl. s. h.	v. s.	v. s.
5960	col. lq.	$0.866_{4}^{20°}$	−95	110.6	i.; s. act.	∞ abs.	∞
5961	yel. pd.	....	122-5	....	i.; s. oil	s.; s. CCl_4	s.; s. bz.
5962	syrup	....	....	....	s.	....	....
5963	pr.	....	....	....	s.	....	....
5964	cr./aq.	....	85-90	....	sl. s.	v. s.; s. h. bz.	v. s.
5965	cr.	....	....	....	s.	....	....
5966	delq. cr.	....	*	$128.8^{0\ 1mm}$	v. s.	s.	....
5967	syrup	....	....	....	v. s.	s.	....
5968	mn.	....	104-5	$146\text{-}7^{0\ 1mm}$	v. s.	s.	....
5969	lf.	....	....	....	s.	....	....
5970	tet. pr.	....	156	....	$0.1^{19°}$	$3.57^{5°}$	....
5971	mn.	....	137	....	$0.2^{9°}$	$7.4^{5°}$	....
5972	tri./aq. al. or bz.	....	103	....	....	v. s.	....
5973	col. rhb.	....	41-2.5	....	i.	s.	v. s.
5974	oil	$1.344^{17°}$	10	126^{10mm}	i.	....	....
5975	tri.	....	69	134.5^{10mm}	i.	s.	s.; s. bz.
5976	pa. yel. lq.	....	....	$233\text{-}4^{20mm}$	i.	s.	s.
5977	col. cr.	....	81-2	....	i.	sl. s.	v. s.
5978	cr./lg.; pl./aq. al.	....	61-3	....	....	....	....
5979	pl./aq. al.	....	77-8	....	v. sl. s.	v. s.	....
5980	mn. pl./ EtOAc	....	93-4	....	....	v. s.	v. s.

* Stable < 100°; forms *p*-isomer 140-50°.

Tolubenzyl alcohol 6016-8
Tolubenzyl-amine 6482-4
Toluene-azo-toluidine 309-12

Toluene hexahydride 4199
Toluene tetrahydride 4207-8
Toluhydroquinone 2372

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
5981	**Toluenesulfonyl** *p*-toluidide (*p*)	....	$CH_3 \cdot C_6H_4 \cdot SO_2 \cdot NH \cdot C_6H_4 \cdot CH_3$	XII-981	261.33
5982	**Toluic** acid†(*o*)	2-Me-benzoic acid	$CH_3 \cdot C_6H_4 \cdot CO_2H$	IX-462	136.14
5983	acid (*m*)	3-Me-benzoic acid	$CH_3 \cdot C_6H_4 \cdot CO_2H$	IX-475	136.14
5984	acid (*p*)	4-Me-benzoic acid	$CH_3 \cdot C_6H_4 \cdot CO_2H$	IX-483	136.14
5985	aldehyde (*o*)	*o*-toluylaldehyde	$CH_3 \cdot C_6H_4 \cdot CHO$	VII-295	120.14
5986	aldehyde (*m*)	*m*-Me-benzaldehyde	$CH_3 \cdot C_6H_4 \cdot CHO$	VII-296	120.14
5987	aldehyde (*p*)	4-Me-benzaldehyde	$CH_3 \cdot C_6H_4 \cdot CHO$	VII-297	120.14
5988	amide (*o*)	*o*-toluamide	$CH_3 \cdot C_6H_4 \cdot CO \cdot NH_2$	IX-465	135.16
5989	amide (*m*)	*m*-toluamide	$CH_3 \cdot C_6H_4 \cdot CO \cdot NH_2$	IX-477	135.16
5990	amide (*p*)	4-toluamide	$CH_3 \cdot C_6H_4 \cdot CO \cdot NH_2$	IX-486	135.16
5991	anhydride (*o*)	....	$(CH_3 \cdot C_6H_4 \cdot CO)_2O$	IX-464	254.27
5992	nitrile (*o*)	*o*-tolunitrile	$CH_3 \cdot C_6H_4 \cdot CN$	IX-466	117.14
5993	nitrile (*m*)	3-tolyl cyanide	$CH_3 \cdot C_6H_4 \cdot CN$	IX-477	117.14
5994	nitrile (*p*)	4-tolunitrile	$CH_3 \cdot C_6H_4 \cdot CN$	IX-489	117.14
5995	**Toluidine** (*o*)	2-methyl aniline	$CH_3 \cdot C_6H_4 \cdot NH_2$	XII-772	107.15
5996	hydrochloride	....	$CH_3 \cdot C_6H_4 \cdot NH_2 \cdot HCl$	XII-782	143.62
5997	**Toluidine** (*m*)	3-methyl aniline	$CH_3 \cdot C_6H_4 \cdot NH_2$	XII-853	107.15
5998	hydrochloride	....	$CH_3 \cdot C_6H_4 \cdot NH_2 \cdot HCl$	XII-856	143.62
5999	**Toluidine** (*p*)	4-methyl aniline	$CH_3 \cdot C_6H_4 \cdot NH_2$	XII-880	107.15
6000	hydrochloride	....	$CH_3 \cdot C_6H_4 \cdot NH_2 \cdot HCl$	XII-896	143.62
6001	**Toluquinone**	*o*-Me-*p*-benzoquinone	$O:C_6H_3(CH_3):O$	VII-645	122.12
6002	**Toluyl-*o*-benzoic acid** (*p*)	(1,4;1′,2′)	$CH_3 \cdot C_6H_4 \cdot CO \cdot C_6H_4 \cdot CO_2H$	X-759	240.25
6003	**Toluylene** diamine	(1;3,4)(*o*)(*uns*)	$CH_3 \cdot C_6H_3(NH_2)_2$	XIII-148	122.17
6004	diamine HCl	(1;3,4)	$C_7H_{10}N_2 \cdot 2HCl$	XIII-148	195.10
6005	diamine (1;2,4)	(*m*)(*uns*)	$CH_3 \cdot C_6H_3(NH_2)_2$	XIII-124	122.17
6006	diamine HCl	(1;2,4)	$C_7H_{10}N_2 \cdot 2HCl$	XIII-129	195.10
6007	diamine (1;2,5)	(*p*)	$CH_3 \cdot C_6H_3(NH_2)_2$	XIII-144	122.17
6008	diamine HCl	(1;2,5)	$C_7H_{10}N_2 \cdot 2HCl$	XIII-144	195.10
6009	diamine H_2SO_4	(1;2,5)	$C_7H_{10}N_2 \cdot H_2SO_4$	XIII-144	220.24
6010	**Tolyl** acetic acid (*o*)	....	$CH_3 \cdot C_6H_4 \cdot CH_2 \cdot CO_2H$	IX-527	150.17
6011	acetic acid (*m*)	....	$CH_3 \cdot C_6H_4 \cdot CH_2 \cdot CO_2H$	IX-528	150.17
6012	acetic acid (*p*)	....	$CH_3 \cdot C_6H_4 \cdot CH_2 \cdot CO_2H$	IX-530	150.17
6013	benzoate (*o*)	*o*-cresyl benzoate	$C_6H_5CO_2 \cdot C_6H_4 \cdot CH_3$	IX-119	212.24
6014	benzoate (*m*)	*m*-cresyl benzoate	$C_6H_5CO_2 \cdot C_6H_4 \cdot CH_3$	IX-120	212.24
6015	benzoate (*p*)	*p*-cresyl benzoate	$C_6H_5CO_2 \cdot C_6H_4 \cdot CH_3$	IX-120	212.24
6016	carbinol (*o*)	*o*-tolubenzyl alcohol	$CH_3 \cdot C_6H_4 \cdot CH_2OH$	VI-484	122.16
6017	carbinol (*m*)	*m*-xylyl alcohol	$CH_3 \cdot C_6H_4 \cdot CH_2OH$	VI-494	122.16
6018	carbinol (*p*)	....	$CH_3 \cdot C_6H_4 \cdot CH_2OH$	VI-498	122.16
6019	*iso*-cyanate (*o*)	*o*-tolylcarbonimide	$CH_3 \cdot C_6H_4 \cdot N:CO$	XII-812	133.14
6020	*iso*-cyanate (*m*)	*m*-tolylcarbonimide	$CH_3 \cdot C_6H_4 \cdot N:CO$	XII-864	133.14
6021	*iso*-cyanate (*p*)	*p*-tolylcarbonimide	$CH_3 \cdot C_6H_4 \cdot N:CO$	XII-955	133.14
6022	hydrazine (*o*)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH_2$	XV-496	122.17
6023	hydrazine HCl (*o*)	....	$C_7H_{10}N_2 \cdot HCl \cdot H_2O$	XV-496	176.65
6024	hydrazine (*m*)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH_2$	XV-506	122.17
6025	hydrazine HCl (*m*)	....	$C_7H_{10}N_2 \cdot HCl$	XV-506	158.63
6026	hydrazine (*p*)	....	$CH_3 \cdot C_6H_4 \cdot NH \cdot NH_2$	XV-510	122.17
6027	hydrazine HCl (*p*)	....	$C_7H_{10}N_2 \cdot HCl$	....	158.63
6028	hydroxylamine	(*o*)(*β*)	$CH_3 \cdot C_6H_4 \cdot NHOH$	XV-13	123.15

† See also No. 5142.

Toluidine sulfonic acid 379-83
Tolunitrile 5992-4
Toluol 5960
Toluphenazine 4334
Toluquinoline 4372, 4374-5
Toluquinone oxime 4881
Toluylaldehyde 5139, 5985-7
Toluylene red 4585

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
5981	col. tri./ac.	....	117-8	....	....	v. s. h.	....
5982	cr./aq.	$1.062_{4}^{115°}$	104-5	259^{751mm}	$2.17^{100°}$	v. s.	s. chl.
5983	pr./aq.	$1.054_{4}^{112°}$	110-1	263	$0.09^{15°}$; $1.6^{100°}$	v. s.	v. s.
5984	cr./aq.	....	179-80	274-5	$1.26^{100°}$	v. s.	v. s.
5985	lq.	$1.039_{4}^{20°}$	....	196-9	sl. s.	∞	∞
5986	lq.	$1.019_{4}^{20°}$	....	199	sl. s.	∞	∞
5987	lq.	$1.019_{4}^{16.7°}$	....	204-5	sl. s.	∞	∞
5988	nd./aq.	....	147	....	v. s. h.	v. s.	s.
5989	nd./et.	....	97	....	v. sl. s. bz.	s.	v. sl. s.
5990	nd./aq.	....	159-60	....	s. h.	s.	s.
5991	cr./et.	....	39	>325	....	....	....
5992	col. lq.	$0.998_{15}^{15°}$	−13	205.2	i.	∞	∞
5993	col. lq.	$0.976^{15°}$	−23	210^{773mm}	0.09 c.	1.7 h. aq.	....
5994	nd./al.	$0.981_{30}^{30°}$	29.5	217.6	i.	v. s.	v. s.
5995	col. lq.	$0.999_{4}^{20°}$	−16.3 (−24.4)	199.7	$1.5^{25°}$; s. dil. a.	∞	∞
5996	mn. pr.	....	218-20	242	s.	sl. s.	....
5997	col. lq.	$0.989_{4}^{21°}$	−31.5	203.3	sl. s.	∞	∞
5998	lf./aq.	....	228	250	$96.3^{12°}$	$61.9^{9°}$	....
5999	cr.	$0.973_{50}^{50°}$; $1.046_{4}^{20°}$	44-5	200.3	$0.74^{21°}$; $1.1^{32°}$	v. s.; s. dil. a.	v. s.; s. CS_2
6000	nd./ac. et.	....	243	257.5	$22.9^{11°}$	$25^{17°}$	i.; i. bz.
6001	yel. nd.	....	68-9	subl.	sl. s. c.	v. s.	v. s.
6002	nd./toluene	....	139-40	d.	v. sl. s. h.; s. act.	v. s.	v. s.
6003	lf./lg.	....	89-90	265	s. c.	....	....
6004	nd.	....	....	....	v. s.	....	....
6005	rhb.	....	99	283-5	s. h.	s.	s.
6006	nd.	....	....	....	s.	....	....
6007	pl./bz.	....	64	273-4	s.; s. h. bz.	s.	s.
6008	lf.	....	....	....	s.	....	....
6009	pd.	....	....	....	$0.8^{11°}$	....	....
6010	nd./aq.	....	88-9	....	s. h.	....	....
6011	nd.	....	60.5-1.5	....	s. h.	....	....
6012	nd./aq.	....	92-4	265-7	s. h.	s.	s.; s. bz.
6013	lq.	....	....	307	i.	....	s.
6014	cr.	....	54-5	313-4	i.	....	....
6015	pl./et. al.	....	71-2	315-6	i.	....	....
6016	nd.	$1.023^{40°}$	34-6	223^{750mm}	1 c.	v. s. abs.	v. s.
6017	lq.	$0.916^{17°}$	<−20	217	5 c.	s.	s.
6018	nd.	....	60°	217	sl. s.	s.	s.
6019	lq.	....	....	184-7	i.; d. h.	d. h.	s.
6020	pa. yel. lq.	....	....	195-8	i.	s.	s.
6021	lq.	....	....	187^{751mm}	....	....	....
6022	nd.	....	56-9	....	sl. s. lg.	v. s.	v. s.
6023	pl.	....	....	....	s.	s.	....
6024	oil	....	....	240-4	i.	s.	s.; s. chl.
6025	nd.	....	....	....	s.	s.	....
6026	rhb.	....	65-6	240-4 sl. d.	sl. s.	v. s.; s. bz.	v. s.
6027	tan pl.	....	....	....	s.	sl.	i.
6028	col./bz. et.	....	44	....	sl. s. lg.	s.	s.

Tolyl-, cf. also cresyl-.
Tolyl-acetamide 26-8
Tolyl acetate 1552-3
Tolyl-benzamide 775-7
Tolyl bromide 999-1001
Tolyl-carbonimide 6019-21
Tolyl chloride 1466-8
Tolyl cyanide 5992-4
Tolyl-diphenyl-methane 2756-7

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
6029	**Tolyl** hydroxylamine	(*m*)(β)	$CH_3\cdot C_6H_4\cdot NHOH$	XV-14	123.15
6030	hydroxylamine	(*p*)(β)	$CH_3\cdot C_6H_4\cdot NHOH$	XV-15	123.15
6031	α-naphthylamine	(*o*)(*N*)	$C_{10}H_7\cdot NH\cdot C_6H_4\cdot CH_3$	XII-1225	233.30
6032	α-naphthylamine	(*p*)(*N*)	$C_{10}H_7\cdot NH\cdot C_6H_4\cdot CH_3$	XII-1225	233.30
6033	β-naphthylamine	(*o*)(*N*)	$C_{10}H_7\cdot NH\cdot C_6H_4\cdot CH_3$	XII-1277	233.30
6034	β-naphthylamine	(*p*)(*N*)	$C_{10}H_7\cdot NH\cdot C_6H_4\cdot CH_3$	XII-1277	233.30
6035	pyrrole (*o*)(*N*)	....	$C_4H_4N\cdot C_6H_4\cdot CH_3$	XX-164	157.21
6036	pyrrole (*m*)(*N*)	....	$C_4H_4N\cdot C_6H_4\cdot CH_3$	....	157.21
6037	pyrrole (*p*)(*N*)	....	$C_4H_4N\cdot C_6H_4\cdot CH_3$	XX-164	157.21
6038	salicylate (*o*)	(1,2;1′,2′)	$HO\cdot C_6H_4\cdot CO_2\cdot C_6H_4\cdot CH_3$	....	228.24
6039	salicylate (*m*)	(1,2;1′,3′)	$HO\cdot C_6H_4\cdot CO_2\cdot C_6H_4\cdot CH_3$	....	228.24
6040	salicylate (*p*)	....	$HO\cdot C_6H_4\cdot CO_2\cdot C_6H_4\cdot CH_3$	....	228.24
6041	*iso*-thiocyanate (*o*)	*o*-tolyl mustard oil	$CH_3\cdot C_6H_4\cdot N{:}CS$	XII-813	149.20
6042	*iso*-thiocyanate (*m*)	*m*-tolyl mustard oil	$CH_3\cdot C_6H_4\cdot N{:}CS$	XII-865	149.20
6043	*iso*-thiocyanate (*p*)	*p*-tolyl mustard oil	$CH_3\cdot C_6H_4\cdot N{:}CS$	XII-956	149.20
6044	thiosemicarbazide	(*o*)	$CH_3\cdot C_6H_4\cdot NH\cdot CS\cdot NH\cdot NH_2$	XII-952	181.25
6045	thiourea (*o*)	....	$CH_3\cdot C_6H_4\cdot NH\cdot CS\cdot NH_2$	XII-806	166.24
6046	thiourea (*m*)	....	$CH_3\cdot C_6H_4\cdot NH\cdot CS\cdot NH_2$	XII-863	166.24
6047	thiourea (*p*)	....	$CH_3\cdot C_6H_4\cdot NH\cdot CS\cdot NH_2$	XII-947	166.24
6048	urea (*o*)	....	$CH_3\cdot C_6H_4\cdot NH\cdot CO\cdot NH_2$	XII-801	150.18
6049	urea (*m*)	....	$CH_3\cdot C_6H_4\cdot NH\cdot CO\cdot NH_2$	XII-862	150.18
6050	urea (*p*)	....	$CH_3\cdot C_6H_4\cdot NH\cdot CO\cdot NH_2$	XII-940	150.18
6051	**Tolylene** cyanide (*o*)	xylylene dicyanide	$C_6H_4(CH_2\cdot CN)_2$	IX-874	156.18
6052	cyanide (*m*)	xylylene dicyanide	$C_6H_4(CH_2\cdot CN)_2$	IX-875	156.18
6053	cyanide (*p*)	xylylene dicyanide	$C_6H_4(CH_2\cdot CN)_2$	IX-875	156.18
6054	**Trehalose**	mycose	$C_{12}H_{22}O_{11}\cdot 2H_2O$	XXXI-378	378.33
6055	**Triacetamide**	....	$(CH_3CO)_3N$	II-181	143.14
6056	**Triacetonamine hydrate**	tetramethyl-piperidone (γ)	$C_9H_{17}ON\cdot H_2O$	XXI-249	173.25
6057	**Triacontane** (*n*)	....	$CH_3(CH_2)_{28}CH_3$	I-176	422.80
6058	**Triamino-** azobenzene	(2,4,3′); Bismarck brown	$NH_2\cdot C_6H_4\cdot N{:}N\ C_6H_3(NH_2)_2$	XVI-386	227.26
6059	benzene (1,2,3)	....	$(NH_2)_3C_6H_3$	XIII-294	123.16
6060	benzene (1,2,4)	....	$(NH_2)_3C_6H_3$	XIII-294	123.16
6061	benzene HCl	(1,2,4)	$(NH_2)_3C_6H_3\cdot 2HCl$	XIII-295	196.09
6062	benzene (1,3,5)	(free base unknown)	$(NH_2)_3C_6H_3$	XIII-299	123.16
6063	benzene HCl	(1,3,5)	$(NH_2)_3C_6H_3\cdot 3HCl$	XIII-299	232.55
6064	benzoic acid (2,3,5)	....	$(NH_2)_3C_6H_2\cdot CO_2H$	XIV-455	167.17

Tolyl iodide 3905-7
Tolyl-mercaptan 5894-6
Tolyl-mercuric chloride 4039
Tolyl-mustard oil 6041-3
Tolyl phosphate 6351-3
Tolyl phosphite 6354-5
Tolyl thiophosphate 6356-8
Tolylene alcohol 6497-9

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6029	lf./bz. pet.	....	68.5	....	sl. s. h.	s.	s.; sl. s. lg.
6030	lf./bz.	....	93-4	....	1 c.; 5 h.	v. s.	s.; sl. s. bz.
6031	nd./lg.	....	94-5	....	i.; v. s. bz.	v. s.	v. s.
6032	pr./al.	....	78-9	236^{15mm}	s. bz.	s. h.	s.; sl. s. h. pet.
6033	cr./lg.	....	95-6	400-5	v. s. bz.; v. s. lg.	v. s.; v. s. chl.	v. s.; v. s. act.
6034	lf./al.	....	102-3	....	sl. s. lg.	sl. s. c.	s. bz.
6035	col. oil	....	....	246	v. sl. s. h.	v. s.	v. s. bz.
6036	yel. lq.	....	....	$149\text{-}51^{41mm}$	i.	s.	s.
6037	lf./aq. al.	....	82	252^{729mm}	v. sl. s. h.	v. s.	v. s. pet.
6038	col. cr.	....	35	....	i.	s.	s.
6039	col. cr.	....	74	....	i.	s.	s.
6040	col. cr.	....	39	....	i.	s.	s.
6041	col. lq.	$1.104^{25°}_{25}$	....	239	i.	v. s.	∞
6042	lq.	....	<-20	244^{732mm}	....	....	....
6043	nd./et.	$1.087^{25°}_{25}$	26	237	d. h.	d. h.	s.
6044	lf./bz.	....	145-6	....	i.	s.	s.; i. lg.
6045	cr./aq.	....	151-2	....	v. s. h.	v. s.	v. sl. s.
6046	pr./al.	....	110-1	....	s. h.	s.	s.
6047	pl./al.	....	188	....	v. sl. s. c.	s. h.	....
6048	lf./al.	....	190-2	....	$0.25^{45°}$; s. h.	s.	s.
6049	lf./aq.	....	142-3	....	....	....	....
6050	nd./aq.	....	180-1	....	$0.3^{45°}$	s.	$0.06^{23°}$
6051	cr./et.	....	59-60	....	....	s.	s.
6052	cr.	....	28-9	$305\text{-}10^{300mm}$ sl. d.	i.	s.	s.; s. chl.
6053	nd./aq.	....	98	....	sl. s. h.	s.	s.; s. chl.
6054	rhb./al.	....	97*	$-2H_2O >$ 130°	s. h.	sl. s. h.	i.
6055	nd./et.	....	78-9	....	....	....	s.
6056	pl./aq.	....	59; 35 (anh.)	205 sl. d.	s.	s.	s.
6057	cr.	lq. $0.780^{65.9°}$	65.9	$235^{1.0mm}$	s. bz.	sl. s.	s.
6058	or. mn./aq.	....	143.5	....	i.	s.	s.
6059	cr.	....	103 ±	336	v. s.	v. s.	v. s.
6060	lf./chl.	....	<100	340 ±	v. s.	v. s.	sl. s.; sl. s. chl.
6061	nd.	....	225	....	s.	v. sl. s.	sl. s. HCl
6062	....	....	....	....	....	....	....
6063	col. cr.	....	....	....	s.; d. h.	sl. s.	i.
6064	cr./aq.	....	....	....	s. h.	v. sl. s. h.	i.

* Anhydrous, m. p. 210°.

Toxilic acid 3995
"Traubensaure" 5690
Triacetin 3418
Triacetyl-hydroquinone 3775
Triacetyl-pyrogallol 5516

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
6065	**Triamino** benzoic acid (3,4,5)	....	$(NH_2)_3C_6H_2\cdot CO_2H\cdot \frac{1}{2}H_2O$	XIV-455	176.17
6066	benzoic acid HCl	(2,4,6)	$(NH_2)_3C_6H_2\cdot CO_2H\cdot 3HCl$	XIV-455	276.56
6067	chlorobenzene HCl	(2,4,6)	$(NH_2)_3C_6H_2Cl\cdot 3HCl$	....	267.00
6068	phenol (2,4,6)	....	$(NH_2)_3C_6H_2\cdot OH$	XIII-569	139.16
6069	toluene (2,4,6)	....	$(NH_2)_3C_6H_2\cdot CH_3$	XIII-303	137.18
6070	toluene HCl	(2,4,6)	$(NH_2)_3C_6H_2CH_3\cdot 3HCl$	XIII-303	246.58
6071	triphenylmethane (*o,p′,p″*)	*o*-leucoaniline	$(NH_2\cdot C_6H_4)_3CH$	XIII-311	289.37
6072	triphenylmethane (*m,p′,p″*)	pseudo-leucoaniline	$(NH_2\cdot C_6H_4)_3CH$	XIII-312	289.37
6073	triphenylmethane (*p,p′,p″*)	*p*-leucoaniline	$(NH_2\cdot C_6H_4)_3CH$	XIII-313	289.37
6074	**Triamyl**-amine (*n*)	....	$(C_5H_{11})_3N$	*IV-378	227.42
6075	amine (*iso*)	....	$(C_5H_{11})_3N$	IV-183	227.42
6076	amine (*d*)	....	$[C_2H_5\cdot CH(CH_3)\cdot CH_2]_3N$	IV-179	227.42
6077	borate (*n*)	*n*-amyl borate	$(C_5H_{11})_3BO_3$	....	272.23
6078	**Triazo**-acetic acid	....	$(N{:}N){:}N\cdot CH_2\cdot CO_2H$	II-229	101.07
6079	benzene	phenyl azide	$C_6H_5\cdot N_3$	V-276	119.12
6080	**Triazole**	pyrrodiazole	$\underline{CH{:}N\cdot NH\cdot CH{:}N}$	XXVI-13	69.07
6081	**Tribenzamide**	....	$(C_6H_5CO)_3N$	IX-214	329.34
6082	**Tribenzoyl** methane (α)	....	$(C_6H_5CO)_2C{:}C(OH)\cdot C_6H_5$	VII-877	328.35
6083	methane (β)	....	$(C_6H_5CO)_3CH$	VII-877	328.35
6084	**Tribenzyl**-amine	....	$(C_6H_5\cdot CH_2)_3N$	XII-1038	287.39
6085	citrate	benzyl citrate	$(C_6H_5CH_2)_3C_6H_5O_7$	....	462.48
6086	**Tribromo**-acetamide	....	$Br_3C\cdot CO\cdot NH_2$	II-221	295.79
6087	acetanilide (2,4,6)	....	$Br_3C_6H_2\cdot NH\cdot COCH_3$	XII-665	371.88
6088	acetic acid	....	$Br_3C\cdot CO_2H$	II-220	296.78
6089	aniline (2,3,4)	....	$Br_3C_6H_2\cdot NH_2$	XII-662	329.85
6090	aniline (2,3,5)	....	$Br_3C_6H_2\cdot NH_2$	XII-662	329.85
6091	aniline (2,4,5)	....	$Br_3C_6H_2\cdot NH_2$	XII-662	329.85
6092	aniline (2,4,6)	....	$Br_3C_6H_2\cdot NH_2$	XII-663	329.85
6093	aniline (3,4,5)	....	$Br_3C_6H_2\cdot NH_2$	XII-668	329.85
6094	anisole (2,4,6)	....	$Br_3C_6H_2\cdot OCH_3$	VI-205	344.86
6095	benzene (1,2,4)	(*uns*)	$Br_3C_6H_3$	V-213	314.83
6096	benzene (1,2,3)	(*vic*)	$Br_3C_6H_3$	V-213	314.83
6097	benzene (1,3,5)	(*sym*)	$Br_3C_6H_3$	V-213	314.83
6098	benzoic acid (2,4,6)	....	$Br_3C_6H_2\cdot CO_2H$	IX-360	358.84
6099	benzoic acid (3,4,5)	....	$Br_3C_6H_2\cdot CO_2H$	IX-361	358.84
6100	butane (1,2,3)	....	$CH_3(CHBr)_2CH_2Br$	I-121	294.84
6101	butane	1,2,3-triBr-2-Me-propane	$(CH_2Br)_2{:}CBr\cdot CH_3$	I-128	294.84
6102	*tert*-butyl alcohol	acetone-bromoform	$(CH_3)_2C(OH)\cdot CBr_3$	*I-193	310.84
6103	ethane (1,1,2)	vinyl tribromide	$Br\cdot CH_2\cdot CHBr_2$	I-93	266.79
6104	ethyl alcohol	avertin	$Br_3C\cdot CH_2OH$	**I-338	282.79
6105	ethylene	ethylene tribromide	$Br\cdot CH{:}CBr_2$	I-191	264.78
6106	mesitylene	(2,4,6;1,3,5)	$Br_3C_6(CH_3)_3$	V-409	356.91
6107	β-naphthol	(1,3,6;2)	$Br_3C_{10}H_4\cdot OH$	VI-652	380.89
6108	phenol (2,4,6)	(*sym*)	$Br_3C_6H_2\cdot OH$	VI-203	330.83

Triamino-diphenyl 262
Triamino-triazine 4020
Triamino-triphenyl carbinol 5038
Triarachin 3419
Tribenzal-diamine 3700
Tribenzoin 3420

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6065	nd./aq.	....	$-H_2O$, > 100	....	s. h.	i.	i.
6066	pr./aq.	....	....	....	s.	sl. s.	i.
6067	brn. pd.	....	....	....	s.	sl. s.	i.
6068	unstable	....	....	257	....	....	....
6069	oil	....	....	....	....	....	....
6070	nd.	....	....	....	s.; d. h.	....	....
6071	cr./al.	....	165	....	....	....	....
6072	nd./et. lg.*	....	150*	....	v. sl. s. lg.	s.	sl. s.
6073	lf./aq.	....	148	....	sl. s. c.	s. abs.	s. bz.
6074	lq.	....	....	240-5	....	....	....
6075	col. lq.	$0.786^{20°}_{4}$	....	235	....	....	....
6076	col. lq.	$0.796^{13°}$	....	230-7	i.	v. s.	∞
6077	col. lq.	....	....	$130\text{-}2^{6mm}$	....	....	....
6078	col. hyg.	$1.354^{33°}$	16 ± ; expl.	93^{3mm}	....	....	....
6079	yel. oil	$1.088^{20°}_{20}$	expl.	73.5^{24mm}	i.	sl. s.	sl. s.
6080	nd./et.	....	120-1	260	v. s.	v. s.	sl. s.
6081	nd./al.	....	207-8	subl.	s. h. bz.	i. c.	v. sl. s.
6082	cr. ppt.	....	210-20	subl.	0.5/3 cc. chl.	s.	s. act.
6083	nd./al.	....	226-31	....	0.5 c. act. 0.2 chl.	0.01 c.	i. 10% Na_2CO_3
6084	mn./et.	$0.991^{95°}_{4}$	92-3	380-90	v. sl. s.	s. h.	s.
6085	col. pl.	....	....	....	i.	sl. s.	i.
6086	mn.	....	121-2	....	v. sl. s. bz.	s. h.	s. h.
6087	nd./al.	....	232	....	....	....	....
6088	cr.	....	135	245 d.	v. s.; d. h.	v. s.	v. s.
6089	lf./aq. al.	....	100.6	....	sl. s.	v. s.	v. s. bz.
6090	nd./al.	....	91	....	....	....	....
6091	nd./al.	....	85-6	....	v. s. bz.	v. s.	v. s.
6092	rhb./bz.	$2.35^{10°}_{10}$	119-20	300	i.; s. chl.	v. s. h.	v. s.
6093	nd.	....	118-9	....	i.	s.	s.
6094	nd./al.	....	87-8	....	....	$1^{15°}$	....
6095	nd./al.	....	44-5	275-6	i.; v. s. bz.	v. s. h.	v. s.
6096	col./al.	2.658	87-8	....	....	....	....
6097	nd./al.	....	119-20	271^{765mm}	i.	sl. s. h.	s.
6098	pr./aq.	....	187	....	$0.35^{15°}$	$0.55^{100°}$ aq.	....
6099	nd./aq. al.	....	234-5	....	v. sl. s. h.	s.	s. h.
6100	col. lq.	$2.190^{16°}_{4}$	−19 ±	$110\text{-}3^{19mm}$	....	....	....
6101	col. lq.	$2.211^{14°}_{4}$	....	222-5	i.	....	....
6102	cr./aq. al.	....	167-76	....	sl. s.	s.	s.
6103	lq.	$2.579^{20°}_{4}$	−26	$187\text{-}8^{752mm}$	....	....	....
6104	col. cr.	....	79-80	$92\text{-}3^{10mm}$	$2.5^{40°}$	s.	s.; s. bz.
6105	lq.	$2.708^{20.5°}$	....	163-4	....	....	....
6106	tri./al.	....	223-6	....	i.	v. sl. s. h.	s. bz.
6107	nd./ac.	....	155	....	....	....	....
6108	nd./aq.	$2.55^{20°}_{20}$	96	subl.	$0.01^{15°}$; $50^{25°}$ bz.	v. s.; v. s. act.	s.; $12^{25°}$ CCl_4

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* Crysts./bz. + $1C_6H_6$, m. p. 145°.

Tribenzylene-benzene 6362
Tribromo-acetaldehyde 876
Tribromo-hydrin 6112
Tribromo-methane 1016
Tribromo-nitromethane 4688

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Tribromo				
6109	phenyl acetate	(1;2,4,6)	$CH_3CO_2 \cdot C_6H_2Br_3$	VI-205	372.87
6110	phenyl salicylate	(2,1;2′,4′,6′); tribromosalol	$HO \cdot C_6H_4 \cdot CO_2 \cdot C_6H_2Br_3$	X-78	450.93
6111	phenyl-*p*-toluenesulfonate (2,4,6)	....	$CH_3 \cdot C_6H_4 \cdot SO_3 \cdot C_6H_2Br_3$	....	485.01
6112	propane (1,2,3)	glyceryl tribromohydrin	$(CH_2Br)_2:CHBr$	I-112	280.82
6113	quinaldine (*ω*)	....	$C_9H_6N \cdot CBr_3$	....	379.90
6114	resorcinol (2,4,6)	....	$Br_3C_6H(OH)_2$	VI-822	346.83
6115	**Tributyl**-amine (*n*)	....	$(C_4H_9)_3N$	IV-157	185.34
6116	amine (*iso*)	....	$(C_4H_9)_3N$	IV-166	185.34
6117	borate (*n*)	*n*-butyl borate	$B(OC_4H_9)_3$	**I-398	230.16
6118	carbinol (*n*)	....	$(C_4H_9)_3C \cdot OH$	**I-464	200.35
6119	citrate (*n*)	*n*-butyl citrate	$(C_4H_9)_3C_6H_5O_7$	**III-371	360.44
6120	phenyl phosphate (*p*; *tert*)	phosphen 7	$[(CH_3)_3C \cdot C_6H_4 \cdot O]_3PO$	....	494.59
6121	phosphate (*n*)	*n*-butyl phosphate	$(C_4H_9O)_3PO$	**I-397	266.32
6122	**Tri-*iso*-butylene**	....	$(CH_3)_2C:C[C(CH_3)_3]_2$	I-225	168.31
6123	**Tricarballylic acid**	....	$(HO_2C \cdot CH_2)_2:CH \cdot CO_2H$	II-815	176.12
6124	**Trichloro**-acetal	....	$Cl_3C \cdot CH(OC_2H_5)_2$	I-621	221.52
6125	acetal	....	$Cl_3C \cdot CH(OC_2H_5)_2$	I-621	221.52
6126	acetamide	....	$Cl_3C \cdot CO \cdot NH_2$	II-211	162.42
6127	acetanilide (2,4,6)	....	$CH_3 \cdot CO \cdot NH \cdot C_6H_2Cl_3$	XII-628	238.51
6128	acetic acid	....	$Cl_3C \cdot CO_2H$	II-206	163.40
6129	acetyl chloride	....	$Cl_3C \cdot CO \cdot Cl$	II-210	181.85
6130	aniline (2,3,4)	....	$Cl_3C_6H_2 \cdot NH_2$	XII-626	196.47
6131	aniline (2,4,5)	....	$Cl_3C_6H_2 \cdot NH_2$	XII-627	196.47
6132	aniline (2,4,6)	....	$Cl_3C_6H_2 \cdot NH_2$	XII-627	196.47
6133	aniline (3,4,5)	....	$Cl_3C_6H_2 \cdot NH_2$	XII-630	196.47
6134	benzene (1,2,3)	(*vic*)	$Cl_3C_6H_3$	V-203	181.46
6135	benzene (1,2,4)	(*uns*)	$Cl_3C_6H_3$	V-203	181.46
6136	benzene (1,3,5)	(*sym*)	$Cl_3C_6H_3$	V-203	181.46
6137	benzoic acid (2,3,4)	....	$Cl_3C_6H_2 \cdot CO_2H$	IX-345	225.47
6138	benzoic acid (2,3,5)	....	$Cl_3C_6H_2 \cdot CO_2H$	IX-345	225.47
6139	benzoic acid (2,4,5)	....	$Cl_3C_6H_2 \cdot CO_2H$	IX-345	225.47
6140	benzoic acid (2,4,6)	....	$Cl_3C_6H_2 \cdot CO_2H$	IX-345	225.47
6141	benzoic acid (3,4,5)	....	$Cl_3C_6H_2 \cdot CO_2H$	IX-346	225.47
6142	bromoethane	(1;2,2,2)	$BrCH_2 \cdot CCl_3$	I-90	212.32
6143	bromomethane	....	$Br \cdot CCl_3$	I-67	198.30
6144	*tert*-butyl acetate	(*β*,*β*,*β*)	$CH_3CO_2 \cdot C \cdot (CH_3)_2CCl_3$	II-131	219.50
6145	*tert*-butyl alcohol	acetone chloroform	$Cl_3C \cdot COH:(CH_3)_2$	I-382	177.47
6146	*o*-cresol (4,5,6)	(4,5,6;2,1)	$Cl_3C_6H(OH) \cdot CH_3$	*VI-175	211.48
6147	*o*-cresol (3,5,6)	(3,5,6;2,1)	$Cl_3C_6H(OH) \cdot CH_3$	*VI-175	211.48
6148	*m*-cresol (2,4,6)	(2,4,6;3,1)	$Cl_3C_6H(OH) \cdot CH_3$	*VI-189	211.48
6149	*p*-cresol (2,3,6)	(2,3,6;4,1)	$Cl_3C_6H(OH) \cdot CH_3$	VI-404	211.48
6150	dibromoethane	(1,1;2,2,2)	$Br_2CH \cdot CCl_3$	I-93	291.23
6151	ethane (1,1,1)	methyl chloroform	$CH_3 \cdot CCl_3$	I-85	133.42
6152	ethane (1,1,2)	vinyl trichloride	$ClCH_2 \cdot CHCl_2$	I-85	133.42
6153	ethyl acetate	....	$CH_3CO_2 \cdot CH_2 \cdot CCl_3$	II-128	191.45
6154	ethyl alcohol	....	$Cl_3C \cdot CH_2OH$	I-338	149.42

Tribromo-salol 6110
Tributyrin 3421
Tricaprin 3422
Tricaproin 3423
Tricaprylin 3424
Trichloro-acetaldehyde 1281

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6109	nd./al.	....	82-3	290-300	....	....	....
6110	wh. pd.	....	189	....	i.; s. chl.	sl. s.; s. act.	s. bz.; s. ac.
6111	col. cr.	....	113-4	....	i.	s.	s.
6112	cr.	2.436^{23°	16-7	219-21	i.	s.	s.
6113	tan pl.	....	127-8	....	i.	i.	i.
6114	nd./aq.	....	111	....	sl. s. c.	s. h.	s.
6115	col. lq.	$0.778^{20^\circ}_{20}$	....	$216.5^{761\,\text{mm}}$	i.	s.	∞
6116	col. lq.	$0.764^{25^\circ}_{4}$	−22	191.5	i.	s.	∞
6117	col. lq.	....	....	$103\text{-}6^{8\,\text{mm}}$	....	....	....
6118	col. lq.	$0.844^{18^\circ}_{4}$	20	$117\text{-}20^{10\,\text{mm}}$	i.	s.	s.
6119	col. lq.	$1.045^{20^\circ}_{20}$	−20	$233^{17\,\text{mm}}$	i.	∞	∞
6120	col. cr.	....	102-5	$300^{5\,\text{mm}}$	i.; ∞ bz.	2^{25°	∞ CCl_4
6121	col. lq.	$0.976^{25^\circ}_{25}$	<−80	289 d.	0.6	∞	∞
6122	col. liq.**	$0.759^{20^\circ}_{4}$	<−30**	$178\text{-}80^{752\,\text{mm}}$	i.	....	....
6123	pr./aq.	....	165-6	d.	41^{15°	v. s.	1^{18°
6124	lq.	1.266^{15°	....	197	0.5	∞	∞
6125	solid	....	83	230 d.	....	....	....
6126	mn.	....	141	$238\text{-}9^{746\,\text{mm}}$	v. sl. s.	v. s.	v. s.
6127	nd.	....	203-4	....	s. 50% ac.	s.; v. sl. s. CS_2	v. sl. s.; v. sl. s. lg.
6128	cr.	$1.617^{46^\circ}_{15}$	58(50 ±)	$195.5^{754\,\text{mm}}$	120^{25°	s.	s.
6129	col. lq.	$1.629^{16.2^\circ}$	....	118	d.	d.	....
6130	nd./lg.	....	67.5	$292^{774\,\text{mm}}$	s. lg.	v. s.	....
6131	nd./lg.	....	96	270 ±	sl. s. lg.	s.; s. CS_2	s. 50% ac.
6132	nd./lg.	....	77.5-8.5	$262^{746\,\text{mm}}$	i. H_3PO_4	s.	s.
6133	nd./aq. al.	....	100	....	....	....	....
6134	cr./al.	....	52-3	218-9	i.	sl. s.	....
6135	col. cr.	1.446^{26°	17	213	i.	....	....
6136	nd.	....	63.5	$208.5^{764\,\text{mm}}$	i.	sl. s.	....
6137	nd.	....	186(129)	....	sl. s.	s.	s.
6138	nd./aq.	....	163	....	v. sl. s. c.	s.	s.
6139	nd./aq.	....	163-4	subl.	v. sl. s. c.	s. c. abs.	....
6140	cr./aq.	....	164	....	sl. s.	s.	s.
6141	nd./aq. al.	....	203	subl.	v. sl. s. c.	s.	s.
6142	lq.	1.884	....	151-3	....	....	....
6143	col. lq.	$2.055^{0^\circ}_{4}$	−21	104.1	....	....	....
6144	lq.	....	....	191	i.; v. s. act.	v. s.; v. s. chl.	v. s.; v. s. bz.
6145	col. cr.	....	97*	167	0.8 c.	111	s.; s. chl.
6146	nd./pet.	....	77	....	sl. s.	s.; s. alk.	s.
6147	nd./ac.	....	62	....	i. pet.	s.; s. alk.	s.
6148	col. nd./aq.	....	47	265	sl. s.	s.; s. alk.	s.; s. lg.
6149	nd./pet.	....	66-7	....	sl. s.	s.; s. alk.	s.
6150	lq.	$2.317^{0^\circ}_{4}$	−4.5	$93\text{-}5^{14\,\text{mm}}$	....	....	....
6151	lq.	$1.325^{26^\circ}_{4}$	....	74.1	i.	∞	∞
6152	col. lq.	$1.441^{25.5^\circ}_{1}$	−36.7	113.5	0.44^{20°	∞	∞
6153	col. oil	1.189^{15°	....	$170^{747\,\text{mm}}$	....	....	....
6154	rhb. pl.	$1.550^{23.3^\circ}$	17.8	$151^{737\,\text{mm}}$	v. sl. s.	∞	∞

* Forms solid solution with H_2O, m. p. 75-97°. **High boiling form, **I-180, d. 0.776, b. p. 195 6°.
Trichloro-butaldehyde 1158

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
6155	**Trichloro** ethylene	ethylene trichloride	$ClCH:CCl_2$	I-187	131.40
6156	hydroquinone	(2,3,5)	$(HO)_2C_6HCl_3$	VI-850	213.46
6157	iodomethane		$Cl_3C\cdot I$	I-71	245.30
6158	lactic acid		$Cl_3C\cdot CHOH\cdot CO_2H$	III-286	193.43
6159	methylchloroformate	diphosgene	$Cl\cdot CO_2\cdot CCl_3$	III-18	197.85
6160	naphthalene (1,4,5)	(δ)	$C_{10}H_5Cl_3$	V-545	231.51
6161	naphthalene (1,4,6)	(ε)	$C_{10}H_5Cl_3$	V-546	231.51
6162	phenol (2,3,5)		$Cl_3C_6H_2\cdot OH$	VI-190	197.46
6163	phenol (2,4,5)		$Cl_3C_6H_2\cdot OH$		197.46
6164	phenol (2,4,6)	omal	$Cl_3C_6H_2\cdot OH$	VI-190	197.46
6165	phenyl phosphate	(*o*); phosphen 8	$(Cl\cdot C_6H_4\cdot O)_3PO$		429.63
6166	propane (1,2,3)	glyceryl trichlorohydrin	$(ClCH_2)_2:CHCl$	I-106	147.44
6167	propane (1,1,2)		$CH_3\cdot CHCl\cdot CHCl_2$	I-106	147.44
6168	*iso*-propyl alcohol	(1,1,1); isopral	$Cl_3C\cdot CHOH\cdot CH_3$	I-365	163.44
6169	quinone		$O:C_6HCl_3:O$	VII-634	211.44
6170	tribromoethane	(1,2,2;1,1,2)	$Cl_2CBr\cdot CClBr_2$	I-94	370.14
6171	**Tricosane** (*n*)		$CH_3(CH_2)_{21}CH_3$	I-175	324.61
6172	**Tricyanogen chloride**	cyanuric chloride	$C_3N_3Cl_3$	XXVI-35	184.43
6173	**Tridecane** (*n*)		$CH_3(CH_2)_{11}CH_3$	I-171	184.35
6174	**Tridecyl alcohol** (*n*)	tridecanol-1	$CH_3(CH_2)_{11}CH_2OH$	I-428	200.35
6175	**Tridecylene**		$C_{13}H_{26}$	I-225	182.34
6176	**Tridecylic** acid	tridecanoic acid	$CH_3(CH_2)_{11}\cdot CO_2H$	II-364	214.34
6177	aldoxime		$C_{12}H_{25}\cdot CH:NOH$	I-715	213.35
6178	**Triethanol**-amine		$N(CH_2\cdot CH_2\cdot OH)_3$	IV-285	149.19
6179	amine HCl		$C_6H_{15}O_3N\cdot HCl$	IV-285	185.65
6180	**Triethylamine**		$(C_2H_5)_3N$	IV-99	101.19
6181	hydrobromide		$(C_2H_5)_3N\cdot HBr$	IV-101	182.11
6182	hydrochloride		$(C_2H_5)_3N\cdot HCl$	IV-101	137.65
6183	**Triethyl** arsine	arsenic triethyl	$(C_2H_5)_3As$	IV-602	162.09
6184	benzene (1,3,5)	(*sym*)	$(C_2H_5)_3C_6H_3$	V-449	162.26
6185	benzene (1,2,4)	(*uns*)	$(C_2H_5)_3C_6H_3$	V-448	162.26
6186	borate	ethyl borate	$(C_2H_5O)_3B$	I-335	146.00
6187	citrate	ethyl citrate	$C_3H_5O(CO_2C_2H_5)_3$	III-568	276.28
6188	phosphate	ethyl phosphate	$(C_2H_5O)_3PO$	I-332	182.16
6189	phosphine		$(C_2H_5)_3P$	IV-582	118.16
6190	phosphine oxide		$(C_2H_5)_3PO$	IV-592	134.16
6191	phosphine sulfide		$(C_2H_5)_3PS$	IV-592	150.22
6192	phosphite	ethyl phosphite	$(C_2H_5O)_3P$	I-330	166.16
6193	propionate, ortho-	Et orthopropionate	$C_2H_5\cdot C(OC_2H_5)_3$	II-240	176.25
6194	silicol		$(C_2H_5)_3Si\cdot OH$	IV-627	132.25
6195	silicol ethyl ether		$(C_2H_5)_3Si\cdot OC_2H_5$	IV-627	160.30
6196	silicon hydride		$(C_2H_5)_3Si\cdot H$	IV-625	116.25
6197	silicon oxide		$[(C_2H_5)_3Si]_2O$	IV-627	246.48
6198	stibine	antimony triethyl	$(C_2H_5)_3Sb$	IV-618	208.94
6199	**Triethylene** glycol		$(HOCH_2CH_2OCH_2)_2$	I-468	150.17
6200	glycol diacetate		$(CH_3CO_2\cdot CH_2\cdot CH_2\cdot O\cdot CH_2)_2$	II-141	234.24
6201	tetramine		$(H_2N\cdot CH_2\cdot CH_2\cdot NH\cdot CH_2)_2$	IV-255	146.24
6202	**Trifluoro**-1-chloroethane	(1,2,2)	$F_2CH\cdot CHFCl$	I-83	118.49

Trichloro-hydroxy toluene 6146-9
Trichloro-lactic nitrile 1284
Trichloro-methane 1477
Trichloro-nitromethane 4697

Tricresol, mixt. of 1545-7
Tridecanoic acid 6176
Tridecanol 6174
Tridecanone 4408

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6155	col. lq.	$1.466^{20^\circ}_{20}$	−73	87.2	0.1^{25°	∞	∞
6156	pr./aq.	....	134	subl.	0.6^{15°	v. s.	v. s.
6157	lq.	2.36^{17°	−19	42 d.	....	....	....
6158	cr./et.	....	124	$140\text{-}70^{45\text{mm}}$	v. s.	v. s.	s.; s. chl.
6159	lq.	1.653^{14°	−57	127.5	d. ?	....	....
6160	nd./al.	....	133	....	....	v. s. h.	....
6161	nd./al.	....	65-6	....	....	sl. s. h.	....
6162	nd./aq. al.	....	55	249-50	sl. s. h.	s.	s.; s. lg.
6163	col./pet.	....	61-3	252	i.; s. CCl_4	s.; s. bz.	s.
6164	nd.	$1.490^{75^\circ}_{4}$	68-9	246	0.09^{25°	v. s.	v. s.
6165	col. cr.	$1.38^{60^\circ}_{4}$	35	$255\text{-}65^{5\text{mm}}$	i.; ∞ bz.	v. s.	∞ CCl_4
6166	lq.	$1.391^{20^\circ}_{4}$	−14.7	158	<0.1	∞	∞
6167	oil	1.372^{25°	<−20	140	i.	∞	∞
6168	col. mn.	....	50-1	$161.8^{773\text{mm}}$	3	s.; s. KOH	s.
6169	yel. lf./aq.	....	168-9	subl.	i. c.	v. s. h.	v. s.
6170	pr.	2.44^{18°	178-80 d.	....	....	....	....
6171	lf.	$0.779^{47.7^\circ}_{4}$	47.7	$234^{15\text{mm}}$	i.	....	....
6172	mn./et.	1.32	145	190	d. h.; s. ac.	v. s. chl.	s. h. abs.
6173	col. lq.	$0.757^{20^\circ}_{4}$	−6.2	234	i.	v. s.	v. s.
6174	cr.	$0.822^{31^\circ}_{4}$	30.5	$155\text{-}6^{15\text{mm}}$	....	....	....
6175	lq.	0.845^{0°	....	232.7	i.	s.	v. s.
6176	cr./al.	....	41	$199\text{-}200^{24\text{mm}}$	i.	v. s.	v. s.
6177	nd./aq. al.	....	80.5	....	sl. s. bz.	sl. s.	v. s.; s. chl.
6178	col. lq.	$1.126^{20^\circ}_{20}$	20-1	$277\text{-}9^{150\text{mm}}$	∞	∞; s. chl.	sl. s.
6179	cr./al.	....	177	....	sl. s.	v. sl. s.	....
6180	col. oil	$0.729^{20^\circ}_{20}$	−114.8	89.4	∞ < 19°	∞	∞
6181	hex./chl.	1.322	248	subl. > 225	151^{25°	23^{25° chl.	i.; s. al.
6182	cr./al.	$1.069^{21^\circ}_{4}$	253-4	subl. > 245	150^{28°	s.; s. chl.	i.
6183	col. lq.	$1.150^{20^\circ}_{4}$	....	140^{736} sl. d.	i.	∞	∞
6184	lq.	$0.861^{20^\circ}_{4}$	....	215	i.	s. abs.	s.
6185	lq.	$0.882^{17^\circ}_{4}$	....	$217\text{-}8^{755\text{mm}}$	i.	s. abs.	s.
6186	lq.	$0.864^{20^\circ}_{20}$	....	120	d.	....	....
6187	oil	$1.137^{20^\circ}_{4}$	....	294±	i.	∞	∞
6188	col. lq.	$1.068^{20^\circ}_{4}$	....	215-6	100^{25°	s.	s.
6189	col. lq.	$0.800^{15^\circ}_{4}$	....	$127.5^{744\text{mm}}$	i.	∞	∞
6190	col. nd.	....	52-3(44)	242.8-3.0	∞; i. KOH	∞	sl. s.
6191	hex. pr.	....	94	ign. 70	....	....	....
6192	lq.	$0.969^{20^\circ}_{4}$	....	$155\text{-}7^{760\text{mm}}$	i.	v. s.	v. s.
6193	col. lq.	0.887^{20°	....	$161^{766\text{mm}}$	....	....	....
6194	lq.	0.871^{0°	....	154	i.	....	....
6195	lq.	0.840^{0°	....	153	i.	∞	∞
6196	lq.	$0.721^{15^\circ}_{4}$	....	95-6	i.	i. H_2SO_4	....
6197	lq.	0.859^{0°	....	231	i.	s. H_2SO_4	....
6198	col. lq.	1.324^{16°	<−29	158-9	....	v. s.	v. s.
6199	col. hyg.	$1.125^{20^\circ}_{20}$	−5	290	∞; i. pet.	∞; ∞ bz.	v. sl. s.
6200	col. lq.	....	....	300	∞	∞	∞
6201	lq.	0.982^{15°	12	266-7	v. s.	v. s.	....
6202	col. lq.	1.365^{0°	....	17	....	v. s.	....

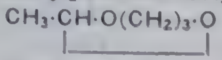
Tridecyl cyanide 4456
Triethyl aluminum 230
Triethyl bismuthine 855
Triethyl boron 871
Triethyl carbinol 3533
Triethyl tin 5953

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Trifluoro				
6203	2-chloroethylene	(1,1,2)	$F_2C{:}CFCl$	....	116.48
6204	1,2-dibromoethane	(1,1,2)	$F_2BrC\cdot CHBrF$	I-92	241.86
6205	1,1,2-tribromoethane	(1,2,2)	$Br_2CF\cdot CBrF_2$	I-94	320.77
6206	1,1,2-trichloroethane	(1,2,2) Freon-113	$Cl_2CF\cdot CClF_2$	....	187.39
6207	**Triglycol dichloride**	....	$Cl(CH_2\cdot CH_2\cdot O)_2\cdot CH_2\cdot CH_2\cdot Cl$	....	187.07
6208	**Triglycyl** glycine	....	$NH_2(CH_2CONH)_3\cdot CH_2\cdot CO_2H$	IV-377	246.22
6209	glycine ester	biuret base	$C_7H_{13}O_3N_4\cdot CO_2C_2H_5$	IV-377	274.28
6210	**Trihexylamine** (*n*)	....	$(C_6H_{13})_3N$	IV-188	269.50
6211	**Trihydroxy**-acetophenone (2,3,4)	gallacetophenone; alizarin yellow C	$(HO)_3C_6H_2\cdot COCH_3$	VII-393	168.14
6212	anthraquinone	anthragallol (1,2,3)	$C_6H_4(CO)_2C_6H(OH)_3$	VIII-505	256.20
6213	anthraquinone	(1,2,4); purpurin	$C_6H_4(CO)_2C_6H(OH)_3$	VIII-509	256.20
6214	anthraquinone (1,2,6)	flavopurpurin	$HO\cdot C_6H_3(CO)_2C_6H_2{:}(OH)_2$	VIII-513	256.20
6215	anthraquinone (1,2,7)	anthrapurpurin	$HO\cdot C_6H_3(CO)_2C_6H_2{:}(OH)_2$	VIII-516	256.20
6216	benzene (1,2,3)(*v*)	pyrogallol	$(HO)_3C_6H_3$	VI-1071	126.11
6217	benzene (1,2,4) (*uns*)	hydroxy-hydroquinone	$(HO)_3C_6H_3$	VI-1087	126.11
6218	benzene (1,3,5) (*sym*)	phloroglucinol	$(HO)_3C_6H_3\cdot 2H_2O$	VI-1092	162.14
6219	benzene (1,3,5)	phloroglucinol	$(HO)_3C_6H_3$	VI-1092	126.11
6220	benzoic acid (2,3,4)	pyrogallol carboxylic acid	$(HO)_3C_6H_2\cdot CO_2H\cdot xH_2O$	X-464	170.12
6221	benzoic acid (2,4,5)	....	$(HO)_3C_6H_2\cdot CO_2H\cdot \frac{1}{2}H_2O$	X-468	179.13
6222	benzoic acid (2,4,6)	phloroglucinol carboxylic acid	$(HO)_3C_6H_2\cdot CO_2H\cdot H_2O$	X-468	188.13
6223	benzoic acid (3,4,5)	gallic acid	$(HO)_3C_6H_2\cdot CO_2H\cdot H_2O$	X-470	188.13
6224	benzophenone (2,3,4)	alizarin yellow A	$C_6H_5\cdot CO\cdot C_6H_2(OH)_3\cdot H_2O$	VIII-417	248.23
6225	benzophenone (2,6,2′)	salicyloyl-resorcinol	$(HO)_2C_6H_3\cdot CO\cdot C_6H_4OH$	VIII-422	230.21
6226	butyrophenone (2,3,4)	*n*-butyropyrogallol	$(HO)_3C_6H_2\cdot COC_3H_7\cdot H_2O$	VIII-399	214.21
6227	butyrophenone (*n*)	(2,4,6)	$(HO)_3C_6H_2\cdot COC_3H_7\cdot H_2O$	*VIII-691	214.21
6228	glutaric acid	(*d* or *l*)	$(CHOH)_3(CO_2H)_2$	III-553	180.11
6229	glutaric acid (*dl*)	....	$(CHOH)_3(CO_2H)_2$	III-553	180.11
6230	methyl-aminomethane	....	$H_2N\cdot C(CH_2OH)_3$	IV-303	121.14
6231	pyridine (*sym*)	(2,4,6)	$(HO)_3C_5H_2N$	XXI-197	127.10
6232	**Triiodo**-acetic acid	....	$I_3C\cdot CO_2H$	II-225	437.79
6233	benzene (1,2,3)	(*vic*)	$I_3C_6H_3$	V-228	455.84
6234	benzene (1,2,4)	(*uns*)	$I_3C_6H_3$	V-228	455.84
6235	benzene (1,3,5)	(*sym*)	$I_3C_6H_3$	V-228	455.84
6236	benzoic acid	(2,3,5)	$I_3C_6H_2\cdot CO_2H$	*IX-150	499.85

Trifluoro-methane 3287
Trigemin 364
Trigenolline, cf. alkd.
Trigonelline, cf. alkd.
Triheptylin 3425
Trihydroxy-ethylamine 6178

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6203	gas	....	−157.5	−27.9	d.	....	....
6204	col. lq.	2.254^{14°	....	76.5	....	....	....
6205	lq.	2.567^{7°	d. 330	117	....	....	....
6206	lq.	$1.576_{4}^{20^\circ}$	−35	47.6	i.	∞	∞; ∞ bz.
6207	lq.	$1.197_{20}^{20^\circ}$	....	241	1.9^{20°	....	....
6208	col. pd.	....	d. > 220	....	2^{15°; 4^{100°	v. sl. s.	....
6209	pl./aq.	....	d. 270	....	v. s. c.	v. sl. s.	v. sl. s.
6210	col. lq.	....	....	263-5	v. sl. s.	v. s.	v. s.
6211	col. cr./aq.	....	173	....	0.2 c.; s. h.	s.	v. sl. s. bz.
6212	cr./al. ac.	....	310 d.	subl. 290 ±	v. sl. s.	s.; s. H_2SO_4	s.
6213	red nd./al.	....	256-7	....	sl. s. h.	s.	s.
6214	yel. nd./al.	....	>360	459 sl. d.	v. sl. s. h.	s.	sl. s.
6215	or. nd./al.	....	369	462 sl. d.	sl. s. h.	v. s. h.	sl. s.
6216	nd.	1.453^{4°	133-4	309	40^{13°	s.; sl. s. bz.	s.
6217	mn./aq.	....	140.5	....	v. s.	v. s.	v. s.; sl. s. bz.
6218	rhb.	....	117; −$2H_2O$, 110	subl. sl. d.	1.13^{25°	v. s.	v. s.
6219	cr.	....	209-19	subl.	....	....	....
6220	nd./aq.	....	206 d. (anh.)	subl. in CO_2	$0.13^{12.5^\circ}$	s.	sl. s.
6221	nd./aq.	....	217-8 d. (anh.)	$-\frac{1}{2}H_2O$, 105	s. h.	s.	....
6222	....	....	....	....	sl. s. c.	s.	v. s.
6223	mn./aq.	$1.694_{4}^{4^\circ}$	235 d. (anh.)	$-H_2O$, 100	1^{13°; 3.3^{100°	28^{15° abs.	2.5^{15°; 20 act.
6224	yel. nd./aq. al.	....	140-1 (anh.)	....	v. sl. s. c.	s.; s. alk.; sl. s. bz.	s.; s. H_2SO_4
6225	yel. pl./al.	....	133-4	....	v. sl. s. h.	s.; s. alk.	s. bz.
6226	yel. nd./aq.	....	76-80; 100 (anh.)	....	....	....	....
6227	nd./aq.	....	179-80 (anh.)	$-H_2O$, 110	sl. s.	v. s.	v. s.
6228	lf./al.	....	128	....	v. s.	s.	s. act.
6229	pl./act.	....	154-5 d.	....	v. s.	v. s.	s. act.
6230	nd./al.	....	171-2	$219\text{-}20^{10\text{mm}}$	v. s.	0.4^{20°	i.; v. sl. s. act. (d.)
6231	nd. or pd.	....	220-30 d.	....	sl. s.; d. h.	i.	i.
6232	yel. lf.	....	150 d.	....	s.	....	....
6233	nd./al.	....	116	....	i.	v. s.	v. s.
6234	nd./al.	....	91.4	....	i.	s.	s. chl.
6235	nd./ac.	....	182-4	....	i.	sl. s.	sl. s.
6236	pr./al.	....	223-4	....	i.; v. sl. s. bz.	s. h.	i.

Trihydroxy-methylanthraquinone 2874
Trihydroxy-toluene 4361
Trihydroxy-triphenylmethane 3963

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
6237	**Triiodo** ethane (1,1,1)	methyl iodoform	$CH_3\cdot CI_3$	I-99	407.80
6238	phenol (2,4,6)	....	$I_3C_6H_2\cdot OH$	VI-211	471.84
6239	**Triketohydrindene hydrate**	ninhydrin	$C_6H_4(CO)_2{:}C(OH)_2$	*VII-475	178.14
6240	**Trimethoxy** benzoic acid (2,3,4)	....	$(CH_3O)_3C_6H_2\cdot CO_2H$	X-465	212.20
6241	benzoic acid (2,4,5)	asaronic acid	$(CH_3O)_3C_6H_2\cdot CO_2H$	X-468	212.20
6242	benzoic acid (3,4,5)	gallic acid trimethyl ether	$(CH_3O)_3C_6H_2\cdot CO_2H$	X-481	212.20
6243	**Trimethyl-** acetaldehyde	pivalic aldehyde	$(CH_3)_3C\cdot CHO$	I-688	86.13
6244	acetaldehyde oxime	....	$(CH_3)_3C\cdot CH{:}NOH$	*I-354	101.15
6245	acetic acid	pivalic acid	$(CH_3)_3C\cdot CO_2H$	II-319	102.13
6246	acetonitrile	*tert*-butyl cyanide	$(CH_3)_3C\cdot CN$	II-320	83.13
6247	acetophenone (2,4,6)	acetomesitylene	$(CH_3)_3C_6H_2\cdot COCH_3$	VII-332	162.22
6248	amine	....	$(CH_3)_3N$	IV-43	59.11
6249	amine HCl	....	$(CH_3)_3N\cdot HCl$	IV-46	95.58
6250	aniline (2,4,5)	pseudocumidine	$(CH_3)_3C_6H_2\cdot NH_2$	XII-1150	135.20
6251	aniline (2,4,6)	mesidine	$(CH_3)_3C_6H_2\cdot NH_2$	XII-1160	135.20
6252	arsine	arsenic trimethyl	$(CH_3)_3As$	IV-600	120.01
6253	benzene (1,2,3)	hemimellitene	$(CH_3)_3C_6H_3$	V-399	120.19
6254	benzene (1,2,4)	pseudocumene	$(CH_3)_3C_6H_3$	V-400	120.19
6255	benzene (1,3,5)	mesitylene	$(CH_3)_3C_6H_3$	V-406	120.19
6256	benzoic acid (2,3,5)	γ-*iso*-durylic acid	$(CH_3)_3C_6H_2\cdot CO_2H$	IX-552	164.20
6257	benzoic acid (2,3,4)	prehnitylic acid	$(CH_3)_3C_6H_2\cdot CO_2H$	IX-552	164.20
6258	benzoic acid (2,3,6)	....	$(CH_3)_3C_6H_2\cdot CO_2H$	IX-552	164.20
6259	benzoic acid (2,4,5)	durylic acid	$(CH_3)_3C_6H_2\cdot CO_2H$	IX-554	164.20
6260	benzoic acid (3,4,5)	α-*iso*-durylic acid	$(CH_3)_3C_6H_2\cdot CO_2H$	IX-554	164.20
6261	benzoic acid (2,4,6)	β-*iso*-durylic acid	$(CH_3)_3C_6H_2\cdot CO_2H$	IX-553	164.20
6262	borate	methyl borate	$(CH_3O)_3B$	I-287	103.92
6263	citrate	....	$C_3H_5O(CO_2CH_3)_3$	III-567	234.20
6264	methoxy-propenyl ammonium bromide	esmodil	$(CH_3)_3N(Br)\cdot CH_2\cdot C({:}CH_2)\cdot OCH_3$	....	210.12
6265	phenol (2,4,5)	pseudocumenol	$(CH_3)_3C_6H_2\cdot OH$	VI-509	136.19
6266	phenol (2,4,6)	mesitol	$(CH_3)_3C_6H_2\cdot OH$	VI-518	136.19
6267	phenyl ammonium iodide	....	$(CH_3)_3C_6H_5N\cdot I$	XII-159	263.13
6268	phosphate	methyl phosphate	$(CH_3O)_3PO$	I-286	140.08
6269	phosphine	....	$(CH_3)_3P$	IV-580	76.08
6270	quinoline (2,3,4)	....	$(CH_3)_3C_9H_4N$	XX-414	171.23
6271	quinoline (2,3,6)	....	$(CH_3)_3C_9H_4N$	XX-414	171.23
6272	quinoline (2,4,6)	....	$(CH_3)_3C_9H_4N\cdot aq.$	XX-414	171.23
6273	quinoline (2,6,8)	....	$(CH_3)_3C_9H_4N$	XX-415	171.23
6274	stibine	antimony trimethyl	$(CH_3)_3Sb$	IV-617	166.86
6275	thioacetamide	....	$(CH_3)_3C\cdot CS\cdot NH_2$	....	117.21
6276	urea	....	$(CH_3)_2N\cdot CO\cdot NHCH_3$	IV-74	102.14
6277	**Trimethylene-** acetal	....	 $CH_3\cdot CH\cdot O(CH_2)_3\cdot O$	....	102.13
6278	bromohydrin	α-bromohydrin	$Br\cdot(CH_2)_3\cdot OH$	I-356	139.00

Triiodo-methane 3887
Triisobutylene 6122
Trilaurin 3426
Trimellitic acid 684
Trimesic acid 685
Trimesitinic acid 5508
Trimethyl aluminum 231
Trimethyl bismuthine 856
Trimethyl boron 872
Trimethyl butene 3556
Trimethyl carbinol 1037
Trimethyl-cyclohexenone 5269
Trimethyl-ethylene 502
Trimethyl-gallic acid 6242
Trimethyl-glycine 846

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6237	yel. octahed.	....	95 d.	....	v. s. CS_2; v. s. bz.	v. sl. s.	v. s.; sl. s. lg.
6238	nd./aq. al.	....	157-8	d.	s. act.	2	s.
6239	pr./aq.	....	239-40 d.; sl. d. 139	....	s. h.	s. alk.	v. sl. s.
6240	cr./et.	....	97-9	....	s.	....	....
6241	nd./al.	....	144	300 ±	s. h.	s.; s. lg.	s. bz.
6242	mn./aq.	....	169-70	$225\text{-}7^{10mm}$	v. sl. s.	v. s.	v. s.; s. chl.
6243	lq.	$0.793^{17°}$	3	74-5	....	....	....
6244	cr.	....	41	65^{20mm}	....	....	....
6245	nd.	$0.905^{50°}$	35.5	163.8	$2.1^{20°}$	v. s.	v. s.
6246	cr.	....	15-6	105-6	....	....	....
6247	lq.	$0.975\frac{20°}{4}$	....	240.5^{735mm}	....	....	....
6248	col. gas	$0.662^{-5°}$	−124	3.2-3.8	$41^{19°}$	s.	s.
6249	cr./al.	....	271-8 d.	....	s.	s.	i.
6250	nd./aq.	....	66-8	234-5	$0.12^{19°}$	....	....
6251	lq.	0.963	....	229-30	....	....	....
6252	col. lq.	$1.124^{22°}$	....	52.8	sl. s.	....	....
6253	col. lq.	$0.894\frac{20°}{4}$	−25.4	176.1	i.	s.	s.
6254	col. lq.	$0.876\frac{20°}{4}$	−43.8	169.4	i.	s.; s. SO_2	s.; s. bz.
6255	col. lq.	$0.865\frac{20°}{4}$	−44.7(−52)	164.7	i.	s.; ∞ bz.	∞; s. SO_2
6256	pl./lg.	....	127	....	....	....	....
6257	pr./al.	....	167.5	....	....	....	....
6258	nd./aq.	....	105-6	....	....	....	....
6259	nd./bz.	....	149-50	....	v. sl. s. h.	v. s.	v. s.; s. bz.
6260	nd./aq.	....	215-6	....	v. sl. s. h.	s.	s.
6261	cr./al.	....	152-5	....	s. chl.	s.	s.
6262	lq.	$0.920\frac{28°}{4}$ burns with	−34 green flame	69	d.	....	....
6263	tri.	....	78-9	283-7 sl. d.	....	....	....
6264	wh. cr. pd.	....	169	....	s.	s.	....
6265	nd.	....	71-2	231-4	v. sl. s. c.	v. s.	v. s.
6266	nd.	....	72	221	v. sl. s.	v. s.	v. s.
6267	lf./al.	....	228-30 d.	subl.	s.	$2^{8°}$	i. chl.
6268	lq.	$1.197\frac{19.5°}{0}$	....	197.2	$100^{25°}$	s.	s.
6269	col. lq.	<1	....	40-2	i.	....	s.
6270	cr.	....	65 ±	285	....	....	s.
6271	cr./lg.	....	86-7	285	sl. s. bz.	s.	v. s.
6272	hyg. cr.	....	63-4	277-8	sl. s.	sl. s.	v. s.
6273	mn./lg.	....	46	260^{719mm}	i.	v. s.	v. s.
6274	col. lq.	$1.523^{15°}$	....	80.6	v. sl. s.	s.	s.
6275	cr.	....	114-6	....	....	....	....
6276	mn.	1.19	75.5	232.5^{765mm}	v. s.	v. s.	s.
6277	col. lq.	....	....	109-11	s.	s.	s.
6278	lq.	$1.571\frac{20°}{4}$	....	$98\text{-}112^{185mm}$	16.6 c.	....	....

Trimethyl-glycocoll, cf. alkd.
Trimethyl-methane 1022
Trimethyl-pentane 4946
Trimethyl-phenylmethane 1052
Trimethyl-pyridine 1526
Trimethyl-trimethylene glycol 4332
Trimethyl-trithiane 5879-81
Trimethyl-vinyl-ammonium hydroxide 4584
Trimethyl-xanthine, cf. alkd.
Trimethylene 1621

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
	Trimethylene				
6279	chlorobromide	3-Cl-1-Br-propane	$Cl\cdot(CH_2)_3\cdot Br$	I-109	157.45
6280	chlorohydrin	α-chlorohydrin	$Cl\cdot(CH_2)_3\cdot OH$	I-356	94.54
6281	diacetate	....	$CH_2(CH_2O_2C\cdot CH_3)_2$	II-143	160.17
6282	diamine	....	$NH_2(CH_2)_3NH_2$	IV-261	74.13
6283	dibutyrate	....	$CH_2(CH_2\cdot O_2C\cdot C_3H_7)_2$	....	216.27
6284	dimercaptan	propandithiol-1,3	$HS\cdot(CH_2)_3\cdot SH$	I-476	108.21
6285	formal	1,3-dioxane	$\underbrace{CH_2\cdot O\cdot(CH_2)_3\cdot O}$	XIX-2	88.10
6286	glycol	propandiol-1,3	$HO\cdot(CH_2)_3\cdot OH$	I-475	76.09
6287	iodohydrin	α-iodohydrin	$I\cdot(CH_2)_3\cdot OH$	I-358	186.01
6288	**Trinitro**-acetonitrile	....	$(NO_2)_3C\cdot CN$	II-229	176.05
6289	aniline (2,4,6)	picramide	$(NO_2)_3C_6H_2\cdot NH_2$	XII-763	228.12
6290	anisole (2,4,6)	methyl picrate	$(NO_2)_3C_6H_2\cdot OCH_3$	VI-288	243.13
6291	benzaldehyde (2,4,6)	....	$(NO_2)_3C_6H_2\cdot CHO$	VII-265	241.12
6292	benzene (1,2,3)	(*vic*)	$(NO_2)_3C_6H_3$	*V-140	213.11
6293	benzene (1,3,5)	(*sym*)	$(NO_2)_3C_6H_3$	V-271	213.11
6294	benzene (1,2,4)	(*uns*)	$(NO_2)_3C_6H_3$	V-271	213.11
6295	benzoic acid (2,4,6)	....	$(NO_2)_3C_6H_2\cdot CO_2H$	IX-417	257.12
6296	*tert*-butyltoluene (2,4,6;1,3)	artificial musk	$(NO_2)_3C_6H:(CH_3)\cdot C(CH_3)_3$	V-439	283.24
6297	*tert*-butylxylene (2,4,6;1,3;5)	musk xylene	$(NO_2)_3C_6(CH_3)_2\cdot C(CH_3)_3$	V-448	297.26
6298	*m*-cresol	(2,4,6;1,3)	$(NO_2)_3C_6H(CH_3)\cdot OH$	VI-387	243.13
6299	ethane (1,1,1)	....	$CH_3\cdot C(NO_2)_3$	I-103	165.07
6300	methane	nitroform	$(NO_2)_3CH$	I-79	151.04
6301	naphthalene (1,2,5)	δ-trinitronaphthalene	$(NO_2)_3C_{10}H_5$	V-563	263.16
6302	naphthalene (1,3,5)	α-trinitronaphthalene	$(NO_2)_3C_{10}H_5$	V-563	263.16
6303	naphthalene (1,3,8)	β-trinitronaphthalene	$(NO_2)_3C_{10}H_5$	V-563	263.16
6304	naphthalene (1,4,5)	γ-trinitronaphthalene	$(NO_2)_3C_{10}H_5$	V-563	263.16
6305	α-naphthol (2,4,5)	naphthopicric acid	$(NO_2)_3C_{10}H_4\cdot OH$	VI-619	279.16
6306	orcinol	(2,4,6;1,3,5)	$(NO_2)_3C_6(OH)_2CH_3$	VI-890	259.13
6307	phenol (γ)	(2,3,6)	$(NO_2)_3C_6H_2\cdot OH$	VI-265	229.11
6308	phenol (β)	(2,4,5)	$(NO_2)_3C_6H_2\cdot OH$	VI-265	229.11
6309	phenol (2,3,5)	....	$(NO_2)_3C_6H_2\cdot OH$	VI-264	229.11
6310	phenol (2,4,6)	picric acid	$(NO_2)_3C_6H_2\cdot OH$	VI-265	229.11
6311	phenylhydrazine	(2,4,6)	$(NO_2)_3C_6H_2\cdot N_2H_3$	XV-493	243.14
6312	resorcinol (2,4,6)	styphnic acid	$(NO_2)_3C_6H(OH)_2$	VI-830	245.11
6313	toluene (β)	(2,3,4)	$(NO_2)_3C_6H_2\cdot CH_3$	*V-172	227.13
6314	toluene (ε)	(2,3,5)	$(NO_2)_3C_6H_2\cdot CH_3$	*V-172	227.13
6315	toluene (γ)	(2,4,5)	$(NO_2)_3C_6H_2\cdot CH_3$	V-347	227.13
6316	toluene (α)	(2,4,6); TNT	$(NO_2)_3C_6H_2\cdot CH_3$	V-347	227.13
6317	toluene (δ)	(3,4,5)	$(NO_2)_3C_6H_2\cdot CH_3$	*V-173	227.13
6318	trimethyl benzene (2,4,6; 1,3,5)	*eso*-trinitro-mesitylene	$(NO_2)_3C_6(CH_3)_3$	V-412	255.19
6319	trimethyl benzene (4,5,6;1,2,3)	trinitro-hemi-mellitene	$(NO_2)_3C_6(CH_3)_3$	V-400	255.19
6320	trimethyl benzene (3,4,6;1,2,4)	*eso*-trinitro-pseudocumene	$(NO_2)_3C_6(CH_3)_3$	V-405	255.19

Trimethylene dibromide 1865
Trimethylene dicarboxylic acid 6425
Trimethylene dichloride 2052
Trimethylene dicyanide 3377
Trimethylene diiodide 2399
Trimethylene-glycol methylene ether 6285
Trimethylene-methylene dioxide 6285
Trimethylene oxide 5469
Trimethylene-trianiline 512
Trimethylene trisulfide 3309

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6279	col. lq.	1.63^{8°	....	142-3	i.	....	....
6280	lq.	$1.131^{20^\circ}_{4}$	....	160-2	50 c.	s.	s.
6281	col. lq.	1.070^{19°	....	209-10	10	....	....
6282	col. lq.	$0.884^{25^\circ}_{4}$	−23.5	$135\text{-}6^{738\text{mm}}$	....	∞	∞
6283	col. lq.	....	....	$125\text{-}30^{8\text{mm}}$	i.	s.	s.
6284	oil	....	....	169-70	v. sl. s.	∞; ∞ chl.	∞; ∞ bz.
6285	col. lq.	$1.034^{20^\circ}_{4}$	−42	105-6	∞	∞	∞
6286	oil	$1.060^{20^\circ}_{4}$	....	214	∞	∞; i. chl.	i. bz.
6287	lq.	$1.998^{20^\circ}_{4}$	....	$225^{748\text{mm}}$	v. sl. s.	s.	s.
6288	waxy	....	41.5	expl. 220	d.	d.	s.
6289	yel. mn.	....	188-90	expl.	i.	sl. s.	s. h. act.
6290	col. mn.	1.408^{20°	68.4	....	s. bz.	s. ac.	....
6291	pl./bz.	....	119	....	....	....	....
6292	lt. gn./al.	....	127.5	....	i.	10 h.	....
6293	col. rhb.	$1.688^{20^\circ}_{4}$	121(61)	d.	0.04 c.	$1.9^{17.5^\circ}$	$1.5^{17.5^\circ}$
6294	col. cr.	1.73^{16°	61-2	....	....	$5.5^{15.5^\circ}$	$7.1^{15.5^\circ}$
6295	rhb./aq.	....	210-20 d.	....	2.05^{24°	....	....
6296	lt. yel./al.	....	112-3; (105-6)	....	i.	s.	s.; s. bz.
6297	nd./al.	....	110	....	i.	sl. s.	s.
6298	yel. nd./aq.	....	109.5	expl. 150	0.22^{20°; 0.81^{100°	v. s.	v. s.
6299	cr.	....	56	....	v. sl. s.	s.; sl. s. lg.	s.
6300	col. cr.	$1.597^{24^\circ}_{4}$	23; expl.	$45\text{-}7^{22\text{mm}}$	s.	....	....
6301	nd./al.		112-3	....	....	s.	....
6302	rhb./chl.	....	122-3	....	s. ac.	s.	s. chl.
6303	cr./al.	....	218-9	....	0.02^{100°	$*0.05^{23^\circ}$	0.13^{15°
6304	yel./chl.	....	148-9	....	1.1^{18° bz.	$*0.11^{19^\circ}$	0.4^{19°
6305	yel. nd./aq.	....	190	expl.	sl. s. h.	sl. s.	0.3 c. ac.
6306	yel. nd.	....	162-3	expl.	s. h.	i. aq. a.	v. s. h. bz.
6307	wh. nd.	....	117-8	....	s. h.	v. s.	v. s.
6308	wh. nd./aq.	....	96	....	s. h.	v. s.	v. s.
6309	yel. nd./aq.	....	119-20	....	s. ac.	s.	s. bz.
6310	yel. rhb.	$1.763^{20^\circ}_{4}$	121.8	expl. > 300	1.23^{20°	6.23^{20° abs.	1.08^{13° abs.
6311	yel. nd./al.	....	186	d.	i.; s. ac.	s. h.; i. bz.	i.; i. chl.
6312	yel./act.	1.829	180	....	0.6^{14°	v. s.	v. s.
6313	cr.	$1.620^{20^\circ}_{4}$	112	expl. 290-310	i.	sl. s. c.	s.
6314	yel. rhb.	....	97.2	d. 335	....	s.	I.
6315	yel. pl/act.	$1.620^{20^\circ}_{4}$	104	expl. 290	I.	s. h.	v. s.
6316	cr./al.	1.654	81-2	expl. 280	0.15 h.	1.5^{22°	5^{33°
6317	cr.	....	137.5	d. 313	....	1^{15°	....
6318	tri./al.	1.48	232	expl. 415	sl. s. act.	sl. s. h.	sl. s. h.
6319	pl./al.	....	209	....	....	....	....
6320	pr.	....	185	....	....	v. sl. s. h.	v. s. h. bz.

* From 85% alcohol.

Trimyristin 3427
Trinitro-chlorobenzene 5308
Trinitro-cyanomethane 6288
Trinitro-hemimellitene 6319
Trinitro-mesitylene 6318
Trinitro-phenyl-methylnitramine 5873
Trinitro-pseudocumene 6320

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
6321	**Trinitro** triphenyl carbinol	(4,4′,4″)	$(NO_2\cdot C_6H_4)_3C\cdot OH$	VI-720	395.32
6322	triphenyl methane	(4,4′,4″)	$(NO_2\cdot C_6H_4)_3CH$	V-707	379.32
6323	*m*-xylene (4,5,6)	....	$(NO_2)_3C_6H(CH_3)_2$	V-381	241.16
6324	*m*-xylene (2,4,6)	....	$(NO_2)_3C_6H(CH_3)_2$	V-381	241.16
6325	*p*-xylene (2,3,6)	*eso*-tri-NO_2-*p*-xylene	$(NO_2)_3C_6H(CH_3)_2$	V-389	241.16
6326	**Trional**	Me-Et ketone di-Et sulfone	$(C_2H_5)(CH_3)C:(SO_2C_2H_5)_2$	I-671	242.34
6327	**Triphenyl** acetic acid	....	$(C_6H_5)_3C\cdot CO_2H$	IX-712	288.33
6328	amine	....	$(C_6H_5)_3N$	XII-181	245.31
6329	benzene (1,3,5)	....	$(C_6H_5)_3C_6H_3$	V-737	306.38
6330	bromomethane	....	$(C_6H_5)_3C\cdot Br$	V-704	323.23
6331	carbinol	tritanol	$(C_6H_5)_3C\cdot OH$	VI-713	260.32
6332	carbinol methyl ether	methyl-trityl ether	$(C_6H_5)_3C\cdot OCH_3$	VI-716	274.34
6333	chloromethane	....	$(C_6H_5)_3C\cdot Cl$	V-700	278.77
6334	guanidine (*α*)	....	$C_6H_5N:C(NHC_6H_5)_2$	XII-451	287.35
6335	guanidine (*β*)	....	$HN:C(NHC_6H_5)N:(C_6H_5)_2$	XII-430	287.35
6336	hydrazine	....	$(C_6H_5)_2N\cdot NHC_6H_5$	XV-125	260.32
6337	methane	tritane	$(C_6H_5)_3C\cdot H$	V-698	244.32
6338	methane *o*-carboxylic acid	....	$(C_6H_5)_2CH\cdot C_6H_4\cdot CO_2H$	IX-714	288.33
6339	methyl	trityl	$(C_6H_5)_3C\cdots$	V-715	243.31
6340	methyl peroxide	....	$[(C_6H_5)_3C\cdot O\cdot]_2$	VI-716	518.62
6341	phosphate	phenyl phosphate	$(C_6H_5O)_3PO$	VI-179	326.28
6342	phosphine	....	$(C_6H_5)_3P$	XVI-759	262.28
6343	phosphite	phenyl phosphite	$(C_6H_5O)_3P$	VI-177	310.28
6344	rosaniline sulfate	Poirrier's blue	$(C_{38}H_{32}N_3)_2SO_4$	XIII-768	1157.38
6345	*p*-rosaniline trisulfonic Na	methyl blue; brilliant cotton blue	$C_{37}H_{27}O_9N_3S_3Na_2$	....	799.78
6346	thiophosphate	....	$(C_6H_5O)_3PS$	VI-181	342.34
6347	**Tri-*iso*-propanolamine**	....	$N(CH_2\cdot CHOH\cdot CH_3)_3$	....	191.27
6348	**Tripropylamine** (*n*)	....	$(C_2H_5\cdot CH_2)_3N$	IV-139	143.27
6349	**Trithio**-carbonic acid	....	$HS\cdot CS\cdot SH$	III-221	110.21
6350	phenyl phosphate	....	$(C_6H_5S)_3PO$	VI-182	374.46
6351	**Tritolyl** phosphate (*o*)	tricresyl phosphate	$(CH_3\cdot C_6H_4\cdot O)_3PO$	VI-358	368.36
6352	phosphate (*m*)	tricresyl phosphate	$(CH_3\cdot C_6H_4\cdot O)_3PO$	....	368.36
6353	phosphate (*p*)	tricresyl phosphate	$(CH_3\cdot C_6H_4\cdot O)_3PO$	VI-401	368.36
6354	phosphite (*m*)	tricresyl phosphite	$(CH_3\cdot C_6H_4\cdot O)_3P$	VI-381	352.36
6355	phosphite (*p*)	tricresyl phosphite	$(CH_3\cdot C_6H_4\cdot O)_3P$	VI-401	352.36
6356	thiophosphate (*o*)	tricresyl thiophosphate	$(CH_3\cdot C_6H_4\cdot O)_3PS$	*VI-173	384.42
6357	thiophosphate (*m*)	....	$(CH_3\cdot C_6H_4\cdot O)_3PS$	*VI-203	384.42
6358	thiophosphate (*p*)	....	$(CH_3\cdot C_6H_4\cdot O)_3PS$	*VI-203	384.42
6359	**Tritriacontane**	....	$C_{33}H_{68}$	I-177	464.87
6360	**Tri-*o*-xenyl phosphate**	tri-*o*-phenylphenyl phosphate	$(C_6H_5\cdot C_6H_4\cdot O)_3PO$	....	554.56
6361	**Tropic acid** (*dl*)	....	$C_6H_5\cdot CH(CH_2OH)\cdot CO_2H$	X-261	166.17
6362	**Truxene** (*α*)	tribenzylene benzene	$C_{27}H_{18}$	V-752	342.41

Triolein 3430
Trioxane 3289
Trioxy-methylene 3289
Trioxy-purine 6393
Tripalmitin 3431
Triphenyl antimony 563
Triphenyl-arsine 580
Triphenyl-bismuthine 857
Triphenyl-bismuthine dichloride 858
Triphenyl-carbinol-*o*-carboxylic anhyd. 5292

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6321	mn. or rhb.	....	193(167)	....	s. bz.; s. ac.	sl. s. h.	sl. s.
6322	cr./bz.	....	212.5	....	v. sl. s. bz.	v. sl. s. ac.	....
6323	pr./al.	1.494^{19°	125	....	i.	1.2^{20°	sl. s.
6324	yel./al. bz.	1.604^{19°	182	....	i.	0.04^{20°	sl. s.
6325	col. mn./al.	1.59^{19°	139-40	expl. 410	....	....	....
6326	pl./al.	$1.199^{8.5^\circ}_{4}$	76	....	0.3^{15°	5.8^{5° abs.	6.6^{15°
6327	mn.	....	264-5 sl. d.	....	sl. s.	s.	v. sl. s. bz.
6328	mn.	$0.774^{0^\circ}_{0}$	126.5	365	i.; s. act.	sl. s.	s.
6329	rhb.	1.205	170-1	....	v. s. bz.	s. abs.	s.
6330	lt. yel. cr.	1.55	152	230^{15mm}	d.	v. s. CS_2	v. s. bz.
6331	cr./bz.	$1.188^{20^\circ}_{4}$	162.5	>360	v. s. bz.	v. s.	v. s.
6332	tri./Me al.	....	87-8	....	....	....	....
6333	col. cr.	....	112-3	$230\text{-}5^{20mm}$	d.	v. s. CS_2	v. s. bz.
6334	rhb./al.	1.13	144-5	d.	i.	4.6^{0° abs.	....
6335	pl.	....	131	....	sl. s. bz.	s.	s.
6336	nd./bz. pet.	....	142	....	i.	s.	v. s. bz.
6337	cr.	$1.014^{90^\circ}_{4}$	93.4(81)	$358\text{-}9^{754mm}$	i.; 4^{4° bz.	v. s. h.	v. s.
6338	nd./al.	....	162	subl.	i.	s.	s.
6339	col. cr.	....	145-7	d.	i.	sl. s. h.	v. s. chl.
6340	cr./CS_2	....	185-6	....	i.	i.	i.
6341	pr./al.	$1.206^{58^\circ}_{4}$	49-50	245^{11mm}	i.	155^{25°	v. s.
6342	mn./et.	1.194	79	>360*	i.; s. HCl	sl. s.	v. s.; s. bz.
6343	lq.	$1.184^{18^\circ}_{18}$	....	360	i.; s. chl.	s.; s. bz.	s.
6344	b. pd.	....	....	....	....	....	....
6345	b. pd.	....	....	....	s.	....	....
6346	pr./al.	$**1.23^{20^\circ}_{4}$	52-3	>360 d.	i.; s. chl.	s.; s. bz.	s.; s. act.
6347	col. pl.	1.020^{20°	35±	....	s.	s.	s.
6348	col. lq.	$0.757^{20^\circ}_{4}$	−93.5	156.5	v. sl. s.	∞	∞
6349	red oil	$1.47^{17^\circ}_{4}$	−30	d. 20–30	i. d.	sl. s.	sl. s.
6350	mn./et.	....	114-5	....	i.	s.	s.; s. chl.
6351	lq.	....	....	410 sl. d.	i.; s. bz.	v. s.	v. s.
6352	col. lq.	....	....	$273\text{-}5^{17mm}$	i.	s.	s.
6353	nd./aq.	....	77-8	....	v. s. bz.	v. s.	v. s.
6354	col. lq.	....	....	$235\text{-}8^{7mm}$	....	....	....
6355	pa. yel. lq.	....	....	$236\text{-}9^{7mm}$	....	....	....
6356	col. nd./al.	....	45-6	....	i.	sl. s.	v. s.
6357	rhb. cr.	....	33-4	....	i.	sl. s.	v. s.
6358	nd./al.	....	93-4	....	i.; v. s. bz.	v. s. chl.	sl. s. lg.
6359	cr.	lq. $0.780^{71.8^\circ}$	71.8	328^{15mm}	....	....	....
6360	col. rhb.	....	112-3	....	i.	$i.^{25^\circ}$	8^{25° bz.; 1^{25° CCl_4
6361	nd./aq.	....	117-8	d.	2^{15°; s. h.	s.; sl. s. bz.	s.; i. CS_2
6362	pl./xylene	....	365-8	....	i.; s. aniline	i.; s. $PhNO_2$	i.

* In hydrogen atm.

** Supercooled liquid.

Triphenyl-dihydroglyoxalin 233
Triphenyl-imidazole 3978
Triphenyl-imidazoline 233
Triphenyl-methyl chloride 6333
Triphenyl-oxazole 698
Triphenyl-stibine 563
Triphenyl-stibine dichloride 564
Triphenyl-tin dichloride 5948
Tripropin 3433
Tripropionin 3433
Triptane 3519
Triquinoyl 1604
Tristearin 3433

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
6363	**Tryptamine**	aminoethyl-indole (ω)(2)	$\mathrm{NH\cdot C_6H_4\cdot CH:C\cdot}$ $\mathrm{CH_2\cdot CH_2\cdot NH_2}$	....	160.21
6364	hydrochloride	....	$\mathrm{C_{10}H_{12}N_2\cdot HCl}$	....	196.68
6365	**Tryptophane** (*l*)	β-indolyl-α-alanine	$\mathrm{C_6H_4\cdot NH\cdot CH:C\cdot}$ $\mathrm{C_2H_3(NH_2)CO_2H}$	XXII-546	204.22
6366	**Tutocaine**	*p*-aminobenzoyl-dimethylamino-1,2-dimethyl propanol HCl	$\mathrm{NH_2\cdot C_6H_4\cdot CO_2CH:(CH_3)\cdot CH(CH_3)\cdot CH_2\cdot N(CH_3)_2\cdot HCl}$	....	286.80
6367	**Tyrosine** (*l*)	β-(*p*-hydroxy-phenyl)-alanine	$\mathrm{HO\cdot C_6H_4\cdot C_2H_3(NH_2)\cdot CO_2H}$	XIV-605	181.19
6368	**Uliron**	4-(4′-aminophenyl-sulfonamido)-phenylsulfondi-methylamide	$\mathrm{NH_2\cdot C_6H_4\cdot SO_2\cdot NH\cdot C_6H_4\cdot SO_2N(CH_3)_2}$	....	355.42
6369	**Umbelliferone**	7-hydroxy-coumarin	$\mathrm{HO\cdot C_6H_3\cdot CH:CH\cdot CO\cdot O}$	XVIII-27	162.14
6370	**Undecane** (*n*)	....	$\mathrm{CH_3\cdot(CH_2)_9\cdot CH_3}$	I-170	156.30
6371	**Undecyl** alcohol (*n*)	undecanol-1	$\mathrm{CH_3(CH_2)_9CH_2OH}$	I-427	172.30
6372	alcohol (*n*)(*sec*)	undecanol-2	$\mathrm{C_9H_{19}\cdot CHOH\cdot CH_3}$	I-427	172.30
6373	**Undecylene** (α)	undecene-1	$\mathrm{CH_3(CH_2)_8CH:CH_2}$	I-225	154.29
6374	**Undecylene** (β)	undecene-2	$\mathrm{C_8H_{17}\cdot CH:CH\cdot CH_3}$	I-225	154.29
6375	alcohol	undecene-1-ol-11	$\mathrm{CH_2:CH(CH_2)_9\cdot OH}$	I-452	170.29
6376	**Undecylenic acid**	10-hendecenoic acid	$\mathrm{CH_2:CH(CH_2)_8CO_2H}$	II-458	184.27
6377	**Undecylic** acid	undecanoic acid	$\mathrm{CH_3\cdot(CH_2)_9\cdot CO_2H}$	II-358	186.29
6378	aldehyde	undecanal	$\mathrm{CH_3\cdot(CH_2)_9\cdot CHO}$	I-712	170.29
6379	aldehyde oxime	....	$\mathrm{CH_3(CH_2)_9CH:NOH}$	I-713	185.30
6380	amide	....	$\mathrm{CH_3(CH_2)_9CO\cdot NH_2}$	II-358	185.30
6381	nitrile	decyl cyanide	$\mathrm{CH_3\cdot(CH_2)_9\cdot CN}$	II-358	167.29
6382	**Undecyne-1**	rutylidene	$\mathrm{CH_3\cdot(CH_2)_8\cdot C\vdots CH}$	I-261	152.27
6383	**Uracil** (2,4)	2,6-dioxy-pyrimi-dine	$\mathrm{CH:CH\cdot CO\cdot NH\cdot}$ $\mathrm{CO\cdot NH}$	XXIV-312	112.09
6384	**Uramil**	5-amino-barbituric acid	$\mathrm{(CONH)_2COCH\cdot NH_2}$	XXV-492	143.10
6385	**Uraminobenzoic acid** (*o*)	....	$\mathrm{NH_2\cdot CO\cdot NH\cdot C_6H_4\cdot CO_2H}$	....	180.16
6386	**Urea**	carbamide	$\mathrm{NH_2\cdot CO\cdot NH_2}$	III-42	60.06
6387	calcium chloride	afenil	$\mathrm{CaCl_2\cdot 4CH_4ON_2}$	*III-26	351.23
6388	hydrochloride	....	$\mathrm{CO(NH_2)_2\cdot HCl}$	III-54	96.52
6389	nitrate	acidogen nitrate	$\mathrm{CO(NH_2)_2\cdot HNO_3}$	III-54	123.07
6390	oxalate	....	$\mathrm{2CH_4ON_2\cdot C_2H_2O_4}$	III-55	210.15
6391	oxalate	....	$\mathrm{2CH_4ON_2\cdot C_2H_2O_4\cdot 2H_2O}$	III-55	246.18
6392	**Urethane**	ethyl carbamate	$\mathrm{NH_2\cdot CO_2\cdot C_2H_5}$	III-22	89.09
6393	**Uric acid**	2,6,8-trioxy-purine	$\mathrm{C_5H_4O_3N_4}$	XXVI-513	168.11
6394	**Usnic acid** (*d*)	....	$\mathrm{C_{18}H_{16}O_7}$	XIX-316	344.31
6395	**Usnic acid** (*dl*)	....	$\mathrm{C_{18}H_{16}O_7}$	XIX-316	344.31

Tritane 6337
Tritanol 6331
Trithio-formaldehyde 3309
Trithio-methylene 3309
Trityl 6339
Triuretdiamidine 396
Trivalerin 3434-5
Tropacocaine, cf. alkd.
Tropaeolin-G 4056
Tropeolin-D 4328
Tropeolin-O 2308
Tropeolin-OO 4996
Tropeolin-OOO 4995
Tropine, cf. alkd.
Tropine mandelate, cf. alkd.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6363	cr.	....	120	....	....	....	....
6364	col. cr.	....	255-8	....	s.	sl. s.	i.
6365	hex., rhb. nd.	....	289	....	sl. s. c.; v. s. h.	i.; i. alk.	i.; i. chl.
6366	col. cr. pd.	....	212-5	....	25	2.5	....
6367	nd./aq.	$1.456^{20°}$	>290 d. *314 d.	....	$0.04^{17°}$; $0.65^{100°}$	$0.01^{17°}$; s. alk.	i.; s. a.
6368	col. cr. pd.	....	193-5	....	sl. s.; v. s. alk.	s.	s. act.
6369	nd./aq.	....	224-7	subl.	1 h.	s.; s. HCl	sl. s.; s. ac.
6370	col. lq.	$0.741^{20°}_{4}$	-25.6	194.5	i.	∞	∞
6371	lq.	$0.822^{35°}_{4}$	19	131^{15mm}	<0.02	s.	....
6372	lq.	$0.827^{20°}_{4}$	12	228-9	i.	s.	....
6373	col. lq.	$0.763^{20°}_{4}$	....	188-90	i.	∞	∞
6374	lq.	$0.774^{15°}_{15}$	....	192-3	i.	∞	∞
6375	lq.	$0.850^{15°}$	-2	245^{756mm}	....	....	....
6376	cr.	$0.907^{24°}_{4}$	24.5	295 d.	i.	s.	s.; s. chl.
6377	col. cr.	$0.891^{30°}$	29-30	228^{160mm}	i.	s.	s.
6378	lq.	$0.862^{15°}_{15}$	-4	$116\text{-}7^{18mm}$	....	....	....
6379	nd./Me al.	....	72(61)	....	....	v. s.	v. s.
6380	col. cr.	....	103	....	....	....	....
6381	col. lq.	....	....	253-4	....	....	....
6382	lq.	$0.867^{25°}_{4}$	-33	210-5	i.	s.	s.
6383	nd./aq.	....	338 d.	....	s. h.; s. NH_4OH	i.	i.
6384	nd.	....	>400	....	sl. s. h.; s. alk.	s. c. H_2SO_4	i.; s. NH_3
6385	nd.	....	152	d. 171-2	d. h.	s.; s. Me al.	s. act.
6386	col. pr.	$1.335^{20°}_{4}$	132.7	d.	$100^{17°}$; ∞ h.	$20^{20°}$	sl. s.
6387	wh. hyg. pd.	....	158-60	....	v. s.	sl. s.	i. Me al.
6388	wh. hyg. lf.	....	d. 145	....	s.	....	....
6389	col. mn. pr.	....	152 d.	....	v. s. h.	s.	i. HNO_3
6390	mn. pr.	....	170-1	d.	$4.4^{16°}$	$1.6^{16°}$	i.
6391	....	....	d. > 120	$-H_2O$, 120	....	....	....
6392	col. lf.	$1.11^{20°}_{20}$	49-50	184	v. s.	v. s.	v. s.
6393	cr.	$1.893^{20°}$	d.	....	0.06 h.	i.; s. aq. LiOH	i.
6394	cr.	....	203	d.	i.	v. sl. s.	sl. s.
6395	yel. pr.	....	195-6	....	i.	v. sl. s. c.	$0.3^{20°}$

* Heated rapidly.

Trypaflavine 5328
Tryparsamide 583
Turicine, cf. alkd.
Tussol 568
Tylcalsin 116
Tyllithin 117
Tylnatrin 119
Tyramine 3799
Ulexine, cf. alkd.
Ultraquinine, cf. alkd.
Umbellic acid 2333
Undecanal 6378
Undecanoic acid 6377
Undecanol 6371-2
Undecanone 3107, 4324
Undecene 6373-4
Undecenol 6375
Undecyl cyanide 3956
Ural 1288

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
6396	**Uvinic acid**	2,5-di Me-furfurane-3-carboxylic acid	$(CH_3)_2C_4HO\cdot CO_2H$	XVIII-297	140.13
6397	**Uvitic acid** (5;1,3)	5-methyl-isophthalic acid	$CH_3\cdot C_6H_3(CO_2H)_2$	IX-864	180.15
6398	**Uvitonic acid** (2;4,6)	*o*-picoline-*o*,*p*-di-carboxylic acid	$CH_3\cdot C_5H_2N(CO_2H)_2$	XXII-161	181.14
6399	**Valeric** acid (*n*)	pentanoic acid	$C_2H_5\cdot CH_2\cdot CH_2\cdot CO_2H$	II-299	102.13
6400	aldehyde (*n*)	pentanal	$C_2H_5\cdot CH_2\cdot CH_2\cdot CHO$	I-676	86.13
6401	aldehyde oxime	....	$C_4H_9\cdot CH{:}NOH$	I-676	101.15
6402	amide (*n*)	....	$CH_3(CH_2)_3CONH_2$	II-301	101.15
6403	anhydride (*n*)	....	$(C_4H_9CO)_2O$	II-301	185.24
6404	chloride (*n*)	*n*-valeryl chloride	$CH_3\cdot(CH_2)_3\cdot COCl$	II-301	120.58
6405	nitrile (*n*)	*n*-butyl cyanide	$CH_3(CH_2)_3\cdot CN$	II-301	83.13
6406	*iso*-**Valeric** acid	*β*-Me-butyric acid	$(CH_3)_2CH\cdot CH_2\cdot CO_2H$	II-309	102.13
6407	aldehyde	2-methyl-butanal-4	$(CH_3)_2CH\cdot CH_2\cdot CHO$	I-684	86.13
6408	aldehyde oxime	....	$C_4H_9\cdot CH{:}NOH$	I-686	101.15
6409	amide	....	$C_4H_9\cdot CO\cdot NH_2$	II-315	101.15
6410	anhydride	....	$(C_4H_9CO)_2O$	II-314	186.24
6411	anilide	....	$C_4H_9\cdot CO\cdot NHC_6H_5$	XII-254	177.24
6412	chloride	*iso*-valeryl chloride	$(CH_3)_2CH\cdot CH_2COCl$	II-315	120.58
6413	nitrile	*iso*-butyl cyanide	$(CH_3)_2CH\cdot CH_2\cdot CN$	II-315	83.13
6414	**Valeryl diethyl-amide** (*iso*)	valyl	$(CH_3)_2CH\cdot CH_2\cdot CO\cdot N(C_2H_5)_2$	....	157.25
6415	**Valylene**	....	$CH_2{:}C(CH_3)\cdot C{\vdots}CH$	I-263	66.10
6416	**Vanillalacetone** (1;3,4)	ferulic methyl ketone	$CH_3\cdot CO\cdot CH{:}CH\cdot C_6H_3(OCH_3)OH$	VIII-291	192.21
6417	**Vanillic acid** (3;4,1)	4-OH-3-MeO-benzoic acid	$(CH_3OC_6H_3(OH)\cdot CO_2H$	X-392	168.14
6418	**Vanillin** (3:4,1)	4-OH-3-MeO-benzaldehyde	$(CH_3O)C_6H_3(OH)\cdot CHO$	VIII-247	152.14
6419	ethyl ether	4-EtO-3-MeO-benzaldehyde	$(CH_3O)C_6H_3{:}(OC_2H_5)CHO$	VIII-256	180.20
6420	*p*-phenetidine ethyl carboxylate	(4,1;1′,3′,4′); eupyrin	$C_2H_5O\cdot C_6H_4\cdot N{:}CH\cdot C_6H_3(OCH_3)O\cdot CO_2\cdot C_2H_5$	....	343.37
6421	*iso*-**Vanillin**	3-OH-4-MeO-benzaldehyde	$(CH_3O)C_6H_3(OH)\cdot CHO$	VIII-254	152.14
6422	**Vanillyl alcohol**	4-OH-3-MeO-benzyl alcohol	$(CH_3O)C_6H_3(OH)\cdot CH_2OH$	VI-1113	154.16
6423	**Veratric** acid	3,4-dimethoxy-benzoic acid	$(CH_3O)_2C_6H_3\cdot CO_2H$	X-393	182.17
6424	aldehyde (3,4;1)	vanillin methyl ether	$(CH_3O)_2C_6H_3\cdot CHO$	VIII-255	166.17
6425	**Vinaconic acid**	ethylene malonic acid	$\underbrace{CH_2\cdot CH_2\cdot C}(CO_2H)_2$	IX-722	130.10
6426	**Vinyl** acetate	....	$CH_3CO_2\cdot CH{:}CH_2$	*II-63	86.09
6427	acetic acid	butenoic acid	$CH_2{:}CH\cdot CH_2\cdot CO_2H$	II-407	86.09
6428	acrylic acid (*β*)	....	$CH_2{:}(CH)_2{:}CH\cdot CO_2H$	II-481	98.10
6429	alcohol	ethenol	$CH_2{:}CH\cdot OH$	I-601	44.05
6430	amine†	....	$CH_2{:}CH\cdot NH_2$	IV-203	43.07
6431	anisole (*o*)	*o*-methoxy styrene	$CH_2{:}CH\cdot C_6H_4\cdot OCH_3$	VI-560	134.17
6432	anisole (*m*)	*m*-methoxy styrene	$CH_2{:}CH\cdot C_6H_4\cdot OCH_3$	VI-561	134.17
6433	anisole (*p*)	*p*-methoxy styrene	$CH_2{:}CH\cdot C_6H_4\cdot OCH_3$	VI-561	134.17
6434	bromide	bromo-ethylene	$CH_2{:}CH\cdot Br$	I-188	106.96

† This product is actually ethylene imine, $CH_2\cdot CH_2\cdot NH$.

Uraline 1288
Uralium 1288
Uranin 3251
Urazine 2851

Urea chloride 1229
Ureido-hydantoin, cf. alkd.
Ureous acid, cf. alkd.
Urotropine 3599

Uroxin 188
Ursin, cf. glcde.
Ursol-D 5260
Ursol-P 349
Vacciniin, cf. glcde.

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6396	cr./aq.	....	135	subl.	0.25 h.	s.	v. s.
6397	nd./aq.	....	290-1	subl.	sl. s. h.	s.	s.
6398	cr. pd.	....	274-82 d.	....	i. c.; s. a.	s. h. aniline	v. sl. s. h. bz.
6399	col. lq.	$0.939^{20^\circ}_{4}$	−34.5(−50)	187	3.3^{16°	∞	∞
6400	lq.	0.819^{11°	−92	103.4	v. sl. s.	s.	s.
6401	cr.	....	52	....	....	....	....
6402	mn. pl.	1.023	106	....	v. s.	v. s.	v. s.
6403	lq.	$0.922^{17^\circ}_{4}$	−56.1	227.5	d. h.	....	....
6404	col. lq.	1.016^{15°	−110	127-8	d.	d.	....
6405	col. lq.	$0.804^{15^\circ}_{4}$	−96	$141\text{-}2^{763mm}$	i.	s.	s.
6406	col. lq.	$0.931^{20^\circ}_{20}$	−37.6	176	4.2^{20°	∞; ∞ chl.	∞
6407	col. lq.	0.803^{17°	−51	92.5	sl. s.	s.	s.
6408	oil	$0.893^{20^\circ}_{4}$	....	161.3^{759mm}	....	....	....
6409	mn.	$0.965^{20^\circ}_{4}$	135-7	232	s.	s.	s.
6410	col. lq.	$0.929^{27^\circ}_{4}$	....	215	....	....	....
6411	nd./lg.	1.078	113-4	....	sl. s. h.	s.	s.
6412	col. lq.	$0.989^{20^\circ}_{4}$	....	$114\text{-}5^{726mm}$	d.	d.	s.
6413	col. lq.	$0.793^{19^\circ}_{4}$	....	$126\text{-}8^{714mm}$	....	....	....
6414	col. lq.	....	....	210	4	s.	s.
6415	col. lq.	....	....	50	....	....	....
6416	yel. nd./ aq. al.	....	129-30	....	v. sl. s.	s.; s. conc. H_2SO_4	s.; s. bz.
6417	nd./aq.	....	207	subl.	0.12^{14°; 2.5^{100°	v. s.	v. s.
6418	mn.	1.056	81-2	285(in CO_2)	1^{14°; 5^{75°	v. s.; v. s. chl.	v. s.; v. s. CS_2
6419	mn.	....	64-5	subl.	v. sl. s. h.	s.	s.
6420	yel. cr.	....	87-8	....	sl. s.	s. h.	s.; s. chl.
6421	mn.	$1.196^{20^\circ}_{4}$	115-7	subl. sl. d.	s. h.	s.; sl. s. CS_2	s.
6422	mn./aq.	....	115	d.	v. s. h.	v. s.	v. s.
6423	cr./aq.*	....	180-1	subl.	0.05^{14°; 0.6^{100°	v. s.	v. s.
6424	nd./et.	....	44-7	280-5	sl. s. h.	s.	s.
6425	tri./et.	....	175	210^{30mm}	v. s.	s.	....
6426	col. lq.**	$0.932^{20^\circ}_{4}$	<−60	72-3	2^{20°	∞	∞
6427	col. lq.	$1.013^{15^\circ}_{15}$	−39	163	s.	∞	∞
6428	hyg. pr./ et.	....	80	d. 110-5	s. h.	s.	s.; sl. s. pet.
6429	not known;	acetalde-	hyde des-	motrope	....	....	....
6430	lq.	0.832	....	56	....	s.	....
6431	lq.	$1.005^{17.2^\circ}_{4}$	....	195-200	i.	s.	s.
6432	lq.	....	....	$89\text{-}90^{14mm}$	i.	s.	s.
6433	lq.	$1.000^{13^\circ}_{4}$	....	$204\text{-}5^{756mm}$	i.	s.	s.
6434	lq.	$1.529^{11^\circ}_{4}$	−138	5.8	i.	∞	∞

* Crysts. + $1H_2O$ < 50°.

** Polymerizes in light.

Valamin 497
Valdivin, cf. glcde.
Valerone 1901
Valerophenone 1117-8
Valeryl chloride 6404, 6412
Valerylene 5087
Validol 4032
Valine 391-5
Valisan 863
Valyl 6414
Valzin 5112
Vanillal 3188
Vanillin methyl ether 6424

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
6435	**Vinyl** chloride	chloro-ethylene	$CH_2{:}CH\cdot Cl$	I-186	62.50
6436	ether	....	$(CH_2{:}CH)_2O$	I-433	70.09
6437	ethyl alcohol	allyl carbinol	$C_3H_5\cdot CH_2OH$	I-441	72.10
6438	ethyl ether	ethyl-vinyl ether	$CH_2{:}CH\cdot O\cdot C_2H_5$	I-433	72.10
6439	fluoride	fluoro ethylene	$CH_2{:}CH\cdot F$	I-186	46.04
6440	glycolic acid	....	$CH_2{:}CH\cdot CHOH\cdot CO_2H$	III-370	102.09
6441	guaiacol (1;3,4)	hesperetole	$CH_2{:}CH\cdot C_6H_3(OH)\cdot(OCH_3)$	VI-954	150.17
6442	iodide	iodoethylene	$CH_2{:}CH\cdot I$	I-192	153.96
6443	phenol (*o*)	*o*-hydroxy styrene	$CH_2{:}CH\cdot C_6H_4\cdot OH$	VI-560	120.14
6444	phenol (*m*)	*m*-hydroxy styrene	$CH_2{:}CH\cdot C_6H_4\cdot OH$	VI-561	120.14
6445	**Violuric** acid	nitroso-barbituric acid	$CO\cdot(NHCO)_2\cdot C{:}NOH$	XXIV-506	157.09
6446	sodium salt	....	$C_4H_2O_4N_3Na$	XXIV-507	179.08
6447	**Xanthene**	2,2′-methylene-diphenyl ether	$C_6H_4\cdot CH_2\cdot C_6H_4\cdot O$	XVII-73	182.21
6448	**Xanthic acid**	xanthogenic acid	$C_2H_5O\cdot CS\cdot SH$	III-209	122.20
6449	**Xanthine**†	2,6-dioxy-purine	$C_5H_4O_2N_4$	XXVI-447	152.11
6450	**Xanthogenamide**	Et-thioncarbamate	$C_2H_5O\cdot CS\cdot NH_2$	III-137	105.15
6451	**Xanthone**	benzophenone oxide	$OC{:}(C_6H_4)_2O$	XVII-354	196.19
6452	**Xanthophyll**	lutein	$C_{40}H_{56}O_2$	XXX-95	568.85
6453	**Xanthydrol**	9-OH-xanthene	$HOCH{:}(C_6H_4)_2O$	XVII-129	198.21
6454	**Xylene** (*o*)	1,2-dimethylbenzene	$C_6H_4(CH_3)_2$	V-362	106.16
6455	sulfonic acid	(1,2;4)	$(CH_3)_2C_6H_3\cdot SO_3H\cdot 2H_2O$	XI-121	222.25
6456	sulfonic Na	(1,2;4)	$(CH_3)_2C_6H_3\cdot SO_3Na\cdot 5H_2O$	XI-121	298.29
6457	**Xylene** (*m*)	1,3-dimethylbenzene	$C_6H_4(CH_3)_2$	V-370	106.16
6458	sulfonic acid	(1,3;4)	$(CH_3)_2C_6H_3\cdot SO_3H\cdot 2H_2O$	XI-123	222.25
6459	sulfonic Na	(1,3;4)	$(CH_3)_2C_6H_3\cdot SO_3Na\cdot H_2O$	XI-123	226.23
6460	sulfonic Ca	(1,3;4)	$[(CH_3)_2C_6H_3\cdot SO_3]_2Ca$	....	410.50
6461	sulfonyl chloride	(1,3;4)	$(CH_3)_2C_6H_3\cdot SO_2Cl$	XI-123	204.67
6462	**Xylene** (*p*)	1,4-dimethylbenzene	$C_6H_4(CH_3)_2$	V-382	106.16
6463	sulfonic acid	(1,4;2)	$(CH_3)_2C_6H_3\cdot SO_3H\cdot 2H_2O$	XI-127	222.25
6464	sulfonic Na	(1,4;2)	$(CH_3)_2C_6H_3\cdot SO_3Na\cdot H_2O$	XI-127	226.23
6465	**Xylenol** (*vic*)(*o*)	2,3-dimethyl phenol	$(CH_3)_2C_6H_3\cdot OH$	VI-480	122.16
6466	**Xylenol** (*uns*)(*o*)	3,4-dimethyl phenol	$(CH_3)_2C_6H_3\cdot OH$	VI-480	122.16
6467	**Xylenol** (*sym*)(*m*)	3,5-dimethyl phenol	$(CH_3)_2C_6H_3\cdot OH$	VI-492	122.16
6468	**Xylenol** (*vic*)(*m*)	2,6-dimethyl phenol	$(CH_3)_2C_6H_3\cdot OH$	VI-485	122.16
6469	**Xylenol** (*uns*)(*m*)	2,4-dimethyl phenol	$(CH_3)_2C_6H_3\cdot OH$	VI-486	122.16
6470	**Xylenol** (*p*)	2,5-dimethyl phenol	$(CH_3)_2C_6H_3\cdot OH$	VI-494	122.16
6471	**Xylidine** (*vic*)(*o*)	2,3-dimethyl aniline	$(CH_3)_2C_6H_3\cdot NH_2$	XII-1101	121.18
6472	**Xylidine** (*uns*)(*o*)	3,4-dimethyl aniline	$(CH_3)_2C_6H_3\cdot NH_2$	XII-1103	121.18
6473	**Xylidine** (*sym*)(*m*)	3,5-dimethyl aniline	$(CH_3)_2C_6H_3\cdot NH_2$	XII-1131	121.18
6474	**Xylidine** (*vic*)(*m*)	2,6-dimethyl aniline	$(CH_3)_2C_6H_3\cdot NH_2$	XII-1107	121.18
6475	**Xylidine** (*uns*)(*m*)	2,4-dimethyl aniline	$(CH_3)_2C_6H_3\cdot NH_2$	XII-1111	121.18
6476	acetate	....	$C_8H_{11}N\cdot HC_2H_3O_2$	....	181.23
6477	**Xylidine** (*p*)	2,5-dimethyl aniline	$(CH_3)_2C_6H_3\cdot NH_2$	XII-1135	121.18

† See also Alkaloid table.

Vanirome 3188
Vasicine, cf. alkd.
Veratridine, cf. alkd.
Veratrine, cf. alkd.
Veratrole 2406
Veratroylaconine, cf. alkd.
Veritol 4117
Veronal 2124
Vesipyrin 120
Vicianin, cf. glcde.
Vicine, cf. alkd.
Victoria yellow 4056
Vinetine, cf. alkd.
Vinopyrin 5110

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6435	gas	$0.908^{25°}_{25}$	–160	–12	sl. s.	s.	v. s.
6436	col. lq.	$0.773^{20°}_{20}$	....	28.3	v. sl. s.	∞	∞
6437	lq.	$0.838^{17.5°}_{4}$	....	113.5^{748mm}	s.	....	....
6438	lq.	$0.763^{14.5°}_{17.5}$	....	35.5	v. sl. s.	s.	....
6439	col. gas	$0.853^{-26°}$	–160.5	–72.2	i.	$400^{20°}$ cc.	$550^{20°}$ cc. act.
6440	hyg. nd.	....	33-40	$129\text{-}30^{12mm}$	v. s.	s.	s.; i. CS_2
6441	cr.	....	57	....	sl. s.	s.	s.
6442	lq.	$2.08^{0°}$	....	56	....	....	....
6443	nd.	$1.061^{19.2°}_{4}$	29	108^{15mm}	s. alk.	s.	s.
6444	oil	....	....	$114\text{-}6^{17mm}$	....	....	....
6445	rhb.	....	224 d.	$-H_2O$, 100	s. h.	s.	....
6446	lf./al.	....	100.5	315	sl. s.	....	....
6447	lf./al.	....	100.5	315	sl. s.; s. H_2SO_4	sl. s. c.	s.; s. bz.
6448	oil	>1	–53	d. 24	v. sl. s.	....	....
6449	pd.	....	d. > 150	....	$0.26^{17°}$	$0.03^{17°}$	s. KOH
6450	mn.	....	40-1	....	$2.3^{20°}$	∞	∞
6451	nd./al.	....	173-4	$349\text{-}50^{730mm}$	sl. s. h.; s. chl.	0.7 c.; 8.5 h.	sl. s.; sl. s. lg.; s. bz.
6452	brn. red	....	190-3	....	i.; s. chl.	sl. s. h.	sl. s.
6453	col./aq. al.	....	122-3 d.	....	v. sl. s.	s.	s. chl.
6454	col. lq.	$0.880^{20°}_{4}$	–25.2	144.4	i.	∞ abs.	∞
6455	pl./aq. H_2SO_4	....	d.	....	s.	....	....
6456	pr.	....	....	....	s.	....	....
6457	col. lq.	$0.864^{20°}_{4}$	–47.9	139.1	i.	∞ abs.	∞
6458	cr./aq. H_2SO_4	....	63-4	....	s.	....	....
6459	pl.	....	....	....	s.	....	....
6460	col. cr.	....	....	....	s.	i.	i.
6461	cr.	....	34	$135\text{-}6^{11mm}$	d. h.	d. h.	....
6462	pl.	$0.861^{20°}_{4}$	13.3	138.4	i.	s.	v. s.
6463	col. lf./aq.	....	86	$149^{0\ 1mm}$	s.	s. chl.	....
6464	mn.pr./aq.	$1.522^{15°}$	....	....	s.	....	....
6465	nd./aq.	....	75	218	s.	s.	....
6466	cr./10% al.	$1.023^{17°}_{15}$	62.5	225^{757mm}	sl. s.	s.	∞
6467	nd./aq.	....	68	219.5	sl. s.	s.	....
6468	lf.	....	48-9	212	s. h.	s.	....
6469	nd.	$1.036^{20°}_{4}$	25-6	211.5^{766mm}	....	....	....
6470	mn.	....	74.5	211.5-3.5	....	....	....
6471	lq.	$0.991^{15°}$	<–15	223	v. sl. s.	s.	s.
6472	pr./lg.	$1.076^{17.5°}$	49-50	224-6	v. sl. s. c.	s. pet.	....
6473	oil	$0.972^{20°}_{4}$	....	221-2	....	....	....
6474	lq.	$0.980^{15°}$	....	216-7	....	....	....
6475	lq.	$0.978^{19.6°}_{4}$	....	213-4	v. sl. s.	....	....
6476	cr.	....	68	....	....	....	....
6477	oil	$0.979^{21°}_{4}$	15.5	215^{739mm}	v. sl. s.	....	....

Vinous alcohol 2946
Vinyl-acetic nitrile 204
Vinyl-benzene 5646
Vinyl cyanide 151
Vinyl tribromide 6103
Vinyl trichloride 6152
Vinyl-trimethylammonium hydroxide 4584
Vioform 1392
Violutin, cf. glcde.
Violutiside, cf. glcde.
Viridine, cf. alkd.
Vitamin-A 1252-4, 1570
Vitamin-B1 5876
Vitamin-B2 5563

No.	Name	Synonym	Formula	Beil. Ref.	Formula Weight
6478	**Xylitol**	pentanpentol	$C_5H_{12}O_5$	I-531	152.15
6479	**Xylorcinol** (*m*)	4,6-diMe-resorcinol	$(CH_3)_2C_6H_2(OH)_2$	VI-912	138.16
6480	***l*-Xylose** (+)	wood sugar	$C_4H_9O_4{\cdot}CHO$	I-865	150.13
6481	**Xylyl** acetate (*p*)	*p*-tolubenzyl acetate	$CH_3C_6H_4CH_2{\cdot}O_2C{\cdot}CH_3$	VI-498	164.20
6482	amine (*o*)	*o*-tolubenzylamine	$CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}NH_2$	XII-1106	121.18
6483	amine (*m*)	....	$CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}NH_2$	XII-1134	121.18
6484	amine (*p*)	....	$CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}NH_2$	XII-1141	121.18
6485	bromide (*o*)	ω-bromo-*o*-xylene	$CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}Br$	V-365	185.07
6486	bromide (*m*)	ω-bromo-*m*-xylene	$CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}Br$	V-374	185.07
6487	bromide (*p*)	ω-bromo-*p*-xylene	$CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}Br$	V-385	185.07
6488	chloride† (*o*)	ω-chloro-*o*-xylene	$CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}Cl$	V-364	140.61
6489	chloride (*m*)	....	$CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}Cl$	V-373	140.61
6490	chloride (*p*)	....	$CH_3{\cdot}C_6H_4{\cdot}CH_2{\cdot}Cl$	V-384	140.61
6491	**Xylylene** dibromide (*o*)	ω,ω′-diBr-*o*-xylene	$C_6H_4(CH_2Br)_2$	V-366	263.98
6492	dibromide (*m*)	....	$C_6H_4(CH_2Br)_2$	V-374	263.98
6493	dibromide (*p*)	....	$C_6H_4(CH_2Br)_2$	V-385	263.98
6494	dichloride (*o*)	ω,ω′ diCl-*o*-xylene	$C_6H_4(CH_2Cl)_2$	V-364	175.06
6495	dichloride (*m*)	....	$C_6H_4(CH_2Cl)_2$	V-373	175.06
6496	dichloride (*p*)	....	$C_6H_4(CH_2Cl)_2$	V-384	175.06
6497	glycol (*o*)	phthal alcohol	$C_6H_4(CH_2OH)_2$	VI-910	138.16
6498	glycol (*m*)	....	$C_6H_4(CH_2OH)_2$	VI-914	138.16
6499	glycol (*p*)	....	$C_6H_4(CH_2OH)_2$	VI-919	138.16
6500	**Xylyl** hydrazine	(2,4;1)	$(CH_3)_2C_6H_3{\cdot}NHNH_2$	XV-549	136.19
6501	hydrazine (2,5;1)	diMe-Ph-hydrazine	$(CH_3)_2C_6H_3{\cdot}NHNH_2$	XV-552	136.19
6502	hydrazine (2,6;1)	diMe-Ph-hydrazine	$(CH_3)_2C_6H_3{\cdot}NHNH_2$	XV-548	136.19
6503	**Zinc** diethyl	zinc ethide	$(C_2H_5)_2Zn$	IV-672	123.50
6504	dimethyl	dimethyl zinc	$(CH_3)_2Zn$	IV-671	95.45
6505	dipropyl (*n*)	*n*-dipropyl zinc	$(C_2H_5{\cdot}CH_2)_2Zn$	IV-675	151.55
6506	di-*iso*-propyl	....	$[(CH_3)_2CH]_2Zn$	IV-675	151.55
6507	**Zingerone**	3-MeO-4-OH-benzylacetone	$HO(CH_3O)C_6H_3{\cdot}CH_2{\cdot}CH_2{\cdot}COCH_3$	*VIII-623	194.22

† See also Nos. 1474-6.

Vitamin-B6 5510
Vitamin-C 586
Vitamin-D2 1187
Vitamin-G 5563
Vitamin-H 853
Vitamin-K 4342
Vomicine, cf. alkd.
Waldivin, cf. glcde.
War gases 1247; 1303; 1473; 1985; 4697
"Weinsaure" 5691
Westrosol 6155
White damp 1239
White tar 4458
Wintergreen oil 4380
Wood alcohol 4100
Wood naphtha 4100
Wood spirit 4100
Wood sugar 6480
Wrightine, cf. alkd.
Wurster's reagent 5840
Xanthaline, cf. alkd.
Xanthenol 6453
Xanthogenic acid 6448
Xanthopuccine, cf. alkd.
Xanthopurpurin 2298

No.	Crystalline Form and Color	Specific Gravity	Melting Point °C.	Boiling Point °C.	Solubility in 100 Parts		
					Water	Alcohol	Ether
6478	syrup	....	....	....	s.	....	....
6479	lf./chl.	....	124-5	276-9	v. s.	v. s.	v. s.
6480	nd.	1.535^{0°	153-4	....	117^{20°	v. sl. s. c.	i.
6481	lq.	....	....	227	....	....	....
6482	oil	$0.977\frac{19^\circ}{0}$	0	205.6^{745mm}	....	....	....
6483	oil	$0.965\frac{20^\circ}{0}$	....	205^{750mm}	i.	s.	s.
6484	lq.	$0.952\frac{20^\circ}{0}$	12.6-13.2	204^{739mm}	v. sl. s.	....	....
6485	pr.	1.381^{23°	21	223-4	i.	s.	s.
6486	col. lq.	1.371^{23°	....	212-5 sl. d.	i.	s.	s.
6487	nd./al.	1.324	38	$218\text{-}20^{740mm}$	i.	v. s. chl.	v. s. h.
6488	col. lq.	....	d. 170 ±	195-203	i.	∞ abs.	∞
6489	lq.	1.064^{20°	d. 170 ±	195-6	i.	∞ abs.	∞
6490	oil	....	d. 170 ±	200-2	i.	∞ abs.	∞
6491	rhb.	1.988^{0°	94.5	d.	16.6 pet.	s.	20
6492	mn./chl.	1.959^{0°	76-7	$135\text{-}40^{20mm}$	33 pet.	v. s. chl.	v. s.
6493	mn./bz.	2.012^{0°	145-7	245	d. >80°	v. s. h. chl.	2.7^{20°
6494	mn.?	1.393^{0°	55	239-41	v. s. chl.	v. s.	v. s.
6495	cr.	1.302^{20°	34.2	250-5	i.	....	....
6496	mn.	1.417^{0°	100.5	240-5 d.	i.; s. act.	s.; s. chl.	v. sl. s.
6497	pl./et.	....	64.2-4.8	....	$>25^{18^\circ}$	$>25^{18^\circ}$	25^{18°
6498	cr./bz.	lq. 1.161^{18°	46-7	$154\text{-}9^{13mm}$	v. s.	....	s.
6499	nd.	....	115-6	....	sl. s.	v. s.	v. s.
6500	nd./et.	....	85	d.	v. sl. s.	v. s.	s.
6501	col. nd.	....	78	....	i.	s.	s.
6502	nd./pet.	....	46 ±	....	s. lg.	....	....
6503	col. lq.	1.182^{18°	−28	118	d.	d.	....
6504	col. lq.	1.386^{11°	−40	46	d.	d.	....
6505	col. lq.	$1.072\frac{21^\circ}{21}$	....	158-60	d.	d.	....
6506	col. lq.	....	....	$94\text{-}8^{40mm}$	d.	d.	....
6507	col. cr./ et. pet.	....	40-1	....	sl. s.	s. dil. alk.	s.; sl. s. pet.

Xanthorhamnin, cf. glcde.
Xenene 2695; cf. also diphenyl.
Xenyl-, cf. diphenylyl-.
Xenyl carbimide 2714
Xenyl chloride 1373-5
Xenyl mustard oil 2755
Xylene musk 6297
Xylic acid 2459
Xylohydroquinone 2379
Xylol 6454, 6457, 6462
Xyloquinone 2549-51
Xylorcin 2380
Xylyl alcohol 6016-8
Xylylene-dicyanide 6051-3
Yageine, cf. alkd.
Yajeine, cf. alkd.
Yara yara 4312
Yellow-AB 661
Yellow-OB 5961
Yohimbine, cf. alkd.
Zingiberon 6507
Zygadenine, cf. alkd.

PHYSICAL CONSTANTS

Compiled by F. E. SHEIBLEY, Ph.D.

Names of the compounds in the table below are arranged alphabetically. No compound is listed more than once in the table and each compound is given a number.

Synonyms. At the bottom of each page is an alphabetical listing of names for compounds which are to be found in the main body of the table but under a different name; the number following the name refers to the numerical place of this compound in the table; thus, *acetyl-benzoyl-aconine 3* indicates that this compound is the 3d compound in the table where it will be found listed under the name *aconitine.*

Appearance. In addition to the crystalline form and color, the solvent used in purification is often given; thus, "rhomb./al." indicates that rhombic crystals were obtained when the compound was crystallized from alcohol.

Optical Properties are given in the column headed "[α]"; only the directions of the specific rotations have been indicated, since the factors affecting the determination of this property are too variable to come within the scope of the table.

Color Reactions with Sulfuric Acid, where available, have been included as an

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Abbreviations used in the table

a., acid
abs., absolute
ac. a., acetic acid
act., acetone
al., alcohol
alk., alkali (i. e. aqueous NaOH or KOH)
am. al., amyl alcohol
amor., amorphous
anh., anhydrous
aq., aqueous; water
bl., blue
B. P., boiling point
br., brown
bz., benzene, C_6H_6
c., cold
chl., chloroform, $CHCl_3$
colorl., colorless
cryst., crystals or crystalline

d, dextro-rotatory
d., decomposes or decomposition
deliq., deliquescent
dil., dilute
dk., dark
diss., dissociates
effl., efflorescent
et., ether $(C_2H_5)_2O$
Et, ethyl (C_2H_5)
EtOAc, ethyl acetate
gly., glycerol
grn., green
h., hot
hex., hexagonal
hyg., hygroscopic
i., insoluble
in., inactive
l, levo-rotatory
leaf., leaflets or leaves

No.	Name	[α]	Formula	Appearance	Melting Point °C.
1	**Aconine**	*d*	$C_{25}H_{41}O_9N$	hyg., amor.	132
2	salts	*l*	....	hyg.	....
3	**Aconitine**	*d*	$C_{34}H_{47}O_{11}N$	rhomb. pr./chl.	204
4	hydrobromide	*l*	$C_{34}H_{47}O_{11}N \cdot HBr \cdot 2\tfrac{1}{2}H_2O$	hex. tab./aq.	sint. 160
5	hydrobromide	...	$C_{34}H_{47}O_{11}N \cdot HBr \cdot \tfrac{1}{2}H_2O$	need./al.	206–7
6	hydrochloride	*l*	$C_{34}H_{47}O_{11}N \cdot HCl \cdot 3H_2O$	cryst.	149; 170*
7	**Adenine**	...	$C_5H_5N_5$	need. + $3H_2O$/aq.	360–5 d. subl. 220
8	**Agmatine**	...	$HN{:}C(NH_2) \cdot NH \cdot (CH_2)_4NH_2$	....	....

* Melting point of the anhydrous compound.

Acetyl-benzoyl-aconine 3
Acidol 34

aid in the making of rapid preliminary examinations.

Solubilities expressed by numbers are given in parts by weight of solvent required to dissolve one part of the alkaloid at a temperature of approximately 25°C. Because of the wide discrepancies existing between many of these figures as found in the literature no claim to accuracy can be made, and the values stated are perhaps best considered as upper limits.

References. The information given in the table has been collected mainly from the following sources:

Henry: **Plant Alkaloids,** 3d edition. Published by J. and A. Churchill, London (1939).

Merck's Index, 5th edition. Published by Merck and Co., Inc., Rahway, N. J. (1940).

Heilbron: **Dictionary of Organic Compounds.** Published by Oxford University Press, New York (1934).

Beilstein: **Handbuch der Organischen Chemie,** 3d edition.

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lig., ligroin
liq., liquid
lt., light
lustr., lustrous
Me, methyl (CH_3)
MeOH, methyl alcohol
met., metallic
mon., monoclinic
need., needles
octahedrl., octahedral
org., orange
orthorhomb., orthorhombic
pa., pale
pet., petroleum ether
powd., powder
pr., prisms
pyr., pyridine

r., red
rhomb., rhombic
s., soluble
sint., sinters
sl., slight or slightly
subl., sublimes
tab., tabular
tricl., triclinic
trim., trimetric
v., very
v. s., very soluble
v. sl. s., very slightly soluble
wh., white
yel., yellow
∞, soluble in all proportions; i.e., miscible
>, greater than

No.	Reaction with H_2SO_4	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Alkaloid					
		Water	Alcohol	Ether	Chloroform	Benzene	Others
1	....	v. s.	v. s.	i.	s.	....	i. pet.
2	....	....	....	....	....	....	....
3	colorl. when pure	3300	23	47	3	6.2	....
4	....	s.	s.	....	....	....	....
5	....	....	....	....	....	....	....
6	....	s.	s.	....	....	....	....
7	....	1086 c.; 40 h.	sl. s. h.	i.	i.	s. a.	s. h. NH_4OH
8	....	....	....	....	....	....	....

ψ-Aconitine 185 Acraconitine 185

No.	Name	[*α*]	Formula	Appearance	Melting Point °C.
9	sulfate	. . .	$C_5H_{14}N_4 \cdot H_2SO_4$	colorl. cryst./aq. MeOH	226–9
10	**Allantoin**†	*in*	$C_4H_6O_3N_4$	need./h. aq.	235–6
11	**Anabasine**	*l*	$C_{10}H_{14}N_2$	colorl. liq.	B.P. 276
12	**Anhalonine**	*l*	$C_{12}H_{15}O_3N$	wh. need.	85
13	**Apomorphine**	. . .	$C_{17}H_{17}O_2N$	pr. + $1Et_2O$/et.	170 d.
14	hydrochloride	*l*	$C_{17}H_{17}O_2N \cdot HCl \cdot \frac{1}{2}H_2O$	pr./aq.	....
15	**Apoquinine**	*l*	$C_{19}H_{22}O_2N_2$	need./et.	180–90 d.
16	**Arecoline**	*in*	$C_8H_{13}O_2N$	very alkaline oil	B.P. 209
17	hydrobromide	*in*	$C_8H_{13}O_2N \cdot HBr$	pr./al.	169–71
18	hydrochloride	. . .	$C_8H_{13}O_2N \cdot HCl$	cryst.	158
19	**Aspidospermine**	*l*	$C_{22}H_{30}O_2N_2$	need./al. or pet.	208
20	**Atisine**	*l*	$C_{22}H_{33}O_2N$	wh., amor.	indefinite
21	hydrochloride	*d*	$C_{22}H_{33}O_2N \cdot HCl$	prisms	296
22	**Atropine**	*in*	$C_{17}H_{23}O_3N$	colorl. pr.	118, subl.
23	sulfate	*in*	$(C_{17}H_{23}O_3N)_2 \cdot H_2SO_4 \cdot H_2O$	need.	194*
24	**Bebeerine, *α***	*l*	$C_{18}H_{19}O_3N$	pr./MeOH	214
25	**Bebeerine, *β***	*d*	$C_{18}H_{19}O_3N$	yel., amor.	142–50
26	hydrochloride	. . .	$C_{18}H_{19}O_3N \cdot HCl$	need. or scales	259–60
27	**Benzoylecgonine**	*l*	$C_{16}H_{19}O_4N \cdot 4H_2O$	lustr. need./aq.	90–2; 193–5*
28	**Berberine**	*in*	$C_{20}H_{19}O_5N \cdot 6H_2O$	red-yel. need./aq.	145d.
29	bisulfate	. . .	$C_{20}H_{17}O_4N \cdot H_2SO_4$	yel. need.	....
30	chloroform	. . .	$C_{20}H_{19}O_5N \cdot CHCl_3$	tricl. tab./chl.	179
31	hydrochloride	. . .	$C_{20}H_{17}O_4N \cdot HCl \cdot 2H_2O$	org. need. or yel. powd.	....
32	nitrate	. . .	$C_{20}H_{17}O_4N \cdot HNO_3$	yel. need.	....
33	**Betaine**†	*in*	$C_5H_{11}O_2N \cdot H_2O$	sweet deliq. cryst.; anh. at 100°	293*
34	hydrochloride	. . .	$C_5H_{11}O_2N \cdot HCl$	mon. cryst.	227–8 d.
35	**Brucine**	*l*	$C_{23}H_{26}O_4N_2 \cdot 4H_2O$	mon. pr./al.	105; 178*
36	hydrochloride	. . .	$C_{23}H_{26}O_4N_2 \cdot HCl$	wh. need.	....
37	nitrate	. . .	$C_{23}H_{26}O_4N_2 \cdot HNO_3 \cdot 2H_2O$	wh. pr.	230 d.*
38	sulfate	. . .	$(C_{23}H_{26}O_4N_2)_2 \cdot H_2SO_4 \cdot 7H_2O$	long need.	....
39	**Caffeine**	*in*	$C_8H_{10}O_2N_4 \cdot H_2O$	need./al.; anh. 100°	235*; subl. 178
40	citrate (true)	. . .	$C_8H_{10}O_2N_4 \cdot C_6H_8O_7$	mon.	....
41	hydrochloride	. . .	$C_8H_{10}O_2N_4 \cdot HCl \cdot 2H_2O$	mon.	d. 80–100
42	mercurichloride	. . .	$C_8H_{10}O_2N_4 \cdot HgCl_2$	colorl. need.	246
43	sulfate	. . .	$C_8H_{10}O_2N_4 \cdot H_2SO_4$	wh. need.	....
44	triiodide	. . .	$C_8H_{10}O_2N_4I_2 \cdot HI \cdot 1\frac{1}{2}H_2O$	long grn. met. pr.	171
45	**Canadine**	*l*	$C_{20}H_{21}O_4N$	silky need./al.	133–4
46	**Carpaine**	*d*	$C_{14}H_{25}O_2N$	pr./al.	121
47	**Carpiline**	*d*	$C_{16}H_{18}O_3N_2$	wh. cryst.	187
48	**Cephaeline**	*l*	$C_{28}H_{38}O_4N_2$	fine need./et.	107–8; 120–30*

* Melting point of the anhydrous compound.

† See also listing in the table Physical Constants of Organic Compounds.

Amino-butyl-guanidine 8
2-Amino-6-hydroxy-purine 115
6-Amino-purine 7
Anhaline 121

No.	Reaction with H_2SO_4	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Alkaloid					
		Water	Alcohol	Ether	Chloroform	Benzene	Others
9	....	s.	v. sl. s.	....	....	....	....
10	....	132 c.; 30 h.	5000 abs.	i.	....	....	s. NaOH
11	....	s.	s.	s.	....	s.	....
12	....	s.	s.	s.	s.	....	....
13	colorl.	sl. s.	s.	sl. s.	v. s.	sl. s.	s. alk.
14	....	39.5	38.2	1864	sl. s.	....	....
15	fluorescent dil.	s. h.	s.	sl. s.	v. s.	v. s.	s. KOH
16	....	s.	s.	s.	s.	....	....
17	....	1	8 c.; 2 h.	sl. s.	sl. s.	....	....
18	....	s.	s.	....	....	....	....
19	colorl.	6000	48	106	s.	s.	s. dil. a.
20	....	sl. s.	s.	s.	s.	s.	s. dil. a.
21	....	v. s.	v. s.	i.	....	....	....
22	colorl.	300	1.46	16.6	1.56	s.	s. dil. a.
23	colorl.	0.38	3.7	2140	620	....	....
24	br.→r. h.	i.	sl. s.	sl. s.	s.	....	s. a., act.
25	....	i.	sl. s.	....	s.	s.	s. dil. a.
26	....	s.	s.	....	....	....	....
27	....	s. h.	s.	i.	....	s. dil. a.	s. alk.
28	grn.→yel.	22	100	v. sl. s.	sl. s.	sl. s.	unstable
29	....	100; s. h.	sl. s.	....	....	....	....
30	....	....	....	....	....	....	....
31	....	400; s. h.	s. h.	i.	i.	....	....
32	....	sl. s.	....	....	....	....	....
33	....	s.	s.	sl. s.	....	....	....
34	....	1.7	15	i.	i.	....	....
35	dk. yel. h.; HNO_3→r.	320 c.; 150 h.	1.1	133	7.5	88	i. alk.
36	....	s.	s.	....	....	....	....
37	....	s.	s.	....	....	....	....
38	....	75 c.; 10 h.	84	....	254	....	....
39	+$K_2Cr_2O_7$ →grn.	45.6	53.2	375 c.; 339 h.	8 c.; 6.4 h.	88 c.; 18.9 h.	s. EtOAc sl. s. pet.
40	....	s. d.	s. d.	....	....	....	....
41	....	s. d.	s. d.	....	....	....	....
42	....	260	....	....	....	....	....
43	....	s. d.	s. d.	....	....	....	....
44	....	i.	s.	....	sl. s.	....	....
45	....	i.	s.	v. s.	v. s.	v. s.	....
46	....	sl. s.	9	33	s.	5.5	s. dil. a.
47	....	s. h.	....	sl. s.	s.	s.	....
48	....	i.	s.	sl. s.	s.	s.	s. alk.; s. dil. a.

Aphrodine 244
Apocupreine 15
Aticine 20
Atroscine 129

Banisterine 118
Baptitoxine 92
Barytine 138
Benzoyl-pseudotropine 235

No.	Name	[*α*]	Formula	Appearance	Melting Point °C.
49	**Cevadine**	*d*	$C_{32}H_{49}O_9N \cdot 2C_2H_5OH$	rhomb.; becomes anh. 130–40	205*
50	**Chelerythrine**	*in*	$C_{21}H_{19}O_5N \cdot C_2H_5OH$	pr. leaf./al.	207
51	**Chelidonine**	*d*	$C_{20}H_{19}O_5N \cdot H_2O$	mon. tab./dil. HCl	135–6*
52	**Cinchonamine**	*d*	$C_{19}H_{24}ON_2$	orthorhomb.need./al.	185
53	**Cinchonidine**	*l*	$C_{19}H_{22}ON_2$	trim. pr./al.	210.5
54	hydrochloride	*l*	$C_{19}H_{22}ON_2 \cdot HCl \cdot 2H_2O$	pyramids or pr.	242*
55	sulfate	*l*	$(C_{19}H_{22}ON_2)_2 \cdot H_2SO_4 \cdot 3H_2O$	mon. pr.	240 d.*
56	**Cinchonine**	*d*	$C_{19}H_{22}ON_2$	rhomb. pr./al.	264
57	bisulfate	. . .	$C_{19}H_{22}ON_2 \cdot H_2SO_4 \cdot 4H_2O$	octahedrl.	....
58	hydrochloride	*d*	$C_{19}H_{22}ON_2 \cdot HCl \cdot 2H_2O$	mon.	217–8 d.*
59	sulfate	*d*	$(C_{19}H_{22}ON_2)_2 \cdot H_2SO_4 \cdot 2H_2O$	rhomb.	198.5*
60	**Cinchotine**	*d*	$C_{19}H_{24}ON_2$	pr. or scales	268–9
61	**Cinnamylcocaine**	*l*	$C_{19}H_{23}O_4N$	need./bz.	121
62	**Cocaine**	*l*	$C_{17}H_{21}O_4N$	mon.pr./al.;need./aq.	98
63	chromate	. . .	$C_{17}H_{21}O_4N \cdot H_2CrO_4 \cdot H_2O$	org. yel. leaf.	127
64	hydrochloride	*l*	$C_{17}H_{21}O_4N \cdot HCl$	short pr./al.	195
65	**Coclaurine**	*l*	$C_{17}H_{19}O_3N$	bitter need.	221
66	**Codamine**	. . .	$C_{20}H_{25}O_4N$	pr./al.	121
67	**Codeine**	*l*	$C_{18}H_{21}O_3N \cdot H_2O$	rhomb. pr./aq.	155*
68	hydrochloride	*l*	$C_{18}H_{21}O_3N \cdot HCl \cdot 2H_2O$	need., pr./aq.	280 d.
69	phosphate	*l*	$C_{18}H_{21}O_3N \cdot H_3PO_4 \cdot 2H_2O$	need. or pr.	235 d.
70	sulfate	*l*	$(C_{18}H_{21}O_3N)_2 \cdot H_2SO_4 \cdot 5H_2O$	rhomb. pr.	278 d.
71	**Colchicine**	*l*	$C_{22}H_{25}O_6N$	yel. varnish; yel. need./EtOAc	143–7*; 155–7
72	chloroform	. . .	$C_{22}H_{25}O_6N \cdot CHCl_3$	need./chl.	d. 60–70
73	**Columbamine**	. . .	$C_{20}H_{21}O_5N$	free base unknown	....
74	chloride	. . .	$C_{20}H_{20}O_4NCl \cdot 2\frac{1}{2}H_2O$	yel. need.	194
75	chloride	. . .	$C_{20}H_{20}O_4NCl \cdot 4H_2O$	br. pr.	184
76	**Conessine**	*d*	$C_{24}H_{40}N_2$	leaf. or need./act.	123–5
77	**Conhydrine**	*d*	$C_8H_{17}ON$	wh. cryst./et.	121; B.P. 226
78	**Coniine**	*d*	$C_3H_7 \cdot C_5H_{10}N$	colorl. liq.	−2; B.P. 166–7
79	hydrochloride	*d*	$C_8H_{17}N \cdot HCl$	rhombs/aq.	220
80	picrate	. . .	$C_8H_{17}N \cdot C_6H_3O_7N_3$	yel. need./h. aq.	75
81	**Corybulbine**	*l*	$C_{21}H_{25}O_4N$	light-sensitive crysts.	238
82	**Corycavine**	*in*	$C_{21}H_{21}O_5N$	rhomb. tab./al.	218–9

* Melting point of the anhydrous compound.

Chinicine 193
Chinidine 195
Chinotine 195
Choline sinapate 215
α-Chondodendrine 24
Cicutine 78
Cinchovatine 53
Cinnamoylcocaine 61

No.	Reaction with H_2SO_4	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Alkaloid					
		Water	Alcohol	Ether	Chloroform	Benzene	Others
49	yel.→r.	sl. s.	10	12	s.	....	s. CS_2
50	grn.→yel.	i.	sl. s.	sl. s.	v. s.	s. dil. a.	sl. s. act.
51	crimson with guaiacum	i.	v. s.	v. s.	s.	....	s. am. al.
52	....	v. sl. s.	30	100	s. h.	s. h.	s. dil. a.
53	no fluorescence	5000	20	200	s.	....	s. dil. a.
54	....	20	s.	300	v. s.	....	....
55	....	63 c.; 20 h.	72 c.; 32 h.	v. sl. s.	923	....	....
56	....	3670	48 c.; 20 h.	370	165	....	s. am. al.
57	....	0.4	0.8	....	....	....	....
58	....	22 c.; 3.5 h.	1 c.	275	22	....	....
59	....	60 c.; 30 h.	10 c.; 6 h.	3230	70	....	....
60	....	1300	sl. s.	534	v. sl. s.	....	....
61	....	i.	s.	s.	s.	s.	....
62	colorl.	600	5	2.5	1.1	s.	s. act.
63	....	sl. s.	....	....	....	....	....
64	....	0.4	2.6	i.	19	....	s. act.
65	....	sl. s.	v. s. h.	sl. s.	sl. s.	i.	s. alk.; s. dil. a.
66	....	s. h.	s.	s.	s.	s.	s. dil. a.
67	h.→bl.	120	1.6 c.; 1 h.	12.5	0.66	10.4	68 NH_4OH
68	....	20 c.; 1 h.	145	....	....	....	....
69	....	2.25	261	1310	6700	....	....
70	....	30 c.; 6.3 h.	1200	i.	i.	....	....
71	yel.→r. h.	22	s.	157	s.	88	i. pet.
72	....	d. h.	....	....	....	....	....
73	....	....	....	....	....	....	....
74	....	s.	s.	....	....	....	....
75	....	s.	s.	....	....	....	....
76	....	v. sl. s.	s.	s.	s.	....	....
77	....	sl. s.	s.	s.	s.	....	....
78	colorl.	100	v. s.	v. s.	sl. s.	s.	sl. s. CS_2
79	....	2	s.	....	s.	....	....
80	....	....	s.	s.	....	....	....
81	....	v. sl. s.	s. h.	v. sl. s.	s.	s.	....
82	....	i.	v. sl. s.	....	s.	s. dil. a.	i. alk.

Cinnamoylecgonine methyl ester 61
Coffearin 234
Conchinine 195
Conicine 78
Conquinine 195
Conydrine 77
Cordianine 10
Cornutine 107

No.	Name	$[\alpha]$	Formula	Appearance	Melting Point °C.
83	**Corydaline**	*d*	$C_{22}H_{27}O_4N$	colorl. pr./al.	135
84	**Corytuberine**	*d*	$C_{19}H_{21}O_4N$	silky need./et.	240
85	**Cotarnine**	. . .	$C_{12}H_{15}O_4N$	need./bz.	132–3 d.
86	hydrochloride	. . .	$C_{12}H_{14}O_3NCl \cdot 2H_2O$	pa. yel. silky need.	197 d.
87	phthalate	. . .	$(C_{12}H_{14}O_3N)_2 \cdot C_6H_4(CO_2)_2$	yel. cryst. or powd.	103
88	**Cryptopine**	*in*	$C_{21}H_{23}O_5N$	pr./al. or bz.	220–1
89	**Cupreine**	*l*	$C_{19}H_{22}O_2N_2 \cdot 2H_2O$	pr./et.	198*
90	**Cuscohygrine**	*in*	$C_{13}H_{24}ON_2$	oil	B.P. 215^{50}
91	hydrate	. . .	$C_{13}H_{24}ON_2 \cdot 3\frac{1}{2}H_2O$	need.	40–1; 120–30**
92	**Cytisine**	*l*	$C_{11}H_{14}ON_2$	large rhomb. cryst.	152–3
93	**Delphinine**	*d*	$C_{33}H_{45}O_9N$	plates/al.	198–200
94	hydrochloride	. . .	$C_{33}H_{45}O_9N \cdot HCl$	need./MeOH + et.	208–10
95	**Diacetylmorphine**	. . .	$C_{21}H_{23}O_5N$	bitter cryst./MeOH	172
96	hydrochloride	*l*	$C_{21}H_{23}O_5N \cdot HCl \cdot H_2O$	cryst. powd.	230 d.
97	**Dilaudid**	. . .	$C_{17}H_{19}O_3N \cdot HCl$	cryst. powd.	. . . .
98	**Dionin**		$C_{19}H_{23}O_3N \cdot HCl \cdot H_2O$	wh. cryst. powd.	123 d.; 170 d.*
99	**Ecgonine**	*l*	$C_9H_{15}O_3N \cdot H_2O$	mon. pr./al.	198; 205*
100	hydrochloride	*l*	$C_9H_{15}O_3N \cdot HCl$	rhomb. or tricl. tab.	246
101	**Emetine**	*l*	$C_{29}H_{40}O_4N_2$	plates/al. or et.	74
102	hydrochloride	*d*	$C_{29}H_{40}O_4N_2 \cdot 2HCl \cdot 7H_2O$	woolly need./h. aq.; thick pr./c. satd. soln.	235–55; dry, d.
103	**Ephedrine** ‡	*l*	$C_{10}H_{15}ON$	unctuous, colorl. cryst.	40; B.P. 255
104	hydrochloride	*l*	$C_{10}H_{15}ON \cdot HCl$	need.	216 d.
105	sulfate	*l*	$(C_{10}H_{15}ON)_2 \cdot H_2SO_4$	wh. odorless cryst.	245 d.
106	**Ergotinine**	*d*	$C_{35}H_{39}O_5N_5$	long need./al.	239 d.
107	**Ergotoxine**	*l*	$C_{35}H_{41}O_6N_5$	pr./bz.	190–200
108	**Evodiamine**	*d*	$C_{19}H_{17}ON_3$	yel. leaf./al.	278
109	hydrate	*in*	$C_{19}H_{19}O_2N_3$	rhomb. leaf.	146–7
110	**Gelsemine**	*d*	$C_{20}H_{22}O_2N_2$	wh. cryst.	178
111	acetone	. . .	$C_{20}H_{22}O_2N_2 \cdot (CH_3)_2CO$	pr./act.	−act. at 120
112	hydrochloride	*d*	$C_{20}H_{22}O_2N_2 \cdot HCl$	pr./aq. al. or aq.	300
113	**Glaucine**	*d*	$C_{21}H_{25}O_4N$	yel. rhomb. pr.	119–20
114	**Gnoscopine**	*in*	$C_{22}H_{23}O_7N$	long need./MeOH	232 d.
115	**Guanine**	*in*	$C_5H_5ON_5$	wh. cryst. powd.	>360 d.
116	**Guvacine**	. . .	$C_6H_9O_2N \cdot H_2O$	short rods/dil. al.	285 d.

* Melting point of the anhydrous compound.

** Becomes anhydrous at 120–30°.

‡ See also listing in table Physical Properties of Organic Compounds.

Corynine 244
Cuskhygrine 90
Daturine 22
Dehydromorphine 188
Diamorphine 95
Dihydromorphinone hydrochloride 97
2,6-Dihydroxy-purine 243
Dimethoxy-strychnine 35
1,3-Dimethyl-xanthine 233
3,7-Dimethyl-xanthine 232

No.	Reaction with H_2SO_4	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Alkaloid					
		Water	Alcohol	Ether	Chloroform	Benzene	Others
83	....	i.	s. h.	v. s.	v. s.	s.	i. alk.
84	....	s. h.	s.	i.	i.	i.	....
85	....	s. h.	s.	s.	....	s. dil. a.	s. NH_4OH
86	....	1	4	....	....	....	....
87	....	v. s.	....	....	....	....	....
88	violet → grn. → yel.	v. sl. s.	100 h.	v. sl. s.	sl. s.	v. sl. s.	s. h. pyr.
89	dil. → no fluorescence	i.	s.	sl. s.	sl. s.	sl. s.	s. alk.; i. NH_4OH
90	....	∞	s.	s.	....	s.	....
91	....	s.	s.	s. †	....	s. †	....
92	....	s.	s.	i.	s.	s.	i. pet.
93	+ malic a. → org. → bl.	50,000	20	10	15	....	....
94	....	....	....	....	....	....	....
95	....	1700	24	70	2.2	s.	s. dil. a.; s. alk.
96	....	2	s.	i.	i.	....	....
97	....	s.	s.	i.	....	....	....
98	....	7	1.4	i.	i.	....	....
99	....	4	50	i.	i.	i.	s. EtOAc
100	....	s.	sl. s.	....	....	....	....
101	....	1000	s.	s.	s.	sl. s.	....
102	....	4	s.	s.	....	....	....
103	....	20	0.2	s.	s.	....	s. oils
104	....	3	12	i.	....	....	....
105	....	1.2	76	i.	....	....	....
106	with et. → org. → bl.	sl. s.	200 c.; 52 h.	1020	s.	77 h.	26 act.
107	ditto	i.	s.	sl. s.	s.	s. h.	s. NaOH
108	....	i.	sl. s.	sl. s.	sl. s.	i.	i. dil. a.
109	....	....	....	....	....	....	....
110	colorl. → yel. br. → yel. grn.	sl. s.	s.	s.	s.	s.	s. dil. a.
111	....	....	....	....	....	....	....
112	....	s.	sl. s.	....	....	....	....
113	colorl. → bl. in time	s. h.	v. s.	s.	v. s.	sl. s.	sl. s. pet.
114	....	i.	1500	....	s. h.	sl. s.	i. alk.
115	....	i.	v. sl. s.	v. sl. s.	s. a.	v. sl. s. NH_4OH	s. KOH
116	....	s.	....	i.	....	....	....

† With separation of droplets of water.

Eserine 174
Ethyl-morphine-HCl 98
Eudermol 163
Feraconitine 185
Fumarine 183
Gelseminine 110
Glyoxyl-diureide 10
Guaranine 39
Gynesin 234

No.	Name	[α]	Formula	Appearance	Melting Point °C.
117	**Harmaline**	*in*	$C_{13}H_{14}ON_2$	pr./al. + bz.	250 d.
118	**Harmine**	*in*	$C_{13}H_{12}ON_2$	rhomb. pr./al.	257–9 d.
119	**Homoatropine**	. . .	$C_{16}H_{21}O_3N$	deliq. pr./et.	99–100
120	hydrobromide	. . .	$C_{16}H_{21}O_3N \cdot HBr$	rhomb.	217–8 d.
121	**Hordenine**	*in*	$C_{10}H_{15}ON$	orthorhomb. pr.	117.8; subl. 140–50
122	sulfate	. . .	$(C_{10}H_{15}ON)_2 \cdot H_2SO_4 \cdot 2H_2O$	colorl. cryst.	208–10*
123	**Hydrastine**	*l*	$C_{21}H_{21}O_6N$	colorl. rhomb. pr./al.	132
124	hydrochloride	*d*	$C_{21}H_{21}O_6N \cdot HCl$	hyg. powd.	116
125	**Hydrastinine**	*in*	$C_{11}H_{13}O_3N$	need./lig.	116–7
126	hydrochloride	*in*	$C_{11}H_{12}O_2NCl$	yel. need.	212 d.
127	**Hydrocotarnine**	*in*	$C_{12}H_{15}O_3N \cdot \frac{1}{2}H_2O$	mon. pr./al.	55–6
128	**Hydroquinine**	*l*	$C_{20}H_{26}O_2N_2 \cdot 2H_2O$	need./chl. or et.	172*
129	**Hyoscine**	*l*	$C_{17}H_{21}O_4N$	syrup or cryst./et.	59
130	hydrobromide	*l*	$C_{17}H_{21}O_4N \cdot HBr \cdot 3H_2O$	rhomb. tab. or need./aq.	194–7*
131	**Hyoscyamine**	*l*	$C_{17}H_{23}O_3N$	silky need./aq. al.	106–8
132	hydrobromide	*l*	$C_{17}H_{23}O_3N \cdot HBr$	deliq. pr.	152
133	hydrochloride	. . .	$C_{17}H_{23}O_3N \cdot HCl$	wh. cryst.	149–51
134	sulfate	*l*	$(C_{17}H_{23}O_3N)_2 \cdot H_2SO_4 \cdot 2H_2O$	need./al.	206*
135	**Hypaphorine**	*d*	$C_{14}H_{18}O_2N_2 \cdot 2H_2O$	large mon. cryst./aq.	255*
136	**Hypoxanthine**	*in*	$C_5H_4ON_4$	minute need.	d. 150
137	**Japaconitine**	*d*	$C_{34}H_{47}O_{11}N$	need./al., et. or chl.	202–9
138	**Jervine**	*l*	$C_{26}H_{37}O_3N \cdot 2H_2O$	long grouped pr.	238–42
139	**Laudanine**	*in*	$C_{20}H_{25}O_4N$	pr./aq. al.	166–7
140	**Laudanosine**	*d*	$C_{21}H_{27}O_4N$	need./bz.	90
141	**Lobeline**	*l*	$C_{22}H_{27}O_2N$	broad colorl. need.	130–1
142	hydrochloride	*l*	$C_{22}H_{27}O_2N \cdot HCl$	wh. granular powd.	180
143	**Lupanine**	*d*	$C_{15}H_{24}ON_2$	need./pet.; very alkaline	40
144	hydrochloride	*d*	$C_{15}H_{24}ON_2 \cdot HCl \cdot 2H_2O$	. . . .	127–8; 250–2*
145	**Lupinine**	*l*	$C_{10}H_{19}ON$	rhomb. cryst./pet.	69–71
146	hydrochloride	*l*	$C_{10}H_{19}ON \cdot HCl$	rhomb. pr./aq. al.	212–3
147	**Lycorine**	*l*	$C_{16}H_{17}O_4N$	colorl. pr./al.	280 d.
148	**Mezcaline**	*in*	$C_{11}H_{17}O_3N$	colorl. alk. oil or cryst.	B.P. 180^{12}; 35–6
149	**Morphine**	*l*	$C_{17}H_{19}O_3N \cdot H_2O$	trim. pr./al.	254 d.*
150	acetate	*l*	$C_{17}H_{19}O_3N \cdot CH_3CO_2H \cdot 3H_2O$	cryst. powd./al.	200 d.

* Melting point of the anhydrous compound.

Herapathite 207
Heroin 95
Hydra-ergotocin 244
Hydro-berberine 45
Hydro-cinchonine 60
Hydroxy-cinchonine 89
Hydroxy-coniine 77
6-Hydroxy-purine 136
Hydroxy-stachydrine 238
dl-Hyoscyamine 22
Iodoquinine sulfate 207
Laburnine 92

No.	Reaction with H_2SO_4	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Alkaloid					
		Water	Alcohol	Ether	Chloroform	Benzene	Others
117	....	v. sl. s.	s. h.	sl. s.	....	....	s. dil. a.
118	yel. with grn. fluorescence	v. sl. s.	sl. s.	sl. s.	s.	....	s. dil. a.
119	....	sl. s.	s.	s.	s.	s.	s. dil. a.
120	....	6	32	i.	625	....	....
121	....	s.	v. s.	v. s.	s.	sl. s.	s. dil. a.; s. alk.
122	....	s.	sl. s.	i.	....	....	....
123	olive grn. with $(NH_4)_2MoO_4$	i.	170	175	1.4	15	....
124	....	s.	s.	v. sl. s.	sl. s.	....	....
125	....	s. h.	s.	s.	s.	d.	s. a.
126	....	v. s.	v. s.	300	286	....	....
127	yel. → r.h.	i.	v. s.	v. s.	v. s.	v. s.	i. alk.
128	dil. → fluorescence	v. sl. s.	s.	s.	s.	s. act.; i. pet.	s. NH_4OH
129	h. → bl.	sl. s.	s.	s.	s.	sl. s.	sl. s. pet.
130	....	1.5	16	i.	750	....	....
131	colorl.	281	s.	49	1.5	132	s. dil. a.
132	....	v. s.	2.5	1610	1.7	....	....
133	....	s.	s.	....	....	....	....
134	....	0.5	4.5	v. sl. s.	v. sl. s.	....	....
135	....	v. s.	v. s.	....	....	....	i.
136	....	1370 c.; 69.5^{100°	900 h.	i.	....	s. a.	s. alk.
137	....	i.	s.	s.	s.	....	i. pet.
138	yel. → grn. h.	i.	s.	sl. s.	s.	sl. s.	s. act.
139	red	v. sl. s.	s.	600	v. s.	v. s.	s. alk. carb.
140	rose red → red violet 150°	i.	s.	19	s.	s. h.	i. alk.
141	red-br.	v. sl. s.; d. h.	s. h.	s.	s.	s.	v. sl. s. pet.
142	....	40	10	....	v. s.	....	....
143	....	s.	s.	s.	s.	....	....
144	....	....	....	....	....	....	....
145	....	s.	s.	s.	s.	s.	sl. s. pet.
146	....	s.	....	....	....	....	....
147	+ MoO_3 → grn. → bl.	i.	sl. s.	sl. s.	sl. s.	sl. s. EtOAc	s. a.
148	yel. → violet	s.	s.	i.	s.	s.	i. pet.
149	pink → grn. h. → br.	3533 c.; 1075 h.	170 c.; 80 h.	4450	1525	9000	475 EtOAc
150	....	2.25	17.3	i.	710	....	6.5 gly.

Lupinidine 220
Lycine 34
Macleyine 183
Mescaline 148
Methoxy-cinchonine 199
Methyl-benzoyl-ecgonine 62
Methyl-granatonine 190
Methyl-hydrocupreine 128
Methyl-6-methoxy-7,8-methylenedioxy-tetrahydro-isoquinoline 12
O-Methyl-morphine 67
N-Methyl-proline-methylbetaine 222
Methyl-theobromine 39

No.	Name	[a]	Formula	Appearance	Melting Point °C.
151	hydrochloride	*l*	$C_{17}H_{19}ON \cdot HCl \cdot 3H_2O$	silky need./aq.	200 d.
152	sulfate	*l*	$(C_{17}H_{19}O_3N)_2 \cdot H_2SO_4 \cdot 5H_2O$	silky or cubic cryst./aq.	250 d.*
153	**Muscarine**	*d*	$C_8H_{19}O_3N$	deliq. cryst.	....
154	**Nandinine**	*d*	$C_{19}H_{19}O_4N$	leaf.	145–6
155	**Narceine**	*in*	$C_{23}H_{27}O_8N \cdot 3H_2O$	need. or pr./aq.	145*
156	bisulfate	...	$C_{23}H_{27}O_8N \cdot H_2SO_4 \cdot 10H_2O$	cryst. powd.	d. →yel.
157	hydrochloride	...	$C_{23}H_{27}O_8N \cdot HCl \cdot 3H_2O$	cryst./HCl	192*
158	**Narcotine**	*l*	$C_{22}H_{23}O_7N$	long need./h. al.	176
159	hydrochloride	...	$C_{22}H_{23}O_7N \cdot HCl \cdot H_2O$	lustrous cryst.	197–8
160	**Nicotine**	*l*	$C_{10}H_{14}N_2$	colorl. oil	B.P. 246^{730}
161	hydrochloride	*d*	$C_{10}H_{14}N_2 \cdot 2HCl$	deliq. cryst.	....
162	picrate	...	$C_{10}H_{14}N_2 \cdot 2C_6H_3O_7N_3$	yel. need. or pr./al.	218
163	salicylate	*d*	$C_{10}H_{14}N_2 \cdot C_7H_6O_3$	wh. plates	117–8
164	tartrate	*d*	$C_{10}H_{14}N_2 \cdot 2C_4H_6O_6 \cdot 2H_2O$	reddish-wh. cryst.	88–90
165	**Oxyacanthine**	*d*	$C_{38}H_{38}O_6N_2$	need./al. or et.	216–7
166	nitrate	...	$C_{38}H_{38}O_6N_2 \cdot 2HNO_3 \cdot 4H_2O$	need.	195–200
167	**Papaveraldine**	...	$C_{20}H_{19}O_5N$	cryst./bz. or pet.	210
168	**Papaverine**	*in*	$C_{20}H_{21}O_4N$	rhomb. pr. or need./al.-et.	147–8
169	hydrochloride	...	$C_{20}H_{21}O_4N \cdot HCl$	mon. pl./aq.	220–1 d.
170	**Paraconiine**	*in*	$C_8H_{15}N$	yel. liq.	B.P. 168–70
171	**Pelletierine**	*in*	$C_8H_{15}ON$	colorl. oil	B.P. 106^{21}; 195^{760}
172	**Pellotine**	...	$C_{13}H_{19}O_3N$	plates/al.	110–2
173	hydrochloride	...	$C_{13}H_{19}O_3N \cdot HCl$	wh. cryst.	....
174	**Physostigmine**	*l*	$C_{15}H_{21}O_2N_3$	hyg. cryst. (2 forms)	86–7; 105–6
175	**Pilecarpidine**	*d*	$C_{10}H_{14}O_2N_2$	viscid oil	....
176	nitrate	*d*	$C_{10}H_{14}O_2N_2 \cdot HNO_3$	pr./aq.	137
177	**Pilocarpine**	*d*	$C_{11}H_{16}O_2N_2$	colorl. oil or need.	34
178	hydrochloride	*d*	$C_{11}H_{16}O_2N_2 \cdot HCl$	pr. or need.	204–5
179	nitrate	*d*	$C_{11}H_{16}O_2N_2 \cdot HNO_3$	pr./al. or aq.	176–8
180	**Piperine**	*in*	$C_{17}H_{19}O_3N$	mon. need./al.	129–30
181	periodide	...	$(C_{17}H_{19}O_3N)_2 \cdot HI \cdot I_2$	steel bl. need.	145
182	**Porphyroxine**	*l*	$C_{19}H_{23}O_4N$	pr./lig.	134–5
183	**Protopine**	*in*	$C_{20}H_{19}O_5N$	mon. cryst./al.	207–8
184	**Protoveratrine**	...	$C_{32}H_{51}O_{11}N$	rectangular tab.	245–50 d.
185	**Pseudoaconitine**	*d*	$C_{36}H_{51}O_{12}N$	rhombs chl. + et.	212–4
186	**Pseudoephedrine**	*d*	$C_{10}H_{15}ON$	rhomb. tab./et.	118–9
187	hydrochloride	...	$C_{10}H_{15}ON \cdot HCl$	need.	176
188	**Pseudomorphine**	*l*	$C_{34}H_{36}O_6N_2 \cdot 3H_2O$	crusts or need.	d. 327

* Melting point of the anhydrous compound.

Napelline 3
Narcissine 147
Naroosine 158
dl-Narcotine 114
Nepaline 185
Neriine 76
Nor-arecaidine 116
Opianin 158
Opin 182
Oxy-dimorphine 188

No.	Reaction with H_2SO_4	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Alkaloid					
		Water	Alcohol	Ether	Chloroform	Benzene	Others
151	....	17.2 c.; 0.5 h.	42	i.	i.	....	19 gly.
152	....	15.3	452	i.	i.	....	....
153	....	v. s.	v. s.	sl. s.	sl. s.	....	d.a.; stable alk.
154	....	sl. s.	s.	s.	s.	s.	s. dil. a.
155	br. → r. h.	769 c.; 220 h.	945 c.; s. h.	i.	v. sl. s.	i.; s. alk.	s. NH_4OH; s. dil. a.
156	....	s. → basic salt	s. h.	s.	s.	....	....
157	....	s. h.	s. h.	....	....	....	s. MeOH
158	yel. grn. → r. h.	3300	100	166	3	22	s. h. alk.
159	....	diss.	s.	....	s.	....	....
160	colorl.	s.	∞	∞	∞	....	s. pet.
161	....	s.	s.	....	....	....	....
162	....	....	....	....	....	....	low solubility
163	....	s.	s.	....	....	....	....
164	....	v. s.	v. s.	....	....	....	....
165	colorl.	i.	s.	s.	s.	s.	s. dil. a.
166	....	sl. s.	....	....	....	....	....
167	....	i.	sl. s.	sl. s.	s.	s.	s. a.; sl. s. pet.
168	colorl. → rose r. h.	i.	45 c.; 4 h.	250	s. h.	s. h.	13 pyr.
169	....	37	s.	i.	s.	....	....
170	....	v. sl. s.	∞	∞	....	....	....
171	grn. with $K_2Cr_2O_7$	20	s.	s.	s.	s.	....
172	yel. → r. with HNO_3	v. sl. s.	s.	s.	s.	....	sl. s. pet.
173	....	s.	....	....	....	....	....
174	colorl. → yel.	sl. s.	s.	s.	s.	s.	....
175	....	s.	s.	....	s.	....	....
176	....	2	82	....	....	....	....
177	colorl.	v. s.	v. s.	sl. s.	v. s.	v. sl. s.	i. pet.; s. alk.
178	....	0.3	3	i.	545	....	....
179	....	4	60	i.	i.	....	....
180	dk. r. → br. blk.	sl. s.	12	26	2.6	s.	i. pet.
181	....	....	s.	....	v. s.	....	....
182	red	sl. s.	s.	s.	s.	s.	s. dil. a.
183	yel. → violet → grn.	i.; sl. s. act.	900	1000	15	v. sl. s.	sl. s. NH_4OH
184	grn. → bl. → violet	i.	s. h.	sl. s.	s.	i.	i. pet.
185	....	v. sl. s.	s.	sl. s.	s.	....	*l* salts
186	....	sl. s.	s.	s.	s.	....	....
187	....	s.	s.	....	....	....	....
188	+sucrose → dk. grn. → br.	i.	i.	i.	i.	s. alk.	s. h. NH_4OH; s. pyr.

Oxy-neurine HCl 34
6-Oxy-purine 136
Paramorphine 228
Peganine 239
1-Phenyl-2-methylamino-propanol 103
Pilosine 47
Pitayine 195
Proline-betaine 222
2-Propyl-piperidine 78
Pseudocinchonine 60

No.	Name	[α]	Formula	Appearance	Melting Point °C.
189	hydrochloride	*l*	$C_{34}H_{36}O_6N_2 \cdot 2HCl \cdot 2H_2O$	cryst. powd.	....
190	**Pseudopelletierine**	*in*	$C_9H_{15}ON$	anh. prism. tab.	48; B.P. 246
191	**Pseudotropine**	*in*	$C_8H_{15}ON$	tab. or pr./et.	108
192	**Pukateine**	*l*	$C_{18}H_{17}O_3N$	cryst./et.	200
193	**Quinicine**	*d*	$C_{20}H_{24}O_2N_2$	yel. oil; hardens on standing	(60)
194	oxalate	*d*	$(C_{20}H_{24}O_2N_2)_2 \cdot H_2C_2O_4 \cdot 9H_2O$	pr./chl. or need./al.	149
195	**Quinidine**	*d*	$C_{20}H_{24}O_2N_2$	pr. +al./al.; tab. + et./et.	174–5*
196	bisulfate	...	$C_{20}H_{24}O_2N_2 \cdot H_2SO_4 \cdot 4H_2O$	hair-like need. or pr.	....
197	hydrochloride	*d*	$C_{20}H_{24}O_2N_2 \cdot HCl \cdot H_2O$	asbestos-like pr.	258–9 d.*
198	sulfate	*d*	$(C_{20}H_{24}O_2N_2)_2 \cdot H_2SO_4 \cdot 2H_2O$	pr. or need./h. aq.	....
199	**Quinine**	*l*	$C_{20}H_{24}O_2N_2$	wh. need. or powd.	175
200	arsenate	...	$3(C_{20}H_{24}O_2N_2) \cdot 2H_3AsO_4 \cdot 5H_2O$	wh. effl. cryst.	....
201	bisulfate	*l*	$C_{20}H_{24}O_2N_2 \cdot H_2SO_4 \cdot 7H_2O$	pr./aq. or al.	160 d.*
202	formate	*l*	$C_{20}H_{24}O_2N_2 \cdot HCO_2H$	cryst. powd.; need.	109 d.
203	hydrate	*l*	$C_{20}H_{24}O_2N_2 \cdot 3H_2O$	efflorescent; anh. at 100°	57
204	hydrobromide	...	$C_{20}H_{24}O_2N_2 \cdot HBr \cdot H_2O$	hyg., silky need.	152–200
205	hydrochloride	*l*	$C_{20}H_{24}O_2N_2 \cdot HCl \cdot 2H_2O$	effl., silky need.	158–60*
206	hydrochloride, di-	*l*	$C_{20}H_{24}O_2N_2 \cdot 2HCl$	wh. powd. or need.	180–5
207	iodosulfate	...	$4C_{20}H_{24}O_2N_2 \cdot 3H_2SO_4 \cdot 2HI \cdot I_4 \cdot 6H_2O$	pl./al.; r. or grn. by reflected or transmitted light	$-H_2O$, 100
208	salicylate	...	$C_{20}H_{24}O_2N_2 \cdot C_7H_6O_3 \cdot H_2O$	need./aq.	195
209	sulfate	*l*	$(C_{20}H_{24}O_2N_2)_2 \cdot H_2SO_4 \cdot 7H_2O$	efflorescent need.	235*
210	sulfate	*l*	$(C_{20}H_{24}O_2N_2)_2 \cdot H_2SO_4 \cdot 2H_2O$	by drying in air	205
211	valerate	...	$C_{20}H_{24}O_2N_2 \cdot C_5H_{10}O_2 \cdot H_2O$	cryst. powd.	95
212	**Rhoeadine**	...	$C_{21}H_{21}O_6N$	small pr. or need.	245–7 d.
213	**Ricinine**	...	$C_8H_8O_2N_2$	pr. or tab./al. or aq.	201, subl.
214	**Rutaecarpine**	...	$C_{18}H_{13}ON_3$	yel. pl.; need./EtOAc	260–2
215	**Sinapine**	...	$C_{16}H_{25}O_6N$	free base unknown	....
216	bisulfate	...	$C_{16}H_{24}O_5NHSO_4 \cdot 3H_2O$	leaf./al.	127*
217	thiocyanate	...	$C_{16}H_{24}O_5NSCN \cdot H_2O$	pale yel. need./aq.	178
218	**Solanidine**	*l*	$C_{26}H_{41}ON$	need./et. or al.	219
219	**Solanine**	*l*	$C_{44}H_{71}O_{15}N$	slender need./al.	244–54 d.

* Melting point of the anhydrous compound.

Pseudo-punicine 190
Punicine 171
Pyridyl-*N*-methyl-pyrrolidine 160
α-(3-Pyridyl)-piperidine 11

Quebrachine 244
α-Quinidine 53
β-Quinine 195

No.	Reaction with H_2SO_4	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Alkaloid					
		Water	Alcohol	Ether	Chloroform	Benzene	Others
189	....	70	....	....	....	....	....
190	$+CrO_3 \rightarrow$ grn.	s.	s.	s.	s.	....	sl. s. pet.
191	....	v. s.	v. s.	sl. s.	s.	....	very alkaline
192	org.→r. and violet h.	i.	s.	161	s.	s. pyr.	s. alk
193	no fluorescence	v. sl. s.	s.	s.	s.	....	....
194	....	s. h.	s.	....	s.	....	....
195	dil.→bl. fluorescence	2000 c.; 800 h.	26	22	2.3	s.	sl. s. lig.
196	....	8; fluorescence	....	....	....	....	....
197	....	60 c.; v. s. h.	s.	sl. s.	s.	....	....
198	....	100 c.; 15 h.	8	v. sl. s.	15	i.	....
199	colorl.→lt. yel.→br. h.	1750	0.6	22.6	1.9	166 c.; 30 h.	s. CS_2; s. NH_4OH
200	....	650 c.; 120 h.	200 c.; 50 h.	....	....	....	s. dil. a.
201	....	fluorescence; 9	19	1770	920	....	18 gly.
202	....	19	s.	v. sl. s.	s.	....	....
203	....	1560 c.; 800 h.	0.6	1.4	1.6	70	212 gly.
204	dil.→fluorescence	40 c.; 3 h.	1	23	1	....	9 gly.
205	ditto	16 c.; 0.5 h.	0.6	340	1	....	9 gly.
206	....	0.6	5	v. sl. s.	7	....	....
207	....	1000 h.	800 c.; 50 h.	....	....	....	60 h. ac. a.
208	....	1500	14	114	38	....	18 gly.
209	dil.→fluorescence	725 c.; 30 h.	60	sl. s.	1000	....	24 gly.
210	....	810 c.; 30 h.	96	sl. s.	sl. s.	....	....
211	....	70 c.; 40 h.	2	10	....	....	....
212	purple r.	1200	700	800	v. sl. s.	i.	s. a., d.
213	....	s. h.; i. pet.	sl. s. c.; s. h.	sl. s.	s.	sl. s.	forms no salts
214	bright yel.	i.	sl. s.	s.	s.	s.	....
215	....	....	....	....	....	....	....
216	....	s.	s. h.	i.	....	....	....
217	....	sl. s.	sl. s.	....	....	....	....
218	....	v. sl. s. h.	s. h.	sl. s.	s.	....	....
219	yel.→rose →r.	i.	s. h.	i.	i.	i.	....

Quinoform 202
Quinotoxine 193
Rheadin 212
Ricidine 213

Sarcine 136
Scopolamine 129
Secaline 106
Sophorine 92

No.	Name	[α]	Formula	Appearance	Melting Point °C.
220	**Sparteine**	*l*	$C_{15}H_{26}N_2$	colorl. oil	B.P. 325^{754} in H_2
221	bisulfate	. . .	$C_{15}H_{26}N_2 \cdot H_2SO_4 \cdot 5H_2O$	transparent cryst.	150–2*
222	**Stachydrine**	. . .	$C_7H_{13}O_2N \cdot H_2O$	deliq. cryst.	235 d*
223	oxalate	. . .	$C_7H_{13}O_2N \cdot H_2C_2O_4$	need.	105–7
224	**Strychnine**	*l*	$C_{21}H_{22}O_2N_2$	colorl. rhombs/al.	286–8; B.P. 270^5
225	hydrochloride	. . .	$C_{21}H_{22}O_2N_2 \cdot HCl \cdot 2H_2O$	efflorescent pr.	. . . .
226	nitrate	*l*	$C_{21}H_{22}O_2N_2 \cdot HNO_3$	shining need.	. . . .
227	sulfate	. . .	$(C_{21}H_{22}O_2N_2)_2 \cdot H_2SO_4 \cdot 5H_2O$	effl., mon. pr.	200 d.*
228	**Thebaine**	*l*	$C_{19}H_{21}O_3N$	leaf. or pr./al.	193
229	hydrochloride	*l*	$C_{19}H_{21}O_3N \cdot HCl \cdot H_2O$	large rhombs or yel. powd.	. . . .
230	*iso*-**Thebaine**	*d*	$C_{19}H_{21}O_3N$	rhomb./al. or et.	203–4
231	sulfate	. . .	$(C_{19}H_{21}O_3N)_2 \cdot H_2SO_4$	. . . .	120–1 d.
232	**Theobromine**	*in*	$C_7H_8O_2N_4$	minute rhomb. cryst.; mon./h. aq.	330†; subl. 290
233	**Theophylline**	*in*	$C_7H_8O_2N_4 \cdot H_2O$	mon. tab. or need./h. aq.	269–72
234	**Trigonelline**	. . .	$C_7H_7O_2N \cdot H_2O$	hyg. pr./al.	218 d.*
235	**Tropacocaine**	*in*	$C_{15}H_{19}O_2N$	need. or plates	49
236	hydrochloride	. . .	$C_{15}H_{19}O_2N \cdot HCl$	need.; pl./aq. al.	283 d.
237	**Tropine**	*in*	$C_8H_{15}ON$	hyg. tab./abs. et.	63
238	**Turicine**	*d*	$C_7H_{13}O_3N \cdot H_2O$	sweet, effl. pr. or need./aq. al.	260 d.*
239	**Vasicine**	*l*	$C_{11}H_{12}ON_2$	need./al.	211–2
240	**Veratridine**	*in*	$C_{36}H_{51}O_{11}N$	amor.; yel.	180
241	**Vicine**	*l*	$C_{10}H_{16}O_7N_4 \cdot 2H_2O$	need.	239–42
242	**Vomicine**	*d*	$C_{22}H_{24}O_4N_2$	need./aq. al.	278–80
243	**Xanthine**	*in*	$C_5H_4O_2N_4 \cdot H_2O$	small pl.; anh. at 125°	>150 d.
244	**Yohimbine**	*d*	$C_{21}H_{26}O_3N_2$	need./aq. al.	247–8
245	hydrochloride	*d*	$C_{21}H_{26}O_3N_2 \cdot HCl$	plates	302
246	nitrate	. . .	. . . .	colorl. pr.	276
247	thiocyanate	. . .	. . . .	rectangular pr./h. aq.	233–4
248	**Zygadenine**	*l*	$C_{39}H_{63}O_{10}N$	need./bz.	200–1

* Melting point of the anhydrous compound.
† Sealed tube.

Stypticin 86
Styptol 87
Telepathine 118
Tetraanhydro-berberine 45
Tetrahydro-nicotinic acid 116
Theine 39
Theocine 233
Trigenolline 234
Trimethyl-glycocoll 33
1,3,7-Trimethyl-xanthine 39
Tropine mandelate 119
Ulexine 92

No.	Reaction with H_2SO_4	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Alkaloid					
		Water	Alcohol	Ether	Chloroform	Benzene	Others
220	colorl.	328	s.	s.	s.	i.	....
221	colorl.	1.1	2.4	i.	i.	....	....
222	....	s.	s.	i.	i.	s. dil. a.	d. in air
223	....	....	i. c.	....	....	....	....
224	colorl.	6400 c.; 3100 h.	110 c.; 28 h.	v. sl. s.	6	150	173 PhMe
225	....	35	60	i.	....	....	i. HCl
226	....	42 c.; 10 h.	120	i.	156	....	60 gly.
227	....	31 c.; 7 h.	65	i.	325	....	7 gly.
228	blood r.	i.	10	135	19	18	i. alk.
229	....	12	s.	....	....	....	....
230	....	....	s.	sl. s.	s.	....	....
231	....	....	....	....	....	....	....
232	....	2000 c.; 150 h.	1775 c.; 260 h.	3125 h.	157 c.; 100 h.	100,000	s. alk.; 4700 h. CCl_4
233	....	120 c.; s. h.	64	sl. s.	164	s. alk.	s. NH_4OH
234	....	v. s.	s.	v. sl. s.	v. sl. s.	i.	neutral reaction
235	....	i.	s.	s.	v. s.	v. s.	s. dil. NH_4OH
236	....	s.	sl. s.	....	....	....	....
237	....	v. s.	v. s.	s.	s.	s.	....
238	....	v. s.	sl. s.	....	....	....	....
239	colorl.	sl. s.	s.	sl. s.	s.	sl. s.	i. pet.; s. dil. a.
240	yel.	s.	....	sl. s.	....	....	....
241	yel.	sl. s.	i. abs.	....	....	s. dil. a.	s. MeOH
242	$+CrO_3 \rightarrow$ deep r.	....	s. h.	sl. s.	s.	....	s. act.
243	....	14,400 c.; 1500 h.	2400	3000	....	....	s. alk.; s. a.
244	colorl. + $K_2Cr_2O_7 \rightarrow$ dirty grn.	v. sl. s.	s.	sl. s.	s.	s. h.	....
245	....	120	400	....	....	....	....
246	....	....	....	....	....	....	....
247	....	....	....	....	....	....	....
248	or. → cherry r.	....	s.	....	s.	s.	....

Ultraquinine 89
5-Ureido-hydantoin 10
Ureous acid 243
Veratrine, a mixture of 49,240 *et al.*
Veratrine (crystallized) 49
Veratroylaconine 185
Vinetine 165
Viridine 138
Wrightine 76
Xanthaline 167
Xanthopuccine 45
Yageine 118
Yajeine 118

PHYSICAL CONSTANTS

Compiled by F. E. SHEIBLEY, Ph.D.

Names of the compounds in the table below are arranged alphabetically.

Appearance. In addition to the crystalline form and color, the solvent used in purification is often given; thus, "rhomb./al." indicates that rhombic crystals were obtained when the compound was crystallized from alcohol.

Optical Properties. These are indicated by the symbols *d*, *l*, or *in.* following the name. Most of the optically active glucosides are levo-rotatory.

Solubilities. Most glucosides are soluble in cold or hot water. The solubilities given for alcohol refer to the ordinary alcohol of approximately 95% concentration. Solubilities expressed by numbers are given in parts by weight of solvent required to dissolve one part of the glucoside. Because of discrepancies existing between many of these figures as found in the literature no claim to accuracy can be made,

Abbreviations used in the table

a., acid
abs., absolute
ac., a., acetic acid
act., acetone
al., alcohol
alk., alkali (i. e. aqueous NaOH or KOH)
amor., amorphous
anh., anhydrous
aq., aqueous; water
br., brown
bz., benzene, C_6H_6
c., cold
Chl., chloroform, $CHCl_3$

colorl., colorless
conc., concentrated
cryst., crystals or crystalline
crystn., crystallization
d., decomposes or decomposition
d, dextro-rotatory
dil., dilute
et., ether $(C_2H_5)_2O$
EtOAc, ethyl acetate
h., hot
hyd., hydrate
hyg., hygroscopic

No.	Name	Formula	Appearance	Melting Point °C.
1	Absinthin	$C_{30}H_{40}O_8$	glossy need. or yel. amor. powd.	68
2	Aesculin (*l*)	$C_{15}H_{16}O_9 \cdot 2H_2O$	pr./aq. or dil. al.	205 d.
3	Amygdalin (*l*)	$C_{20}H_{27}O_{11}N \cdot 3H_2O$	orthorhomb. pr./aq.; glossy scales ($+2H_2O$)/80% al.	214–6*
4	Antiarin	$C_{27}H_{42}O_{10} \cdot 4H_2O$	plates/aq.	220–5
5	Apiin (*l*)	$C_{26}H_{28}O_{14} \cdot H_2O$	glossy need. or yel. cryst. powd.	228
6	Arbutin (*l*)	$C_{12}H_{16}O_7 \cdot H_2O$	long silky need./aq.	195–200*
7	Baptisin (*l*)	$C_{28}H_{30}O_{14} \cdot 3H_2O$	thin wh. need./al. slowly becomes anh.	sint. 150; m. 249–51
8	Bryonin (*d*)	$C_{34}H_{50}O_9$	amor. bright yel. powd.	softens 208
9	Carminic acid	$C_{22}H_{20}O_{13}$	purplish-br. mass or bright r. powd.; r. pr.	d. 136

* Melting point of the anhydrous compound.

Abietin 15
Acocantherin 51
Arthanitin 22

Asebotin 55
Aurantiin 49

OF GLUCOSIDES

and the numerical values stated are perhaps best considered as upper limits.

Hydrolytic Products. By hydrolysis glucosides are split into a sugar (generally glucose) or a mixture of sugars, and a principle characteristic of the glucoside. The hydrolysis is usually effected with hot dilute sulfuric acid or hydrochloric acid, and less often with emulsin or baryta water.

References. The information given in the table has been collected mainly from the following sources:—

J. J. L. van Rijn: **Die Glykoside.** Published by Borntraeger, Berlin (1900).
Merck's Index, 5th edition. Published by Merck and Co., Inc., Rahway, N. J.
Beilstein: **Handbuch der Organischen Chemie,** 3d edition.

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i., insoluble
in, inactive
K_2CO_3, aq. soln of
KOH, aq. soln. of
l, levo-rotatory
leaf., leaflets or leaves
m-, meta
m., melts
m.p., M.P., melting point
mon., monoclinic
need., needles
org., orange
orthorhomb, orthorhombic

pet., petroleum ether
powd., powder
pr., prisms
pyr., pyridine
r., red
rhomb., rhombic
s., soluble
sint., sinters
sl., slight or slightly
v., very
wh., white
yel., yellow
>, greater than

No.	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Glucoside					Hydrolytic Products		
	Water	Alcohol	Ether	Chloroform	Others	Principle	M.P. °C.	Sugar
1	sl. s.	s.	s.	s.	s. bz.; s. NaOH	resinous substance	......	glucose
2	576 c.; s. h.†	24 h.	sl. s.	s. h.	v. s. dil. alk.	aesculetin	270 d.	glucose
3	12 c.; v. s. h.	720 c.; 9 h.	i.	......	....	hydrocyanic acid benzaldehyde	−12 −26	glucose
4	s.	s.	sl. s.	......	....	antiarigenin	180	antiarose
5	sl. s. c.; s. h.	s. h.	i.	......	....	apigenin	subl. 292–5	glucose + apiose
6	8 c.; 1 h.	13	i.	i.	i. CS_2	hydroquinone	170.3	glucose
7	sl. s. c.; s. h.	sl. s. dil.	v. sl. s	v. sl. s.	s. glacia ac. a.	baptigenin	296–8	glucose + rhamnose
8	s.	s.	i.	i.	....	bryogenin (resinous)	......	glucose
9	s.	s.	v. sl s	i.	s alk.; s. conc. H_2SO_4	carmine red	......	sugar

† Aqueous solutions fluoresce faint blue.

Avenein 35
Avornin 30

6-Benzoyl-*d*-glucose 79
6-Benzoyl-salicin 59

No.	Name	Formula	Appearance	Melting Point °C.
10	Cerberin (*l*)	$C_{27}H_{40}O_8$	glossy cryst./et.	191–2
11	α-Chinovin (*d*)	$C_{30}H_{48}O_8$	rosettes of small need./al.	....
12	β-Chinovin (*d*)	$C_{30}H_{48}O_8$	scales/dil. al.	235 d.
13	Clavicepsin (*d*)	$C_{18}H_{34}O_{16} \cdot H_2O$	wh. cryst.	91; 198*
14	Colocynthin	$C_{56}H_{84}O_{23}$	microscopic pr.	....
15	Coniferin (*l*)	$C_{16}H_{22}O_8 \cdot 2H_2O$	wh. pointed satiny need.	185
16	Convallamarin (*l*)	$C_{23}H_{44}O_{12}$, mixture	wh., cryst. powd.	....
17	Convallarin (*l*)	$C_{34}H_{62}O_{11}$, mixture	rectangular pr.	....
18	Convolvulin (*l*)	$C_{54}H_{96}O_{27}$	wh. amor. powd.	155–8
19	Coriamyrtin (*d*)	$C_{15}H_{18}O_5$	mon. pr.	228–30
20	Crocin	$C_{44}H_{64}O_{26} \cdot H_2O$	br. red cryst.	186 d.
21	Curangin (*d*)	$C_{48}H_{77}O_{20}$	amor.	172
22	Cyclamin (*l*)	$C_{27}H_{38}O_{13}$	wh. amor. powd.; microscopic cryst.	236
23	Daphnin (*l*)	$C_{15}H_{16}O_9 \cdot 2H_2O$	pr. or need./aq.	215 d.
24	Datiscin (*l*)	$C_{27}H_{30}O_{15} \cdot 4H_2O$	glossy need. or pl./aq.	192
25	Digitalin	$C_{36}H_{56}O_{14}$	wh. cryst. powd.	229
26	Digitonin (*l*)	$C_{55}H_{90}O_{29}$	wh. cryst. powd.	sint. 225; d. 235
27	Digitoxin**	$C_{41}H_{64}O_{13}$	wh. leaf.	255–6*
28	Digitoxin hydrate	$C_{41}H_{64}O_{13} \cdot 6H_2O$	leaf./al.	145
29	Euxanthic acid	$C_{19}H_{16}O_{10} \cdot H_2O$	straw yel. need.	155–8 d.
30	Frangulin (*l*)	$C_{21}H_{20}O_9 \cdot H_2O$	org. need./aq. pyr.	246–9
31	Fraxin	$C_{16}H_{18}O_{10}$	need./al.	205
32	Fustin	$C_{36}H_{26}O_{14}$	wh. glossy need./aq.	217 d.
33	Gaultherin (*l*)	$C_{14}H_{18}O_8 \cdot H_2O$	need. or pr./al.	179–80
34	Glucogallin (*l*)	$C_{13}H_{16}O_{10}$	wh.-yel. cryst.	193 d.
35	Glycovanillin (*l*)	$C_{14}H_{18}O_8 \cdot 2H_2O$	wh. need./dil. al.	192
36	Glycyphyllin	$C_{21}H_{24}O_9 \cdot 3H_2O$	long, thin, glossy pr./et.	175–80 d.
37	Gratiolin	$C_{43}H_{70}O_{15}$	fine, glossy need.	235–7 d.
38	α-Hederin (*l*)	$C_{41}H_{64}O_{11}$	wh. need.	256–7
39	Helicin ‡ (*l*)	$C_{13}H_{16}O_7 \cdot \frac{3}{4}H_2O$	fine, radiating need./aq.	175 *; —aq. 100
40	Helleborein (*l*)	$C_{37}H_{56}O_{18}$	warts of fine need./al.	270

* Melting point of the anhydrous compound.

** Crystalline digitalin.

‡ Does not occur naturally but is obtained by oxidizing salicin.

Cuspidatin 58
Datiscosid 24
Digitalin, crystalline 27
Digitin 26
Esculin 2
Esculinic acid 2

No.	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Glucoside					Hydrolytic Products		
	Water	Alcohol	Ether	Chloroform	Others	Principle	M.P. °C.	Sugar
10	sl. s.	12	sl. s.	9	sl. s. CCl_4	cerberetin	85.5	glucose
11	i.	s. dil.	v. sl. s.	v. sl. s.	s. alk.	chinovic acid	d. 295	chinovose
12	....	v. s.‡	i.	......	i. EtOAc	chinovic acid	d. 295	chinovose
13	s.	sl. s.	i.	i.	i. bz.	*d*-mannitol	166	glucose
14	s.	s. h.	i.	......	....	colocynthein (resinous)	......	glucose
15	200 c.; v. s. h.	sl. s.	i.	......	....	coniferyl alcohol†	73–4	glucose
16	s.	s. dil.	sl. s.	i.	....	convallamaretin	......	sugar
17	sl. s.	s.	i.	......	....	convallaretin	......	sugar
18	sl. s.	s.	i.	sl. s.	s. EtOAc	methylethylacetic and other acids	......	glucose, rhodeose
19	sl. s. c.	s. h.	s.	s.	....	indefinite	......	sugar
20	sl. s. c.; s. h.	sl. s. abs.	i.	......	....	crocetin	285	gentiobiose
21	v. sl. s.	s.	sl. s.	......	s. aq. act.	curangaegenin	132	rhamnose + a little glucose
22	sl. s.	57	i.	i.	i. bz.	cyclamiretin	198	fructose, cyclose
23	sl. s. c.; s. h.	v. s. h.	i.	.. ...	s. alk.	daphnetin	253–6 d.	glucose
24	s.	s.	i.	......	....	datiscetin	276	rhamnose
25	1000	12	sl. s.	sl. s.	s. MeOH	digitaligenin	210–2	glucose, digitalose
26	sl. s.	s.	v. sl. s.	v. sl. s.	s. MeOH	digitogenin	softens 250	glucose, galactose
27	v. sl. s.	s.	v. sl. s.	s.	....	digitoxigenin	230	digitoxose
28	....	....	......	......	....	....	......	....
29	s. h.	s. h.	v. sl. s.	......	s. alk.	euxanthone	240	glycuronic acid
30	i.	sl. s. h.	i.	s. alk.	s. h. bz.	frangula-emodin	256–7	rhamnose
31	sl. s. c.; s. h.	s. h.	i.	......	§	fraxetin	227	glucose
32	v. s. h.	v. s.	sl. s.	......	s. alk.	fisetin	>360	rhamnose
33	slowly s.	s.	v. sl. s.	v. sl. s.	v. sl. s. act.	methyl salicylate	−8.3	glucose
34	s.	s.	sl. s.	i.	s. alk.	gallic acid	235 d.	glucose
35	s.	sl. s.	i.	......	....	vanillin	80	glucose
36	s. h.	s.	s.	i.	i. bz.	phloretin	180	isodulcite
37	s. h.	s.	i.	......	....	gratiogenin	198	glucose
38	i.	s.	i.	......	s. ac. a.	hederagenin	331	arabinose, rhamnose
39	60 c.; v. s. h.	s.	sl. s.	......	....	salicylaldehyde	−7	glucose
40	v. s.	sl. s.	i.	......	....	helleboretin	>200	glucose, arabinose, ac. a.

‡Heat evolved; forms penta-alcoholate, m.p. 70–80°, which separates.

†By the action of emulsin; heating with dilute acids gives resinous material.

§Solutions fluoresce blue.

Franguloside 30
Fraxinin 31
Glucosido-methyl salicylate 33
Glucosido-salicylaldehyde 39
Gratus strophanthin 51
Helixin 38

No.	Name	Formula	Appearance	Melting Point °C.
41	Helleborin	$C_{28}H_{36}O_6$	lustrous need.	>250
42	Hesperidin	$C_{28}H_{34}O_{15}$	wh., micro. need./aq. MeOH	251–2; d. 254
43	Indican	$C_{14}H_{17}O_6N \cdot 3H_2O$	need./aq.	57–8; 176–8 *
44	Iridin	$C_{24}H_{26}O_{13}$	wh. need.→yel. in air	208
45	Jalapin (*l*)	$C_{34}H_{56}O_{16}$	colorl. amor. mass	131–50
46	Linamarin (*l*)	$C_{10}H_{17}O_6N$	need.	142–3
47	Maclayin	$C_{17}H_{32}O_{10}$	deliquescent cryst.	158–65
48	Murrayin	$C_{18}H_{22}O_{10}$	microscopic need.	170
49	Naringin (*l*)	$C_{27}H_{32}O_{14} \cdot 8H_2O$	need./aq.	82
50	Ononin	$C_{25}H_{26}O_{11}$	small pr., need. or plates	210
51	Ouabain (*l*)	$C_{29}H_{44}O_{12} \cdot 7H_2O$	transparent plates	185 *
52	Parillin (*l*)	$C_{26}H_{44}O_{10} \cdot 2\frac{1}{2}H_2O$	fine plates	177
53	Periplocin (*d*)	$C_{30}H_{48}O_{12}$	long, thin need.	205
54	Phillyrin	$C_{27}H_{34}O_{11}$	need. or plates	162
55	Phloridzin (*l*)	$C_{21}H_{24}O_{10} \cdot 2H_2O$	small, wh., silky need.	108 **
56	Picein (*l*)	$C_{14}H_{18}O_7 \cdot H_2O$	need./aq.	194 *
57	Picrocrocin (*l*)	$C_{16}H_{26}O_7$	pr./et.-chl.-MeOH mixt.	154–6
58	Polygonin	$C_{21}H_{20}O_{10}$	glossy, yel. need.	202–3
59	Populin (*l*)	$C_{20}H_{22}O_8 \cdot 2H_2O$	wh. cryst. powd. or very fine need./aq.	180 *
60	Prulaurasin (*l*)	$C_{14}H_{17}O_6N$	bitter need.	120–2
61	Quercitrin	$C_{21}H_{20}O_{11} \cdot 2H_2O$	pale yel. need. or plates	182–5; 250–2 *
62	Robinin	$C_{32}H_{40}O_{19} \cdot 7\frac{1}{2}H_2O$	yellowish need./aq.	195 *
63	Ruberythric acid	$C_{25}H_{26}O_{13}$	small, citron yel. need.; yel. pr./aq.	258–60
64	Rubiadin glucoside	$C_{21}H_{20}O_9$	yel. need./glacial ac. a.	270 d.
65	Rutin	$C_{27}H_{30}O_{16} \cdot 2H_2O$	bright yel. need./aq.	188–90
66	Salicin (*l*)	$C_{13}H_{18}O_7$	glossy need., plates or rhomb. pr./aq.	199–201, then remelts 230–40
67	Saponin	$C_{32}H_{52}O_{17}$	wh. amor. powd.	d. 195
68	Saporubrin (*l*)	$(C_{18}H_{28}O_{10})_4$	wh. amor. powd.	....
69	Sapotoxin	$C_{17}H_{26}O_{10}$	wh. amor. powd.	....
70	Sarsasaponin (*l*)	$C_{44}H_{76}O_{20} \cdot 7H_2O$	long need./al.	sint. 200; m. 248

* Melting point of the anhydrous compound.

** Melts at 108°, then solidifies at 130° and remelts at 170–1 o.

iso-Hesperidin 49
Indoxyl-β-glucoside 43
Kalmin 55
Laricin 15
Lilacin 74
Macleyin 47

dl-Mandelonitrile-glucoside 60
Melin 65
Methoxy-coniferin 74
Monotropitoside 33
Orizabin 45
Paviin 31

No.	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Glucoside					Hydrolytic Products		
	Water	Alcohol	Ether	Chloroform	Others	Principle	M.P. °C.	Sugar
41	i.	sl. s.	sl. s.	s.	....	helleboresin	d. >140	glucose
42	v. sl. s.	sl. s.	i.	i.	v. s. dil. alk.	hesperetin	226	glucose, rhamnose
43	v. s.	v. s.	sl. s.	sl. s.	sl. s. bz.	indigo	390–2 d.	glucose
44	v. sl. s.	s. h.	i.	i.	sl. s. act.	irigenin	186	glucose
45	sl. s	s.	s. h.	s.	d. alk.	jalapinolic acid	67–9	sugars
46	v. s.	sl. s.	sl. s.	sl. s.	s. h. act.	hydrocyanic acid	−12	glucose, act.
47	....	sl. s.	i.	i.	....	maclayetin	209–10	glucose
48	s. h.	s.	i.	......	s. alk.	murrayetin	110	glucose
49	sl. s. c.; s. h.	v. s.	i.	i.	v. s. h. ac. a.	naringenin	251	glucose, rhamnose
50	sl. s. h.	s. h.	i.	......	s. h. KOH	formononetin	265	glucose
51	100 c.; 5 h.	20 c.; 8 h.	i.	i.	i. EtOAc	acocanthic acid lactone	......	rhamnose
52	v. sl. s. c.; 20 h.	s.	i.	s.	i. pet.	parigenin	......	sugars
53	125 c.	s.	v. sl. s.	v. sl. s.	i. bz.	periplogenin	185	glucose
54	s. h.	s.	i.	s. h.	....	phillygenin	......	glucose
55	1000 c.; s. h.	4	sl. s.	i.	....	phloretin	262–4	glucose
56	sl. s.	s.	s.	i.	s. ac. a.	*p*-hydroxyacetophenone	109	glucose
57	v. s.	v. s.	sl. s.	sl. s.	i. bz.	safranol	......	glucose
58	sl. s. h.	sl. s. h.	i.	......	....	emodin	254	glucose
59	i. c.; sl. s. h.	sl. s. c.; s. h.	i.	s. dil. a.	s. dil. alk.	saligenin	87	glucose, benzoic a.
60	s.	s.	i.	......	....	*dl*-mandelonitrile	−10	glucose
61	i. c.; sl. s. h.	s.	sl. s.	......	s. alk.	quercetin	313–4 *	rhamnose
62	s. h.	s. h.	i.	......	s. alk.	caempferol	271	rhamnose
63	sl. s. c.; s. h.	v. sl. s. abs.	v. sl. s.	s. alk. →r.	i. bz.	alizarin	290	glucose; xylose
64	v. sl. s. h.	s.	s.	......	i. K_2CO_3	rubiadin	290	glucose
65	s. h.	s. h.	i.	i.	s. alk.	quercetin	313–4 *	glucose, rhamnose
66	23 c.; 3 h.	72	i.	i.	s. alk.	saligenin	87	glucose
67	s. †	i.	i.	i.	i. bz.	sapogenin	257–60	sugar
68	v. s. †	s. dil.	i.	i.	i. bz.	sapogenin	257–60	glucose
69	s. †	s. dil.	i.	i.	s. alk.	sapotoxin-sapogenin	......	sugar
70	v. s. †	s. h.	v. sl. s.	......	....	sarsasapogenin	197–8	glucose

Aqueous solutions foam on shaking.

Phaseolunatin 46
Phillyroside 54
Phlorizin 55
Phyllyrin 54
iceoside 56
otassium myronate 72
rimulin 22
Quercimelin 61
Quercitrinic acid 61
Rhamnin 83
Rhamnoxanthin 30
Rhodeoretin 18
Rubianic acid 63
Salinigrin 56
Scammonin 45

No.	Name	Formula	Appearance	Melting Point °C.
71	Sinalbine (*l*)	$C_{30}H_{42}O_{15}N_2S_2 \cdot 5H_2O$	pale yel. need.	83–4; 139 *
72	Sinigrin (*l*)	$C_{10}H_{16}O_9NS_2K \cdot H_2O$	rhomb. pr./aq.; need./al.	127–9; 179 *
73	Strophanthin (*in*)	$C_{31}H_{48}O_{12}$	microcryst., hyg.	179
74	Syringin (*l*)	$C_{17}H_{24}O_9 \cdot H_2O$	rosettes of long need./aq.	192
75	Tampicin	$C_{34}H_{54}O_{14}$	amor., colorl. to yel.	130
76	Tannic acid (*d*)	$C_{76}H_{52}O_{46}$	yel. to br. amor. bulky powd. or spongy masses; shining scales	d. 210–5
77	Thevetin (*l*)	$C_{42}H_{66}O_{18} \cdot 3H_2O$	need./al.	210
78	Thujin	$C_{20}H_{22}O_{12}$	yel. microscopic tablets	....
79	Vacciniin (*d*)	$C_6H_{11}O_6COC_6H_5 \cdot H_2O$	cryst./aq. act.	104–6
80	Valdivin (*in*)	$C_{36}H_{48}O_{20} \cdot 2H_2O$	hexagonal pr.	230 d.*
81	Vicianin (*l*)	$C_{19}H_{25}O_{10}N$	wh. need.	147–8
82	Violutin (*l*)	$C_{19}H_{26}O_{12}$	wh. cryst.	169–72
83	Xanthorhamnin (*d*)	$C_{34}H_{42}O_{20}$	yel. micro need. + EtOH/al.	−EtOH, at 120

* Melting point of anhydrous compound.

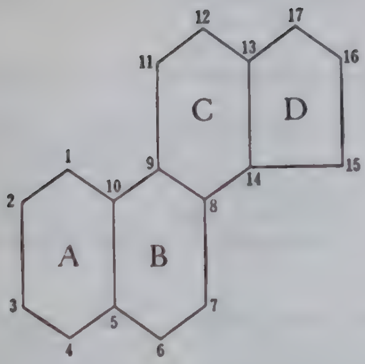
Sinigroside 72
Smilacin 52
Sophorin 65
Strophanthin Thoms 51

No.	Solubility Expressed in Parts of Solvent Required to Dissolve 1 Part Glucoside					Hydrolytic Products		
	Water	Alcohol	Ether	Chloroform	Others	Principle	M.P. °C.	Sugar
71	s.	sl. s.	i.	......	i. CS_2	sinapine sulfate, and higher mustard oils	127 *	glucose
72	s.	sl. s. c.; i. abs.	i.	i.	i. bz.	allyl mustard oil	−80	glucose
73	43	s.	i.	i. CS_2	i. bz.	strophanthidin	170; 235 *	sugars; no glucose
74	s. h.	s. h.	i.	......	....	syringenin	......	glucose
75	i.	s.	s.	......	....	tampicolic acid	......	sugar
76	v. s.	sl. s.	v. sl. s.	v. sl. s.	v. sl. s. act.	gallic acid	235 d.*	glucose
77	s. h.	s.	sl. s.	sl. s.	s. EtOAc	thevetigenin	140	glucose
78	s. h.	s.	......	......	....	thujetin	......	glucose
79	s.	s.	i.	sl. s.	sl. s. bz.	benzoic acid	121.7	glucose
80	s. h.	s. dil.	i.	v. s.	....	?	......	sugar
81	s. h.	sl. s.	......	i.	i. bz.	benzaldehyde hydrocyanic acid	−26 −12	vicianose
82	s.	s.	i.	......	i. act.	methyl salicylate	−8.3	glucose; arabinose
83	v. s.; d.	s.	i.	i.	i. bz.	rhamnetin	>300	rhamnose

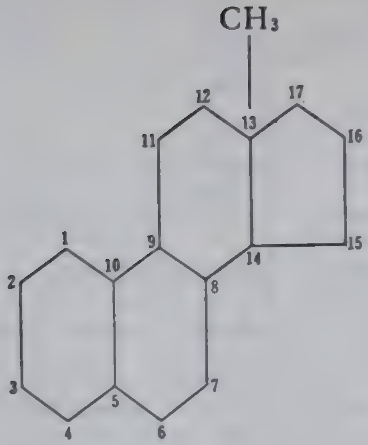
Ursin 6

Violutiside 82
Waldivin 80

PROPERTIES



Perhydro-cyclopenteno-
phenanthrene skeleton



Estrane $C_{18}H_{30}$
Parent substance of
estrogenic hormones

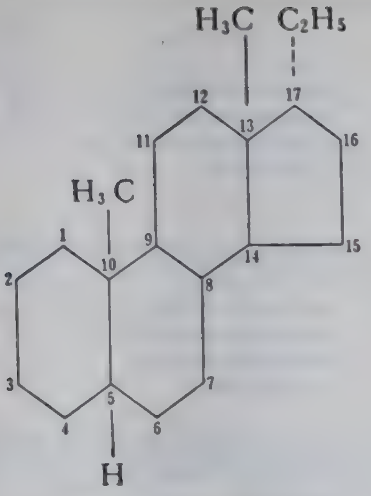
UNITS. When first isolated from natural materials, steroid hormones were measured by their biological functions and expressed in functional units. For a number of reasons, among which are isomerism, methods of extraction, methods of administration, type of solvent, number of doses, species difference and particularly because of individual biological vagary, comparatively few investigators agreed on the number of units to which a given weight of hormone was equivalent. Expression in milligrams of pure substance was a later development, particularly after syntheses and analytical methods had been perfected. There is no difference of opinion regarding units by definition but only regarding units as a result of experimental work. Unfortunately, practically any relationship or equivalence can be "proven" by the interconversion of units. Because units, as a method of mensuration, are still very frequently used to express potency, a conversion table is appended.

Abbreviations used in the table:

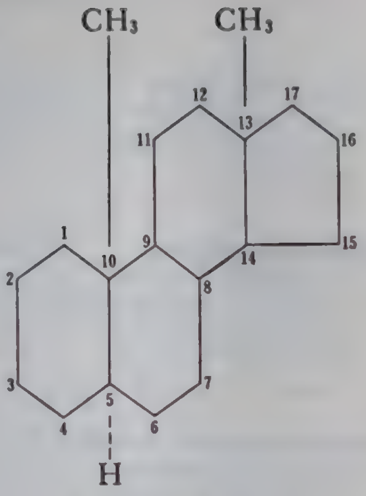
a., acid
alk., alkali
al., alcohol
app., approximately
aq., water
compd., compound
et., ether
i., insoluble
s., soluble
sl., slightly
solv., solvent
veg., vegetable
vol., volatile

No.	Name	Source	Synonyms	Formula; mol. wt.
1	**Androsterone** androstane-3-*cis*-ol-17-one; 3-hydroxy-androstan-17-one.	Synthetic from cholesterol; from male urine.	*cis*-androsterone.	$C_{19}H_{30}O_2$ 290.43
2	**Corticosterone** 17 (β)-[1-keto-2-hydroxyethyl]-Δ^4-androstene-3-one-11 (β)-ol.	From adrenal cortex; from urine.	11, 21-dihydroxyprogesterone; Kendall's compd. "B"; Reichstein's compd. "H."	$C_{21}H_{30}O_4$ 346.45

OF HORMONES



Pregnane $C_{21}H_{36}$
(17 (α)-ethyl-etiocholane)
Parent substance of progestational and cortical hormones



Androstane $C_{19}H_{32}$
(etio-allo-cholane)
Parent substance of androgenic hormones

EQUIVALENTS IN UNITS OF 1 MILLIGRAM QUANTITIES

Androsterone	10 CU	(*a*; *j*)
Benzestrol	25,000 IU	(*b*)
Benzestrol	1,250 RU	(*c*)
Estradiol	70,000 to 120,000 IU	(*b*; *k*)
Estradiol	12,000 RU	(*c*; *m*)
Estradiol benzoate	70,000 to 120,000 IBU	(*d*; *k*)
Estradiol benzoate	6,000 RU	(*c*; *m*)
Estradiol, ethinyl	100,000 IU	(*c*; *n*)
Estradiol, ethinyl	20,000 IU	(*b*; *n*)
Estriol	16,000 IU	(*b*; *n*; *q*)
Estriol	1,600 RU	(*c*; *k*; *q*)
Estrone	10,000 IU	(*b*; *j*)
Estrone	2,666 RU	(*c*; *p*)
Estrone	1,000 RU	(*c*; *k*; *q*)
Estrone benzoate	10,000 IBU	(*d*)
Insulin	22 IU	(*e*)
Progesterone	1 IU	(*f*)
Progesterone	1 CAU	(*g*)
Progesterone	2 CIU	(*h*; *q*)
Progesterone	4 to 6 ECU	(*i*; *q*)
Testosterone	70 to 75 CU	(*a*; *m*)
Testosterone propionate	50 CU	(*a*; *m*)
Testosterone, methyl	15 CU	(*a*; *m*; *n*)

(*a*) Capon Units of androgenic potency; (*b*) International Units of estrogenic potency or Estrone Units; (*c*) Rat Units of estrogenic potency by Allen-Doisy method; (*d*) International Benzoate Units of estrogenic potency; (*e*) International Units of insulin activity; (*f*) International Units of progestational activity; (*g*) Corner-Allen Units; (*h*) Clauberg Rabbit Units; (*i*) European Clinical Units; (*j*) by definition; (*k*) by calculation; (*m*) by experimental finding; (*n*) for oral use only; (*p*) chemical determination, *J. Biol. Chem.* 116, *415* (*1936*); (*q*) conversion data unreliable.

No.	Melting point °C	$[\alpha]^{25}_D$	Solubility	Method of testing	Use and method of administration
1	178-185	+86- +90 1% in dioxane.	aq.-i.; vol. solv.-s.; veg. oils-sl. s.	Biological: increase in size of capon comb; increase in weight of seminal vesicles.	Excretion product of testosterone which supplanted it, and which is app. 10 times as active; for uses, see testosterone and testosterone propionate.
2	180-182	+222 1% in al.	aq.-sl. s.; vol. solv.-s.; veg. oils-sl.s.	Biological.	In shock, by intramuscular or subcutaneous injection of aq. or oil solution; of the adrenal hormones, desoxycorticosterone acetate is the one most widely used, *q. v.*

No.	Name	Source	Synonyms	Formula; mol. wt.
3	**Dehydroandrosterone** Δ^{5}-androstene-3-***trans***-ol-17-one; Δ^{5}-androstene-3-(α)-ol-17-one.	Synthetic from cholesterol; from male urine.	***trans***-dehydroandrosterone; dehydro-***iso***-androsterone; dehydroandrosterone.	$C_{19}H_{28}O_2$ 288.41
4	**Desoxycorticosterone** 17(α)-[1-keto-2-hydroxyethyl]-Δ^{4}-androstene-3-one; Δ^{4}-pregnene-21-ol-3,20-dione; Δ^{4}-21-hydroxypregnene-3,20-dione.	Synthetic.	11-desoxycorticosterone; 21-hydroxyprogesterone; 21-oxyprogesterone; deoxycorticosterone; deoxycostone.	$C_{21}H_{30}O_3$ 330.45
5	**Desoxycorticosterone acetate** 11-desoxycorticosterone-21-acetate; see also desoxycorticosterone.	Synthetic.	deoxycostone acetate; see also desoxycorticosterone.	$C_{23}H_{32}O_4$ 372.49
6	**Dihydroandrosterone** 3-***cis***-17-***trans***-androstandiol.	Synthetic from cholesterol.	androstandiol.	$C_{19}H_{32}O_2$ 292.45
7	**Equilenin** $\Delta^{1,3,5:10,6,8}$-estrapentaene-3-ol-17-one; 3-hydroxy-17-keto-$\Delta^{1,3,5:10,6,8}$-estrapentaene.	Pregnant mares' urine.	....	$C_{18}H_{18}O_2$ 266.32
8	**Equilin** $\Delta^{1,3,5:10,7}$-estratetraene-3-ol-17-one; 3-hydroxy-17-keto-$\Delta^{1,3,5,7}$-estratetraene.	Pregnant mares' urine.	....	$C_{18}H_{20}O_2$ 268.34
9	**Estradiol** $\Delta^{1,3,5}$-estratriene-3,17-***trans***-diol; 3-dihydroxy-1,3,5-estratriene; 3,17-dihydroxy-$\Delta^{1,3,5}$-estratriene.	Reduction of estrone; pregnant mares' urine; sows' ovaries.	dihydrotheelin; dihydrofolliculin; dihydroxyestrin; α-estradiol; dihydroestrone.	$C_{18}H_{24}O_2$ 272.37
10	**Estradiol benzoate** 3-benzoxy-$\Delta^{1,3,5}$-estratriene-17-ol; see also estradiol.	esterification of estradiol.	See also estradiol.	$C_{25}H_{28}O_3$ 376.47
11	**Estriol** $\Delta^{1,3,5:10}$-estratriene-3,16-***cis***-17-***trans***-diol; 3,16,17-trihydroxy-$\Delta^{1,3,5}$-estratriene.	Pregnant mares' urine; placenta.	theelol; destriol; trihydroxyestrin; follicular hormone hydrate.	$C_{18}H_{24}O_3$ 288.37

OF HORMONES

No.	Melting point °C	$[\alpha]^{25}_D$	Solubility	Method of testing	Use and method of administration
3	148; polymorphic m. 138	+10 in al.	aq.-i.; vol. solv.-s.; veg. oils-sl. s.	Biological: see androsterone.	Excretion product of testosterone (*q.v.*) which supplanted it; for effect see testosterone and testosterone propionate.
4	....	....	....	Biological: see desoxycorticosterone acetate.	The acetate of desoxycorticosterone is used therapeutically, *q.v.*
5	154-160	+168-+178 1% in dioxane at 20°.	aq.-i.; vol. solv.-sl. s.; veg. oils-sl. s.	Biological: on adrenalectomized dogs.	In Addison's disease, by intramuscular injection of oil solution, or by subcutaneous implantation of pellets, or sublingually.
6	218-223	+12	aq.-i.; vol. solv.-s.; veg. oils-sl. s.	Biological: see androsterone.	Rarely used; for effect see testosterone and testosterone propionate.
7	258-259	+89 in dioxane.	aq.-i.; al.-sl.s.; vol. solv.-s.; veg. oils-sl. s.	Biological: see estrone.	A component of natural estrogenic substance; for effect see estrone.
8	236-240	+325 in al.; +308 1% in dioxane.	aq.-i.; vol. solv.-s.; veg. oils-sl. s.	Biological: see estrone.	A component of natural estrogenic substance; for effect see estrone.
9	173-179; stereoisomeric β-estradiol m. 223	+76-+83 1% in dioxane.	aq.-i.; vol. solv.-s.; alk.-s.; veg. oils.-sl. s.	Biological: see estrone.	See estrone; estradiol is active orally, parenterally and topically.
10	191-196 (174-175)	+58-+63 2% in dioxane.	aq.-i.; vol. solv.-s.; et.-sl. s.; veg. oils-sl. s.	Biological: see estrone.	See estrone; estradiol benzoate differs from estradiol or estrone in that its effect is protracted.
11	282	+53-+63 1% in dioxane.	aq.-i.; vol. solv.-s.; veg. oils-sl. s.	Chemical: triacetate deriv. melts at 125-127°. Biological: see estrone.	See estrone; estriol differs from estrone and estradiol benzoate in that it is active orally.

No.	Name	Source	Synonyms	Formula; mol. wt.
12	**Estrone** $\Delta^{1,3,5}$-estratriene-3-ol-17-one; 3-hydroxy-17-keto-1,3,5-estratriene.	Pregnant mares' urine.	folliculin; ketohydroxyestrin; theelin.	$C_{18}H_{22}O_2$ 270.36
13	**Estrone benzoate** 3-benzoxy-$\Delta^{1,3,5}$-estratriene-17-one.	Esterification of estrone.	See also estrone.	$C_{25}H_{26}O_3$ 374.46
14	**Ethinyl estradiol** 17-(β)-ethinyl-$\Delta^{1,3,5:10}$-estratriene-3,17(α)-diol; 17-ethinyl-3,17-dihydroxy-$\Delta^{1,3,5}$-estratriene.	Estradiol.	17-ethinyl estradiol; 17-ethynyl estradiol.	$C_{20}H_{24}O_2$ 296.39
15	**Insulin**	Pancreas.	soluble insulin.	$C_{45}H_{75}O_{17}N_{11}S$ 20,000 to 40,000 (?)

OF HORMONES

No.	Melting point °C	$[\alpha]^{25}_D$	Solubility	Method of testing	Use and method of administration
12	258-262	+158-+168 1% in dioxane.	aq.-v. sl. s.; vol. solv.-s.; alk.-s.; al.-s.; veg. oils-sl. s.	Chemical: with 2,4-dinitrophenylhydrazine; colorimetric: Kober reaction with phenolsulfonic acid; spectrographic: see ref. to J. A. Ph. A. Biological: cornified cells in vaginal smears of ovariectomized rats, injected with estrone (or estradiol or estradiol benzoate). Estriol and ethinyl estradiol may be tested by same criteria, except that they are are not injected, but fed by mouth or stomach tube, since they are used orally.	In menopause, female hypogonadism and other gynecological disturbances by intramuscular injection of oil solution or water suspension, subcutaneous implantation of pellets, intravaginal insertion of suppositories or topical application of ointment.
13	220	+120 1% in dioxane.	aq.-i.; vol. solv.-s.; et.-sl. s.; veg. oils-sl. s.	Biological: see estrone.	See estrone; estrone benzoate differs from estradiol or estrone in that its effect is protracted; bears the same relation to estrone as estradiol benzoate bears to estradiol; little used in U. S. A.
14	141-146	+1-+10 1% in dioxane.	aq.-i.; vol. solv.-s.; alk.-s.; veg. oils-sl. s.	Chemical: benzoylated deriv. melts 200-202°. Biological: see estrone.	See estrone; ethinyl estradiol is active orally.
15	233	levorotatory.	aq.-s.; al.-s.	Chemical: nitrogen. Biochemical: blood sugar. Biological: lowering blood sugar level in rabbits, inducing hypoglycemic convulsions.	In diabetes mellitus by subcutaneous injection of aqueous solution for rapid effect; by subcutaneous injection of aqueous solution, with protamine and zinc for protracted effect.

No.	Name	Source	Synonyms	Formula; mol. wt.
16	**Pregneninolone** Δ^4-17-ethinyl-androsten-17-ol-3-one; 17 (β)-ethinyl-Δ^4-androstenene-3-one-17-(α)-ol.	Synthetic.	pregneninonol; anhydro-hydroxyprogesterone; ethinyl testosterone; ethisterone.	$C_{21}H_{28}O_2$ 312.43
17	**Progesterone** 17 (β) (or α)-[1-ketoethyl]-Δ^4-androsten-3-one; Δ^4-pregnen-3,20-dione.	Corpus luteum; synthetic from stigmasterol.	pregnendione; progestin; progestone.	$C_{21}H_{30}O_2$ 314.45
18	**Testosterone** Δ^4-androstene-17-*trans*-ol-3-one; Δ^4-etiocholen-17 (α)-ol-3-one; 17-hydroxy-Δ^4-androsten-3-one; Δ^4-androstene-3-one-17-ol; Δ^4-androstene-3-one-17 (α)-ol.	Testicular tissue; synthetic from cholesterol.	....	$C_{19}H_{28}O_2$ 288.41
19	**Testosterone, Methyl** 17-methyl-Δ^4-androstene-17-*trans*-ol-3-one; 17 (β)-methyl-Δ^4-androstene-3-one-17 (α)-ol; see also testosterone.	Testosterone.	....	$C_{20}H_{30}O_2$ 302.44
20	**Testosterone propionate** Δ^4-androstene-17-*trans*-ol-3-one-17-propionate; see also testosterone.	Esterification of testosterone.	....	$C_{22}H_{32}O_3$ 344.48

No.	Melting point °C	$[\alpha]^{25}{}_D$	Solubility	Method of testing	Use and method of administration
16	266-273	+18-+28 1% in dioxane.	aq.-i.; vol. solv.-sl. s.; veg. oils-sl. s.	Biological: see progesterone.	See progesterone; pregneninolone is active orally.
17	β-isomer, 121; α-isomer, 127-131	+172-+182 2% in dioxane.	aq.-i.; al.-s.; vol. solv.-s.; veg. oils-sl. s.	Biological: endometrial proliferation in vaginal smears of immature rabbits, injected with progesterone, but previously sensitized with estrone. Pregneninolone may be tested by same criteria, except that it is not injected but fed by mouth or stomach tube to rats, since it is active orally.	In meno-metrorrhagia, habitual abortion, and to assure integrity of the fetus; by intramuscular injection of oil solution.
18	151-156	+104-+106 1% in dioxane.	aq.-i.; al.-s.; vol. solv.-s.; veg. oils-sl. s.	Biological: increase in size of capon comb; increase in size of seminal vesicles.	In the male, hypogonadism and other disturbances peculiar to the male; in the female, to inhibit menometrorrhagia and cancer of the breast; each by intramuscular injection of oil solution or water suspension; also by subcutaneous implantation of pellets, topical application of ointment, or sublingual (oral) use of tablets.
19	161-166	+69-+75 1% in dioxane.	aq.-i.; vol. solv.-s.; veg. oils-sl. s.	Biological: see testosterone.	See testosterone; methyl testosterone is active orally.
20	118-122	+83-+90 1% in dioxane.	aq.-i.; vol. solv.-s.; veg. oils.-s.	Biological: see testosterone.	See testosterone; testosterone propionate differs from testosterone in that its effect is protracted.

No.	Name	Source	Synonyms	Formula; mol. wt.
21	**Thyroxin** β-[3,5-diiodo-4-(3′,5′-diiodo-4′-hydroxy-phenoxy)-phenyl]-α-aminopropionic acid; 3,5,3′,5′-tetraiodothyronine.	Thyroid gland; synthetic.	thyro-oxyindol; iodothyroglobulin.	$C_{15}H_{11}O_4NI_4$ 776.93

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OF HORMONES

No.	Melting point °C	$[\alpha]^{25}_D$	Solubility	Method of testing	Use and method of administration
21	232-233	....	aq.-i.; al.-i.; alk.-s.; al. & alk.-s.; al. & a.-s.; vol. solv.-i.	Chemical: iodometric.	In hypothyroidism (cretinism, myxedema) by intravenous injection and occasionally orally.

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CONSTANTS OF FATS,

See also table on *Composition and Use of Foods.*

Classification: Class SV, semi-drying vegetable oil; NVO, non-drying vegetable oil of the olive oil type; AF, animal fat; AW, animal wax; NVR, non-drying vegetable oil of the rape oil type; DV,

No.	Name	Class	Specific Gravity $\frac{15^\circ}{15}$C.
1	Acorn, *Quercus agrifolia*	SV	0.916
2	Almond, *Prunus amygdalus*	NVO	0.914–0.921
3	Apricot kernel, *Prunus Armeniaca*	NVO	0.915–0.926
4	Beef marrow, *Bos taurus*	AF	0.931–0.938
5	Beef tallow, *Bos taurus*	AF	0.895
6	Beechnut, *Fagus sylvatica F. Americana*	SV	0.922
7	Beeswax, *Apis mellifera*	AW	0.961–0.968
8	Black mustard, *Sinapis nigra*	NVR	0.915–0.919
9	Black walnut, *Juglans nigra*; (*cf. Walnut*)	DV	0.918–0.921
10	Bone fat, *Sevum ossis*	AF	0.914–0.916
11	Brazil nut, *Bertholletia excelsis*	SV	0.917–0.918
12	Butter fat, *Vaccae lactis adeps*	AF	0.907–0.912$\frac{40}{15}^\circ$
13	Candlenut, *Aleurites moluccana*	DV	0.925
14	Candlenut, *Aleurites triloba*	DV	0.927
15	Carnauba wax, *Corypha cerifera*	VW	0.995–0.999
16	Castor, *Ricinus communis*	NVC	0.960–0.967
17	Chaulmoogra, U. S. P. X Revision	SV	0.950$^{25^\circ}$
18	Chaulmoogra, *Taraktogenos Kurzii*	SV	0.943–0.954
19	Cherry kernel, *Prunus cerasus*	NVO	0.918–0.929
20	Chicken fat, *Gallus domesticus*	AF	0.924
21	Chinese insect wax, *Coccus cerifera*	AW	0.809–0.811
22	Chinese vegetable tallow, *Stillingia sebifera*	VF	0.918–0.922
23	Coconut, *Cocos butyracea; C. nucifera*	VF	0.926
24	Cocoa (Cacao) butter, *Theobroma cacao*	VF	0.964–0.974
25	Cod liver, *Gadus morrhua*	MA	0.922–0.931
26	Corn (Maize), *Zea Mays*	SV	0.921–0.928
27	Cottonseed, *Gossypium* Species	SV	0.917–0.918$\frac{25}{25}^\circ$
28	Cottonseed stearin, *Gossypium*	VF	0.867–0.868$^{100^\circ}$
29	Croton, *Croton tiglium*	SV	0.942–0.944
30	Date kernel, *Phoenix dactylifera*	NVO	—
31	Deer fat, *Cervus elephus*	AF	0.962–0.967
32	Dolphin, *Delphinus globiceps*	MA	0.908–0.930
33	Goat's butter, *Capellae lactis adeps*	AF	0.917–0.935$\frac{37.7}{37.7}^\circ$
34	Goose fat, *Anser cinereus*	AF	0.923–0.930
35	Grape seed, *Vitis vinefera*	NVC	0.917–0.933
36	Hazelnut, *Corylus avellana*	NVO	0.917
37	Hemp seed, *Cannibis sativa*	DV	0.928–0.934
38	Herring, *Clupea harengus*	MA	0.920–0.939
39	Horse fat, *Equus caballus*	AF	0.919–0.933
40	Human fat	AF	0.9033
41	Japan wax, *Rhus succedaneum*	VF	0.970–0.980 0.875$^{100^\circ}$
42	Lard oil, *Sus scrofa*	NA	0.913–0.915
43	Lard oil (fatty tissue), *Sus scrofa*	AF	0.934–0.938 0.861$\frac{100}{15.5}^\circ$
44	Laurel (bayberry), *Laurus nobilis*	VF	0.880$^{100^\circ}$
45	Linseed, *Linum usitatissimum*	DV	0.930–0.938
46	Menhaden, *Alosa manhaden—Brevortia tyrannus*	MA	0.923–0.933
47	Mutton tallow, *Ovis aries*	AF	0.937–0.953 0.858$\frac{100}{15.5}^\circ$

OILS AND WAXES

drying vegetable oil; VW, vegetable wax; NVC, non-drying vegetable oil of the castor oil type; VF, vegetable fat; MA, marine animal or fish oil; NA, non-drying animal oil; Sp, sperm oil.

Solidification point °C.	Acid value	Saponification value	Iodine value	Reichert-Meissl value	No.
−10	....	199.3	100.0	....	1
−15 to −20	0.5–3.5	183.3–207.6	93–103.4	0.5	2
−17	3.5	191.4–198.2	100–108.7	0.2	3
29 to 31	1.6	196–199	39–55.4	2	4
31 to 38	0.25	196–200	35.4–42.3	0.25	5
−17	....	191–196	97–111	....	6
60.5 to 62	16.8–20.6	88–96	8.8–10.7	0.3–0.5	7
16	5.7–7.3	173–175	99–110	....	8
turbid −12	8.6–9.0	190.1–191.5	141–142.7	....	9
15 to 17	29.6–53	185–198	46–55.8	0.2–1.7	10
0 to 3	1.4	193	90–106	....	11
20 to 23	0.45–35.4	210–230	26–38	17.0–34.5	12
<−18	2	189–195	163–164	1.2	13
....	....	202–204	139–143.8	....	14
80 to 87	4–8	79–84	13.5	....	15
turbid −12 solid − 17 to − 18	0.12–0.8	175–183	84	1.4	16
<25	....	196–213	98–104	....	17
20 to 25	0.79–21.5	196–213	97.6–110.4	....	18
−19 to −20	1.1	193.3–195	110–114.3	....	19
21 to 27	1.2	193–204.6	66–71.5	1.8	20
80 to 81	63	78–93	1.4	....	21
24 to 34	2.4	179–206	23–40.5	0.2–0.9	22
14 to 22	2.5–10	253.4–262	6.2–10	6.6–7.5	23
21.5–23	1.1–1.9	192.8–195	32.8–41.7	0.3–1	24
−3	5.6	171–189	137–166	0.2	25
−10 to −20	1.37–2.02	187–193	111–128	4.3	26
+12 to −13	0.6–0.9	194–196	103–111.3	0.95	27
16 to 22	4–10	195	88.7–93.6	0.22	28
−8 to −18	27–30.9	193–215	108–109	12–13.6	29
18.1	....	211	52.3	0.88	30
....	0.8–5.3	194.5–200	26–36	0.68	31
+5 to −3	2–12	body 203.4 jaw 290	126.9 body 32.8 jaw	body 46.9 jaw 65.9	32
....	....	233–236	25–37	20.8–27.7	33
22 to 24	0.59	191–193	58–67	0.2–0.98	34
−10 to −17	0.75	171–191	94.3–135	0.46	35
−17 to −18	....	191–197	87	0.99	36
−15 to −28	0.45	190–195	145–161.7	....	37
....	1.8–44	170–194	102–149	....	38
20 to 45	0–2.4	195–200	75–86	1.6–2.1	39
15	....	193–200	57–73	....	40
40.5 to 46	11–12	206.6–237.5	4.9–12.8	....	41
+4 to −2	0.1–2.5	193–198	62.5–79	0–0.2	42
27.1 to 29.9	0.5–0.8	195–203	47–66.5	0.5–0.8	43
25	26.3	198–199	68–80	1.6	44
−19 to −27	1–3.5	188–195	175–202	0.95	45
−5	3–11.6	189–192.9	148–185	1.2	46
32 to 41	1.7–14	195–196	48–61	....	47

No.	Name	Class	Specific Gravity $\frac{15^{\circ}}{15}$ C.
48	Myrtle wax, *Myrica cerifera—M. Carolinensis*	VF	$0.995–0.875^{100°}$
49	Neat's foot, *Bos taurus*	NA	0.913–0.918
50	Nutmeg (mace) butter, *Myristica officinalis*	VF	0.945–0.966
51	Olive, *Olea Europaea sativa*	NVO	0.9140–0.918
52	Palm, *Elaeis guineensis* (W. Africa)	VF	$0.924; 0.858^{100°}$
53	Palm kernel, *Elaeis guineensis* (S. America)	VF	....
54	Palm kernel, *Elaeis guineensis* (W. Africa)	VF	$0.866–0.873^{100°}$
55	Peach kernel, *Amygdalus Persica*	NVO	0.918–0.925
56	Peanut, *Arachis hypogaea*	NVO	0.917–0.926
57	Perilla, *Perilla ocimoides*	DV	0.930–0.937
58	Pistachio nut, *Pistacia vera*	NVO	0.913–0.919
59	Plum kernel, *Prunus domestica* and *P. damascena*	NVO	0.912–0.913
60	Poppy seed, *Papaver somniferum*	DV	0.924–0.926
61	Porpoise—body oil, *Delphinus phocaena*	MA	0.926
62	Pumpkin seed, *Cucurbita pepo*	SV	0.923–0.925
63	Rabbit fat, *Lepus cuniculus*	AF	0.934–0.936 $0.861^{100°}_{15}$
64	Rape seed, *Brassica campestris*	NVR	0.913–0.917
65	Safflower, *Carthamus tinctorius*	DV	0.925–0.928
66	Sardine, *Clupea pilchardus* and *C. scombrinus*	MA	0.920–0.934
67	Seal, *Phoca* species	MA	0.915–0.926
68	Sesame, *Sesamum indicum*	SV	$0.919^{25°}_{25}$
69	Shark, *Selache (cetorhinus) maxima et al.*	MA	0.916–0.919
70	Soya, soy or soja bean, *Soja hispida; Dolichos hispida*	SV	0.924–0.927
71	Sperm, *Physeter macrocephalus*	Sp	0.878–0.884
72	Spermaceti, *Physeter macrocephalus*	AW	0.905–0.945 $0.806–0.812^{99°}_{15.5}$
73	Sunflower, *Helianthus annuus*	DV	0.924–0.926
74	Tallow, *Oleum adipis bovis*	NA	0.914–0.919
75	Tallow, *Sevum*	AF	0.925–0.950
76	Tung,—China wood, *Aleurites fordii*	DV	0.939–0.949
77	Tung,—China wood, *Aleurites montana*	DV	0.939–0.949
78	Walnut, *Juglans regia* (cf. Black walnut)	DV	0.925–0.927
79	Whale, *Balaena mysticetus*	MA	0.917–0.924
80	White mustard seed, *Sinapis alba*	NVR	0.912–0.916
81	Wool fat, *Ovis aries*	AW	0.970–0.973

CONSTANTS OF FATS,

No.	Name	Index of Refraction at 25°C. or *40°C.	Hehner value	Acetyl value	Unsaponifiable matter
1	Acorn	....	....	....	....
2	Almond	1.4593–1.4646*	96.0	9.6	0.75
3	Apricot kernel	1.4636–1.4705	....	12.2	....
4	Beef marrow	....	....	....	....
5	Beef tallow	1.4552–1.4587*	96–96.5	2.7–8.6	....
6	Beechnut	1.4698	95–96	....	....
7	Beeswax	1.4538–1.4566*	....	15.2	52–55
8	Black mustard	1.4718	96	....	3.3
9	Black walnut	....	95.8	....	....
10	Bone fat	....	91–95	11.3	0.5–1.8
11	Brazil nut	1.4671	....	....	....
12	Butter fat	1.4555–1.4578*	87.6–89.6	1.9–8.6	0.3–0.6
13	Candlenut *Al. mol.*	1.4760–1.4790	95–96	9.8	0.5–9
14	Candlenut *Al. tri.*	1.4760–1.4790	....	....	....

OILS AND WAXES

Solidification point °C.	Acid value	Saponification value	Iodine value	Reichert-Meissel value	No.
39 to 43	3–4.4	205.5–211.7	3.9–9.5	0.5	48
+ 10 to —2	0.1–0.6	193–199	57.5–75	0.9–1.2	49
41 to 42	17.2	154–178	40–81	1.1–4.2	50
turbid + 2 ppt. —6	0.3–1.0	185–196	79–88	0.6–1.5	51
35 to 42	10	200–205	49.2–58.9	0.9–1.9	52
27.4	0.33–0.55	220.2–231.4	25.5–31.6	....	53
....	....	243–255	10.5–17.5	5–6.8	54
—20	1–1.5	191–193	92–99.7	....	55
3	0.8	186–194	88–98	0.4	56
....	....	188–194	185–206	....	57
—5 to —10	....	191	83–87	....	58
—5 to —8	0.55	191–193	100–103.6	....	59
—16 to —18	2.5	193–195	128–141	0.6	60
—16	body 1.2 jaw 5.0	body 203.4 jaw 253–272	body 126.9 jaw 30.9–49.6	body 46.9 jaw 132	61
—15	....	188-193	121–130	4.45	62
17 to 23	1.4–7.2	199–203	70–99.8	0.7–2.8	63
—10	0.36–1.0	168–179	94–105	0.0–7.9	64
—13 to —18	0.6	188–203	122–141	0.0–0.2	65
20 to 22	4–25	187.7–196	150–193	0.5–1	66
3	1.9–40	187.5–196.2	130–152	0.2	67
—4 to —6	9.8	188–193	103–117	1.1–1.2	68
....	....	157–164	115–139	....	69
—10 to —16	0.3–1.8	189–193.5	122–134	0.5–2.8	70
15.5	13.2	120–137	80–84	0.6	71
42 to 47	0.5–2.8	126–135	3.8–9.5	....	72
—17	11.2	188–193	129–136	0.5	73
2 to 7.5	0.2–0.25	193.5–199	56–60.5	0.3	74
....	....	193–198	35–45	0.5–1.0	75
<17	2	190–197	163–171	1.10	76
<17	2	190–197	163–171	0.35	77
—15 to —27	2.5	190.1–197	139–150	0.92	78
—2 to 0	1.9	160–202	90–146	14	79
—8 to —16	5.4	171–174	94–98.4	....	80
38 to 40	59.8	82–130	17–29	5–8	81

OILS AND WAXES (Continued)

Maumené number	Insoluble fatty acids				No.
	Melting point°C.	Solidification point or Titer	Acid value	Iodine value	
....	25	....	....	....	1
51–54	13–14	9.5–11.5	196–207	93–96.5	2
42.5	2.3–4.5	....	197	99.4–108	3
....	44–46	....	204.5	44–56	4
....	42.5–44	37.9–46.2	197–202	41.3	5
64	23–24	17	....	114	6
....	....	....	....	....	7
43	16–17	13.4–13.7	187.1	109.6	8
....	0	....	....	....	9
....	41–43	39–43	200	48–57	10
....	28–30	31.1–32.2	....	....	11
....	38–41	33–39	210–233	36–52	12
....	20–21	....	....	....	13
....	....	17.8	....	....	14

No.	Name	Index of Refraction at 25° C. or *40°C.	Hehner value	Acetyl value	Unsaponifiable matter
15	Carnauba wax	1.4672–1.4701*	....	55.2	54–55
16	Castor	1.4771	....	146–150.5	0.6
17	Chaulmoogra, U.S.P. X Revision	....	....	....	....
18	Chaulmoogra, *Taraktogenos Kurzii*	1.4777–1.4779	....	....	2.4–2.6
19	Cherry kernel	1.4635	....	....	....
20	Chicken fat	1.4580*	94.6	45	....
21	Chinese insect wax	1.4566*	....	....	50
22	Chinese vegetable tallow	1.4470–1.4579*	95.3	....	....
23	Coconut	1.453	82.3–90.5	2.3–6.9	....
24	Cocoa (Cacao) butter	1.4537–1.4580*	94–95	1.97	....
25	Cod liver	1.4758–1.4783	95.3	1.15	0.54–2.68
26	Corn	1.4733	93–95	7.5–11.5	1.5–2.8
27	Cottonseed	1.4743–1.4752	95.7	21–25	1.1
28	Cottonseed stearin	1.4700–1.4725	96.5	....	....
29	Croton	1.4710*	89.0	19.8–38.6	0.6
30	Date kernel	1.4535–1.4633	95.2	....	....
31	Deer fat	....	95.8	....	0.52
32	Dolphin	1.4665	93.1	....	2
33	Goat's butter	1.4499–1.4551*	....	....	....
34	Goose fat	1.4583–1.4626	94.5–95.3	....	....
35	Grape seed	1.4713–1.4725	92	13.5–14.5	1.6
36	Hazelnut	1.4667	95.5	3.2	0.5
37	Hemp seed	1.4740–1.4745*	....	....	1.08
38	Herring	1.4665–1.4729	95–96	....	1–2
39	Horse fat	1.4658–1.4702	95–98	....	....
40	Human fat	1.4593–1.4607*	94–96	....	....
41	Japan wax	1.4560–1.4591*	90–91	17.3–26.5	1.1–1.6
42	Lard oil	1.4607*	97	2.6	0.6
43	Lard oil (fatty tissue)	1.4609–1.4620	93–95	2.6	....
44	Laurel (bayberry)	1.4783	....	....	....
45	Linseed	1.4797–1.4802	94.5–95.5	....	0.4–1.2
46	Menhaden	1.4787	....	....	0.6–1.43
47	Mutton tallow	1.4545–1.4585*	95.5	....	....
48	Myrtle wax	1.4511*	92–94	....	....
49	Neat's foot	1.4643–1.4685	94.8–95.9	7.7–9.3	0.12–0.65
50	Nutmeg	1.4700–1.4812*	....	....	....
51	Olive	1.4657–1.4667	95	10.5	0.4–1.0
52	Palm	1.4603–1.4639*	94.5–97	15.7	....
53	Palm kernel (S. America)	....	....	....	....
54	Palm kernel (W. Africa)	1.4492–1.4543*	91–91.5	7.6	....
55	Peach kernel	1.4682–1.4701	94–96	6.5	....
56	Peanut	1.4620–1.4653*	95	3.5	0.5–0.9
57	Perilla	1.4753*	95.8	....	....
58	Pistachio nut	1.4672	96	....	....
59	Plum kernel	1.4679–1.4702	95.2	....	....
60	Poppy seed	1.4739–1.4742	95.4	....	0.43
61	Porpoise—body oil	1.4622–1.4625	body 85.5 jaw 68–72	....	body 3.7 jaw 16–17
62	Pumpkin seed	1.4724–1.4739	96	....	....
63	Rabbit fat	1.4586*	99.5	....	....
64	Rape seed	1.4649–1.4659	94.5–96.3	14.75	1.48
65	Safflower	1.4769	95	16.1	....
66	Sardine	1.4763–1.4852	93.3–96	21–22	0.98
67	Seal	1.4742–1.4762	93–96	33–34	0.3–1.0
68	Sesame	1.4704–1.4717	95	....	0.9–1.3
69	Shark	1.4825	87–97	11.9	2.8–15.2
70	Soya	1.4723–1.4756	93–94.5	4.9	1.27–1.54

Maumené number	Insoluble fatty acids				No.
	Melting point °C.	Solidification point or Titer	Acid value	Iodine value	
....	....	....	....	....	15
46–47	13	3	192	87–93	16
....	....	....	....	....	17
....	44–45	39.6	215	103	18
45	19–21	13–15	....	104–114	19
....	38–40	32–34	200.8	64.6	20
....	92	....	....	....	21
....	39–57	45.2–47.2	202–208	30–55	22
21	24–27	21.2–25.2	258–273	8.4–9	23
....	48–53	47.2–49.2	190–198	33–39	24
102–113	21.8–38	17.5–24.3	204–207	130–170	25
74–86	17–20	14–16	198.4	113–126	26
75–81	34.5	....	202–208	111–115	27
....	27–45	39.9–51	....	94	28
....	17–19	17–19	201	112	29
....	....	....	....	....	30
....	50–64	46–50	....	....	31
....	....	....	....	....	32
....	....	....	....	....	33
....	36.6–40	31–34	202	65.3	34
53	23–25	18–20	187.4	99	35
36	22–25	19–20	201	91–98	36
97	17–21	15.6–16.6	....	141	37
....	30–32	....	179	....	38
46–54	31.3–53.4	33.7–45	203	72–87	39
....	35.5	....	....	64	40
....	53–56.5	54–55	214	....	41
40–47	33–38.4	27–33	....	....	42
24–28	37–46.6	36–42.4	202	64.2	43
116	....	15.1	....	82	44
103–126	20–24	16–20.6	197	179–192	45
123–128	....	....	....	....	46
....	33.5–49	40–48.5	210	34.8	47
....	47–48	....	231	....	48
47–58.5	29–41	16–26.5	200.6	62–76	49
....	42.5	36	....	....	50
35–52	26–30	16.9–26.4	193–198	86–90	51
....	50	42.5–45.5	204–207	53	52
....	....	....	....	....	53
....	25–28.5	20–25.5	258–264	12	54
42.5	10–18	13–13.5	201–205	94–102	55
44–67	26–36	30.5–39	202	96–103	56
124	—5	....	....	200–211	57
44.5–45	17–20	13–14	....	89–96	58
45	12.4–18	....	....	95.7–104	59
71–88	20.5	17–19	199	139	60
body 50	....	....	207	126	61
....	26	26–28	197	134	62
....	39–50	35–41	218	64	63
50–67	18.5–20	11.7–13.6	185	99-106	64
....	11–17	7-12	199	148	65
....	30–34.8	28.2	177–185	....	66
....	22–23	13–17	193	186–201	67
61–68.5	25–35	24	197–201	110–116	68
....	21–22	....	....	....	69
59–61	26.2–27.5	24	198	115–140	70

No.	Name	Index of Refraction at 25° C. or *40° C.	Hehner value	Acetyl value	Unsaponifiable matter
71	Sperm	1.4573	....	4.5–6.4	37–41
72	Spermaceti	....	....	2.6	51.5
73	Sunflower	1.4659–1.4721	95	....	0.31
74	Tallow (oil)	....	....	....	....
75	Tallow (sevum)	....	95–96	....	....
76	Tung (*Al. ford.*)	1.515–1.520	96	....	0.4–0.8
77	Tung (*Al. mont.*)	1.515–1.520	....	....	0.4–0.8
78	Walnut	1.4770	93.4–95.4	....	....
79	Whale	1.4679–1.4724	93–95	11–23	1–4
80	White mustard seed	1.4649*	96–97	....	....
81	Wool fat	1.4784–1.4822	91	23	39–44

GLYCERIDE CONTENT OF DRYING OILS

The values in the table give the percentage content of various fatty acid esters present in the glyceride structure of the common drying oils.

The composition of different samples of the same drying oil may vary considerably. These variations are often reflected in changes in the constants of the oil, particularly the iodine value.

Oil	Saturated	Oleate	Linoleate	Linolenate	Eleostearate
Cottonseed	25	40	35	..	..
Soybean	14	26	52	8	..
Dehydrated Castor	5	10	85	..	..
Linseed	10	18	17	55	..
Perilla	7	14	16	63	..
Tung	5	7	3	..	85
Oiticica	10	6	10	..	74*

* Licanate, $(C_{17}H_{27}OCO_2)_3C_3H_5$

Maumené number	Insoluble fatty acids				No.
	Melting point °C.	Solidification point or Titer	Acid value	Iodine value	
51	13.4	11.9	23.6	83–86	71
....	....	....	....	....	72
60–75	22–24	18–19.8	202	124–134	73
....	43–46	35–37.5	197–202	25–40	74
....	....	40–50	....	....	75
....	31–44	....	189–198	144–159	76
....	....	....	....	....	77
103	15–20	14.3	200	150	78
85–92	14–27	10–24	....	131	79
44–49	15–16	9–10	185.8	95	80
....	41.8	....	....	17	81

For information concerning the properties of various commercial resins, see **Circular No. 430** issued in May 1933 by the Educational Bureau of the American Paint and Varnish Manufacturers' Association.

Classification. The 3d column headed "Class," places each resin into one of the following groups:

I. Natural gum-resins of vegetable origin, which contain some resinous constituents in admixture with carbohydrate bodies, so that the resulting complex will yield some water-soluble constituents.

II. Natural resins of animal origin.

III. Natural resins of vegetable origin—largely mixtures of resin acids, alcohols and esters, with some resenes or hydrocarbon bodies. This class is divided into the following groups:

A. Oleo-resins and balsams—very fresh exudations containing volatile solvents which act as carriers.

B. New resins—same as IIIA—with the solvents gone completely.

C. Semi-fossil resins—the products of the action of the elements on new resins over a relatively short time. These resins are not entirely soluble unless melted

Name	Source		Class	Sp. Gr.
Gum Accroides Used to color spirit varnishes and nitrocellulose lacquers, and in sealing wax. Composition is 85% p-coumaric ester of xanthoresinotannol.	A species of *Xanthorroea* in Australia	Yellow variety	III. B	....
		Red variety	III.B	....
Accra Copal	W. Africa		III. C	1.033
Amber Used in jewelry; it is the hardest and most highly fossilized resin. Composition is 28% succino-abietic acid, 70% esters of succinic acid and succino-resinol.	Baltic coast and Burma. Fossil resin from extinct conifers		III. D	1.052 (1.05–1.11)
Gum Ammoniacum Composition:—20-26% gum, 65-75% resin, balance water, ash, etc.	*Dorema Ammoniacum*, from Persia and Africa		I.	1.19–1.21
Red Angola Copal Commonly used in Europe; less in U. S. A.	Semi-fossil from Angola, W. Africa		III. C	1.066–1.068
White Angola Copal	W. Africa		III. C	1.055
Gum Arabic (**Acacia**) Used in adhesives and emulsions. Varieties:—gum senegal, kordofan.	Dried juice from bark of *Acacia senegal*		True gum	....
Asafoetida Composition:–25% gum, 60% resin ester, 7% essential oil. U. S. P. requires ash to be under 10%. Used in treatment of heaves.	Species of *Ferula*		I.	....
Batu An important variety of East India resin (*q.v.*).				

and partially depolymerized.

D. Fossil resins—those exposed for long periods of time. They are substantially insoluble.

IV. Treated natural resins including esters, etc.

V. Pure synthetics—resinous complexes made under controlled conditions.

The 4th column gives the **specific gravity**, the 5th gives the **softening point** (S. P.), and the 6th gives the **melting point** (M. P.). The next three columns give the **acid, saponification,** and **iodine numbers** in that order. Figures enclosed in parentheses indicate the extreme values reported by different investigators. The 10th and last column gives the solubility of the resins in various solvents. The figures 1 to 12 refer to the following solvents: 1-ethyl alcohol; 2-methyl alcohol; 3-ether; 4-benzene; 5-acetone; 6-amyl alcohol; 7-chloroform; 8-aniline; 9-benzaldehyde; 10-carbon tetrachloride; 11-turpentine; 12-amyl acetate. The letter "s." (soluble), indicates that over 90% of the resin is soluble in the solvents numbered there-after; "p. s." (partly soluble), indicates that from 41-90% of the resin will dissolve, while "i." (insoluble), indicates that 40% or less dissolves. The **ester number** is indicated by **E**, and the methoxyl number by **M.**

S. P., °C.	M. P., °C.	Acid No.	Sap. No.	Iod. No.	Solubility
....	....	64–88	98–176	156–192	s. 1
....	....	64–106	18–25	....	....
75	120 (106–156)	98 (46–129)	140 (133–168)	58 (58–62)	s. 6, 8, 12; p. s. [illegible], 3, 5, 7, 9; i. 2, 4, 10, 11.
175	300 (280–315)	15 (15–34)	115 (86–145)	62 E. =71–91	v. sl. s. or i. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12
....	....	Resin:–57–135	Resin:– E. =19–98	M. =8.6–11.0	....
90	>300 (305)	128 (128–143)	132 (132–162)	63–137 E. =58–62	s. 5, 6, 8, 9, 12; p. s. 1, 3; i. 2, 4, 7, 10, 11
45	95 (95–125)	127 (57–127)	160 (132–160)	130	s. 5, 6, 8, 9, 12; p. s. 1, 2, 3, 4, 7; i. 10, 11
....	....	2–8	56–90	0.5	s. water.
....	....	Resin.– 11–82	Resin:– E. =82–214	M. =7–18	s. in 90% alcohol over 50%.

Name	Source	Class	Sp. Gr.
Benguela Copal An uncommon resin.	W. Africa	III. C	1.058 (1.035–1.062)
Gum Benzoin Composition:—69% cinnamic acid esters, 30% cinnamic acid, 1% or less of vanillin.	Sumatra and Siam *Styrax Benzoin*	III. A, B	1.063–1.092
Brazil Copal	S. America *Hymenae courbaril*	III. C	1.053
Cameron Copal	W. Africa	III. C	1.052
Canada Balsam Used in optometric work.	*Abies balsamea*	III. A	0.90
Colombia Copal	S. America	III. C	1.054
Congo Copal Composition:—89% resin acids, 8.5% resenes. It is the commonest fossil varnish resin, widely used because of its low price. Loango copal is a variety of Congo.	Belgain Congo	III. C	1.061
Copaiba Balsam Oleo resin, named, as are many others, from port of shipment. Used in medicine.	S. American species of *Copaiba*	III. A	0.916–0.995
Dammar A common resin, used in varnish and lacquer. It is dissolved in coal tar solvents and alcohol, which precipitate incompatible ingredients.	East Indian trees of *Shorea* variety	III. B	1.031 (1.031–1.123)
Demerara Copal Semi fossil gum. Not in common use.	British Guiana	III. D	1.047
Dragon's Blood Used as red coloring agent.	E. Indies (Sumatra) *Calamus draco*	III. A, B	1.25
East India A very common resin, widely used in the varnish industry. Composition:—12% resin acids, 78% resenes.	Species of *Dipterocarpus* in East Indies	III. B, C	....
Gum Elemi Contains some essential oils, mixed with resins. Used in lacquers and spirit varnishes.	Mainly from the Philippines; *Canarium commune*	III. A, B	1.018–1.083

S. P., °C.	M. P., °C.	Acid No.	Sap. No.	Iod. No.	Solubility
65 (65–95)	165 (140–215)	123 (123–137)	157 (135–168)	61–85 E. =50–64	s. 6, 8, 12; p. s. 1, 2, 3, 5, 7, 9; i. 4, 10, 11.
....	<100	127–142 (98–142)	190–207 (148–207)	57–76 M. =13–44	s. completely in 1.
50	100	123 (123–130)	133 (133–143)	123–134 E. =1–5	s. 6, 8, 12; p. s. 1, 2, 3, 4, 5, 7, 9, 10, 11.
100 (96–110)	150 (110–150)	160 (129–160)	70 (70–168)	65–70	s. 8; p. s. 3, 6, 9, 12; i. 1, 2, 4, 5, 7, 10, 11.
....	Liquid	88–106	105–116 E. =4–10	Refr. Index = 1.532; M. =0	....
90	>300	119	156	....	s. 6, 8, 12; p. s. 1, 3, 5, 7, 9; i. 2, 4, 10, 11.
90 (90–95)	195 (115–195)	132 (132–151)	132–179	58–59	s. 6, 8, 12; p. s. 1, 2, 3, 5, 9; i. 4, 7, 10, 11.
....	....	34–98	E. =2–33	....	....
75	100 E. =4–20 M. =0	35 (21–35)	39 (31–47)	64–142	s. 3, 4, 7, 8, 9, 10, 11, 12; p. s. 1, 2, 5, 6.
90	180	98	102	....	p. s. 3, 7, 9, 12; i. 1, 2, 4, 5, 8, 10, 11.
....	100 E. =142	11 M. =25–34	153	54–98	s. 1, 3; p. s. 7, CS_2, petr. ether, ethyl acetate.
....	....	21	35	....	s. coal tar hydrocarbons; i. 1, esters.
....	soft	15–22 E. =3–24	24–28 M. =0–2.5	81–175	....

Name	Source	Class	Sp. Gr.
Galbanum Composition:—64% alcohol-soluble resin, 27% gum, 9% essential oil. Used in medicine.	*Ferula galbaniflua*	I	1.109–1.133
Gamboge Composition:—65-75% resin, 20-25% gum. Used as a yellow coloring agent and as a purgative.	Siam. *Garcinia Hanburii*	I	....
Guaiacum Used in medicine.	From wood of *Guajacum officinale* and *G. sanctum*	III. B	....
Gurjun Balsam	Java and Cochin, China *Dipterocarpus*	III. A	0.960–0.966
Jalap Resin of, Used in medicine; purgative.	*Exogonium jalapa*	III. B	....
Karaya Gum (Indian gum) Resembles tragacanth. Used in hair "wave set" and in foods.	India; Africa. *Sterculia urens*	I	1.461–1.480
Kauri, Bush Composition:—64.5% resin acids, 12% resenes.	A recent to semi-fossil variety of Kauri. It is the softest grade of Kauri on the market.	III. B, C	1.030–1.038
Kauri, Fossil Composition:—69% resin acids, 9.5% resenes. A common resin used for high grade varnishes.	*Agathis australis* (the New Zealand Kauri Pine)	III. C, D	1.053
Kissel Copal Said to make poor varnishes.	Africa	III. C	1.066
Gum Lac (**Shellac**) (Data given is for orange shellac.)	Secretion of *Coccus lacca,* the lac insect	II.	1.182 (1.113–1.214)
Madagascar Copal A hard fossil resin, used little because of its high price.	Fossil gum from Madagascar	III. D	1.056
Manila, Soft Used as a cheap shallac substitute in spirit varnishes.	E. Indies. Trees of *Hymenea* group	III. B	1.060
Manila, Hard The hardest grade used in the varnishes. A very common resin.	E. Indies	III. C	1.065
Mastic Formerly much used in lacquers and spirit varnishes. Not so popular now.	Evergreen shrubs in Mediterranean regions. *Pistacia lentiscus*	III. B	1.057 (1.04–1.07)
Mecca Balsam (**Balm of Gilead**) Used as a tonic in the Orient.	*Balsamodendron gileadense* in Arabia	III. A	....

S.P., °C	M. P., °C.	Acid No.	Sap. No.	Iod. No.	Solubility
....	....	Resin:– 19–40	Resin:– E. =55–91	....	....
....	....	79–100 E. =57–67	148 M. =0–2.4	71 (116)	s. 1; emulsifies in water.
....	....	23–44	M. =74–84	....	54–74% soluble in ether.
....	Sticky liquid	....	....	....	s. 4, 7, CS_2; p. s. 1.
....	....	12–13	E. =120	M. =0	....
....	....	13–23	....	....	....
50	125	82 (74–82)	87 (79–102)	74–170	s. 1, 6, 8, 9, 12; p. s. 2, 3, 4, 5, 7; i. 10, 11.
90	185	79 (63–79)	90 E. =26–36	120 (120–164)	s. 6, 8, 9, 12; p. s. 1, 5, 7; i. 2, 3, 4, 10, 11.
65	110	70	118	....	s. 8; p. s. 1, 3, 5, 7, 9, 12; i. 2, 4, 6, 10, 11.
95	150	61 (55–65) E. =150	201 (200–212) Unsap. = 3.5	18 (15–18)	s. alcohols, borax solutions; p. s. 3, 5, 7, CS_2, ethyl acetate; i. 4, toluene, petr. ether.
130	300	66	78.5	126	p. s. 6, 8, 9, 12; i. 1, 2, 3, 4, 5, 7, 10, 11.
45	120	145 (136–150)	185 (185–196)	91–111	s. 1, 2, 5, 6, 8, 9, 12; p. s. 3, 4, 7; i. 10, 11.
80	190	73 E. =44–50	87	90 (86–91)	s. 6, 8, 9; p. s. 1, 3, 5, 7; i. 2, 4, 10, 11.
80–93	95	63 (50–71)	79 (70–194)	64–159 E. =23–29	s. 3, 4, 6, 7, 8, 9, 10, 11, 12; p. s. 1, 2, 5.
....	....	....	....	....	....

Name	Source	Class	Sp. G .
Myrrh (Bdellium is a variety.) Has 50-60% gum. Used in medicine.	Turkey, India, Arabia, Somaliland. Species of *Commiphora*	I.	....
Peru Balsam Has 55-66% cinnamein. Used in medicine and perfumery.	Central America. Black liquid from *Toluifera pereirae*	III. A	1.14–1.151
Olibanum or **Frankincense** Used in perfumery.	*Boswellia Carterii*, etc. Somaliland and S. Australia	I.	....
Pontianak Composition:—84.5% resin acids, 4% resenes. A recent to semi-fossil resin. Similar to, but harder and less odorous than soft manila. Used in spirit varnishes.	Borneo	III. B, C	1.037
Rosin or **Colophony** Largely abietic acid, $C_{20}H_{30}O_2$. Commonest and cheapest resin. Graded according to color. Used in paints, soap, paper, etc.	*Pinus* species. Mostly *Pinus palustris*. Gum obtained on distillation	III. B	1.045–1.086
Gum Sandarac Composition:—85% sandaracolic acid, 10% callitrolic acid. Common resin for use in spirit varnishes.	N. E. Africa. Small trees; *Callitris quadrivalvis*	III. B	1.073
Sierra Leone Copal The hardest of the recent resins.	W. Africa. *Guibourtia Copalifera*	III. B	1.072
Balsam Storax Used in medicine.	Levant and Greece. *Styrax officinalis*	III. A	....
Balsam Tolu	S. America. *Toluifera balsamum*	III. A	....
Gum Thus A soft, fresh oleoresin from slashed trees, yielding turpentine and rosin on distillation.	*Pinus* species	III. A	....
Gum Tragacanth Swells in water—used in adhesives.	Asia Minor and Persia. *Astragalus gummifer*	Gum	....
Venice Turpentine	European larch. *Larix europaea*	III. A	1.094–1.190
Zanzibar Copal Composition:—85% resin acids, 10% essential oils, 5% resenes. A common resin, little used only because of its high price. Soluble in oils after depolymerization.	Zanzibar and E. Africa. *Trachylobium verrucosum*	III. D	1.054–1.063

S. P., °C.	M. P. °C.	Acid No.	Sap No.	Iod. No.	Solubility
....	M. =ca.13	Resin:– 42–70	Resin:– 159–216	Resin:– E. =95–145	....
....	....	....	....	....	s. 1, 3.
....	E. =7–131	42–50	M. =5–7	....	....
55	135	134	186	119–142	s. 1, 5, 6, 8, 9, 12; p. s. 2, 3, 7; i. 4, 10, 11.
70–80	120–135	155–175 E. =8–23	167–194 M. =0	80–220	s. nearly all organic solvents; p. s. 3, petr. ether.
....	145	140 (154)	154 (142–174)	66–160 E. =1–11 M. =0	s. 1, 3, 6, 8, 12; p. s. 2, 5, 7, 9; i. 4, 10, 11.
60	130 (130–200)	110 (73–130)	123 (123–158)	63–133	s. 6, 8, 9, 12; p. s. 2, 3, 4, 5, 7; i. 1, 10, 11.
....	....	128–131	191–206	65	s. 3, 1 (hot).
....	....	....	....	....	....
....	....	108–145	140–161	E. =3–60	....
....	....	....	....	....	....
E. =30–56	M. =0	67–101	81–127	144	s. 1, 3, 4, 7, petr. ether.
150	300	93 (87–93)	93 (70–93)	115–123	p. s. 8, 12; i. 1, 2, 3, 4, 5, 6, 7, 9, 10, 11.

(*Completed on following page.*)

Aldehyde Resins—V. These resins result from the polymerization of acetaldehyde, crotonaldehyde, etc. They are marketed in Germany as substitutes for shellac.

Alkyd Resins—V. These resins are the reaction products of polyhydric alcohols (particularly glycerol) with polybasic acids (chiefly phthalic, although succinic, maleic, sebacic, etc. have been used), in the presence of some modifying acid. The reaction progresses through an esterification into a polymerization. Eventually a stage is reached where the complex becomes insoluble. The modifying acid (generally a fatty acid of one of the various oils) is added to increase the solubility and flexibility. In order that the reaction may proceed as far as possible, it is generally carried to the point of incipient gelation and dissolved in hot solvent. The resulting products are usually sold in the form of a solution for use in lacquer and oleoresinous varnishes. "Glyptal" resins are of this type.

Cumar Resins—V. These resins are manufactured by various distillers of coal tar by polymerization of cumarone and indene hydrocarbon fractions. They are neutral (acid No. =0) although impure grades contain saponifiable matter. They are soluble in nearly all organic solvents except the alcohols. They are graded according to hardness, which, in turn, increases with increasing melting point. The soft varieties (soft rubber grades) melt from 50 to 65°C., while the hardest varieties (varnish grades) have melting points ranging from 135 to 150°C. Specific gravity of 1.2 to 1.3, iodine number from 23 to 29, acid number from 0 to 20, and saponification number from 0 to 25 have been obtained. These resins decompose on heating to 300-400°C.

Ester Gum—IV. These products are rosin glycerides prepared by condensation of rosin with glycerol or other polyhydric alcohols. They are of two types, one high in acid and the other low in acid. The high acid types are used in spar varnishes and have acid numbers from 40 to 80, melting points from 100 to 110°C.; the low acid types are used in lacquers and have acid numbers from 2 to 10, melting points from 90 to 100°C. They are soluble in toluene, acetone, and esters. Solubility in mineral spirits or in alcohols depends on type and treatment.

Hardened Rosin—IV. Rosin is often brought into reaction with zinc oxide or lime to produce a hardened material of lower acidity for use in varnish. These resinates with the remaining free or unchanged rosin are soluble in the common solvents.

Modified Ester Gums—IV. To obtain increased hardness in ester gums, it is common practice to react glycerol and rosin with other acids or phenol-aldehyde complexes, thus forming a mixed glyceride. The modifying or hardening acid may be succinic, maleic, etc. The esters modified with phenol-formaldehyde (so-called Albertol Copals) are heat reactive with tung oil and produce very rapid drying varnishes. These modified with maleic anhydride have excellent solvent release.

Petroleum Hydrocarbons—V. The gasoline cracking stills yield some polymerizable hydrocarbons which are now being exploited as resins. **Phenol-Aldehyde Types—V.** These resins are condensation products of phenols with aldehydes, and vary widely in properties. They are all initially soluble in organic solvents; special types are oil soluble, and react with wood oil to produce fast-drying varnishes. All but one type are heat-convertible to insoluble gels or films. This is the commonest type of resin (Bakelite, "Durez", etc.) used in plastics; the resins are also widely used in varnishes. **Acrylate Resins—V.** These are polymers of acrylic and alkacrylic acid esters, yielding water-white, tough, soluble products used for plastics and coatings. "Lucite" is a methacrylate. **Styrol Resins—V.** Styrene polymers give resins possessing properties similar to acrylate and vinyl resins. **Vinyl Resins—V.** These are polymers of vinyl acetate or vinyl chloride, or copolymers of mixtures thereof. Their properties are similar to acrylate resins and they are used extensively in safety glass. "Vinylite" and "Vinyon" are vinyl resins. **Amine- or Amide- (Urea) Formaldehyde Resins—V.** These heat-convertible resins are obtained by the reactions of amines or amides with formaldehyde. Urea, melamine and related compounds give transparent, colorless resins which heat-convert with extraordinary rapidity. Some types can be dissolved in solvents. They are used extensively in plastics ("Beetle"), in fast-drying coatings, and in textile treatment. **Rubber Resins and Substitutes—IV and V.** Rubber is essentially poly-isoprene. Its conversion products, obtained by halogenation with or without other treatment, are used for special coatings ("Pliolite", "Tornesit"). Many synthetic rubbers and rubber substitutes are available; e.g., polychloroprene ("Neoprene"), polyisobutylene ("Vistanex"), etc.

FORMULAS OF THERMOPLASTIC MATERIALS

(*1*) **Polyethylene**

$CH_2{:}CH_2 \longrightarrow [\text{—}CH_2{\cdot}CH_2\text{—}]_n$

Ethylene

Polyethylene
Polythene

(*2*) **Polystyrene**

$CH(C_6H_5){:}CH_2 \longrightarrow [\text{—}CH(C_6H_5){\cdot}CH_2\text{—}]_n$

Styrene

Styron,
Lustron

(*3*) **Polyvinylchloride**

$CH_2{:}CHCl \longrightarrow [\text{—}CH_2{\cdot}CHCl\text{—}]_n$

Vinyl
chloride

Geon,
Koroseal

(*4*) **Polyvinylchloride Acetate**

$CH_2{:}CHCl + CH_2{:}CH(OAc) \longrightarrow [\text{—}CH_2{\cdot}CHCl{\cdot}CH_2{\cdot}CH(OAc){\cdot}CH_2{\cdot}CHCl\text{—}]_n$

Vinyl
chloride

Vinyl
acetate

Vinylite V

(*5*) **Polyvinylidene Chloride**

$CH_2{:}CHCl + CH_2{:}CCl_2 \longrightarrow [\text{—}CH_2{\cdot}CCl_2{\cdot}CH_2{\cdot}CHCl\text{—}]_n$

Vinyl
chloride

Vinylidene
chloride

Saran,
Geon, Velon

(*6*) **Polytetrafluoroethylene**

$CF_2{:}CF_2 \longrightarrow [\text{—}CF_2{\cdot}CF_2\text{—}]_n$

Tetra-
fluoro-
ethylene

Teflon

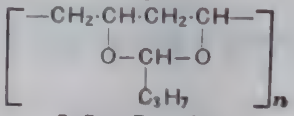
(*7*) **Polyvinyl Butyral**

$[\text{—}CH_2{\cdot}CH(OAc)\text{—}]_n \longrightarrow [\text{—}CH_2{\cdot}CH(OH)\text{—}]_n + C_3H_7{\cdot}CHO \longrightarrow$

Polyvinyl
acetate

Polyvinyl
alcohol

Butyr-
aldehyde



$$\left[\begin{array}{c}\text{—}CH_2{\cdot}\underset{|}{C}H{\cdot}CH_2{\cdot}\underset{|}{C}H\text{—}\\ O\text{—}\underset{|}{C}H\text{—}O\\ C_3H_7\end{array}\right]_n$$

Saflex, Butacite,
Vinylite X

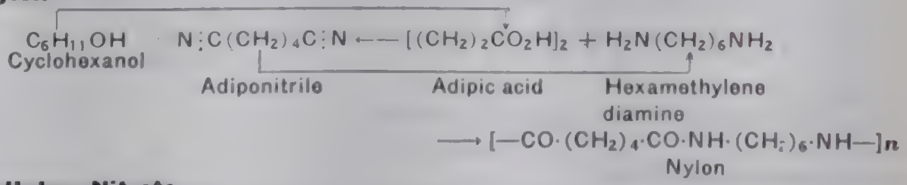
(*8*) **Polymethyl Methacrylate**

$CH_2{:}C(CH_3){\cdot}CO{\cdot}OCH_3 \longrightarrow [\text{—}CH_2{\cdot}C(CH_3)(CO{\cdot}OCH_3)\text{—}]_n$

Methyl methacrylate

Plexiglas, Lucite

(*9*) **Nylon**



$C_6H_{11}OH \quad N{\vdots}C(CH_2)_4C{\vdots}N \longleftarrow [(CH_2)_2CO_2H]_2 + H_2N(CH_2)_6NH_2$

Cyclohexanol

Adiponitrile

Adipic acid

Hexamethylene
diamine

$\longrightarrow [\text{—}CO{\cdot}(CH_2)_4{\cdot}CO{\cdot}NH{\cdot}(CH_2)_6{\cdot}NH\text{—}]_n$

Nylon

(*10*) **Cellulose Nitrate**

$C_6H_{10}O_5 + HNO_3 \longrightarrow [\text{—}C_6H_7O_2(OH)(ONO_2)_2\text{—}]_n$

Cellulose

Nitric
acid

Celluloid

(*11*) **Cellulose Acetate**

$C_6H_{10}O_5 + Ac_2O \longrightarrow [\text{—}C_6H_7O_2(OH)(OAc)_2\text{—}]_n$

Cellulose

Acetic
anhydride

Lumarith,
Tenite

(*12*) **Cellulose Acetate Butyrate**

$C_6H_{10}O_5 + Ac{\cdot}O{\cdot}COC_3H_7 \longrightarrow [\text{—}C_6H_7O_2(OH)(OAc)(O_2CC_3H_7)\text{—}]_n$

Cellulose

Acetic-butyric
anhydride

Tenite II

(*13*) **Ethyl Cellulose**

$C_6H_{10}O_5 + C_2H_5Cl \longrightarrow [\text{—}C_6H_7O_2(OH)(OC_2H_5)_2\text{—}]_n$

Cellulose

Ethyl
chloride

Ethocel

FORMULAS OF THERMOSETTING MATERIALS

(*14*) **Phenol-Formaldehyde**

C_6H_5OH	+	$HCHO$	$\longrightarrow$	$[-C_6H_2(OH)CH_2-]_n$
Phenol		Formaldehyde		Durez, Resinox

(*15*) **Phenol-Furfural**

C_6H_5OH	+	$C_4H_3O(CHO)$	$\longrightarrow$	$[-C_6H_3(OH)\cdot\overset{\vert}{CH}\cdot C_4HO=]_n$
Phenol		Furfural		Durite

(*16*) **Urea-Formaldehyde**

$CO(NH_2)_2$	+	$HCHO$	$\longrightarrow$	$[-CH_2\cdot\overset{\vert}{N}\cdot CO\cdot NH-]_n$
Urea		Formaldehyde		Plaskon, Beetle

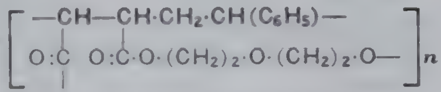
(*17*) **Melamine-Formaldehyde**

$H_2N\cdot CN$	$\longrightarrow$	$C_3H_3(NH_2)_3$	+	$HCHO$	$\longrightarrow$	$[-NH\cdot C_3N_3:(NHCH_2-)_2]_n$
Cyanamide		Melamine		Formaldehyde		Melmac, Resimene

(*18*) **Polyester**

$(CHCO)_2O$	+	$(HOCH_2CH_2)_2O$	+	$C_6H_5CH:CH_2$
Maleic anhydride		Diglycol		Styrene

$\longrightarrow$



$$\left[\begin{array}{l} -CH-CH\cdot CH_2\cdot CH(C_6H_5)- \\ \quad\vert \qquad\ \vert \\ O:C\quad O:C\cdot O\cdot(CH_2)_2\cdot O\cdot(CH_2)_2\cdot O- \\ \quad\vert \end{array}\right]_n$$

(*19*) **Silicone Rubber**

$Cl_2Si(CH_3)_2$	$\longrightarrow$	$(HO)_2Si(CH_3)_2$	$\longrightarrow$	$[-Si(CH_3)_2\cdot O-]_n$
Dimethylchlorosilane				Silastic

FORMULAS OF SYNTHETIC RUBBERS

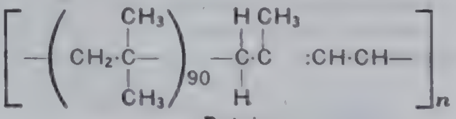
Approximate proportions in parts by weight.

(*a*) **GR-S**

$CH_2:CH\cdot CH:CH_2$	+	$CH(C_6H_5):CH_2$	$\longrightarrow$	$[-CH_2\cdot CH:CH\cdot CH_2\cdot CH(C_6H_5)\cdot CH_2-]_n$
1,3-Butadiene 75 parts		Styrene 25 parts		GR-S

(*b*) **Butene-Diene**

$CH_2:C(CH_3)_2$	+	$CH_2:C(CH_3)\cdot CH:CH_2$	$\longrightarrow$
Isobutene 98 parts		Diene 2 parts	



$$\left[-\left(CH_2\cdot\overset{CH_3}{\underset{CH_3}{C}}-\right)_{90}-\overset{H}{\underset{H}{C}}\cdot\overset{CH_3}{C}\quad :CH\cdot CH-\right]_n$$

Butyl

(*c*) **Neoprene**

$CH_2:C(Cl)\cdot CH:CH_2$	$\longrightarrow$	$[-CH_2\cdot C(Cl):CH\cdot CH_2-]_n$
Chloroprene		Neoprene

(*d*) **Acrylonitrile copolymers**

	$CH_2:CH\cdot CN$	+	$CH_2:CH\cdot CH:CH_2$	$\longrightarrow$	$[-CH_2\cdot CH:CH\cdot CH_2\cdot CH(CN)-]_n$
	Acrylonitrile		Butadiene		Hycar, Chemigum, Butaprene, Perbunan
Low	10-20 parts		60-80 parts		
Medium	20-35 parts				
High	35 parts				

(*e*) **Thiokol**

$Cl\cdot R\cdot Cl$	+	Na_2S_4	$\longrightarrow$	$[-R-S_4-]_n$
Dichloride		Sodium polysulfide		Thiokol

where R $-CH_2\cdot CH_2-$

or $-CH_2\cdot CH_2\cdot O\cdot CH_2\cdot CH_2-$

or $-CH_2\cdot CH_2\cdot O\cdot CH_2\cdot O\cdot CH_2\cdot CH_2-$

THERMOPLASTIC MATERIALS *

Property	(1) Poly-ethylene	(2) Poly-styrene	(2) Polyvinyl Chloride Non-Rigid	(4) Polyvinylchloride Acetate		(5) Poly-vinylidene Chloride	(6) Poly-tetrafluoro-ethylene
				Rigid	Non-Rigid		
Fabrication							
Bulk factor	2.2-3.6	2.0-2.3	....	2	....	2	....
Injectn. moldg. temp., °F	325-375	325-500	330-375	280-300	300-330	300-400	....
Injectn. moldg. press., psi $\times 10^{-3}$	4.5-30	10-30	15-25	18-30	7-20	10-30	....
Mold shrinkage, mils/in.	20-50	2-8	17	1	20-100	5-15	....
Physical							
Specific gravity	0.92	1.06	1.18-1.65	1.35-1.45	1.15-1.45	1.65-1.72	2.1-2.3
Specific volume, in.^{3}/lb	30	26	16-20	19-21	17-23	16-17	12-13
Coefficient thermal expansion, linear $\times 10^5$	18	6-8	7	6.9	7-25	19	9
Specific heat, cal/g	0.52	0.32	0.36	0.24	0.3-0.5	0.32	0.25
Thermal conductivity $\times 10^4$	8	1.9	3.9	4	3.9	2.2	6
Heat distortion temperature, °F	115-122	165-190	....	125-135	....	150-180	266
Heat resistance—continuous, °F	....	150-170	125	130	150	160-200	550
Flammability, in./min	1.1-1.4	2.0	0-0.3	None	0-0.7	None	None
Water absorption, %	0.01-0.03	0.04-0.06	0.4-1.3	0.15	0.1-1.0	<0.1	0
Mechanical							
Impact strength, Izod ft-lbs/in.	No break	0.26-0.6	....	0.25-0.50	....	0.3-1.0	4
Tensile strength, psi $\times 10^{-3}$	1.4-2.4	3-8.5	1-2.6	4.5-8	1-3.2	4-7	2-4.5
Elongation at break, %	200-600	1.5-3.5	200-390	....	225-370	10-40	200-300
Flexural strength, psi $\times 10^{-3}$	1.5-1.7	4.8-19	....	7.5-13	....	15-17	2.0
Compressive strength, psi $\times 10^{-3}$	....	11.5-17	....	9-10	....	4.5-5.5	1.7
Electrical							
Dielec. strength, short, v./mil	400-475	500-700	325-425	400-425	150-400	350-400	450
Vol. resistivity, ohms-cm	10^7-10^9	10^{17}-10^{19}	10^{11}-10^{15}	$>10^{14}$	10^7	10^{14}-10^{16}	10^{16}
Dielec. constant, 60 cycles	2.3	2.5-2.7	6.2-6.4	3.2-3.3	8.1-8.3	3-5	2
" " , 1,000 cycles	2.3	2.5-2.7	4.2-4.9	3.1-3.2	6.9-8.4	3-5	2
" " , 10^6 cycles	2.3	2.5-2.7	....	3.0-3.1	....	3-5	2
Power factor, 60 cycles	0.3-0.5	0.06-0.5	97-150	7-10	50-100	30-80	0.2
" " , 1,000 cycles	0.3-0.5	0.05-0.5	109-115	11-13	85-108	30-150	0.2
" " , 10^6 cycles	0.3-0.5	0.10-0.5	....	18-19	....	30-50	0.2

* The values were chosen as the most representative for each type. Considerable variation may occur since the properties of a molded article depend not only on the plastic used but on many other factors including conditions of forming and design of the molded part itself. Improvement of specific properties may often be accomplished by changes in formulation. Often improvement in one property may be accomplished at the expense of other properties.

THERMOPLASTIC MATERIALS (Cont.)

Property	(*7*) Polyvinyl Butyral Plasticized	(*8*) Poly-methyl Methacrylate	(*9*) Nylon	(*10*) Cellulose Nitrate	(*11*) Cellulose Acetate	(*12*) Cellulose Acetate Butyrate	(*13*) Ethyl Cellulose
Fabrication							
Bulk factor	....	1.7-2.5	2.3	....	2.0-2.6	2.0-2.4	2.0-2.5
Injectn. moldg. temp., °F	250-340	325-480	510-600	....	300-500	330-430	350-500
Injectn. moldg. press., psi $\times 10^{-3}$	15-30	10-30	Low	....	8-32	8-32	3-30
Mold shrinkage, mils/in.	4-20	3-6	12-15	....	1-7	1-5	1-10
Physical							
Specific gravity	1.05-1.50	1.18-1.20	1.14-1.16	1.35-1.57	1.26-1.5	1.1-1.23	1.07-1.18
Specific volume, in.^{3}/lb	18-26	18-20	24	20	20-22	22	23-26
Coefficient thermal expansion, linear $\times 10^5$	....	7-9	10.3	9-16	8-16	11-17	9-16
Specific heat, cal/g	0.4	0.35	0.43	0.34-0.38	0.4	0.4	0.36
Thermal conductivity $\times 10^4$	....	4-6	6	3.1-5.1	4-8	4-8	3-5
Heat distortion point, °F	....	135-200	165-170	110-150	100-235	103-182	100-180
Heat resistance—continuous, °F	....	120-140	....	Poor	140-220	140-220	140-220
Flammability, in./min	....	0.5-1.0	Self ext.	V. rapid	2-self ext.	1.5-self ext.	2-self ext.
Water absorption, %	1-2	0.3-0.6	1.5	0.7-4.0	2-6	1.3-2.4	0.7-4.0
Mechanical							
Impact strength, Izod ft-lbs/in.	....	0.2-0.4	0.6-0.9	0.2-8.0	0.5-5.7	0.4-9.4	3-11
Tensile strength, psi $\times 10^{-3}$	0.5-3.5	4-6	9-10.5	3-10	1.5-8	1.4-6.5	2.5-8
Elongation at yield, %	150-450	1-10	45-55	25-50	10-75	35-100	2-100
Flexural strength, psi $\times 10^{-3}$	....	10-20	11-13	6-15	2-16	1.6-11	....
Compressive strength, psi $\times 10^{-3}$	....	9-15	14-16	20-30	10-37	....	8-20
Electrical							
Dielec. strength, short, v/mil	175-375	500	350-400	250-365	250-265	250-400	470-550
Vol. resistivity, ohms-cm	10^{10}	10^{15}-10^{19}	10^{11}-10^{13}	10^{11}	10^{10}-10^{12}	10^{10}-10^{12}	10
Dielec. constant, 60 cycles	5.6	3.4-3.6	4-5	6.7-7.3	3.7-7.5	3.5-6.4	3.2-4
" " , 1,000 cycles	4-13	3.3-3.5	4.5-5	....	3.5-7.0	....	3-3.8
" " , 10^6 cycles	4	2.8-3.3	3.4-4.0	....	3.2-7.0	....	3-3.7
Power factor, 60 cycles	115	50-60	14-50	60-150	10-60	10-40	8-30
" " , 1,000 cycles	10-100	40-70	20-50	....	10-60	....	8-15
" " , 10^6 cycles	20-100	28-33	40-70	....	10-100	....	17-36

THERMOSETTING MATERIALS *

(14) Phenol-Formaldehyde

Property	No Filler	Wood Flour	Mica	Asbestos	Fabric	Sisal Felt	No Filler Cast
Fabrication							
Bulk factor	2.3	2.2	2.5	2-12	4-18	2-5	....
Molding temp., °F	300	300-350	350	350	350	300	200
Molding press., psi $\times 10^{-3}$	3	4	5	2-6	8	3	None
Colors	Dark	Limited					
Mold shrinkage, mils/in.	10	7	3	3	6	20	....
Molding qualities	Fair	Excellent	Fair	Good-Fair	Fair	Fair	....
Physical							
Specific gravity	1.27	1.37	1.6-2.0	1.80	1.40	0.7-1.4	1.30
Specific volume, in.^{3}/lb	22	20	14-17	1.6	19-21	20-40	22
Coefficient thermal expansion, linear $\times 10^5$	2.5-6	3-4.4	2	2	1-3	7-20	5-15
Specific heat, cal/g	0.40	0.4	0.28-0.32	0.28-0.32	0.30-0.35	0.3-0.4	0.4
Thermal conductivity $\times 10^4$	3-6	4-7	10-14	8-16	4-7	2-8	3-5
Heat distortion point, °F	240-260	260-300	210-320	285-350	250-300	320	100-170
Heat resistance—continuous, °F	250	300	250-300	350-400	250	250	160
Water absorption, %	0.1-0.2	0.8	0.02-0.1	0.1-0.3	0.5-1.8	0.5-15	0.2-2.0
Mechanical							
Impact strength, Izod ft-lbs/in.	0.4-0.5	0.2-0.4	....	....	1-8	3-16	0.3-0.4
Tensile strength, psi $\times 10^{-3}$	7-10	6.5-9.5	4.5-7	4-8	4-8	7-12	2-9
Elongation at yield, %	1-1.5	0.4-0.8	....	....	0.7	....	....
Flexural strength, psi $\times 10^{-3}$	12-17	9-12	7-13	7-13	9-13	16-20	6-9
Compressive strength, psi $\times 10^{-3}$	10-30	24-32	15-25	15-25	15-30	10-35	9-25
Electrical							
Dielec. strength, short, v/mil	300-400	300-375	325-500	200-350	200-325	25-400	75-450
Vol. resistivity, ohms-cm	10^{12}	10^{11}	10^{11}-10^{14}	10^{9}-10^{12}	10^{10}-10^{12}	10^{11}-10^{12}	10^{11}-10^{12}
Dielec. constant, 60 cycles	5-6	5.5-7	5-6	12-50	6-10	5-10	6.5-30
" " , 1,000 cycles	4-5	4.8-6	4.5-5.5	18-50	5.5-9	....	5-18
" " , 10^6 cycles	4.5-5	4.5-5.5	4.5-5.2	5.5-8.0	4.5-6	3-5	5-11
Power factor, 60 cycles	0.3-0.65	0.16-0.84	0.01-0.06	0.15-0.4	0.08-0.3	0.1-0.3	0.4-4.0
" " , 1,000 cycles	0.14-0.45	0.14-0.36	0.01-0.04	0.1-0.4	0.04-0.18	....	1.2-3.6
" " , 10^6 cycles	0.07-0.15	0.13-0.28	0.05-0.03	0.05-0.2	0.03-0.06	0.3-0.5	0.05-1.1
Arc resistance, secs	....	....	....	....	....	....	120-250

* The values were chosen as the most representative for each type. Considerable variation may occur since the properties of a molded article depend not only on the plastic used but on many other factors including conditions of forming and design of the molded part itself. Improvement of specific properties may often be accomplished by changes in formulation. Often improvement in one property may be accomplished at the expense of other properties.

THERMOSETTING MATERIALS (Cont.)

Property	(15) Phenol-Furfural		(16) Urea-Formaldehyde	(17) Melamine-Formaldehyde			(18) Polyester	(19) Silicone Rubber
	Wood Flour	Fabric	Cellulose	Cellulose	Asbestos	Fabric	None	Mineral
Fabrication								
Bulk factor	2.2-3	2.5	2.2-3	2.2-2.7	2.1-2.5	5-10	Cast	1-1.5
Molding temp., °F	280-400	270-360	275-370	275-370	275-370	275-340	....	300
Molding press., psi ×10^{-3}	1-5	1-8	1.56	1-6	1-7	3-5	....	0.1-0.8
Colors	Limited		Unltd.	Unltd.	Gray	....	....	Unltd.
Mold shrinkage, mils/in.	5-10	3-70	5-11	6-12	3-5	3-5	....	4-6
Molding qualities	Excellent	Good	Excellent	Excellent	Good	Good	Excellent	Good
Physical								
Specific gravity	1.32-1.42	1.3-1.45	1.45-1.55	1.40-1.55	1.7-2.00	1.5	1.32-1.40	1.4-2.0
Specific volume, in.^{3}/lb	20	20	18-19	18-19	14-16	18	20-21	14-20
Coefficient thermal expansion, linear ×10^5	3-7	2-16	2.5-3	2.5-4.5	2-4.5	....	5.5-10	....
Specific heat, cal/g	0.3-0.4	0.3-0.4	0.4	....	....	....	0.3-0.5	....
Thermal conductivity ×10^4	3-12	3-8	7-10	10	13.7	11	5	....
Heat distortion point, °F	240-300	240-285	260-280	285-300	265	310	140-200	....
Heat resistance—continuous, °F	300	240-300	180	210	250-400	250	220	500
Water absorption, %	0.2-0.6	0.5-2.5	0.75-2.0	0.08-1.7	0.08-1.4	0.3-0.6	0.2	0.25-1.0
Mechanical								
Impact strength, Izod ft-lbs/in.	0.2-0.4	0.6-4.8	0.24-0.36	0.24-0.35	0.3-0.4	1.0	0.3-0.4	....
Tensile strength, psi ×10^{-3}	5-8.5	5.5-8	6-13	7-13	6-7	7-8	5-6	0.200-0.60
Elongation at yield, %	....	....	....	....	....	....	....	100-225
Flexural strength, psi ×10^{-3}	8-15	8-13	10-18	9-16	9-11	10-15	8-14	....
Compressive strength, psi ×10^{-3}	16-36	20-32	27-43	30	21-32	30	19-23	....
Electrical								
Dielec. strength, short, v/mil	300-550	150-450	300-400	300-400	350-400	250-350	570-1275	290-450
Vol. resistivity, ohms-cm	10^9-10^{12}	10^9-10^{11}	10^{12}-10^{13}	10^{10}-10^{13}	10^{11}	....	10^{14}	10^{11}
Dielec. constant, 60 cycles	5-12	5-10	7-9.5	8.0-9.5	6.4-9.9	7.7-8.3	3.45	....
" " , 1,000 cycles	4-10	4-9	6.4-9	7.6-8.7	....	7.2-7.6	3.50	....
" " , 10^6 cycles	4-9	4-8	6.3-7.5	7.2-8.0	6.7	6.7	3.6	3.2-7.4
Power factor, 60 cycles	0.04-6.3	0.06-0.3	0.035-0.045	0.025-0.075	0.07-0.17	0.075-0.12	0.2	....
" " , 1,000 cycles	0.04-0.8	0.06-0.2	0.027-0.055	0.015-0.035	....	0.035-0.05	0.014	....
" " , 10^6 cycles	0.03-0.1	0.03-0.1	0.027-0.04	0.025-0.45	0.041	0.035-0.036	0.06	0.003
Arc resistance, secs	....	....	100-140	125	120-140	....	126	....

PROPERTIES OF NATURAL AND SYNTHETIC RUBBERS *

	Natural Rubber	(*a*) Styrene-Butadiene Copolymer, GR-S	(*b*) Butene-Diene Copolymer	(*c*) Neoprene Poly-chloroprene	(*d*) Butadiene-Acrylonitrile Copolymers			(*e*) Poly-sulfide Thiokol
					Acrylonitrile Content			
					Low	Medium	High	
Density	0.92	0.94	0.915	1.23	0.96	0.98	1.00	1.35
Refractive index	1.52	1.53	1.51	1.56	1.54	1.52	1.54	1.65
Specific heat, cal/g	0.452	0.454	0.464	....	....	....	....	....
Gum Stocks:								
Tensile strength, psi	3,100	300	2,000	2,800	500	700	900	1,000
Elongation, %	775	380	800	600	400	400	500	200
Black-loaded Stocks:								
Tensile strength, psi	3,900	3,000	2,200	3,600	3,000	3,500	4,000	1,000
Elongation, %	780	650	600	350	400	450	400	200
Stress 300%, psi	1,400	1,200	8,000	2,000	1,500	1,500	1,500	....
Swelling, % by volume, in:								
Kerosene at 25°C	200	100	300	60	10	8	4	4
Benzene at 25°C	200	200	300	150	....	120	....	50
Acetone at 25°C	25	30	30	20	60	100	150	25
Mineral oil at 70°C	120	150	130	10	10	5	2	1
Brittle point, °C	−56	−60	−45	−40	−40	−30	−1	−35
Rel. permeability to H_2	50	....	....	12	....	20	....	4
Rel. permeability to air	11	....	1	....	....	....	....	....
Insulation resist., ohms/cm	10^{17}	10^{15}	10^{16}	10^{10}	10^{10}	10^{10}	10^{10}	10^{15}
Resilience, %	90	75	50	75	....	74	63	62
Tear resistance, psi	1,640	550	1,000	1,100	....	....	....	....
Creep, 70°C	26	14.6	....	62	....	17	....	....

* The values were chosen as the most representative for each type. Considerable variation may occur since properties of a rubber compound can be varied greatly by choice of fillers, softeners, resins, accelerators, condition of cure, and numerous other factors.

COMMON OR TRADE NAMES OF CHEMICALS WITH THEIR CHEMICAL SYNONYMS AND FORMULAS

See also the tables: *Properties of Minerals*, *Physical Constants of Inorganic Compounds*, *Physical Constants of Organic Compounds*, *Composition and Physical Properties of Alloys*, and *Commonly Used Ceramic Materials.*

Common or Trade Name	Chemical Synonym	Formula
A acid	1, 7-Dihydroxy-naphthalene-3, 6-disulfonic acid	$C_{10}H_8O_8S_2$
Acenaphthenequinone	7, 8-Diketo-acenaphthene	$C_{12}H_6O_2$
3-Acenaphthol	3-Hydroxy-acenaphthene	$C_{12}H_{10}O$
Acetosol	Acetylene tetrachloride	$Cl_2CH{\cdot}CHCl_2$
Acetyl-H acid	8-Acetamido-1-naphthol-3, 6-disulfonic acid	$C_{12}H_{11}O_8NS_2$
Acrylic liquid	Methyl methacrylate	$CH_2{:}C(CH_3)CO_2CH_3$
Actol	Silver lactate	$AgC_3H_5O_3{\cdot}H_2O$
Adalin	Bromo-diethylacetyl urea	$(C_2H_5)_2CBr{\cdot}CO{\cdot}NHCONH_2$
Adorin	Formaldehyde	$HCHO$
Adronol acetate	Cyclohexanol acetate	$CH_3CO_2C_6H_{11}$
Aerngo	Copper acetate	$Cu(C_2H_3O_2)_2{\cdot}6H_2C$
Agnin, or agnolin	Anhydrous lanolin	....
Air saltpeter	cf. Saltpeter	....
Aldoform	Formaldehyde	$HCHO$
Alembroth	cf. Sal alembroth	....
Alen's α-acid	cf. Freund's acid	....
Alizarin assistant	cf. Turkey red oil	....
Alumino-ferric	Mixed sodium and aluminum sulfates	....
Amide powder	An explosive powder	40% KNO_3, 38% NH_4NO_3, 22% C
4-Amino-chrysoidine	2, 4, 4′-Triamino-azo-benzene	$C_{12}H_{13}N_5$
Aminoform	cf. Hexamin	....
Amino-naphthol-δ	1-Amino-7-naphthol	$C_{10}H_9ON$
Amino-naphthol-disulfonic acid K	cf. K acid	....
Amino-naphthol-disulfonic acid RR or 2R	cf. 2R acid	....
Amino-naphthol-disulfonic acid SS	1-Amino-8-naphthol-2, 4-disulfonic acid	$C_{10}H_9O_7NS_2$
Amino-naphthol-sulfonic acid or G	2-Amino-8-naphthol-6-sulfonic acid	$C_{10}H_9O_4NS$
Amino-naphthol-sulfonic acid R	2-Amino-3-naphthol-6-sulfonic acid	$C_{10}H_9O_4NS$
Amino-naphthol-sulfonic acid S	1-Amino-8-naphthol-4-sulfonic acid	$C_{10}H_9O_4NS$
Amino-phenol-sulfonic acid III	3-Amino-phenol-4-sulfonic acid	$C_6H_7O_4NS$
Amino-phenol-sulfonic acid IV	3-Amino-phenol-6-sulfonic acid	$C_6H_7O_4NS$
Amino-phenol-sulfonic acid V	3-Amino-phenol-5-sulfonic acid	$C_6H_7O_4NS$
Amino-R acid	2-Naphthylamine-3,6-disulfonic acid	$C_{10}H_9O_6NS_2$
Ammoniated iron	Ferric ammoniochloride	2.5% $FeCl_3$ + 97.5% NH_4Cl
Amylum	Corn starch	$(C_6H_{10}O_5)_n$
Analite	Explosive mixture of gasoline and N_2O_4	....
Andresen's acid	1-Naphthol-3,8-disulfonic acid or 2-Naphthylamine-4,7-disulfonic acid	$C_{10}H_9O_6NS_2$

TRADE NAMES OF CHEMICALS WITH SYNONYMS AND FORMULAS

Common or Trade Name	Chemical Synonym	Formula
Animal Oil	cf. Bone Oil	……………………
o-Anisidine	*o*-Methoxy-aniline	C_7H_9ON
Antimonine	Antimony lactate	$Sb(C_3H_5O_3)_3$
Antimony red Antimony vermilion	Antimony pentasulfide or antimony oxysulfide	Sb_2S_5 or $Sb_2S_3+Sb_2O_3$
Antimony yellow	Basic lead antimonate	$PbO\cdot Sb_2O_5$
Ant oil (artificial)	Furfural	$C_4H_3O\cdot CHO$
Apple acid	Malic acid	$H_2C_4H_4O_5$
Aqua regia	Mixture of nitric and hydrochloric acids	HNO_3+3HCl
Aquadag	Colloidal solution of graphite	……………………
Arctic essence	Methyl chloride	CH_3Cl
Argatoxyl	Silver atoxylate	$NH_2C_6H_4\cdot AsO\cdot AgO\cdot OH$
Armstrong and Wynne's acid	1-Naphthol-3-sulfonic acid	$C_{10}H_8O_4S$
Arnaudon's green	Chromic hydroxide combination with some acid as boric, phosphoric, etc.	……………………
Ascarite	Sodium hydroxide deposited on inert material	$NaOH$
Atabrine	cf. Quinacrine hydrochloride	……………………
Atoxyl	Sodium *p*-aminophenyl-arsonate	$NH_2C_6H_4AsO\cdot OH\cdot ONa$
Azure blue	cf. Cobalt blue	……………………
Azure copper	cf. Copper carbonate blue	……………………
B acid	1-Amino-8-naphthol-3,5-disulfonic acid	$C_{10}H_9O_7NS_2$
Bakelite	Phenol-formaldehyde condensation resin	……………………
Ballistite	Smokeless powder	50% nitroglycerin and 50% collodion cotton
Baryta water	Barium hydroxide solution	$Ba(OH)_2+aq$
Bentonite	Impure aluminum silicate	……………………
Benzine	Gasoline, petroleum ether	……………………
Benzinoform	Carbon tetrachloride	CCl_4
Benzoline	cf. Naphtha, petroleum	……………………
Bicarburetted hydrogen	Ethylene	C_2H_4
Bichrome	Potassium (or sodium) dichromate	K_2(or Na_2)Cr_2O_7
Bismuth white	Bismuth subnitrate or bismuth oxychloride	$BiONO_3\cdot H_2O$ or $BiOCl$
Bismuth yellow	Bismuth chromate	$Bi_2(CrO_4)_3$
Black ash	Impure sodium carbonate	Na_2CO_3
Black flux	Mixture of potassium carbonate and carbon	K_2CO_3 and C
Blau gas	Blue gas	44% CH_4, 52% H_2
Blue malachite	cf. Copper carbonate blue	……………………
Boletic acid	Fumaric acid	$(CH\cdot CO_2H)_2$
Bone black	Animal charcoal	C
Bone oil	Mixture of pyrrole, pyridine, quinoline, fatty acids and nitriles, amines, and hydrocarbons from distillation of bones	……………………
Boroform	Acetylene tetrachloride	$(CHCl_2)_2$
Bremen blue	cf. Copper carbonate blue	……………………
"Butter of"	Chloride of	……………………
Butyl glycol	Glycol monobutyl ether	$HOC_2H_4OC_4H_9$
C acid	2-Naphthol-4,8-disulfonic acid	$C_{10}H_8O_7S_2$

TRADE NAMES OF CHEMICALS WITH SYNONYMS AND FORMULAS

Common or Trade Name	Chemical Synonym	Formula
Calcic liver of sulfur	Calcium sulfide	CaS
Calgon	Sodium phosphate glass	$1.1Na_2O \cdot 1P_2O_5$
Caliche	Impure sodium nitrate	$NaNO_3$
Calomel	Mercurous chloride	$HgCl$
Calx	Calcium oxide	CaO
Calx chlorinata	Calcium chloro-hypochlorite	$CaClOCl$
Canadol	cf. Naphtha, petroleum	....
Canton's phosphorus	Calcium sulfide	CaS
Caoutchouc	Rubber	$(C_5H_8)_n$
Caput mortum	Ferric oxide, red	Fe_2O_3
Carbon chloride, Julin's	Hexachlorobenzene	C_6Cl_6
Carbon hexachloride	Hexachloroethane	C_2Cl_6
Carbonic acid	Carbon dioxide	CO_2
Carbonic anhydride	Carbon dioxide	CO_2
Carrene	Methylene chloride	CH_2Cl_2
"Caustic"	Hydroxide of	....
Cellon	Acetylene tetrachloride	$(CHCl_2)_2$
Charlton white	cf. Lithopone	....
Chinacrin	cf. Atabrin	....
Chloride of soda	Sodium hypochlorite solution	$NaOCl + aq.$
Chloro-H acid	1-Chloro-8-naphthol-3,6-disulfonic acid	$C_{10}H_7O_7S_2Cl$
Cinnabar, Austrian	Basic lead chromate	$PbCrO_4 \cdot PbO$
Cleve's α-acid	1-Naphthylamine-5-sulfonic acid	$C_{10}H_9O_3NS$
Cleve's β-acid	1-Naphthylamine-6-sulfonic acid	$C_{10}H_9O_3NS$
Cleve's γ-acid	1-Naphthylamine-3-sulfonic acid	$C_{10}H_9O_3NS$
Cleve's δ-acid	1-Naphthylamine-7-sulfonic acid	$C_{10}H_9O_3NS$
Cleve's θ-acid	1-Naphthylamine-7-sulfonic acid	$C_{10}H_9O_3NS$
Cobalt blue	Oxides of cobalt and aluminum in varing proportions, or cobalt aluminate	....
Cobalt green	Cobalt zincate	$CoZnO_2$
Cobalt violet	Cobaltous ammonium phosphate	$CoNH_4PO_4 \cdot H_2O$
Cobalt yellow	Potassium cobaltinitrite	$Co(NO_2)_3 \cdot 3KNO_2 \cdot 1.5H_2O$
Cobalt ultramarine	cf. Cobalt blue	....
Copper carbonate blue	Basic copper carbonate, composition variable	*ca.* $2CuCO_3 \cdot Cu(OH)_2$
Cresolin; Cresotal	Carbonate esters of cresols, guaiacol, etc.	....
Crocus of antimony	Antimony sulfide, or a slag obtained in refining antimony, mainly sodium or potassium thioantimonite	Sb_2S_3, or Na_3SbS_3 or K_3SbS_3
Crocus of Mars (or Martis)	A red-brown ferric oxide obtained by heating ferrous sulfate	Fe_2O_3
Cupren	Acetylene polymer	$(C_2H_2)_n + 0.2\%$ to $0.3\% Cu$
Cystamine	cf. Hexamin	....
Cystogen	cf. Hexamin	....
Dahl's acid II	1-Naphthylamine-4,6-disulfonicacid	$C_{10}H_9O_6NS_2$
Dahl's acid III	1-Naphthylamine-4,7-disulfonic acid	$C_{10}H_9O_6NS_2$
de Haens salt	Mixture of sodium fluoride and antimony trifluoride	$NaF + SbF_3$
Dehydro-thio-*p*-toluidine	1-*p*(-Aminophenyl)-3-methyl-benzothiazole	$C_{14}H_{12}N_2S$
Depurated tartar	Pure potassium hydrogen tartrate	$KHC_4H_4O_6$
Dermatol	Basic bismuth gallate	$Bi(OH)_2C_7H_5O_5$
Detonal	Diethylacetyl urethane	$(C_2H_5)_2CHCONHCO_2C_2H_5$

TRADE NAMES OF CHEMICALS WITH SYNONYMS AND FORMULAS

Common or Trade Name	Chemical Synonym	Formula
Diapthol	*o*-Hydroxyquinoline-*m*-sulfonic acid	$HOC_9H_5NSO_3H$
Diatol	Diethyl carbonate	$(C_2H_5O)_2CO$
Dimethyl-gamma acid	2-Dimethylamino-8-naphthol-6-sulfonic acid	$C_{12}H_{13}O_4NS$
Diolin	Octadecanediol	$CH_3(CH_2)_5CHOH(CH_2)_{10}\cdot CH_2OH$
Dioxogen	cf. Bone oil	....
Dippel's oil	cf. Bone oil	....
Dissolvan CA or DN	Mixture of 60-80°C. boiling solvents for nitro- and acetyl-celluloses	....
Disulfo acid E	1-Naphthol-3,8-disulfonic acid	$C_{10}H_8O_7S_2$
Disulfo acid F	2-Naphthylamine-3,7-disulfonic acid	$C_{10}H_7O_6NS_2$
Disulfuric acid	Fuming sulfuric acid	$H_2SO_4+SO_3$
Dowicide	Various chlorophenols	ClC_6H_4OH
Dragonic acid	Anisic acid	$CH_3O\cdot C_6H_4\cdot CO_2H$
DTS	Dehydrothio-*p*-toluidine sulfonic acid	$C_{14}H_{12}O_3N_2S_2$
Dulcose	Dulcitol	$C_6H_8(OH)_6$
Duresco	cf. Lithopone	....
Eau-de-Javelle	Potassium hypochlorite solution	$KOCl$ +aq.
Eau-de-Labarraque	Sodium hypochlorite solution	$NaOCl$ +aq.
Elayl	Ethylene	C_2H_4
Emeraude green	cf. Guignet's green	....
Enamel white	cf. Lithopone	....
Epsilon acid or ε acid	1-Naphthylamine-3,8-disulfonic acid	$C_{10}H_9O_6NS_2$
	1-Naphthol-3,8-disulfonic acid	$C_{10}H_8O_7S_2$
	1, 8-Dihydroxy-naphthalene-3-sulfonic acid	$C_{10}H_8O_5S$
Erdmann's μ acid	1-Naphthylamine-6-sulfonic acid	$C_{10}H_9O_3NS$
Etherin	Ethylene	C_2H_4
Ethiops mineral	Impure black mercuric sulfide	*ca.* 60% HgS+40% S
Ethocel	Ethyl cellulose	....
Ethyl F acid	2-Ethylaminonaphthalene-7-sulfonic acid	$C_{12}H_{13}O_3NS$
Ethyl-gamma acid	2-Ethylamine-8-naphthol-6-sulfonic acid	$C_{12}H_{13}O_4NS$
Euonymit	Dulcitol	$C_6H_8(OH)_6$
Everitt's salt	Potassium ferrous Ferrocyanide	$K_2Fe_2(CN)_6$
F acid	2-Naphthol-7-sulfonic acid	$C_{10}H_8O_4S$
	2-Naphthylamine-7-sulfonic acid	$C_{10}H_9O_3NS$
	2-Naphthylamine-3,-disulfonic acid	$C_{10}H_9O_6NS_2$
	2-Amino-7-naphthol-3-sulfonic acid	$C_{10}H_9O_4NS$
	2, 7-Dihydroxy-naphthalene-3-sulfonic acid	$C_{10}H_8O_5S$
Ferro prussiate	Any ferrocyanide, specifically potassium ferrocyanide	$K_4Fe(CN)_6$
Flake white	Bismuth subnitrate, or (in paint) white lead	$BiONO_3\cdot H_2O$ $2PbCO_3\cdot Pb(OH)_2$
"Flowers of" a metal	Oxide of the metal	....
Fluoremetic	Antimony sodium fluoride	$SbF_3\cdot NaF$
Formalin	40% Formaldehyde	$HCHO$ +ao
Formalith	Kieselguhr soaked in formaldehyde solution	$HCHO$
Formin	cf. Hexamin	....
Formitrol	Formaldehyde	$HCHO$
Formolyptyol	Formaldehyde	$HCHO$
Freund's acid	1-Naphthylamine-3,6-disulfonic acid	$C_{10}H_9O_6NS_2$

TRADE NAMES OF CHEMICALS WITH SYNONYMS AND FORMULAS

Common or Trade Name	Chemical Synonym	Formula
Fuller's earth	Hydrated aluminum and magnesium silicates	....
Fulton white	cf. Lithopone	....
Fusel Oil	Mixed amyl alcohols	$C_5H_{11}OH$
Galloformin	cf. Hexamin	....
Gasoline	Benzine or petrol	....
Gelbin	Barium chromate, or calcium chromate	$BaCrO_4$, or $CaCrO_4 \cdot 2H_2O$
Glanzstoff	Cuprammonium artificial silk	....
Glover acid	78% Sulfuric acid	$H_2SO_4 + aq.$
Gold salts	Sodium aurodichloride	Mixture of $AuCl_3$ and NaCl
GR acid	cf. RG acid	....
Grain oil	cf. Fusel oil	....
Gray antimony	Native antimony trisulfide	Sb_2S_3
Gray powder	Mixture of mercury and chalk	Hg and $CaCO_3$
Green cinnabar	Fired oxides of cobalt and zinc, or a mixture of chrome yellow and Prussian blue	....
Green nickel oxide	Nickel oxide	NiO
Green verditer	Basic copper carbonate, or ground mineral malachite	$CuCO_3 \cdot Cu(OH)_2$
Griffith's white	cf. Lithopone	....
Guignet's green	Chromic oxide and hydroxide (variable)	$Cr_2O_3 \cdot 3H_2O$
Gun cotton	Nitrocellulose	....
Halazone	*p*-Dichlorosulfamido-benzoic acid	$Cl_2NSO_2C_6H_4CO_2H$
Halowax	Hexachloronaphthalene	$C_{10}H_2Cl_6$
Heavy carburetted hydrogen	Ethylene	C_2H_4
Hedonal	Methyl-propyl-carbinol urethane	$NH_2CO_2CH(CH_3)C_3H_7$
Helcosol	Basic bismuth pyrogallate	*ca.* $C_6H_5O_4Bi$
Hepar antimony	cf. Crocus of antimony	....
Hepar sulfuris	Impure potassium sulfide, or calcium sulfide	K_2S, or CaS
Hexamin	Hexamethylene-tetramine	$(CH_2)_6N_4$
Hexil, or hexite	Hexanitro-diphenylamine	$(NO_2)_6C_{12}H_5N$
Hexoram	Hexachloroethane	C_2Cl_6
HNM	Mannitol hexanitrate	$C_6H_8(ONO_2)_6$
Horse brimstone	Impure, dark native sulfur	S
α-Hydro-juglone	1,4,5-Trihydroxy-naphthalene	$C_{10}H_8O_3$
Hydrone	Lead-sodium alloy (*ca.* 30% Na)	Pb + Na
Imperial green	Copper acetoarsenite	$Cu(C_2H_3O_2)_2 \cdot 3Cu(AsO_2)_3$
Indanthrene	Dianthraquinone-dihydroazine	$C_{28}H_{14}O_4N_2$
Indanthrone	cf. Indanthrene	....
Infusible white precipitate	Dimercuri-diammonium chloride	$N_2H_4Hg_2Cl_2$
Intarvin	Glyceryl margarate	$(C_{16}H_{33}CO_2)_3C_3H_5$
Invert sugar	Mixture of equal parts of glucose and fructose	$C_6H_{12}O_6$
Iron black	Precipitated antimony	Sb
Iron tartar	Potassium ferrous tartrate	*ca.* $K_2Fe(C_4H_4O_6)_2 \cdot xH_2O$
Isonaphthol	β-Naphthol	$C_{10}H_7OH$
James' powder	33.3% Sb_2O_3 and 66.6% $Ca_3(PO_4)_2$	....
Javelle water	cf. Eau de Javelle	....
Julin's carbon chloride	cf. Carbon chloride	....

TRADE NAMES OF CHEMICALS WITH SYNONYMS AND FORMULAS

Common or Trade Name	Chemical Synonym	Formula
K acid	1-Amino-8-naphthol-4,6-disulfonic acid	$C_{10}H_9O_7NS_2$
Kainit	Magnesium chloride and potassium magnesium sulfate double salt	$K_2Mg(SO_4)_2 \cdot MgCl_2 \cdot 6H_2O$
Kalle's acid	1-Naphthylamine-2,7-disulfonic acid	$C_{10}H_9O_6NS_2$
Kalle's salt	Acetone sodium bisulfite	$(CH_3)_2CO \cdot NaHSO_3$
Kasil	Potassium silicate solution	$K_2SiO_3 + aq.$
King's blue	cf. Cobalt blue	....
KMS	Potassium metabisulfite	$K_2S_2O_5$
Knight's patent zinc white	cf. Lithopone	....
Lac sulfur(is)	Precipitated sulfur	S
Lamp black	Impure carbon	C
Landschoff and Meyer's acid	1-Naphthylamine-2,5-disulfonic acid	$C_{10}H_9O_6NS_2$
Lanolin	Wool grease; cholesteryl esters of fatty acids	....
Laurent's α-acid	1-Nitronaphthalene-5-sulfonic acid	$C_{10}H_7O_5NS$
Lead oxide (brown)	Lead dioxide	PbO_2
Lead plaster	Essentially a mixture of lead oleate with small amounts of glycerol and oleic acid; also lead linoleate	$(C_{17}H_{33}CO_2)_2Pb$, or $(C_{17}H_{31}CO_2)_2Pb$
Lead vinegar	Aqueous solution of basic lead acetate	$Pb(C_2H_3O_2)_2 \cdot PbO + aq.$
Leucotrope	Benzyl-dimethyl-phenyl-ammonium chloride	$C_{15}H_{18}NCl$
Leyden blue	cf. Cobalt blue	....
Lichenic acid	Fumaric acid	$(CH \cdot CO_2H)_2$
Liebman and Studer's acid	1-Naphthol-7-sulfonic acid	$C_{10}H_8O_4S$
Light oil	Coal tar distillate up to 170°C., or any petroleum oil having a high Baume gravity	....
Ligroin(e)	Petroleum distillate, b. p. 120-35°C.	....
Lime water	Aqueous solution of calcium hydroxide	$Ca(OH)_2 + aq.$
Liquid glass	cf. Water glass	....
Lithopone	Zinc sulfide and barium sulfate	$ZnS + BaSO_4$
Liver of antimony	Impure double sulfide of antimony and alkali or alkaline earth	....
Liver of sulfur	Mixed potassium sulfides and thiosulfate, or calcium sulfide	....
Lucidol	Benzoyl peroxide	$(C_6H_5CO)_2O_2$
Lysol	Mixture of crude cresols in aqueous soap solution	....
M acid	1-Amino-5-naphthol-7-sulfonic acid	$C_{10}H_9O_4NS$
Magister of sulfur	Amorphous precipitated sulfur	S
"Magistery" of	A precipitate, especially a white precipitate from metallic solutions	....
Magistery of lead	Basic lead carbonate	$2PbCO_3 \cdot Pb(OH)_2$
Marbon white	cf. Lithopone	....
Marignac's salt	Potassium stannonsulfate	$K_2Sn(SO_4)_2$
Melanpyrit	Dulcitol	$C_6H_8(OH)_6$
Mercurius vitae	Mixture of antimony oxychloride and trioxide	$SbOCl + Sb_2O_3$
Meta	Metaldehyde	$(CH_3CHO)_3$
Methocel	Methyl cellulose	....
Methyl anol	Methyl cyclohexanone	$CH_3 \cdot C_6H_9O$
Methyl-benzanthrene	9-Methyl-7-*meso*-benzanthrone	$C_{18}H_{12}O$

Common or Trade Name	Chemical Synonym	Formula
Methyl-gamma acid	2-Methylamino-8-naphthol-6-sulfonic acid	$C_{11}H_{11}O_4NS$
Methylglycol acetate	Acetate of glycol monomethyl ether	$CH_3CO_2 \cdot C_2H_4 \cdot OCH_3$
Middle oil	Coal tar distillate, b. p. 170-230°C.	....
Milk acid	Lactic acid	$CH_3 \cdot CHOH \cdot CO_2H$
Milk of barium	Suspension of barium hydroxide in water	$Ba(OH)_2 + aq.$
Milk of lime	Suspension of calcium hydroxide in water	$Ca(OH)_2 + aq.$
Milk of magnesia	Suspension of magnesium hydroxide in water	$Mg(OH)_2 + aq.$
Milk of sulfur	Amorphous sulfur obtained by precipitation	S
Mineral Hamburg	cf. Copper carbonate blue	....
Mitigated caustic	Fused mixture of 1 part silver nitrate and 2 parts potassium nitrate	$AgNO_3 + KNO_3$
Mittler's green	cf. Guignet's green	....
Mixed acid	Mixture of nitric and sulfuric acids	$HNO_3 + H_2SO_4$
Mixed vitriol	Cupric-ferrous sulfate	$CuSO_4 \cdot 3FeSO_4 \cdot 28H_2O$
Monomeric liquid	Methyl methacrylate	$CH_2{:}C(CH_3)CO_2CH_3$
Monsel's salt	Basic ferric sulfate	**ca.** $Fe_4(SO_4)_5(OH)_2 \cdot 10H_2O$
Mountain vertditer	cf. Copper carbonate blue	....
Mu acid or μ-acid	1-Naphthylamine-6-sulfonic acid	$C_{10}H_9O_3NS$
"Muriate of" a metal	Chloride of	....
Muriatic ether	Ethyl chloride	C_2H_5Cl
Muthmann's liquid	Acetylene tetrabromide	$(CHBr_2)_2$
Naphtha (petroleum)	Petroleum distillate, b. p. 95-100°C	....
Naphtha (solvent)	Coal tar distillate, b. p. 80-110°C.	....
Naphthalin	Naphthalene	$C_{10}H_8$
α-Naphthol sulfonic acid B	2-Naphthol-8-sulfonic acid	$C_{10}H_8O_4S$
β-Naphthol sulfonic acid S	2-Naphthol-6-sulfonic acid	$C_{10}H_8O_4S$
β-Naphthol disulfonic acid F	2-Naphthol-3,7-disulfonic acid	$C_{10}H_8O_7S_2$
β-Naphthol disulfonic acid R	2-Naphthol-3,6-disulfonic acid	$C_{10}H_8O_7S_2$
α-Naphthol disulfonic acid S α-Naphthol disulfonic acid Sch. α-Naphthol disulfonic acid	cf. Schoellkopf's acid	....
α-Naphthylamine acids Cl	cf. Cleve's acids	....
α-Naphthylamine disulfonic acids D	1-Naphthylamine-4,6- and 4,7-disulfonic acids	$C_{10}H_9O_6NS_2$
β-Naphthylamine-disulfonic acid R	cf. Amino-R acid	....
α-Naphthylamine-disulfonic acid S	1-Naphthylamine-4,8-disulfonic acid	$C_{10}H_9O_6NS_2$
Naples yellow	cf. Antimony yellow	....
Natural gas	Mixture of gaseous hydrocarbons	CH_4, etc.
Nevin's white	cf. Lithopone	....
Nigrot(in)ic acid	1,7-Dihydroxy-6-naphthoic-3-sulfonic acid	$C_{11}H_8O_7S$

TRADE NAMES OF CHEMICALS WITH SYNONYMS AND FORMULAS

Common or Trade Name	Chemical Synonym	Formula
Nitric ether	Ethyl nitrate	$C_2H_5O{\cdot}NO_2$
Nitro-1,2,4-acid	1-Amino-8-nitro-2-naphthol-4-sulfonic acid	$C_{10}H_8O_6N_2S$
3-Nitro-flavopurpurin	3-Nitro-1,2,6-trihydroxy-anthraquinone	$C_{14}H_7O_7N$
Nordhausen acid	Fuming sulfuric acid	55% H_2SO_4 + 45% SO_3
Oil of hartshorn	cf. Bone oil	....
Oil of sweet birch, synthetic	Methyl salicylate	$HOC_6H_4CO_2CH_3$
Oil of philosophers	cf. Philosopher's oil	....
Oil of wine	Ethyl pelargonate, or a mixture of ethyl caprylate and ethyl caprate	$C_8H_{17}CO_2C_2H_5$ or $C_7H_{15}CO_2C_2H_5 + C_9H_{19}CO_2C_2H_5$
Oil of wintergreen, synthetic	Methyl salicylate	$HOC_6H_4CO_2CH_3$
Oil soluble	cf. Turkey red oil	....
Oleine	cf. Turkey red oil	....
Oleum white	cf. Lithopone	....
Orr's white	cf. Lithopone	....
Orthoform	Methyl *p*-amino-*m*-hydroxy-benzoate	$(NH_2)(OH)C_6H_3CO_2CH_3$
Oxy-dyz-ene	Mixture of potassium polysulfides and potassium thiosulfate	....
Oxysalicylate	Bismuth subsalicylate	$HOC_6H_4CO_2Bi(OH)_2$
Palite	Chloromethyl-chloroformate	$ClCH_2OCOCl$
Pamaquine	6-Methoxy-8-(1-methyl-4-diethyl-aminobutylamino)-quinoline	$C_{19}H_{29}ON_3$
Paradow	*p*-Dichlorobenzene	$C_6H_4Cl_2$
Paraform	Paraformaldehyde	$(CH_2O)_3$
Paranaphthalene	Anthracene	$C_6H_4(CH)_2C_6H_4$
Perhydrol	Hydrogen peroxide (30%)	H_2O_2 + aq.
Permanent green	cf. Guignet's green	....
Permutit	Synthetic hydrated aluminum silicate with replaceable sodium	....
Petrol	Petroleum distillate, gasoline	....
Petroleum ether	Petroleum distillate, b. p. 30-60°C. and other boiling ranges	....
Petroline	Petroleum distillate, b. p. 120-150°C.	....
Phene	Benzene	C_6H_6
Phenyl-gamma acid	2-Phenylamino-8-naphthol-6-sulfonic acid	$C_{16}H_{13}O_4NS$
Philosopher's egg	Mixture of salt, sulfur and mercury	NaCl, S, Hg
Philosopher's oil	Linseed oil and powdered brick	....
Picrotol	Silver picrate	$(NO_2)_3C_6H_2OAg{\cdot}H_2O$
Pinolith	cf. Lithopone	....
Plasmochin	cf. Pamaquine	....
Plate sulfate	Double salt of potassium-sodium sulfates	$K_2SO_4{\cdot}Na_2SO_4$
Porcelain white	cf. Lithopone	....
Potato oil	cf. Fusel oil	....
Potato spirit	cf. Fusel oil	....
Powder of algaroth	Antimony oxychloride or a mixture of antimony oxychloride and antimony trioxide	$SbOCl$ or $SbOCl + Sb_2O_3$
Preservaline	Formaldehyde	$HCHO$
Primuline base	*p*-Toluidine heated with sulfur	$C_{28}H_{18}N_4S_3$

TRADE NAMES OF CHEMICALS WITH SYNONYMS AND FORMULAS

Common or Trade Name	Chemical Synonym	Formula
Producer gas	An artificial heating gas	28-33% CO, 0.8-4% CO_2, 62-64% N_2
Pyroligneous acid	Crude acetic acid	$HC_2H_3O_2$
Quinacrinehydrochloride	3-Chloro-7-methoxy-9-(1-methyl-4-diethylaminobutylamino)-acridine dihydrochloride	$C_{23}H_{30}ON_3Cl\cdot 2HCl$
2R acid	2-Amino-8-naphthol-3, 6-disulfonic acid	$C_{10}H_9O_7NS_2$
Rayon	Regenerated cellulose	***ca.*** $(C_6H_{10}O_5)_n$
Rectified spirit	90-95% Ethyl alcohol	C_2H_5OH + aq.
Red acid	1,5-Dihydroxy-naphthalene-3,7-disulfonic acid Nitric acid of 40° Baume or stronger, containing dissolved nitrogen oxide	$C_{10}H_8O_8S_2$ ....
Red antimony	Antimony oxysulfide	$Sb_2O_3\cdot 2Sb_2S_3$
Red liquor	Aluminum acetate in water	$Al(C_2H_3O_2)_3$ + aq.
Red oil	cf. Turkey red oil	....
Reinecke salt	Ammonium (or potassium) tetrathiocyano-diammono-chromate	$NH_4[Cr(NH_3)_2(SCN)_4]\cdot H_2O$
RG acid	1-Naphthol-3,6-disulfonic acid	$C_{10}H_8O_7S_2$
Ross' white	cf. Lithopone	....
S acid	1,8-Dihydroxy-naphthalene-4-sulfonic acid 1-Naphthylamine-4,8-disulfonic acid 1-Naphthol-4,8-disulfonic acid	$C_{10}H_8O_5S$ $C_{10}H_9O_6NS_2$ $C_{10}H_8O_7S_2$
Sal alembroth	Mercuric ammonium chloride	$HgCl_2\cdot 2NH_4Cl\cdot H_2O$
Sal ethyl	Ethyl salicylate	$HOC_6H_4CO_2C_2H_5$
Salimenthol	Menthyl salicylate	$HOC_6H_4CO_2C_{10}H_{19}$
Salt of amber	Succinic acid	$(CH_2CO_2H)_2$
Salt of wisdom	cf. Sal alembroth	....
Salt of wormwood	Impure potassium carbonate obtained from ashes of wormwood	K_2CO_3
Saltpeter, air	Mixed calcium nitrate and calcium nitrite	$Ca(NO_3)_2 + Ca(NO_2)_2$
Salzburg vitriol	Crystals of a mixture of 1 part copper sulfate and 3 parts ferrous sulfate	....
Saran	Polyvinylidene chloride	$(H_2CCl_2)_n$
Satin spar	cf. Satin white	....
Satin white	Mixture of aluminum hydroxide, calcium sulfate, and calcium oxide	$Al(OH)_3$, $CaSO_4$, CaO
Schoellkopf's acid	1-Naphthol-4,8-disulfonic acid 1-Naphthylamine-4,8-disulfonic acid	$C_{10}H_8O_7S_2$ $C_{10}H_9O_6NS_2$
Scotch soda	Impure sodium carbonate	Na_2CO_3
Secaline	Trimethylamine	$(CH_3)_3N$
Sellite	Sodium sulfite	Na_2SO_3
Sericose	Cellulose acetate	....
Sigmaform	cf. Xeroform	....
Soda lime	Mixture of sodium hydroxide and calcium oxide	NaOH, CaO
Soft soap	Potassium soap	....
Soluble glass	cf. Water glass	....
Soubieran's ammoniacal salt	Mercury ammonium nitrate	$(NH_2Hg_2O)NO_3$
Spirit(s) of hartshorn	Aqueous ammonia solution, or 10% solution of ammonia in alcohol	NH_3 + aq., or $NH_3 + C_2H_5OH$
Spirit of wine	84% Ethyl alcohol	C_2H_5OH + aq.

TRADE NAMES OF CHEMICALS WITH SYNONYMS AND FORMULAS

Common or Trade Name	Chemical Synonym	Formula
SS acid or 2S acid	1-Ammino-8-naphthol-2,4-disulfonic acid	$C_{10}H_9O_7NS_2$
Styron	Polystyrene	$(C_6H_5CH:CH_2)_n$
Sugar of milk	Lactose	$C_{12}H_{22}O_{11}\cdot H_2O$
Sulfide white	cf. Lithopone	....
Sweet oil	Olive oil	....
Sylvinite	Sylvine with rock salt	....
Tar camphor	Naphthalene	$C_{10}H_8$
δ-Tetranitro-naphthalene	1,2,5,8-Tetranitro-naphthalene	$C_{10}H_4O_8N_2$
Thenard's blue	cf. Cobalt blue	....
Thioindoxyl	2-Hydroxy-1-thionaphthene	C_8H_6OS
Tin white	Stannic hydroxide	$Sn(OH)_4$
Tolite	cf. Trotyl	....
Tolyl-peri acid	*p*-Tolyl-1-naphthylamine-8-sulfonic acid	$C_{17}H_{15}O_3NS$
Toughened caustic	Fused mixed of silver and potassium nitrates	95% $AgNO_3$ + 5% KNO_3
Trotyl	Trinitrotoluene	$CH_3C_6H_2(NO_2)_3$
Transparent chromium oxide	cf. Guignet's green	....
Triformol	Paraformaldehyde	$(CH_2O)_3$
Trisulfonic acid	Naphthalene-1,3,6-trisulfonic acid	$C_{10}H_8O_9S_3$
Turkey red oil	Sulfonated castor oil	....
Verte emeraude	cf. Guignet's green	....
Vichy salt	Sodium hydrogen carbonate, or a mixture of salts obtained on evaporation of Vichy water	$NaHCO_3$
Vinegar acid	Acetic acid	$HC_2H_3O_2$
Vinegar naphtha	Ethyl acetate	$CH_3CO_2C_2H_5$
Viridian	cf. Guignet's green	....
"Vitriolate of"	Sulfate of	....
Water gas	An artificial gas	43% CO, 49% H_2, 4% CO_2 4% N_2
Water glass	Aqueous solution of sodium silicates	$H_2O + Na_2SiO_3 + Na_2SiO_4$
Westrosol	Trichloroethylene	$CHCl:CCl_2$
White acid	Mixture of ammonium fluoride and hydrofluoric acid	$NH_4F + HF$
White caustic	Sodium hydroxide	$NaOH$
White tar	Naphthalene	$C_{10}H_8$
White wax	Beeswax, bleached	....
Xeroform	Bismuth tribromophenate	*ca.* $BiOH(C_6H_2OBr_3)_2\cdot Bi_2O_3$
Yellow acid	1,3-Dihydroxy-naphthalene-5,7-disulfonic acid	$C_{10}H_8O_8S_2$
Yellow wax	Beeswax	....
Zinc baryta white	cf. Lithopone	....
Zincolith	cf. Lithopone	....
Zinc sulfide white	cf. Lithopone	....

COMPOSITION AND

See also special tables on

Proteins contain the elements of carbon, oxygen, hydrogen, nitrogen and often among others sulfur and phosphorus, thus furnishing the elements for the building and repairing of tissue as well as energy for heat and muscular power. They are supplied by vegetable proteins—grain foods, legumes and nuts, and animal proteins—flesh foods, eggs and dairy products. **Fats** contain the elements of carbon, hydrogen and oxygen and are utilized for heat and muscular power; the excess is stored as fat in the body. The sources of this type of food are the vegetable and animal fats or oils. **Carbohydrates** contain the elements of carbon, hydrogen and oxygen; they furnish fuel for heat and muscular energy. The excess is transformed and stored in the body as fat. **Water** contains the elements oxygen and hydrogen and is a neutral substance which does not furnish energy but is necessary for the digestive fluids, for transporting soluble substances in the blood and lymph, for maintaining proper dilution of soluble substances in the body, for excreting soluble wastes and for regulating the temperature of the body. It is furnished by fluids taken (water, beverages, soups, etc.), by the water content of solid foods and by that formed in metabolism. **Mineral salts** share in forming and maintaining bones, teeth, blood, etc., and aid in digestion and metabolism. Among such minerals are the following elements. **Aluminum** occurs only in traces and is probably of very little importance. **Arsenic** is an acid forming element occurring in traces in many animal and vegetable foods; it is probably of very little importance. **Calcium,** a base forming element, is a sinew, muscle, and blood mineral and maintains the bone structure. It is supplied by watercress, turnip tops, dandelions, spinach, lettuce, tomatoes, lemons, oranges, strawberries, cranberries, cheese, milk, buttermilk, wheat, oats, rye, barley, peas, lentils, and nuts. **Chlorine,** an acid forming element, is a secretion mineral. The amount required per day is 6 to 8 grams. It is supplied by table salt, lettuce, spinach, cabbage, beets, parsnips, milk, cheese, strawberries, bananas, pineapples, grapes, potatoes, beans, barley, corn, oats, peas, and sea foods. **Fluorine,** an acid forming element, furnishes a substance needed in building tooth enamel and eye tissue. It is supplied in minute amounts by vegetables, fruits, eggs, milk and seeds. **Iodine,** an acid forming element, is a gland mineral. It is supplied by iodized salt, salt water fish, asparagus, cabbage, green peas, beans, rice, potatoes, lettuce, mushrooms, tomatoes, grapes, pears, and pineapples. **Iron** is a blood mineral occurring in the red blood cells. It is supplied by

No.	Food item, edible portion	% Water	% Protein	% Fat	% Carbohydrate	Ash, mg/100g		
						Ca	P	Fe
1	Almonds	4.7	18.6	54.1	19.6	254	475	4.4
2	Apples (d)	1.6	1.4	1.0	93.9	24	42	4.1
3	Apples (f)	84.1	0.3	0.4	14.9	6	10	0.3
4	Applesauce (c)	79.8	0.2	0.1	19.7	4	6	0.2
5	Apricots (c)	77.3	0.6	0.1	21.4	10	15	0.3
6	Apricots (f)	85.4	1.0	0.1	12.9	16	23	0.5
7	Apricots† (d)	24	5.2	0.4	66.9	86	119	4.9
8	Artichokes, jer.	....	2.4	0.1	16.5	....	....	....
9	Asparagus (c)	93.6	1.6	0.3	3.0	20	34	1.0
10	Asparagus (f)	93.0	2.2	0.2	3.9	21	62	0.9
11	cream soup	88	2.5	3.2	5.5	130	100	0.5
12	Avocados (f)	65.4	1.7	26.4	5.1	10	38	0.6
13	Bacon, raw	20	9.1	65	1.1	13	108	0.8
14	cooked	....	21.3	64.6	....	13	213	2.7
15	Bananas	74.8	1.2	0.2	23	8	28	0.6
16	Barley, pearled	11.1	8.2	1.0	78.8	16	189	2.0
17	Beans, baked (c)	71.0	5.7	2.0	19.0	49	154	3.4
18	kidney (d)	10.5	22.0	1.5	62.1	148	463	10.3
19	lima (f)	66.5	7.5	0.8	23.5	63	158	2.3

† Sulfured.

USE OF FOODS

Vitamins, and Fats and Oils.

lettuce, spinach, turnips, asparagus, leeks, onions, cabbage, artichokes, radishes, pumpkin, oats, rice, rye, beans, mushrooms, grapes, raisins, strawberries, gooseberries, cherries, prunes, grapefruit, pineapple, currants, and almonds. **Magnesium,** a base forming element and a cell-building substance, maintains chiefly teeth, bone and muscular tissue. The amount required per day is the equivalent of 0.3 to 0.5 grams magnesium oxide (MgO). It is supplied by dandelions, lettuce, watercress, turnip tops, cabbage, celery, asparagus, tomatoes, berries, lemons, bananas, oranges, limes, pineapple, raisins, almonds, walnuts, wheat, oats, rice, and barley. **Phosphorus** is an acid forming element which is necessary for the building of nervous tissue, bones, and teeth. It is supplied by eggs, milk, sea foods, liver, asparagus, watercress, turnips, beans, lentils, figs, prunes, currants, apples, berries, wheat, oats, barley, rice, and rye. **Potassium** is a strongly basic element helping to make the tissues elastic. The amount required per day is the equivalent of 2 to 3 grams of the oxide (K_2O). It is supplied by potato skins, spinach, beans, turnips, parsnips, lettuce, tomatoes, rhubarb, huckleberries, limes, and lemons. **Silicon,** an acid forming element, supplies a substance necessary for building hair, nails, skin, and teeth. It is supplied by egg whites, meat, nuts, lettuce, dandelions, asparagus, onions, radishes, cucumbers, celery, strawberries, apples, apricots, cherries, prunes, mushrooms, olives, oats, rye, and millet. **Sodium,** a strongly basic element, aids digestion and is a blood and gland mineral. The amount required per day is the equivalent of 4 to 6 grams of the oxide (Na_2O). It is supplied by table salt, spinach, dandelions, cabbage, beets, cauliflower, asparagus, carrots, cucumbers, turnips, strawberries, figs, prunes, apricots, olives, tomatoes and milk. **Sulfur** is an acid element utilized in building protein tissue. The amount required per day is the equivalent of 2 to 3.5 grams of the oxide (SO_3). It is supplied by eggs, cabbage, meats, fish, corn, cheese, brussels sprouts, string beans, lima beans, raspberries, cranberries, and raisins. **Manganese** is a tissue mineral and aids in carrying oxygen from the lungs to the cells. It is supplied by endive, watercress, parsley, almonds, walnuts, and egg yolks.

Abbreviations: a, acid; Asc., ascorbic acid; b, basic; c, canned; d, dried; e, excellent source; f, fresh (food item), fair source (vitamin); g, good source; h, high; l, low; m or med., medium; n, neutral; Nia., niacin; r, rich source; Reac., reaction; Rib., riboflavin; sl., slice; Thi., thiamin; tr., trace.

No.	% Fiber	Kg-cal per 100 g	100 g Portion	Vitamin					Reac.
				A	Thi.	Rib.	Nia.	Asc.	
1	2.0	640	¾ cup or 107	0	0.25	0.67	4.6	tr	ma
2	.....	390	....	0	0.05	0.08	0.5	11	...
3	1.2	64	1 small	90	0.04	0.02	0.2	5	lb
4	.....	80	....	60	0.01	0.01	tr	1	....
5	.....	89	....	1350	0.02	0.02	0.3	4	b
6	.....	56	⅜ cup	2790	0.03	0.04	0.7	4	b
7	2.6	292	16 halves	7430	0.01	0.16	3.3	12	...
8	...	77	....	e	....	g	...	g	b
9	...	21	....	600§	0.06	0.09	0.8	15	lb
10	0.8	26	12 stalks, 5 in.	1000	0.16	0.17	1.2	33	lb
11	...	62	....	f	....	....	...	...	lb
12	0.7	265	one, 2 in.	290	0.12	0.15	1.1	16	...
13	0.5	626	10 sl., ⅛x1½x4½ in.	0	0.42	0.10	2.1	0	a
14	1.0	667	26 sl., ⅛x1½x3 in.	......	....	....	...	...	a
15	1.0	99	½ large	430	0.09	0.06	0.6	10	lb
16	0.3	357	½ cup	0	0.12	0.08	3.1	0	ma
17	1.4	117	½ cup	70†	0.05	0.05	0.8	4†	...
18	4.4	350	½ cup	0	0.60	0.24	2.1	2	...
19	0.8	131	⅔ cup	280	0.25	0.14	0.9	32	mb

§ Based on green product; bleached product contains only a trace.
† Contributed by tomatoes.

No.	Food item, edible portion	% Water	% Protein	% Fat	% Carbohydrate	Ash, mg/100g		
						Ca	P	Fe
1	lima (c)	80.9	3.8	0.3	13.5	27	73	1.7
2	lima (d)	12.6	20.7	1.3	61.6	68	381	7.5
3	navy (d)	10.5	22.0	1.5	62.1	148	463	10.3
4	soya (d)	7.5	34.9	18.1	12.0‡	227	586	8.0
5	string (f)	88.9	2.4	0.2	7.7	65	44	1.1
6	string (c)	94.0	1.0	0	3.8	27	19	1.4
7	Beef, chuck roast	65	18.6	16	0	11	200	2.8
8	corned (c)	57.3	24.4	15	0	29	113	4.0
9	dried, chipped	47.7	34.3	6.3	0	20	370	5.1
10	hamburger	55	16	28	0	9	172	2.4
11	heart (f)	75.4	16.5	6.3	0.7	10	236	6.2
12	liver (f)	70.9	19.8	4.2	3.6	8	373	12.1
13	loin steak	57	16.9	25	0	10	182	2.5
14	rib roast	59	17.4	23	0	10	188	2.6
15	round steak	67	19.3	13	0	11	208	2.9
16	rump roast	53	15.5	31	0	9	167	2.3
17	soup meat	70	20.3	9	0	12	219	3.0
18	stew 73% lean	53	15.8	30	0	9	170	2.4
19	tongue (f)	68	16.4	15	0.4	30	119	6.9
20	Beet greens (f)	90.4	2.0	0.3	5.6	118*	45	3.2
21	Beets (f)	87.6	1.6	0.1	9.6	27	43	1.0
22	Beets (c)	89.4	1.0	0	8.7	15	29	0.6
23	Biscuits, baking powder	36	8.6	8.9	50.0	60	106	0.7
24	Blackberries	84	1.2	1.1	11.9	17	34	1.0
25	Bologna sausage	62.4	14.8	15.9	3.6	9	160	2.2
26	Bouillon	94	2.2	0.1	0.2	....	....	....
27	Bran	20	16.3	8.5	54.4	120	1215	8.5
28	Bread, graham	37	8.9	1.8	52.1	50	218	2.5
29	rye, light	37.6	6.4	3.4	51.7	22	96	0.8
30	white, enriched	35.9	8.5	2.0	52.3	56	100	1.8
31	whole wheat	37	9.5	3.5	48.0	60	370	2.6
32	Bread pudding	86	5.0	8.1	15.9	110	90	0
33	Broccoli	89.9	3.3	0.2	5.5	130	76	1.3
34	Brussels sprouts	84.9	4.4	0.5	8.9	34	78	1.3
35	Butter	15.5	0.6	81	0.4	16	16	0.2
36	Buttermilk	90.5	3.0	0.5	4.8	105	97	0.3
37	Cabbage	92.1	1.4	0.2	5.3	46	31	0.5
38	dehydrated, unsulfited	8.8	13.7	1.8	68.8	374	274	4.7
39	Cake, light batter	26.8	6.4	8.2	57.0	62	126	2.0
40	Candy, marshmallows	13	6.7	0	80	....	....	....
41	chocolate creams	24	1.4	11	63	....	....	....
42	chocolate fudge	12	2	10	76	32	39	0.1
43	gum drops	12	11	0	77	....	....	....
44	mints	12	0	0	88	....	....	....
45	nut bar	14	5.3	18.6	62	67	26	1.5
46	Cantaloups	94	0.6	0.2	4.6	17	16	0.4
47	Carrots (f)	88.2	1.2	0.3	9.3	39	37	0.8
48	Carrots (c)	92.2	0.5	0.4	6.1	22	24	0.6
49	dehydrated	5.6	4.0	1.4	83.1	242	102	5.9
50	Catsup	69.5	2.0	0.4	24.5	12	18	0.8
51	Cauliflower	91.7	2.4	0.2	4.9	22	72	1.1
52	Celery	93.7	1.3	0.2	3.7	50	40	0.5
53	cream soup	90	2.1	2.8	5.0	110	76	0.3
54	Chard	91.8	1.4	0.2	4.4	105*	36	4.0
55	Cheese, cheddar	39	23.9	32.3	1.7	873	610	0.6

‡ Available carbohydrate.
* May not be available because of presence of oxalic acid.

No.	% Fiber	Kg-cal per 100 g	100 g Portion	Vitamin					Reac.
				A	Thi.	Rib.	Nia.	Asc.	
1	...	72	½ cup	130	0.03	0.05	0.5	8	...
2	4.6	341	½ cup	0	0.60	0.24	2.1	2	mb
3	4.4	350	½ cup	0	0.60	0.24	2.1	2	lb
4	4.4	351	½ cup	110	1.14	0.31	2.1	tr	...
5	1.9	42	⅔ cup	630	0.08	0.10	0.6	19	lb
6	...	19	½ cup	410	0.03	0.05	0.3	4	...
7	...	218	8 cu. in.	0	0.12	0.15	5.0	0	...
8	...	232	...	0	0.02	0.19	2.7	0	a
9	...	194	6 sl., 4x6 in.	0	0.11	0.22	3.7	0	a
10	...	316	½ cup	0	0.10	0.13	4.3	0	...
11	...	126	½x4x4 in.	0	0.54	0.90	6.8	14	...
12	...	131	½x3x6 in.	19200	0.27	2.80	16.1	31	ma
13	...	293	½x4x4 in.	0	0.10	0.13	4.6	0	...
14	...	277	8 cu. in.	0	0.11	0.14	4.7	0	ma
15	...	194	½x4x4 in.	0	0.12	0.15	5.2	0	ma
16	...	341	8 cu. in.	0	0.10	0.12	4.2	0	ma
17	...	162	8 cu. in.	0	0.13	0.16	5.5	0	...
18	...	333	8 cu. in.	0	0.10	0.12	4.3	0	...
19	...	202	½x4x4 in.	0	0.22	0.27	5.0	0	...
20	...	33	½ cup, cooked	6700	0.05	0.17	0.3	34	...
21	0.9	46	⅔ cup	20	0.03	0.05	0.4	10	...
22	0.8	39	⅔ cup	20	0.01	0.03	0.1	5	...
23	...	715	6 small	...	...	...	...	...	la
24	2.5	62	1⅙ cup	g	...	...	...	...	b
25	...	217	3 sl., ⅛x4x4 in.	0	0.31	0.30	3.0	0	a
26	...	11	½ cup	...	...	...	...	...	...
27	18	...	2 cups	...	...	g	...	...	a
28	1.1	266	3⅓ sl., ⅜ in.	f	...	...	...	...	la
29	0.5	263	3⅓ sl., ⅜ in.	0	0.16	0.04	1.1	0	la
30	0.2	261	3⅓ sl., ⅜ in.	0	0.24	0.15	2.2	0	la
31	1.2	262	3⅓ sl., ⅜ in.	0	0.28	0.15	3.5	0	la
32	...	156	...	f	...	...	...	...	la
33	...	37	...	3500	0.09	0.21	0.9	118	...
34	...	58	⅔ cup	400	0.11	0.06	0.3	94	...
35	0	733	7 tablespoons	3300	tr	0.01	0.1	0	n
36	0	36	½ cup	tr	0.04	0.18	0.1	1	lb
37	...	29	1½ (f), ⅔ cooked	80	0.07	0.06	0.3	52	lb
38	...	346	...	520	0.41§	0.37	2.4	189§	lb
39	...	327	2x3x3 in.	...	0.03	0.10	0.7	0	ma
40	...	345	...	...	...	...	...	...	...
41	...	350	...	...	...	...	...	...	n
42	...	400	...	f	...	...	...	...	n
43	...	350	...	...	...	...	...	...	n
44	...	350	...	...	...	...	...	...	n
45	...	435	...	...	...	...	...	...	...
46	2.1	23	⅓ of 4½ in. melon	3240†	0.06	0.04	0.8	33	mb
47	1.1	45	⅔ cup	12000	0.07	0.06	0.5	6	mb
48	...	30	...	12000	0.03	0.02	0.3	2	mb
49	...	361	...	117000	0.29	0.28	3.2	11	mb
50	...	110	...	1880	0.09	0.07	2.2	11	...
51	...	31	⅔ cup	90	0.10	0.11	0.6	69	lb
52	0.98	22	4 stalks	0	0.03	0.04	0.3	7	lb
53	...	55	½ cup	f	...	...	...	...	lb
54	...	25	⅓ cup, cooked	2800	0.06	0.13	0.2	38	mb
55	...	393	1x2x3 in.	1740	0.04	0.50	0.2	0	la

§ If sulfited, the thiamine value would be much lower, and the ascorbic value about double; also loss on storage.

† Deeply colored varieties.

No.	Food item, edible portion	% Water	% Protein	% Fat	% Carbohydrate	Ash, mg/100g		
						Ca	P	Fe
1	Cheese, cottage	74.0	19.2	0.8	4.3	82	263	0.5
2	cream	53.3	7.1	36.9	1.7	298	208	0.2
3	Swiss	35	27.6	34.9	1.3	1100	810	1.4
4	Cherries (f)	87	1.3	0.5	13.3	19	31	0.5
5	canned	78.1	0.6	0.1	20.8	11	14	0.3
6	Chestnuts	....	6.3	5.4	40.3	....	....	4.1
7	Chicken, roasters§	66.0	20.2	12.6	0	16	218	1.9
8	boned (c)	67.1	21.8	9.8	0	32	218	1.9
9	soup	85	10.5	0.8	2.4	....	9	0.1
10	Chickpeas	10.6	20.8	4.7	60.9	92	375	7.1
11	Chocolate, bitter	2.3	5.5	52.9	18	95*	343	2.5
12	milk choc.	....	8.0	34.9	51.1	....	....	....
13	Clam chowder	....	1.8	0.8	6.7	130	110	0.5
14	Cocoa	4.3	9.0	18.8	31.0	160*	709	2.7
15	Coconut, dry, shredded	3.3	3.6	39.1	53.2	43	191	3.6
16	Codfish	82.6	16.5	0.4	0	18	189	0.9
17	salt, cooked	....	42.3	0.5	....	....	....	....
18	Cod liver oil	0	0	100	0	0	0	0
19	Collards	86.6	3.9	0.6	7.2	249	58	1.6
20	Consomme	95	2.5	....	0.4	....	....	....
21	Cookies, plain	4.8	6.0	12.7	75.0	22	65	0.6
22	Cooking oil	0	0	100	0	0	0	0
23	Corn, sweet (f)	73.9	3.7	1.2	20.5	9	120	0.5
24	canned	80.5	2.0	0.5	16.1	4	51	0.5
25	Corn bread	37	6.2	7.0	39.0	55	102	0.7
26	Corn flakes	9.3	7.9	0.7	80.3	10	56	1.0
27	Corn meal, cooked	....	1.4	0.8	11.9	5	39	0.2
28	white, degerminated	12	7.5	1.1	78.8	10	140	1.0
29	white, whole-grain	12	9.1	3.7	73.9	18	248	2.7
30	yellow, degerminated	12	8.3	1.2	78.0	10	140	1.0
31	yellow, whole-grain	12	9.1	3.7	73.9	18	276	2.7
32	Cornstarch	12	0.5	0.2	87.0	tr	tr	tr
33	Corn oil	0	0	100	0	....	....	....
34	Corn syrup	....	....	....	75	6	103	0.8
35	Cowpeas	10.6	22.9	1.4	61.6	80	450	7.8
36	Crackers, assorted	4.5	9.5	10.3	72.7	22	102	1.5
37	graham	5.5	8.0	10.0	74.3	20	203	1.9
38	soda	4.0	6.6	8.8	68.8	22	11	0.2
39	Cranberries (f)	85	0.4	0.7	11.3	18	13	0.6
40	dried	4.9	2.9	6.6	84.4	82	22	3.4
41	sauce	48.1	0.1	0.3	51.4	8	7	0.3
42	Cream, 20%	72.5	2.9	20.0	4.0	97	77	0.1
43	Crisco	0	0	100	0	0	0	0
44	Cucumbers	96.1	0.7	0.1	2.7	10	21	0.3
45	Currants (d)	3	2.4	1.7	74.2	82	195	4.7
46	Currants (f)	82	1.6	0.4	12.7	26	38	0.7
47	Dandelion greens	85.8	2.7	0.7	8.8	187	70	3.1
48	Dates	11	2.1	2.8	78.4	65	72	5.1
49	Doughnuts	....	6.6	22.2	54.4	....	....	....
50	Duck	....	18.3	19.0	0	10	197	1.7
51	Egg, white, boiled	....	12.3	0.6	....	14	14	0.1
52	whole (f)	74.0	12.8	11.5	0.7	54	210	2.7
53	whole (d)	2	48.2	43.3	2.6	187	800	8.7
54	yolk (f)	49.4	16.3	31.9	0.7	147	586	7.2
55	Eggplant	92.7	1.1	0.2	5.5	15	37	0.4
56	Endive	94.8	1.0	0.6	2.6	104	38	....

§ Vitamin values based on muscle meat only.
* May not be available because of presence of oxalic acid.

No.	% Fiber	Kg-cal per 100 g	100 g Portion	Vitamin					Reac.
				A	Thi.	Rib.	Nia.	Asc.	
1	...	101	½ cup	30	0.02	0.29	0.1	0	...
2	...	367	1x2x3 in.	2210	0.01	0.14	0.1	0	...
3	...	...	....	g	....	....	...	...	...
4	0.2	70	⅔ cup	g	....	....	...	g	b
5	...	86	....	430	0.03	0.02	0.2	3	b
6	1.8	235	¼ cup	......	....	....	...	...	lb
7	...	194	½ broiler	tr	0.11	0.18	8.6	...	ma
8	...	175	....	tr	0.01	0.15	3.7	2	...
9	...	61	....	......	....	....	...	...	a
10	...	369	....	tr	0.35	0.15	1.4	2	...
11	...	570	3⅛ squares	0	tr	0.24	1.1	0	...
12	...	551	3 bars	......	....	....	...	...	...
13	...	45	....	g	....	....	...	...	a
14	...	329	40 teaspoons	0	tr	0.39	2.3	0	...
15	...	579	5⅘ cups	0	tr	tr	tr	0	mb
16	...	70	1x1½x4 in.	......	0.04	0.05	2.3	2	...
17	...	173	½ cup flakes	f	....	....	...	...	ma
18	0	900	7 tablespoons	r†	....	....	...	...	n
19	...	50	....	6870	0.22	0.20	0.8	100	...
20	...	12	....	......	....	....	...	...	n
21	...	438	8, 2¼ in. diam.	0	0.04	0.04	0.5	0	la
22	0	900	7 tablespoons	0	0	0	0	0	...
23	0.5	108	⅜ cup	390‡	0.15	0.14	1.4	12	...
24	0.5	77	⅜ cup	200‡	0.02	0.05	0.8	5	...
25	0.2	240	2 sl., 1x2x2 in.	......	....	....	...	...	la
26	0.2	359	3½ cups	0	0.16	0.08	1.6	0	la
27	0.2	59	½ cup	......	....	....	...	...	...
28	0.2	355	....	0	0.16	0.09	0.9	0	...
29	...	365	....	0	0.41	0.12	1.7	0	...
30	...	356	....	300	0.15	0.06	0.9	0	a
31	...	365	....	510	0.45	0.17	2.1	0	...
32	...	352	16 tablespoons	0	0	0	0	0	...
33	...	900	7 tablespoons	f	....	....	...	...	n
34	0	300	5 tablespoons	......	....	....	...	...	n
35	0	351	....	0	0.83	0.23	2.2	2	...
36	...	422	15 crackers	0	0.07	0	0.6	0	...
37	1.5	419	10 crackers	0	0.30	0.12	1.5	0	a
38	0	378	22 crackers	......	....	....	...	...	ma
39	1.5	53	1 cup	f	....	....	...	f	a
40	...	409	....	660	0.19	0.18	0.9	33	...
41	...	209	....	30	....	0.04	...	2	a
42	0	208	½ cup	830	0.03	0.14	0.1	1	n
43	0	900	10 tablespoons	......	....	....	...	...	n
44	0.7	14	one, 1¾x3 in.	0#	0.04	0.09	0.2	8	lb
45	18.2	322	⅔ cup	......	....	....	...	...	...
46	3.2	61	½ cup	......	....	....	...	g	b
47	0.7	52	....	13650	0.19	0.14	0.8	36	...
48	5.5	358	14	g	....	....	...	...	mb
49	...	444	1	......	....	....	...	...	...
50	...	244	½x1½x1¾ in.	......	....	g	...	...	a
51	...	57	3 whites	......	....	f	...	...	la
52	...	158	2	1140	0.12	0.34	0.1	0	ma
53	...	593	....	4460	0.35	1.23	0.2	0	ma
54	...	355	7 yolks	3210	0.32	0.52	....	0	ha
55	...	28	....	30	0.07	0.06	0.8	5	b
56	0.7	15	½ head	......	....	....	...	...	...

† Rich in vitamin D.

‡ Based on yellow corn; white corn contains only a trace.

# Based on pared cucumber; unpared contains about 260 I. U. per 100 g.

No.	Food item, edible portion	% Water	% Protein	% Fat	% Carbohydrate	Ash, mg/100g		
						Ca	P	Fe
1	Farina	11	11.5	1.0	76.1	21	125	0.8
2	enriched	11	11.5	1.0	76.1	21	125	1.3
3	Fig bars	13.8	4.2	4.8	75.8	69	69	1.3
4	Figs (d)	18	4.3	0.3	74.2	162	116	4.0
5	Fish, medium fat	77.2	19.0	2.5	0	21	218	1.0
6	Flour, buckwheat	12	6.3	1.1	79.7	11	88	1.0
7	graham	11	13.3	2.2	71.4	18	289	3.7
8	rye, light	11	8.9	0.9	78.5	18	278	1.3
9	rye, whole-grain	10	11.2	1.7	75.2	61	369	4.8
10	soy, low fat	11	44.7	1.1	14.2†	265	623	13.0
11	soy, medium fat	9	42.5	6.5	13.6†	244	610	13.0
12	soy, full fat	9	35.9	20.6	11.4†	195	553	12.1
13	wheat, patent	12	10.8	0.9	75.9	19	93	0.7
14	wheat, pat. enriched	12	10.8	0.9	75.9	19	93	2.9
15	whole wheat	11	13.0	2.0	72.4	38	385	3.8
16	Frankfurters	64.3	15.2	14.1	3.3	9	164	2.3
17	Fruit cocktail (c)	80.6	0.4	0.2	18.6	9	12	0.4
18	Fudge	18.8	2.0	5.6	73.6	40	72	0.4
19	Gelatin	8.5	91.4	0.1	0	....	....	....
20	Goose	....	16.3	36.2	0	9	176	2
21	Gooseberries	88.2	0.8	0.4	10.1	35	31	4.7
22	Grapes	81.6	0.8	0.4	16.7	17	21	0.6
23	Grapefruit (f)	88.8	0.5	0.2	10.1	17	18	0.3
24	Grapefruit (c)	79.8	0.6	0.2	19.1	13	14	0.3
25	juice (c)	89.4	0.5	0.2	9.4	8	12	0.4
26	Gravy, meat stock	86	0.9	8.6	4.5	2	8	0
27	Haddock (f), raw	77	16.8	0.3	0	19	190	0.9
28	Halibut (f)	75.7	18.6	5.2	0	20	213	0.9
29	Ham, lean (f)	60	25.0	14.4	0	14	269	1.7
30	medium fat (f)	53	15.2	31	0	9	164	2.3
31	med. fat, smoked	42	16.9	35	0.3	10	182	2.5
32	Heart, beef (f)	75.4	16.5	6.3	0.7	10	236	6.2
33	Hickory nuts	5.8	15.4	67.4	11.4	....	....	2.4
34	Hominy	11.4	8.5	0.8	78.9	11	70	1.0
35	cooked	....	1.1	....	11.2	2	20	0.1
36	Honey	20	0.3	0	79.5	5	16	0.9
37	Ice cream	62.0	4.0	12.3	20.8	132	104	0.1
38	Jam	28	0.5	0.3	70.8	12	12	0.3
39	Jellies	34.5	0.2	0	65.0	12	12	0.3
40	Kale	86.6	3.9	0.6	7.2	225	62	2.2
41	Kidney, veal	76	16.9	6.4	0	9	171	4.1
42	Lamb, leg roast	63.7	18.0	17.5	0	10	194	2.7
43	shoulder roast	58.3	15.6	25.3	0	9	168	2.3
44	sirloin chop	63.7	18	17.5	0	10	194	2.7
45	Lard	0	0	100	0	0	0	0
46	Lemons	89.3	0.9	0.6	8.7	14	10	0.1
47	Lentils, dry	10	25.7	1.0	59.2	107	438	8.6
48	Lettuce, headed	94.8	1.2	0.2	2.9	22	25	0.5
49	all other	94.8	1.2	0.2	2.9	62	20	1.1
50	Limes	86.0	0.8	0.1	12.3	14	10	0.1
51	Liver, beef, raw	70.9	19.8	4.2	3.6	11	373	12.1
52	calves, raw	70	19.0	5.3	3.6	9	171	5.4
53	Lobster (c)	81	16.4	1.8	0.4	18	188	0.4
54	Loganberries	84	1.0	0.6	15.0	....	....	....
55	Macaroni	11	13	1.4	73.9	22	144	1.2
56	cooked	83	2.5	0.2	14.2	4	25	0.2

† Available carbohydrate.

No.	% Fiber	Kg-cal per 100 g	100 g Portion	Vitamin					Reac.
				A	Thi.	Rib.	Nia.	Asc.	
1	...	359	....	0	0.06	0.06	1.0	0	a
2	...	359	....	0	0.37	0.26	1.3	0	...
3	...	363	....	0	0.02	0.06	0.9	0	...
4	1.8	317	17	f	....	f	...	...	mb
5	...	98	¾x1¾x4 in.	......	0.07	0.07	4.2	2	...
6	...	354	¾ cup	0	0.31‡	0.08	2.1	0	a
7	1.9	359	¾ cup	......	....	....	...	...	ma
8	...	358	¾ cup	0	0.15	0.07	0.9	0	a
9	...	361	¾ cup	0	0.47	0.21	1.7	0	...
10	...	246	¾ cup	70	1.10	0.35	2.9	0	...
11	...	283	¾ cup	110	0.82	0.34	2.6	0	...
12	...	375	¾ cup	140	0.77	0.28	2.2	0	...
13	...	355	¾ cup	0	0.07	0.03	0.8	0	ma
14	...	355	¾ cup	0	0.44	0.26	3.5	0	...
15	0.9	360	¾ cup	0	0.56	0.12	5.6	0	ma
16	0.1	201	3 links	0	0.19	0.23	2.4	0	ma
17	...	78	....	160	0.01	0.01	0.4	2	...
18	...	356	1 cu in.	......	....	....	...	...	...
19	...	367	33 teaspoons	......	....	....	...	...	...
20	...	391	....	......	....	f	...	...	la
21	2.5	47	½ cup	......	....	....	...	...	...
22	4.3	74	24 grapes	80	0.05	0.03	0.4	4	b
23	0.4	44	½, 4 in. diam.	tr	0.04	0.02	0.2	40	b
24	...	81	....	tr	0.03	0.02	0.2	30	b
25	...	41	⅜ cup	tr	0.03	0.02	0.2	35	b
26	0	99	½ cup	......	....	....	...	...	...
27	...	74	¾x1¾x4 in.	f	....	f	...	...	a
28	...	121	¾x1¾x4 in.	f	....	....	...	...	ma
29	...	236	¼x3x4½ in.	f	....	f	...	...	ma
30	...	340	¼x3x4½ in.	0	0.96	0.19	4.1	0	...
31	...	384	¼x3x4½ in.	0	0.78	0.19	3.8	0	ma
32	...	126	1x2x3 in.	0	0.54	0.90	6.8	14	...
33	...	714	½ cup	......	....	....	...	...	...
34	...	357	....	0	0.15	0.05	0.9	0	...
35	...	49	½ cup	......	....	....	...	...	...
36	...	319	....	0	tr	0.04	0.2	4	...
37	0	210	⅝ cup	g	....	....	...	...	lb
38	...	288	....	10	0.02	0.02	0.2	6	..
39	0	261	....	10	0.02	0.02	0.2	4	n
40	...	50	....	7540	0.12	0.35	0.8	115	...
41	...	125	½ cup, diced	g	....	g	g	f	ma
42	...	230	½x4x4 in.	0	0.21	0.26	5.9	0	ma
43	...	290	½x4x4 in.	0	0.18	0.23	5.2	0	...
44	...	230	½x4x4 in.	0	0.21	0.26	5.9	0	ma
45	0	930	10 tablespoons	0	0	0	0	0	n
46	0.9	44	1 lemon	0	0.04	tr	0.1	45	lb
47	2.0	357	3 cups	g	....	g	...	...	la
48	0.7	18	⅜ head	540	0.06	0.07	0.2	8	...
49	0.7	18	....	1620	0.06	0.07	0.2	18	...
50	0.9	53	1½ limes	0	0.04	tr	0.1	27	...
51	...	131	½x3x6 in.	19200	0.27	2.80	16.1	31	ma
52	...	124	½x3x6 in.	......	....	....	...	...	...
53	...	83	⅔ cup	......	....	....	...	...	a
54	1.4	69	1⅙ cup	......	....	....	...	g	b
55	...	360	....	0	0.13	0.08	2.1	0	...
56	...	69	½ cup	......	....	....	...	...	...

‡ Whole-grain flour has approximately 0.61 mg thiamine; 0.16 mg riboflavin; and 4.2 mg niacin per 100 g.

No.	Food item, edible portion	% Water	% Protein	% Fat	% Carbohydrate	Ash, mg/100g		
						Ca	P	Fe
1	Mackerel (f)	77	18.7	7.1	0	20	213	0.8
2	Maple sugar	....	....	0	82.8	110	9.2	3
3	syrup	....	....	0	71.4	110	13	3
4	Marmalade	28	0.5	0.3	70.8	12	12	0.3
5	Mayonnaise	16	1.5	78	3.0	19	60	1.0
6	Milk, whole‡	87.0	3.5	3.9	4.9	118	93	0.1
7	whole, dry	3.5	25.8	26.7	38.0	949	728	0.6
8	skim	90.5	3.5	0.1	5.1	118	93	0.1
9	skim, dry	3.5	35.6	1.0	52.0	1300	1030	0.6
10	evaporated, unsweetened	73.7	7.0	7.9	9.9	243	195	0.2
11	condensed, sweetened	27.0	8.1	8.4	54.8	273	228	0.2
12	chocolate flavored	83.0	3.2	2.2	10.6	109	91	0.1
13	human	87.6	1.5	3.3	6.5	....	....	....
14	Molasses, cane	24	2.4	0	60	273	51	6.7
15	Mushrooms	90	3.5	0.4	6.0	17	108	3.1
16	Mustard greens	92.2	2.3	0.3	4.0	220	38	2.9
17	Noodles	9.1	14.3	5.0	70.6	24	156	1.9
18	cooked	78	2.0	2.9	16.5	....	....	....
19	Oatmeal	8.3	14.2	7.4	68.2	54	365	5.2
20	cooked	85	2.8	0.5	11.5	11	65	0.6
21	Okra	89.8	1.8	0.2	7.4	82	62	0.7
22	Oleomargarine§	15.5	0.6	81	0.4	2	15	0.2
23	Olives, green	75.2	1.5	13.5	4.0	101	15	2.0
24	ripe	....	1.4	21.0	3.5	....	....	....
25	Olive oil	0	0	100	0	....	....	....
26	Onions, mature	87.5	1.4	0.2	10.3	32	44	0.5
27	dehydrated	9.9	10.1	1.0	75.2	158	256	3.1
28	Oranges	87.2	0.9	0.2	11.2	33	23	0.4
29	juice	86	0.6	0.1	12.9	33	23	0.4
30	Oysters, solids & liquor	87.1	6.0	1.2	3.7	68	172	7.1
31	stew	....	4.8	6.3	7.2	140	25	0.8
32	Parsley	....	....	....	....	....	....	19.2
33	Parsnips	78.6	1.5	0.5	18.2	57	80	0.7
34	Peaches (f)	86.9	0.5	0.1	12.0	8	22	0.6
35	canned	80.9	0.4	0.1	18.2	5	14	0.4
36	dried, sulfured	24	3.0	0.6	69.4	44	126	6.9
37	Peanuts, roasted	2.6	26.9	44.2	23.6	74	393	1.9
38	Peanut butter	1.7	26.1	47.8	21.0	74	393	1.9
39	Pears (f)	82.7	0.7	0.4	15.8	13	16	0.3
40	canned	81.1	0.2	0.1	18.4	8	10	0.2
41	Peas (f)	74.3	6.7	0.4	17.7	22	122	1.9
42	canned	82.3	3.4	0.4	12.9	25	67	1.8
43	(d), cooked	77	6.6	0.3	15.8	22	108	1.5
44	(d), split	10.0	24.5	1.0	61.7	73	397	6.0
45	Pecans	3.0	9.4	73.0	13.0	74	324	2.4
46	Peppers, green (f)	92.4	1.2	0.2	5.7	11	25	0.4
47	Pickles, cucumber	95.2	0.5	0.2	1.9	24	22	0.9
48	Pie, apple	....	2.9	9.6	42.0	11	22	1.9
49	cream	....	2.8	9.8	31.0	20	38	0.5
50	custard	....	4.2	6.3	26.1	140	160	1.2
51	lemon meringue	....	3.6	10.1	37.4	14	38	0.6
52	mince	....	5.8	12.3	38.1	83	170	2.5
53	pumpkin	....	4	5.4	34	54	81	0.8
54	Pineapple (f)	85.3	0.4	0.2	13.7	16	11	0.3
55	canned	78.0	0.4	0.1	21.1	29	7	0.6

‡ See also special tables.
§ With vitamin A added.

No.	% Fiber	Kg-cal per 100 g	100 g Portion	Vitamin					Reac.
				A	Thi.	Rib.	Nia.	Asc.	
1	...	139	1x2x3 in.	g	....	....	...	...	ma
2	0	340	...	......	....	....	...	...	n
3	0	293	...	......	....	....	...	...	n
4	...	288	...	10	0.02	0.02	0.2	6	...
5	0	720	½ cup	210	0.04	0.04	0	0	la
6	0	69	⅜ cup	160	0.04	0.17	0.1	1	lb
7	0	496	...	1400	0.30	1.46	0.7	6	...
8	0	35	⅜ cup	tr	0.04	0.18	0.1	1	lb
9	0	359	...	40	0.35	1.96	1.1	7	...
10	0	139	...	400	0.05	0.36	0.2	1	lb
11	0	327	...	430	0.05	0.39	0.2	1	lb
12	0	75	...	90	0.03	0.16	0.1	0	...
13	0	62	...	r	....	f	...	...	b
14	0	240	5½ tablespoons	0	0.08	0.16	2.8	0	...
15	0.8	42	½ cup (c)	......	....	....	...	...	lb
16	...	28	...	6460	0.09	0.20	0.8	102	...
17	...	385	...	200	0.13	0.12	2.1	0	a
18	...	92	½ cup	......	....	....	...	...	...
19	1.3	396	1⅓ cups	0	0.55	0.14	1.1	0	la
20	0.2	62	½ cup	g	....	f	...	g	...
21	...	39	...	740	0.12	0.10	0.7	30	...
22	0	733	7 tablespoons	1980†	0	0	0	0	n
23	...	144	...	420	tr	....	...	...	b
24	...	209	20	g	....	....	...	...	b
25	0	900	½ cup	f	....	....	...	...	n
26	0.8	49	3 medium size	50	0.03	0.02	0.1	9‡	lb
27	...	350	...	20	0.23	0.15	1.1	37	...
28	0.6	50	1, 2½ in. diam.	190	0.08	0.03	0.2	49	lb
29	0	55	⅜ cup	100	0.07	0.02	0.2	42	lb
30	...	50	...	......	0.18	0.23	1.2	...	ma
31	...	102	...	g	....	f	...	...	la
32	...	...	5 in. bunch	......	....	....	...	...	...
33	2.5	83	½ cup	0	0.11	0.09	0.2	18	mb
34	0.6	51	1 medium size	880	0.02	0.05	0.9	8	lb
35	...	75	½ peach	450	0.01	0.02	0.7	4	lb
36	...	295	...	3250	0.01	0.20	5.4	19	...
37	2.5	600	¾ cup	0	0.30*	0.16	16.2	0	la
38	2.4	619	6 tablespoons	0	0.20	0.16	16.2	0	...
39	2.7	70	1 medium size	20	0.02	0.04	0.1	4	...
40	1.5	75	2 halves + 3 tbs juice	tr	0.01	0.02	0.1	2	lb
41	1.7	101	¾ cup	680	0.36	0.18	2.1	26	lb
42	...	69	...	540	0.11	0.06	0.9	8	lb
43	1.2	93	½ cup	......	..	....	...	...	...
44	4.4	354	½ cup	370	0.87	0.29	3.0	2	lb
45	...	747	⅞ cup	50	0.72	0.11	0.9	2	...
46	...	29	1 large size	630	0.07	0.04	0.4	120	...
47	0.7	11	1, 1¾x3 in.	190	0.01	0.02	tr	7	...
48	0.8	266	⅑ of 9 in. diam.	0	0.05	0.04	0.4	0	b
49	0	233	⅐ of 9 in. diam.	0	0.03	0.08	0.2	0	...
50	0	183	...	g	....	....	...	...	a
51	0	262	...	g	....	g	...	f	a
52	...	308	...	g	....	....	...	...	a
53	...	200	...	e	....	....	...	...	a
54	0.4	58	⅔ cup, diced	130	0.08	0.02	0.2	24	lb
55	0.4	87	½ cup, diced	80	0.07	0.02	0.2	9	b

† Plain oleomargarine is considered to have no vitamin A value.
‡ Green bunching onions contain about 23 mg ascorbic acid per 100 gm.
* Without skins; with skins thiamine value is higher.

No.	Food item, edible portion	% Water	% Protein	% Fat	% Carbohydrate	Ash, mg/100g Ca	P	Fe
1	Pineapple juice (c)	86.2	0.3	0.1	13.0	15	8	0.5
2	Plums (f)	85.7	0.7	0.2	12.9	17	20	0.5
3	canned	78.6	0.4	0.1	20.4	8	12	1.1
4	Popcorn, popped	5	10.7	5.0	78.7	....	....	....
5	Pork, chops, lean	60	20.3	19.0	0	12	180	2.5
6	chops, med. fat	52	16.6	31.0	0	10	140	1.3
7	loin	58	16.4	25	0	10	177	2.5
8	spareribs	53	14.6	32	0	8	157	2.2
9	salt, fat	8	3.9	85	0	2	42	0.6
10	sausage, links	41.9	10.8	44.8	0	6	116	1.6
11	Potato	77.8	2.0	0.1	19.1	11	56	0.7
12	baked	72	3.1	0.12	25.4	18	73	1.1
13	boiled	77	2.5	0.1	20.3	14	58	0.9
14	chips	4	9.0	40.0	46.5	35	160	4
15	desiccated	7.2	7.1	0.7	82.0	25	103	3.7
16	fried	70	2.3	8.6	18.3	12	54	1.2
17	mashed	75	2.5	4.6	18.0	125	59	1.0
18	sweet, baked	68.5	1.8	0.7	27.9	30	49	0.7
19	sweet, desiccated	5.3	5.1	0.9	86.1	76	75	2.3
20	soup	....	3.2	3.6	10	120	99	0.5
21	Prunes (d), cooked	....	0.8	0	29.3	22	1	2.1
22	(d), unsulfured	24	2.3	0.6	71.0	54	85	3.9
23	Puffed rice	8.8	7.2	0.4	82.6	9	92	0.9
24	wheat	6.2	11.9	1.5	77.7	33	353	3.7
25	Pumpkin (f)	90.5	1.2	0.2	7.3	21	44	0.8
26	canned	90.2	1.0	0.3	7.9	20	36	0.7
27	Quinces	84	0.3	0.1	13.9	....	....	1.0
28	Radishes	93.6	1.2	0.1	4.2	37	31	1.0
29	Raisins (d), unsulfured	24	2.3	0.5	71.2	78	129	3.3
30	Raspberries (f), black	....	1.5	1.6	15.6	49	52	1.0
31	(f), red	....	1.1	0.6	14.4	49	52	1.0
32	Rhubarb (f)	94.9	0.5	0.1	3.8	51*	25	0.5
33	Rice, brown	12.0	7.5	1.7	77.7	39	303	5.5
34	white	12.3	7.6	0.3	79.4	9	92	0.7
35	polished, cooked	....	2.2	0.1	22.5	2	24	0.2
36	pudding	....	4.0	4.6	31.4	41	42	0.2
37	Rutabagas	89.1	1.1	0.1	8.9	55	41	0.4
38	Salad dressing	44.7	1.1	36.8	13.9	9	30	0.4
39	French	38.3	0.8	39	17.3	5	5	0.1
40	mayonnaise	16	1.5	78	3.0	19	60	1.0
41	Thousand Island	50	3.3	43	3.3	43	84	1.4
42	Salad oil	0	0	100	0	0	0	0
43	Salmon (f)	66	22.0	12.3	0	24	253	0.8
44	canned	67.4	20.6	9.6	0	67	286	1.3
45	Sardines‡	57.4	25.7	11.0	1.2	35	365	1.8
46	Sardines§	47.1	21.1	27	1.0	29	299	1.5
47	Sauerkraut (c)	93.2	1.1	0.2	3.4	46	31	0.5
48	Shredded wheat	7.7	10.4	1.4	78.7	38	385	3.8
49	Shrimp (c)	78.3	17.8	0.8	0.8	75	210	2.0
50	Sirup, table blends	25	0	0	74	46	16	4.1
51	Soybeans (d), whole	7.5	34.9	18.1	12.0#	227	586	8.0
52	Spaghetti	11	13	1.4	73.9	22	144	1.2
53	cooked	83.5	2.2	0.1	13.7	4	25	0.2
54	Spinach (f)	92.7	2.3	0.3	3.2	81*	55	3.0

* May not be available because of presence of oxalic acid.
‡ Canned in oil, drained solids.
§ Canned in oil, total contents of can.
# Available carbohydrate.

No.	% Fiber	Kg-cal per 100 g	100 g Portion	Vitamin					Reac.
				A	Thi.	Rib.	Nia.	Asc.	
1	...	54	⅜ cup	80	0.05	0.02	0.2	9	...
2	0.5	56	3 medium size	350	0.15	0.03	0.6	5	a
3	...	84	...	230	0.03	0.03	0.4	1	...
4	...	403	9 cups	...	...	...	...	...	...
5	...	253	1 chop, ½ in. thick	f	...	f	...	...	ma
6	...	337	1 chop, ½ in. thick	f	...	f	...	...	ma
7	...	291	...	0	1.04	0.20	4.4	0	...
8	...	346	...	0	0.92	0.18	3.9	0	...
9	0.5	781	10 sl., ½x1½x3 in.	0	0.18	0.04	0.9	0	...
10	...	446	2⅕ links, 3x3¼ in.	0	0.22	0.15	2.3	0	...
11	...	85	...	20	0.11	0.04	1.2	17	...
12	0.4	115	1¼, 2½ in. diam.	...	...	...	...	...	...
13	0.4	92	1, 2½ in. diam.	g	...	...	...	f	lb
14	...	580	50 large chips	...	...	...	...	...	...
15	...	363	...	0	0.25	0.10	4.8	26	...
16	0.3	160	½ cup	...	...	...	...	...	...
17	0.3	123	½ cup	...	...	...	...	...	...
18	...	125	1¼, 2½ in. diam.	7700†	0.10	0.06	0.7	22	lb
19	...	373	...	21900	0.18	0.14	1.9	34	...
20	...	85	...	f	...	...	...	...	lb
21	1.3	122	4 prunes + 3 tbs juice	e	...	g	...	f	a
22	...	299	...	1890	0.10	0.16	1.7	3	...
23	...	363	...	0	0.05	0.03	1.4	0	la
24	...	372	...	0	0.15	0.12	4.2	0	la
25	1.2	36	½ cup cooked	3400	0.05	0.08	0.6	8	lb
26	...	38	½ cup	3400	0.02	0.06	0.5	0	lb
27	1.8	58	⅔ med. size	...	...	...	...	...	...
28	0.7	22	10, 1 in. diam.	30	0.04	0.04	0.1	24	lb
29	1.8	298	¾ cup	50	0.15	0.08	0.5	tr	hb
30	3.5	83	1⅙ cup	...	...	...	...	g	lb
31	2.8	67	1 cup	...	...	...	...	...	...
32	0.7	18	½ cup, cooked	30	0.01	...	0.1	9	mb
33	...	356	...	0	0.29	0.05	4.6	0	...
34	...	351	...	0	0.05	0.03	1.4	0	...
35	0.1	100	½ cup	...	...	...	...	...	la
36	...	182	...	...	...	...	...	...	lb
37	1.3	41	½ cup, cooked	330	0.06	0.06	0.5	36	mb
38	0	391	½ cup	140	0.02	0.03	0	0	...
39	0	423	½ cup	0	0	0	0	0	n
40	0	720	½ cup	210	0.04	0.04	0	0	la
41	...	413	½ cup	f	...	f	...	...	a
42	0	900	7 tablespoons	0	0	0	0	0	...
43	...	203	¾x3x4 in.	g	...	...	f	...	ma
44	...	169	...	80*	0.03	0.18	6.5	0	...
45	...	207	...	290	0.06	0.12	5.2	0	ma
46	...	331	...	710	0.05	0.10	4.3	0	...
47	...	20	⅔ cup	tr	0.03	0.20	0.2	18[a]	b
48	1.7	369	3⅓ biscuits	0	0.20	0.14	4.2	0	a
49	...	82	...	60	0.01	0.03	1.9	0	a
50	0	296	6 tablespoons	0	0	0.01	0.1	0	...
51	4.4	351	½ cup	110	1.14	0.31	2.1	tr	...
52	...	360	...	0	0.13	0.08	2.1	0	a
53	...	66	½ cup	...	...	...	...	...	...
54	...	25	...	9420	0.12	0.24	0.7	59	hb

† Pale colored varieties much lower.

* Based on pink salmon; red variety may be several times higher.

[a] Drained solids only.

No.	Food item, edible portion	% Water	% Protein	% Fat	% Carbohydrate	Ash, mg/100g		
						Ca	P	Fe
1	Spinach, canned	92.3	2.3	0.4	3.0	90*	33	1.6
2	Squash, summer	95.0	0.6	0.1	3.9	15	15	0.4
3	winter	88.6	1.5	0.3	8.8	19	28	0.6
4	Strawberries (f)	90.0	0.8	0.6	8.1	28	27	0.8
5	canned	....	0.7	....	24	....	....	....
6	Sugar, granulated	0.5	0	0	99.5	0	0	0.1
7	brown	3	0	0	95.5	76[a]	37[a]	2.6
8	maple	....	....	....	82.8	110	9.2	3
9	Sweetbreads	72	16.8	12.1	0	....	....	....
10	Tangerines	87.3	0.8	0.3	10.9	33	23	0.4
11	Tapioca	12.6	0.6	0.2	86.4	12	12	1.0
12	cooked	....	0.1	0	13.7	4	14	0.3
13	Tomato (f)	94.1	1.0	0.3	4.0	11	27	0.6
14	canned	94.2	1.0	0.2	3.9	11	27	0.6
15	juice	93.5	1.0	0.2	4.3	7	15	0.4
16	puree	89.2	1.8	0.5	7.2	11	37	1.1
17	catsup	69.5	2.0	0.4	24.5	12	18	0.8
18	Tuna fish (c) †	57.7	27.7	11.8	0	34	290	1.7
19	Turkey, light, cooked	....	34.6	4.9	0	21	373	....
20	dark, cooked	....	39.2	4.3	0	23	423	....
21	medium fat	58.3	20.1	20.2	0	23	320	3.8
22	Turnips	90.9	1.1	0.2	7.1	40	34	0.5
23	Turnip greens	89.5	2.9	0.4	5.4	259	50	2.4
24	Veal, chops, med. fat	69	19.2	11	0	11	207	2.9
25	cutlet	70	19.5	9	0	11	210	2.9
26	roast	68	19.1	12.2	0	11	206	2.9
27	stew meat	64	18.3	17	0	11	197	2.7
28	Vegetable soup	....	2.9	....	0.5	....	....	....
29	Walnuts, black	6	27.6	56.3	10.0	....	....	6
30	English	3.3	15.0	64.4	15.6	83	380	2.1
31	Watercress	95	0.7	0.5	3.7	187	5	7.2
32	Watermelons	92.1	0.5	0.2	6.9	7	12	0.2
33	Wheat germ	11.0	25.2	10.0	49.5	84	1096	8.1
34	Whitefish	71	22.9	6.5	0	25	263	0.4
35	Yeast (d), brewer's	7.0	46.1	1.6	37.4	106	1893	18.2
36	compressed, baker's	70.9	13.3	0.4	13.0	25	605	4.9
37	Zwieback	6	9.8	9.9	73.5	53	140	1.6

* May not be available because of presence of oxalic acid.

[a] Based on dark brown sugar; lower values for light brown sugar.

† Drained solids.

No.	% Fiber	Kg-cal per 100 g	100 g Portion	Vitamin					Reac.
				A	Thi.	Rib.	Nia.	Asc.	
1	0.9	25	⅓ cup	6790	0.02	0.08	0.3	14	...
2	...	19	...	260	0.04	0.05	1.1	17	...
3	0.8	44	½ cup, mashed	4950	0.05	0.08	0.6	8	b
4	1.2	41	1 cup	60	0.03	0.07	0.3	60	b
5	...	99	½ cup	g	....	....	...	f	b
6	0	398	⅔ cup	0	0	0	0	0	n
7	0	382	⅔ cup	......	....	....	...	...	n
8	...	340	...	......	....	....	...	...	n
9	...	176	...	......	....	....	...	...	...
10	0.4	50	...	420	0.07	0.03	0.2	31	b
11	...	350	...	......	....	....	...	...	n
12	...	57	⅓ cup	......	....	....	...	...	...
13	0.6	23	1 medium size	1100	0.06	0.04	0.6	23	lb
14	0.5	21	½ cup	1050	0.05	0.03	0.7	16	lb
15	0	23	...	1050	0.05	0.03	0.7	16	lb
16	...	40	...	1880	0.09	0.07	1.8	28	lb
17	...	110	...	1880	0.09	0.07	2.2	11	...
18	...	217	...	70	0.04	0.13	10.6	0	a
19	...	183	2 sl., ¼x3x3½ in.	......	....	....	...	...	...
20	...	196	2 sl., ¼x3x3½ in.	......	....	....	...	...	...
21	...	262	...	tr†	0.12†	0.19†	7.9†	...	a
22	1.3	35	½ cup, cooked	tr	0.06	0.06	0.5	28	lb
23	...	37	½ cup, cooked	9540	0.10	0.56	0.8	136	...
24	...	176	1, ⅔ in. thick	0	0.18	0.27	6.3	0	ma
25	...	159	...	0	0.18	0.28	6.4	0	...
26	...	186	...	0	0.17	0.27	6.3	0	ma
27	...	226	...	0	0.17	0.26	6.0	0	...
28	...	15	...	g	....	g	...	...	lb
29	1.7	657	½ cup, chopped	f	....	....	...	...	...
30	...	702	½ cup, chopped	30	0.48	0.13	1.2	3	la
31	...	22	3 cups	g	....	g	g	f	b
32	0.6	31	1½x2½x2½ in.	590	0.05	0.05	0.2	6	b
33	...	389	...	0	2.05	0.80	4.6	0	...
34	...	150	1x2x3 in.	f	....	....	...	...	...
35	...	348	...	0	9.69	5.45	36.2	0	...
36	...	109	6½ cakes	0	0.45	2.07	28.2	0	...
37	...	422	...	......	....	....	...	...	la

† Vitamin values based on muscle meat only.

RECOMMENDED DAILY DIETARY ALLOWANCES

Revised 1948, Food and Nutrition Board, National Research Council

	Calories[1]	Protein g	Ca g	Fe mg	Vitamin					
					A[2] IU	Thi.[3] mg	Rib.[3] mg	Nia.[3] mg	Asc. mg	D IU
Man (154 lb, 70 kg)										
Sedentary	2400	70	1.0	12[4]	5000	1.2	1.8	12	75	[5]
Physically active	3000	70	1.0	12[4]	5000	1.5	1.8	15	75	[5]
With heavy work	4500	70	1.0	12[4]	5000	1.8	1.8	18	75	[5]
Woman (123 lb, 56 kg)										
Sedentary	2000	60	1.0	12	5000	1.0	1.5	10	70	[5]
Moderately active	2400	60	1.0	12	5000	1.2	1.5	12	70	[5]
Very active	3000	60	1.0	12	5000	1.5	1.5	15	70	[5]
Pregnancy (latter half)	2400[6]	85	1.5	15	6000	1.5	2.5	15	100	400
Lactation	3000	100	2.0	15	8000	1.5	3.0	15	150	400
Children up to 12 yrs[7]										
Under 1 yr[8]	110/2.2 lb (1 kg)	3.5/2.2 lb (1 kg)	1.0	6	1500	0.4	0.6	4	30	400
1–3 yrs (27 lb, 12 kg)	1200	40	1.0	7	2000	0.6	0.9	6	35	400
4–6 yrs (42 lb, 19 kg)	1600	50	1.0	8	2500	0.8	1.2	8	50	400
7–9 yrs (58 lb, 26 kg)	2000	60	1.0	10	3500	1.0	1.5	10	60	400
10–12 yrs (78 lb, 35 kg)	2500	70	1.2	12	4500	1.2	1.8	12	75	400
Children over 12 yrs[7]										
Girls, 13–15 yrs (108 lb, 49 kg)	2600	80	1.3	15	5000	1.3	2.0	13	80	400
16–20 yrs (122 lb, 55 kg)	2400	75	1.0	15	5000	1.2	1.8	12	80	400
Boys, 13–15 yrs (108 lb, 49 kg)	3200	85	1.4	15	5000	1.5	2.0	15	90	400
16–20 yrs (141 lb, 64 kg)	3800	100	1.4	15	6000	1.7	2.5	17	100	400

[1] Allowances must be adjusted to meet specific needs. The proper allowance is that which over an extended period will maintain body weight or growth at the level most conducive to well-being.

[2] Allowance depends on relative amounts of vitamin A and carotene. Values in the table are based on the premise that approximately two-thirds of the vitamin A is contributed by carotene and that carotene has half or less than half the value of vitamin A.

[3] For adults (except pregnant and lactating women) receiving 2000 calories or less, the allowances of thiamin and niacin may be 1 mg and 10 mg respectively. Other members of the B complex also are required, though no values can be given. Foods with adequate thiamin, riboflavin, and niacin will tend to supply sufficient of remaining B vitamins.

[4] Male adults need relatively little. The need will usually be provided for if the diet is satisfactory in other respects.

[5] Vigorous adults leading a normal life need no supplemental amounts. Ingestion of small supplemental amounts is desirable for persons shielded from sunlight and for elderly persons.

[6] For pregnant, sedentary women. During the latter part of pregnancy a 20% increase is recommended.

[7] Allowances are based on needs for the middle year (2, 5, 8, etc.), for moderate activity, and for average weight.

[8] Needs increase from month to month; amounts given are for approximately 6 to 8 months. Requirements for protein and calcium are less if derived largely from human milk.

RECOMMENDED DAILY DIETARY ALLOWANCES

Fat. Allowances must be based at present more on food habits than on physiological requirements. It is desirable that fat be included in the diet to the extent of at least 20 to 25% of the total calories and that fat intake include essential unsaturated fatty acids (the linoleic and arachidic acids of natural fatty acids) to the extent of at least 1% of the total calories. For a very active person consuming 4500 calories and for children and for adolescent persons, it is desirable that 30 to 35% of the total calories be derived from fat. Since foodstuffs such as meat, milk, cheese, nuts, etc., contribute fat to the diet, it is necessary to use separated or "visible" fats such as butter, oleomargarine, lard, or shortenings to supply only one-third to one-half the amounts indicated.

Water. A suitable allowance for adults is 2.5 liters (2.5 quarts) daily. An ordinary standard is one milliliter for each calory of food. Most of this quantity is contained in prepared foods. At work or in hot weather, requirements may reach 5 to 13 liters daily. Water should be allowed *ad libitum*, since sensations of thirst usually serve as adequate guides to intake except for infants and sick persons.

Salt. The needs for salt and for water are closely interrelated. The average normal intake of sodium chloride is 10 to 15 grams daily, an amount which meets the requirements for a water intake up to 4 liters daily. When sweating is excessive, one additional gram of salt should be consumed for each liter of water in excess of 4 liters daily. With heavy work or in hot climates 20 to 30 grams daily may be consumed. Even then, most persons do not need more salt than usually occurs in prepared foods. After acclimatization persons produce sweat that contains only about 0.5 grams to the liter in contrast with a content of 2 to 3 grams for sweat of the unacclimatized person; after acclimatization the need for increase of salt beyond that of ordinary food disappears.

Iodine. The requirement for iodine is probably about 0.002 to 0.004 mg daily for each kg of body weight. This need is met by the regular use of iodized salt; its use is especially important in adolescence and pregnancy.

Phosphorus. The allowances should be at least equal to those for calcium in the diets of children and of women during the latter part of pregnancy and during lactation. In the case of other adults the allowances should be approximately 1.5 times those for calcium. In general it is safe to assume that if the calcium and protein needs are met through common foods, the phosphorus requirement also will be covered because the common foods richest in calcium and protein are also the best sources of phosphorus.

Copper. The requirement for adults is about 1 to 2 mg daily. Infants and children require approximately 0.05 mg for each kg of body weight. A good diet normally will supply sufficient copper.

Vitamin K. The requirement usually is satisfied by any good diet except for the infant in utero and for the first few days after birth. Supplemental vitamin K is recommended during the last month of pregnancy. When it has not been given in this manner, it is recommended for the mother preceding delivery or for the baby immediately after birth.

Folic acid (pteroylglutamic acid, vitamin B_c, L. casei factor or vitamin M). The quantitative requirement cannot be closely estimated from evidence now available.

THE VITAMINS

In compiling data for this revision certain facts became evident in making additions to the previous table. Some of the new factors which have now been added have not as yet been shown to be indispensible to man. The importance of some are only now being recognized and clinical experimentation is practically just beginning. However, it is known that the animal body does not function properly where the intake of these factors is low. Some of these factors have been shown to be synthesized in the intestines of some animals by the intestinal flora and consequently it is very difficult to produce a recognizable deficiency. Almost invariably a deficiency of any factor in man is accompanied by a deficiency of other factors and this gives the chief impetus to preparation of poly-vitamin products. Thus far no factor essential for lower animals, bacteria, etc., has been found which is not also essential for man. Some signs of deficiencies are apparently attributable to more than one vitamin. Some deficiencies are only partially cured by one or another vitamin while complete cure is obtained only by administration of all vitamins concerned. Most of the vitamins are interdependent upon the presence of each other for proper functioning.

INTERNATIONAL VITAMIN STANDARDS

1 Unit vitamin A $\approx$ 0.6 microgram (μg) or 0.6γ of β-carotene.
1 Unit vitamin B_1 $\approx$ 3.3 micrograms thiamin chloride.
1 Unit vitamin C $\approx$ 50 micrograms of *l*-ascorbic acid.
1 Unit vitamin D $\approx$ 1 milligram of standard solution of irradiated ergosterol (corresponding to 0.1 microgram of the ergosterol used in its preparation or 0.025 microgram crystalline vitamin D_2 (viosterol or calciferol).

Name and Synonym	Physiological Effect	Sources *		
		Concentrates for Medicinal Use	Plant	Animal
Vitamin A Axerophthol Provitamins A (α-, β-, and γ-carotenes, cryptoxanthin, aphanin, aphanicin, echinenone, myxoxanthin, leprotene (and probably other carotinoids) Anti-infective Anti-ophthalmic (Fat soluble)	Increases resistance to infection of eyes, sinuses, ears, kidneys, skin, and mucous membranes. Prevents xerophthalmia, hyperkeratosis of skin and mucous membranes. Promotes appetite and growth. Essential for reproduction. The vitamin is stored in the body and is required at all ages. Deficiency results in night blindness and injury to the nervous system. Adult human requirements approximately 3000 to 5000 units daily.	Carotene, obtained from carrots or vegetables, is converted by the body into vitamin A. Unsaponifiable fractions of halibut liver oil, cod liver oil and other fish liver oils.	All yellow and green vegetables. Raw carrots, yellow turnips, yellow corn, spinach, squash, canned and fresh tomatoes, sweet potatoes, oranges, prunes, apricots and pimento peppers.	Halibut liver oil, cod liver oil and other fish liver oils, fresh milk, cream, butter, cheddar and cream cheese, egg yolk, liver and kidney.
Thiamin chloride Vitamin B_1 Anti-neuritic Anti-beriberi	Promotes appetite and digestion by stimulating metabolism. Vital to health at all ages. Required by the mother for reproduction and lactation. Prevents the diseases beriberi and	Synthetic thiamine chloride. From yeast and wheat germ.	Whole grain cereals, green leafy vegetables, water cress, carrots, canned tomatoes, green	Milk, cheese, raw oysters, brain, kidney and liver.

* See also table: Composition and Use of Foods.

THE VITAMINS (Continued)

(Soluble in water and in 90% alcohol; heat labile; acid stable; adsorbed from acid solution)	polyneuritis. Promotes normal oxidation of carbohydrates in the body and formation of fat from carbohydrates. Adult human requirements approximately 1.5 to 2.0 milligrams daily.		corn, baked potatoes, dried lima beans, turnips and nuts.	
p-Aminobenzoic acid PAB Chromotrichia factor Anti-gray-hair factor	Influences enzyme activity. In experimental rats it apparently prevents achromotrichia. Inhibits oxidation of adrenaline. Nutrilite for certain bacteria. Antagonizes sulfanilamide and sulfapyridine.	Synthetic. Extracts of yeast.	Yeast.	Widely distributed over entire plant and animal kingdoms.
Choline (Choline is replaceable by methionine or betaine with estimated efficacy of 30%)	Maintains integrity of tissues. In chickens it is necessary for normal nutrition and egg production. Deficiency results in marked deposition of liver fat. Acts as transmethylating agent. Deficiency in young rats produces severe renal lesions. Important in lipid metabolism. Deficiency causes a type of cirrhosis of the liver, hemorrhagic degeneration of kidneys, necrosis of kidney cortex, enlargement of spleen. Necessary for normal growth and lactation of rat.	Synthetic choline chloride. As lecithin in phospholipids.	Rice bran, yeast.	Liver. Present in phospholipids of practically all animal and plant cells.
Ascorbic acid Vitamin C Cevitamic acid Anti-scorbutic (Soluble in water; heat labile at alkaline reaction)	Prevents and cures scurvy. Important in formation and maintenance of connective tissue in the body; essential for normal tooth and bone formation and strength of capillary walls. Inhibits dental caries, pyorrhea, certain gum infections, anorexia, anemia, failure of wound healing and susceptibility to infection. Important in carbohydrate metabolism and in controlling infective processes. Body stores readily depleted. Adult human requirements 75 to 100 milligrams daily.	Synthetic *l*-ascorbic acid.	Oranges, lemons, grapefruit, raw and leafy vegetables, raw apples, tomatoes, carrots and paprika.	Adrenal cortex, pituitary, ovary, thymus, intestinal wall, and milk.
Vitamin D Anti-rachitic (Fat soluble)	Prevents and cures rickets in young and osteoporosis in adults. Promotes absorption of calcium and phosphorus, and highly important for normal metabolism of these mineral elements in the young. Prevents spasmophilia and osteomalacia. Limited storage in the body. Approximate human requirements: for premature babies 600 to 800 units with milk; for full term infants 300 to 400 units with milk; for children 300 to 400 units and for pregnant and nursing women 800 units daily.	The effect of this vitamin is produced by the exposure of the body to direct sunlight or ultraviolet light. Ergosterol and foods exposed to (or irradiated with) ultraviolet. Unsaponifiable fractions of liver oils of halibut, cod, and many other fish. Cholesterol and several of its derivatives after exposure to ultraviolet light.	Practically none.	Cod, halibut and other fish liver oils, butter, egg yolk, and fish.

THE VITAMINS

Name and Synonym	Physiological Effect	Sources *		
		Concentrates for Medicinal Use	Plant	Animal
Pantothenic acid Pantothen Filtrate factor Factor II Chick anti-dermatitis factor	Prevents dermatitis in chicks. Deficiency may produce lesions in nervous system or endocrine systems, or may involve skin or hair. May play a part in maintaining integrity of nervous tissue. Necessary in treatment of peripheral neuritis along with other B-vitamins. Prevents hemorrhagic adrenals and achromotrichia in rats. Prevents ulcers in intestinal tract. Essential for growth in various experimental animals and plants. Needed for reproduction in chicks and increases egg hatchability.	Synthetic calcium *d*-pantothenate. Liver and yeast extracts.	Rice bran, wheat bran, brewer's yeast, Irish potato, taro root, alfalfa, wheat germ, molasses, peanuts, cabbage, cucumbers, and rolled oats.	Mammalian liver, egg yolk, eggs, canned salmon, whole milk, kidney, heart, spleen, brain, pancreas, tongue, lung, muscle, beef.
Pyridoxin Vitamin B_6 Adermin Factor Y Anti-dermatitis Anti-acrodynia factor (Soluble in water and in dilute alcohol; heat and acid stable)	Deficiency of this vitamin causes dermatitis in rats; anemia in dogs and pigs, and is presumably essential for hemoglobin formation. In experimental animals deficiency produces convulsions resembling human epileptic fits. Requirements proportional to metabolism. Apparently concerned with metabolism of the aminoacids. Deficiency impairs liver function, produces erythrodemic dermatosis, impairs growth.	Synthetic pyridoxin. From the germ and bran of wheat and rice; yeast, and liver extracts.	Grains, chiefly in the germ, yeast, maize, and molasses, seeds, legumes, spinach, and lettuce.	Liver, heart muscles, milk, and egg yolk.
Riboflavin Vitamin B_2 Vitamin G (Soluble in water and in dilute alcohol; heat and acid stable)	Plays an important role in vision mechanism. In fowls important in production and hatchability of eggs. Deficiency produces cheilosis, glossitis, seborrheic lesions about eyes and nose, vascularizing keratitis, and mild photophobia. Is a component of several enzymes. Plays part in metabolism of amino-acids and carbohydrates. Deficiency produces loss of hair, injury to nervous system, failure to grow, yellow liver, anemia and death. Adult human requirements approximately 2 to 3 milligrams daily.	Synthetic *d*-riboflavin. From milk whey, liver and yeast. Fermentation residues.	Fruits, leafy vegetables, soy beans, wheat germ, yeast.	Kidney, liver, milk, eggs.
Vitamin E α-, β-, and γ-Tocopherols Anti-sterility (Fat soluble)	Absence of this vitamin causes sterility in either sex. It is stored in the body to a certain degree. Exerts favorable influence on growth. Limited value in certain cases of muscular dystrophy and amyotropic lateral sclerosis.	Synthetic *dl*-α-tocopherol. Unsaponifiable fraction of wheat germ oil.	Vegetable oils, lettuce, beans, whole wheat, rice, barley, corn, and water cress.	Meat, liver, milk, and eggs.

* See also table: Composition and Use of Foods.

THE VITAMINS (Continued)

Nicotinic acid Niacin Nicotinic acid amide Niacin amide Anti-pellagra Pellagra preventive (P-P) factor	Prevents and cures black tongue in dogs and pellagra in man. Is a component of several enzymes. Influences carbohydrate, protein, water, and heavy metals metabolism. Deficiency produces a certain type of anemia. Adult human requirement approximately 10 to 20 milligrams daily.	Synthetic nicotinic acid, its amide, and all hydrolyzable nicotinoyl derivatives. From liver and yeast.	Yeast, wheat germ, peas, beans, green leafy vegetables.	Liver, lean meat, milk, egg yolk.
Vitamin K Anti-hemorrhagic Coagulation factor Prothrombin factor Phylloquinones Menadione (2-methyl-1, 4-naphthoquinone) (Fat soluble, heat stable, alkali labile)	Promotes normal blood coagulation time. In chicks it prevents intestinal, subcutaneous and intramuscular hemorrhage. Deficiency reduces prothrombin formation, hemorrhagic diathesis in newborn, certain types of hepatic and biliary diseases.	Synthetic K-vitamers; i.e., many related 1,4-naphthoquinones and compounds readily converted to them, most important is 2-methyl-1, 4-naphthoquinone, which replaces commercially the vitamin, and is known commercially as menadione.	All green vegetables and green leaves, tomatoes, oat sprouts, dried carrot tops, hemp-seed oil, cotton-seed oil, soy-bean oil, and bacterial action on rice bran.	Hog-liver fat, egg yolk, bacterial action on casein and fish meal. K_2 from putrefied fish meal.
Biotin Vitamin H Coenzyme R Anti-egg-white factor Curative factor of egg-white injury Bios II Bios II_b Factor X Factor W	Essential in vital economy of animals and in normal pigment metabolism in animals. Important in intermediary metabolism. Prevents dermatitis. Prevents perosis in chicks and fatty livers. Deficiency results in seborrheic desquamative dermatitis, emaciation and death. Nutrilite for certain bacteria and for yeast. It is antagonized by avidin which occurs in egg white.	Synthetic. Extracts of egg yolk, liver, milk-sugar residues, fermentation residues.	Widely distributed in nature. Yeast, seeds, nuts, tomatoes, carrots, corn and other vegetables.	Liver, kidney, pancreas, egg yolk, pork, and milk. Occurs in small amounts in all mammals and birds, tissue of eye only exception found so far.
Inositol (Meso-inositol) Bios I Anti-alopecia factor	Promotes growth, cures baldness in mice, important in fat metabolism, prevents fatty liver, favors growth of yeast and other microorganisms.	Liver extracts. Wheat bran extracts in the form of the hexa-phosphate ester (phytic acid) which on hydrolysis yields inositol.	Citrus fruits, nuts, yeast, various whole cereals and grains.	Muscle, kidney, liver, brain, milk, and eggs.
Folic acid	Nutrilite for yeast and certain bacteria. Anti-anemia factor. Appears to be a growth factor for rats.	Extracts of yeast, milk sugar residue, spinach.	Yeast, mushrooms. Leaves of many plants.	Milk. Present in all animal tissues.
Citrin Vitamin P Permeability vitamin	Promotes tissue and capillary permeability. Prolongs life of scorbutic guinea pigs. Deficiency causes nutritional purpura.	Extracts of citrus fruits.	Citrus fruit juices and the leaves of several plants.	None.

COMPOSITION OF MILK FROM VARIOUS MAMMALS

Mammal	Specific Gravity	Water	Casein	Albumin	Total Proteins	Fat	Sugar	Ash	Total Solids
Ass	1.0320	90.12	0.79	1.06	1.85	1.37	6.19	0.47	9.88
Bitch	1.0350	75.44	....	....	11.17	9.57	3.09	0.73	24.56
Buffalo	1.0350	82.25	....	....	5.05	7.51	4.44	0.75	17.75
Camel	1.0420	86.57	....	....	4.00	3.07	5.59	0.77	13.43
Cow	1.0313	87.27	2.88	0.51	3.39	3.68	4.94	0.72	12.73
Cow colustrum	1.0420	75.07	4.19	12.99	17.18	3.97	2.28	1.53	24.93
Dolphin	....	41.00	....	....	11.00	46.00	1.30	0.60	59.00
Elephant	1.0313	79.30	....	....	2.51	9.10	8.59	0.50	20.70
Goat	1.0305	86.88	2.87	0.89	3.76	4.07	4.64	0.85	13.12
Human	1.0298	87.58	0.80	1.21	2.01	3.74	6.37	0.30	12.42
Llama	1.0340	86.55	....	....	3.90	3.15	5.60	0.80	13.45
Mare	1.0347	90.58	1.30	0.75	2.05	1.14	5.87	0.36	9.42
Rabbit	1.0470	69.50	....	....	12.00	13.50	2.00	2.50	30.50
Rat	....	....	0.9	10.4	11.3	14.8	3.9	1.5	....
Reindeer	....	67.00	8.30	1.50	9.80	17.00	2.80	1.50	33.00
Sheep	1.0355	83.57	4.17	0.98	5.15	6.18	4.17	0.93	16.43
Sow	1.0380	83.94	....	....	7.23	4.55	3.23	1.05	16.06
Commercial products:									
Milk	....	87.17	3.02	0.53	3.55	3.69	4.88	0.71	12.83
Cream	....	65.51	3.61*	....	3.61	26.75	3.52	0.61	34.39
Skimmed milk	....	90.66	3.11*	....	3.11	0.74	4.75	0.74	9.34
Butter milk	....	90.27	4.06*	0.74**	4.06	0.93	3.73	0.67	9.37
Whey	....	93.24	0.85*	0.33**	0.85	0.23	4.77	0.65	6.76

*Per cent casein plus albumin
**Per cent lactic acid

COMPOSITION OF COWS MILK

(According to Van Slyke)

Whole milk = 100
- Water = 87.1
- Solids = 12.9
- 100.0
- Gases — CO_2, N_2, O_2

Fat	3.9
Non-fat	9.0
	12.9

Nitrogen compds.	3.2
Milk sugar	5.1
Ash	0.7
	9.0

Casein	2.5
Albumin	0.7
	3.2

(According to Babcock)

Whole milk = 100

Casein	3.00	Containing nitrogen =	3.8	Solids not fat = 9.1	Total solids = 12.7
Albumin	0.60				
Galactin	0.20				
Fibrin					
Globulin					
	3.80				
Lactose	4.5	=	4.6		
Citric acid	0.1				
	4.6				
Potassium oxide	0.175	Ash =	0.7		
Sodium oxide	0.070				
Calcium oxide	0.140				
Magnesium oxide	0.017				
Ferric oxide	0.001				
Sulfur trioxide	0.027				
Phosphorus trioxide	0.170				
Chloride	0.100				
	0.700				
Olein	Glycerides of insoluble and non-volatile acids	=	3.3	Fat = 3.6	
Palmitin					
Stearin					
Myristin					
Butin (trace)					
Caprylin (trace)	Glycerides of soluble and volatile acids	=	0.3		
Caproin					
Caprinin (trace)					
Butyrin					
Water					= 87.3

STANDARDIZATION OF MILK AND CREAM

Pearson's Square Method. *Univ. of Illinois Bull.* 323

The following procedure is a convenient method for calculating the relative parts by weight of two materials containing the same component but in different amounts which are to be mixed in order to obtain a product in which the component is present in an amount lying between that of the two starting products. Thus, to calculate the relative parts by weight of a 3% butter fat milk and a 40% butter fat cream which would be required in order to obtain 500 pounds of a 5% butter fat milk, proceed as follows: Draw a square and place the number corresponding to the desired % in the center (Fig. 1) and on the two corners at the left place the numbers corresponding to the % of starting materials (Fig. 2); subtract the number in the center of the square from the larger of the two numbers on the left and write this number on the corner diagonally opposite the larger of the numbers on the left (Fig. 3); then subtract the smaller of the two numbers on the left from the number in the center and write the result on the remaining corner (Fig. 4). The two numbers on the right side of the square represent the parts by weight of each of the starting products and which in this example gives the answer that 35/37 of 500 (or 473 pounds) of 3% butter fat milk and 2/37 of 500 (or 27 pounds) of 40% butter fat cream when mixed will give 500 parts of 5% butter fat milk.

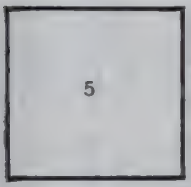


Fig. 1

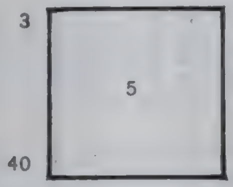


Fig. 2

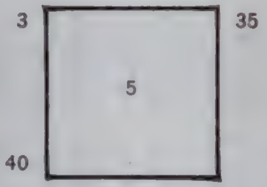


Fig. 3

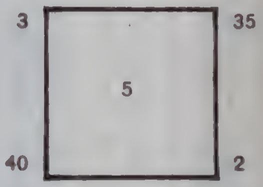


Fig. 4

ICE CREAM INGREDIENTS

Ingredient	Pounds per gallon at 60° F	% Total solids	% Fat	% Non-Fat milk solids
Water	8.3	....	....	.....
Skim milk	8.6	9.3	0.05	9.25
Milk	8.6	13.0	4.0	9.0
18% Cream	8.4	25.5	18.0	7.5
20% Cream	8.4	27.4	20.0	7.4
25% Cream	8.4	31.9	25.0	6.9
30% Cream	8.35	36.4	30.0	6.4
35% Cream	8.3	41.0	35.0	6.0
40% Cream	8.3	45.5	40.0	5.5
45% Cream	8.25	50.0	45.0	5.0
50% Cream	8.2	54.6	50.0	4.6
Condensed whole milk	8.9	27.3	7.9	19.4
3:1 Condensed skim milk	9.3	27.9	0.15	27.75
4:1 Condensed skim milk	9.66	37.1	0.19	36.91
5:1 Condensed skim milk	10.09	46.4	0.23	46.17
3:1 Sweetened skim condensed milk	11.25	71.9	0.15	27.75
3:1 Sweetened whole condensed milk	10.8	72.5	8.8	21.7
Evaporated milk	8.9	25.5	7.8	17.7
Butter	....	84.0	83.0	1.0
Skim milk powder	....	97.2	1.35	95.85
Ice cream mix 13% sugar	9.00	29.0	8.0	8.0
Ice cream mix 15% sugar	9.20	....	....	11.7
Ice cream mix 14% sugar	9.10	....	8.0	10.5

Table showing the per cent total solids in milk corresponding to the per cent of fat and Quevenne lactometer reading.*

To use the table, first find in the column at the extreme left the number correspond-

Per Cent Fat	Quevenne Lactometer Reading at 15.56°C (60°F)										
	25.0	25.5	26.0	26.5	27.0	27.5	28.0	28.5	29.0	29.5	30.0
2.6	9.5	9.6	9.8	9.9	10.0	10.1	10.3	10.4	10.5	10.6	10.8
2.7	9.6	9.8	9.9	10.0	10.1	10.3	10.4	10.5	10.6	10.8	10.9
2.8	9.8	9.9	10.0	10.1	10.3	10.4	10.5	10.6	10.8	10.9	11.0
2.9	9.9	10.0	10.1	10.2	10.4	10.5	10.6	10.7	10.9	11.0	11.1
3.0	10.0	10.1	10.2	10.4	10.5	10.6	10.7	10.9	11.0	11.1	11.2
3.1	10.1	10.2	10.4	10.5	10.6	10.7	10.9	11.0	11.1	11.2	11.4
3.2	10.2	10.4	10.5	10.6	10.7	10.9	11.0	11.1	11.2	11.4	11.5
3.3	10.4	10.5	10.6	10.7	10.9	11.0	11.1	11.2	11.4	11.5	11.6
3.4	10.5	10.6	10.7	10.8	11.0	11.1	11.2	11.3	11.5	11.6	11.7
3.5	10.6	10.7	10.8	11.0	11.1	11.2	11.3	11.5	11.6	11.7	11.8
3.6	10.7	10.8	11.0	11.1	11.2	11.3	11.5	11.6	11.7	11.8	12.0
3.7	10.8	11.0	11.1	11.2	11.3	11.5	11.6	11.7	11.8	12.0	12.1
3.8	11.0	11.1	11.2	11.3	11.5	11.6	11.7	11.8	12.0	12.1	12.2
3.9	11.1	11.2	11.3	11.4	11.6	11.7	11.8	11.9	12.1	12.2	12.3
4.0	11.2	11.3	11.4	11.6	11.7	11.8	11.9	12.1	12.2	12.3	12.4
4.1	11.3	11.4	11.6	11.7	11.8	11.9	12.1	12.2	12.3	12.4	12.6
4.2	11.4	11.6	11.7	11.8	11.9	12.1	12.2	12.3	12.4	12.6	12.7
4.3	11.6	11.7	11.8	11.9	12.1	12.2	12.3	12.4	12.6	12.7	12.8
4.4	11.7	11.8	11.9	12.0	12.2	12.3	12.4	12.5	12.7	12.8	12.9
4.5	11.8	11.9	12.0	12.2	12.3	12.4	12.5	12.7	12.8	12.9	13.0
4.6	11.9	12.0	12.2	12.3	12.4	12.5	12.7	12.8	12.9	13.0	13.2
4.7	12.0	12.2	12.3	12.4	12.5	12.7	12.8	12.9	13.0	13.2	13.3
4.8	12.2	12.3	12.4	12.5	12.7	12.8	12.9	13.0	13.2	13.3	13.4
4.9	12.3	12.4	12.5	12.6	12.8	12.9	13.0	13.1	13.3	13.4	13.5
5.0	12.4	12.5	12.6	12.8	12.9	13.0	13.1	13.3	13.4	13.5	13.6
5.1	12.5	12.6	12.8	12.9	13.0	13.1	13.3	13.4	13.5	13.6	13.8
5.2	12.6	12.8	12.9	13.0	13.1	13.3	13.4	13.5	13.6	13.8	13.9
5.3	12.8	12.9	13.0	13.1	13.3	13.4	13.5	13.6	13.8	13.9	14.0
5.4	12.9	13.0	13.1	13.2	13.4	13.5	13.6	13.7	13.9	14.0	14.1
5.5	13.0	13.1	13.2	13.4	13.5	13.6	13.7	13.9	14.0	14.1	14.2
5.6	13.1	13.2	13.4	13.5	13.6	13.7	13.9	14.0	14.1	14.2	14.4
5.7	13.2	13.4	13.5	13.6	13.7	13.9	14.0	14.1	14.2	14.4	14.5
5.8	13.4	13.5	13.6	13.7	13.9	14.0	14.1	14.2	14.4	14.5	14.6
5.9	13.5	13.6	13.7	13.8	14.0	14.1	14.2	14.3	14.5	14.6	14.7
6.0	13.6	13.7	13.8	14.0	14.1	14.2	14.3	14.5	14.6	14.7	14.8

*See also a table: *Conversion Table for Quevenne and New York Board of Health Lactometer Readings to Specific Gravity*

TOTAL MILK SOLIDS

The percentage of total milk solids may be calculated from the following expression: (A+B+0.14) = % total solids; where A = % butter fat × 1.2; and B = Quevenne lactometer reading × 0.25.

ing to the % of butterfat, then in the same line with this and in the same column as the observed lactometer reading as given across the top of the table will be found the % of total solids.

Quevenne Lactometer Reading at 15.56°C (60°F)											
30.5	31.0	31.5	32.0	32.5	33.0	33.5	34.0	34.5	35.0	35.5	36.0
10.9	11.0	11.1	11.3	11.4	11.5	11.6	11.8	11.9	12.0	12.1	12.3
11.0	11.1	11.3	11.4	11.5	11.6	11.8	11.9	12.0	12.1	12.3	12.4
11.1	11.3	11.4	11.5	11.6	11.8	11.9	12.0	12.1	12.3	12.4	12.5
11.2	11.4	11.5	11.6	11.7	11.9	12.0	12.1	12.2	12.4	12.5	12.6
11.4	11.5	11.6	11.7	11.9	12.0	12.1	12.2	12.4	12.5	12.6	12.7
11.5	11.6	11.7	11.9	12.0	12.1	12.2	12.4	12.5	12.6	12.7	12.9
11.6	11.7	11.9	12.0	12.1	12.2	12.4	12.5	12.6	12.7	12.9	13.0
11.7	11.9	12.0	12.1	12.2	12.4	12.5	12.6	12.7	12.9	13.0	13.1
11.8	12.0	12.1	12.2	12.3	12.5	12.6	12.7	12.8	13.0	13.1	13.2
12.0	12.1	12.2	12.3	12.5	12.6	12.7	12.8	13.0	13.1	13.2	13.3
12.1	12.2	12.3	12.5	12.6	12.7	12.8	13.0	13.1	13.2	13.3	13.5
12.2	12.3	12.5	12.6	12.7	12.8	13.0	13.1	13.2	13.3	13.5	13.6
12.3	12.5	12.6	12.7	12.8	13.0	13.1	13.2	13.3	13.5	13.6	13.7
12.4	12.6	12.7	12.8	12.9	13.1	13.2	13.3	13.4	13.6	13.7	13.8
12.6	12.7	12.8	12.9	13.1	13.2	13.3	13.4	13.6	13.7	13.8	13.9
12.7	12.8	12.9	13.1	13.2	13.3	13.4	13.6	13.7	13.8	13.9	14.1
12.8	12.9	13.1	13.2	13.3	13.4	13.6	13.7	13.8	13.9	14.1	14.2
12.9	13.1	13.2	13.3	13.4	13.6	13.7	13.8	13.9	14.1	14.2	14.3
13.0	13.2	13.3	13.4	13.5	13.7	13.8	13.9	14.0	14.2	14.3	14.4
13.2	13.3	13.4	13.5	13.7	13.8	13.9	14.0	14.2	14.3	14.4	14.5
13.3	13.4	13.5	13.7	13.8	13.9	14.0	14.2	14.3	14.4	14.5	14.7
13.4	13.5	13.7	13.8	13.9	14.0	14.2	14.3	14.4	14.5	14.7	14.8
13.5	13.7	13.8	13.9	14.0	14.2	14.3	14.4	14.5	14.7	14.8	14.9
13.6	13.8	13.9	14.0	14.1	14.3	14.4	14.5	14.6	14.8	14.9	15.0
13.8	13.9	14.0	14.1	14.3	14.4	14.5	14.6	14.8	14.9	15.0	15.1
13.9	14.0	14.1	14.3	14.4	14.5	14.6	14.8	14.9	15.0	15.1	15.3
14.0	14.1	14.3	14.4	14.5	14.6	14.8	14.9	15.0	15.1	15.3	15.4
14.1	14.3	14.4	14.5	14.6	14.8	14.9	15.0	15.1	15.3	15.4	15.5
14.2	14.4	14.5	14.6	14.7	14.9	15.0	15.1	15.2	15.4	15.5	15.6
14.4	14.5	14.6	14.7	14.9	15.0	15.1	15.2	15.4	15.5	15.6	15.7
14.5	14.6	14.7	14.9	15.0	15.1	15.2	15.4	15.5	15.6	15.7	15.9
14.6	14.7	14.9	15.0	15.1	15.2	15.4	15.5	15.6	15.7	15.9	16.0
14.7	14.9	15.0	15.1	15.2	15.4	15.5	15.6	15.7	15.9	16.0	16.1
14.8	15.0	15.1	15.2	15.3	15.5	15.6	15.7	15.8	16.0	16.1	16.2
15.0	15.1	15.2	15.3	15.5	15.6	15.7	15.8	16.0	16.1	16.2	16.3

CURDLING OF MILK

Approximate Time Required to Reach the Curdling Point of Milk at Various Temperatures.

Milk kept at deg. F	Hours to reach curdling point
40	80
45	76
50	68
55	51
60	42
65	37

Milk kept at deg. F	Hours to reach curdling point
70	33
75	30
80	28
85	27
90	26

TEMPERATURE CORRECTION TABLE FOR SPECIFIC GRAVITY OF MILK

(Quevenne Lactometer)

To use the table below, first find the temperature in one of the vertical columns at the extreme left or right, then in the same line with this and in the same column as the observed lactometer reading is given across the top of the table is the corrected lactometer reading.*

Temp. °F	Observed Reading on Quevenne Lactometer																Temp. °C
	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	
45	19.0	19.9	20.9	21.9	22.9	23.8	24.8	25.8	26.7	27.7	28.6	29.5	30.4	31.3	32.2	33.0	7.2
46	19.0	20.0	21.0	22.0	22.9	23.9	24.9	25.9	26.8	27.8	28.7	29.6	30.5	31.4	32.3	33.1	7.8
47	19.1	20.0	21.0	22.0	23.0	24.0	24.9	25.9	26.8	27.8	28.7	29.6	30.5	31.4	32.3	33.2	8.3
48	19.1	20.1	21.1	22.1	23.1	24.0	25.0	26.0	26.9	27.9	28.8	29.7	30.6	31.5	32.4	33.4	8.9
49	19.2	20.2	21.2	22.2	23.2	24.1	25.1	26.1	27.0	28.0	28.9	29.8	30.7	31.6	32.5	33.5	9.4
50	19.2	20.2	21.2	22.2	23.2	24.1	25.1	26.1	27.0	28.0	29.0	29.9	30.9	31.8	32.7	33.6	10.0
51	19.3	20.3	21.3	22.3	23.3	24.2	25.2	26.2	27.1	28.1	29.1	30.0	31.0	31.9	32.9	33.8	10.6
52	19.4	20.3	21.3	22.3	23.3	24.3	25.2	26.2	27.2	28.2	29.1	30.1	31.1	32.0	33.0	33.9	11.1
53	19.4	20.4	21.4	22.4	23.4	24.4	25.3	26.3	27.3	28.3	29.2	30.2	31.2	32.1	33.1	34.0	11.7
54	19.5	20.5	21.5	22.5	23.5	24.5	25.4	26.4	27.4	28.4	29.3	30.3	31.3	32.3	33.2	34.2	12.2
55	19.6	20.6	21.6	22.6	23.6	24.6	25.5	26.5	27.5	28.5	29.4	30.4	31.4	32.4	33.3	34.3	12.8
56	19.7	20.7	21.7	22.7	23.6	24.6	25.6	26.6	27.6	28.6	29.6	30.5	31.5	32.5	33.5	34.5	13.3
57	19.8	20.8	21.8	22.8	23.7	24.7	25.7	26.7	27.7	28.7	29.7	30.6	31.6	32.6	33.6	34.6	13.9
58	19.9	20.9	21.9	22.8	23.8	24.8	25.8	26.8	27.8	28.8	29.8	30.8	31.7	32.7	33.7	34.7	14.4
59	19.9	20.9	21.9	22.9	23.9	24.9	25.9	26.9	27.9	28.9	29.9	30.9	31.9	32.9	33.9	34.9	15.0
60	20.0	21.0	22.0	23.0	24.0	25.0	26.0	27.0	28.0	29.0	30.0	31.0	32.0	33.0	34.0	35.0	15.6
61	20.1	21.1	22.1	23.1	24.1	25.1	26.1	27.1	28.1	29.1	30.1	31.2	32.2	33.2	34.2	35.2	16.1
62	20.2	21.2	22.2	23.2	24.2	25.2	26.2	27.3	28.3	29.3	30.3	31.3	32.3	33.3	34.3	35.3	16.7
63	20.2	21.3	22.3	23.3	24.3	25.3	26.3	27.4	28.4	29.4	30.4	31.4	32.5	33.5	34.5	35.5	17.2
64	20.3	21.4	22.4	23.4	24.4	25.4	26.5	27.5	28.5	29.5	30.5	31.5	32.6	33.6	34.6	35.6	17.8
65	20.4	21.5	22.5	23.5	24.5	25.5	26.6	27.6	28.6	29.6	30.7	31.7	32.7	33.8	34.8	35.8	18.3
66	20.5	21.6	22.6	23.6	24.6	25.6	26.7	27.7	28.7	29.8	30.8	31.8	32.9	33.9	34.9	35.9	18.9
67	20.6	21.7	22.7	23.7	24.7	25.7	26.8	27.8	28.8	29.9	30.9	31.9	33.0	34.0	35.0	36.1	19.4
68	20.7	21.8	22.8	23.8	24.9	25.9	27.0	28.0	29.0	30.1	31.1	32.0	33.2	34.2	35.2	36.2	20.0
69	20.9	22.0	23.0	24.0	25.0	26.0	27.1	28.1	29.1	30.2	31.2	32.2	33.3	34.3	35.3	36.4	20.6

*See also a table: *Conversion Table for Quevenne and New York Board of Health Lactometer Readings to Specific Gravity.*

WATER ANALYSIS

Hypothetical Results Calculated from Alkalinity and Non-carbonate Hardness Determinations.

Compiled by **O. F. Schoepfle**

M is methyl orange alkalinity
P is phenolphthalein alkalinity
N or NCH is non carbonate hardness

T or TH is total hardness
C is causticity
N^- is negative NCH

				Carbonate Hardness									
				Bicarbonates		Carbonates		Hydroxides					
				Ca Mg	Na	Ca Mg	Na	C	Ca	Na	Total	NCH	TH
1	$T>M$		$P=0$	M	0	0	0	0	0	0	M	N	$M+N$
2	$T>M$		$P<\frac{1}{2}M$	$M-2P$	0	2P	0	0	0	0	M	N	$M+N$
3	$T>M$		$P=\frac{1}{2}M$	0	0	2P	0	0	0	0	M	N	$M+N$
4	$T>M$		$P>\frac{1}{2}M$	0	0	$2(M-P)$	0	$2P-M$	$2P-M$	0	M	N	$M+N$
5	$T>M$		$P=M$	0	0	0	0	M	M	0	M	N	$M+N$
6	$T=M$		$P=0$	M	0	0	0	0	0	0	M	0	M
7	$T=M$		$P<\frac{1}{2}M$	$M-2P$	0	2P	0	0	0	0	M	0	M
8	$T=M$		$P=\frac{1}{2}M$	0	0	2P	0	0	0	0	M	0	M
9	$T=M$		$P>\frac{1}{2}M$	0	0	$2(M-P)$	0	$2P-M$	$2P-M$	0	M	0	M
10	$T=M$		$P=M$	0	0	0	0	M	M	0	M	0	M
11	$T<M$		$C>N^-$	0	0	$M-C$	0	$2P-M$	$C-N^-$	N^-	$M-N^-$	N^-	$M-N^-$
12	$T<M$		$C=N^-$	0	0	$M-C$	0	$2P-M$	0	C	$M-N^-$	N^-	$M-N^-$
13	$T<M$		$C<N^-$	0	0	$M-N^-$	N^--C	$2P-M$	0	C	$M-N^-$	N^-	$M-N^-$
14	$T<M$	$2P<M$	$2P>N^-$	$M-2P$	0	$2P-N^-$	N^-	0	0	0	$M-N^-$	N^-	$M-N^-$
15	$T<M$	$2P<M$	$2P=N^-$	$M-N^-$	0	0	N^-	0	0	0	$M-N^-$	N^-	$M-N^-$
16	$T<M$	$2P<M$	$2P<N^-$	$M-N^-$	N^--2P	0	2P	0	0	0	$M-N^-$	N^-	$M-N^-$
17	$T<M$		$P=0$	$M-N^-$	N^-	0	0	0	0	0	$M-N^-$	N^-	$M-N^-$
18		$M<0$										T	
19		$T<M$										$(M-T)=N^-$	

NATURAL WATERS FOR INDUSTRIAL USE

Cf. W. D. Collins, *Chem. and Eng. News* **21**, *1062* (*1943*).
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SURFACE AND GROUND WATERS

Typical natural waters available for industrial use in the United States are shown in *Table I*. They have been classified into five types as follows:

Type A. Catskill supply of New York City. This type is a *natural soft water*. For practical purposes it may be considered the equivalent of distilled or rain water and may contain not more than approximately 30 parts per million of dissolved mineral matter. Public water supplies of this type are the Catskill supply of New York City, the supply of Boston and surrounding territory, the Hetch Hetchy supply of San Francisco, and the supply of Asheville, N. C. Rivers and lakes in Maine and other New England states, and streams and lakes in or near mountains may supply these clear waters of low mineral content. The hardness of these natural waters is less than the best that could be obtained by softening methods in use before development of the ion-exchange systems. The very soft waters have a tendency to be corrosive and may require treatment or special precautions to prevent damage from corrosion.

Type B. Niagara River, filtered for public supply of Niagara Falls, N. Y. This type is a *hard water* intermediate between *Type A* and *Type C*. This water, represented by the waters of the Great Lakes, except Lake Superior, is more like the soft waters than the real hard waters. As such it has been used for many domestic supplies but for industrial uses where hardness is detrimental the water must be softened. Public supplies of this type of water are those in Detroit, Milwaukee, Chicago, Cleveland, Sandusky, Toledo, Erie, Buffalo, Niagara Falls, and many smaller places along the lakes and the St. Lawrence River.

Type C. Wells 30 to 60 feet deep used for public supply of Dayton, Ohio. This type is a genuinely *hard water* as commonly used throughout the industrial areas in the heart of the country. These hard waters are the most widely distributed throughout the United States and the water obtained from the wells is so hard that softening is needed to make it acceptable for general domestic use or for most industrial uses.

Type D. Well 2,000 feet deep used for public supply of Maywood, Ill. This type contains enough chloride to require a separate listing. In a few waters nitrate is present as a major constituent but these waters may be classed as variants of the *hard water* type if their total mineral content is in the range of usable waters.

Type E. Well 330 feet deep at Smithfield, Va. This type is representative of a smaller but distinct class of *naturally softened waters*. Their hardness may be well below the average hardness of the waters classed as soft whereas their total mineral content may be well up in the range of the really hard waters. Many of the softened waters in Louisiana and Mississippi are highly colored. The softened, or sodium bicarbonate waters, are found in widely scattered areas but they are somewhat more common in the Atlantic and Gulf Coastal Plain.

NATURAL WATERS FOR INDUSTRIAL USE

Salt Waters. This class may include all waters not considered generally usable. **Sea water** may be taken as the typical salt water. It has about 35,000 parts per million of dissolved salts. Cf. Clarke, "The Data of Geochemistry," *U. S. Geol. Survey Bull.* 770 (*1924*). It is characteristic of sea water that the magnesium greatly exceeds the calcium. Most **brines from inland wells** carry more calcium than magnesium. They also have a smaller proportion of sulfate than sea water and may have much more dissolved mineral matter, often running up to 200,000 or 300,000 parts per million. Such brines may be the raw materials of certain chemical industries.

General Characteristics. An important characteristic of natural waters is the hydrogen-ion concentration. In general the *pH* of natural waters tends to center around 7.0 or a little above. Well waters low in dissolved solid mineral constituents and high in carbon dioxide are often found with a *pH* below 6.0, and not too rarely with a *pH* below 5.0. Sodium bicarbonate waters may have a *pH* of 8.0 or more. **Temperature** is an important factor in relation to industrial use. Cf. Collins, "Temperature of Water Available for Industrial Use in the United States," *U. S. Geol. Survey Water-Supply Paper* **520-F** (1925). Ground waters normally have a constant temperature that is close to the mean annual air temperature for water from depths of 30 to 60 feet. Below 60 feet the temperature increases about 1° F. for each increase in depth of from 60 to 100 feet according to location. Surface water temperatures are variable and not wholly predictable. Reservoirs and lakes may show stratification. In deep lakes a top layer of 20 to 30 feet responds to atmospheric changes while the temperature at greater depths remains constant.

In *Table I* following, the waters used industrially are illustrated by analyses from a report on industrial water supplies that gives analyses for 670 supplies used by about 57,000,000 consumers. The extent to which the five analyses can be taken as representative of waters available for industrial use is as follows:

Type	Number of Supplies	Number of States	Population Supplied
A	131	25	11,170,968
B	75	29	11,581,024
C	47	16	2,153,459
D	19	10	600,785
E	8	3	128,583

Although *Table I* is based on the public supplies of only 670 places, including the larger places in each state, the general conclusions can safely be applied to water supplies that are available for industrial use in the United States. Cf. Collins, Lamar, and Lohr, "The Industrial Utility of Public Water Supplies in the United States, 1932," *U. S. Geol. Survey Water-Supply Paper* 658 (*1934*).

RIVER WATERS

Analyses of river waters are shown in *Table II*. River waters carry widely varying amounts of suspended matter. Some streams regularly have only a few parts per million of suspended matter. At times of heavy rains or rapid melting of snow they may carry much more. Rivers like the Missouri and Colorado normally carry from a few hundred to several thousand parts per million of suspended matter. The average load in the Missouri is of the order of magnitude of about 2,000 parts per million. The average load of suspended matter in the Colorado River at Grand Canyon, Ariz., is about 1 per cent, 10,000 parts per million. At times the Colorado at Grand Canyon has carried as much as 12 per cent, 120,000 parts per million, for a day. The **temperature** of river waters follows the changes in air temperature, with a lag that is dependent on many conditions. In a very general way it has been found that the mean monthly temperature of a river water at any point is likely to be within a few degrees of the mean monthly air temperature unless there are conditions that affect the temperature strongly. There is a lag in the rise of spring and early summer temperature in streams that are fed by melting snow.

TABLE I. TYPICAL ANALYSES OF SURFACE AND GROUND WATERS IN THE UNITED STATES

From U. S. Geological Survey Water Supply Paper 658.

	(Parts per million)				
Type	A	B	C	D	E
Silica (SiO_2)	2.4	12	10	9.4	22
Iron (Fe)	0.14	0.02	0.09	0.2	0.08
Calcium (Ca)	5.8	36	92	96	3.0
Magnesium (Mg)	1.4	8.1	34	27	2.4
Sodium (Na)	1.7	6.5	8.2	183	215
Potassium (K)	0.7	1.2	1.4	18	9.8
Bicarbonate (HCO_3)	14	119	339	334	549
Sulfate (SO_4)	9.7	22	84	121	11
Chloride (Cl)	2.0	13	9.6	280	22
Nitrate (NO_3)	0.54	0.1	13	0.2	0.52
Total Dissolved Solids	31	165	434	983	564
Total Hardness as $CaCO_3$	20	123	369	351	17

	(Equivalents per million)				
Type	A	B	C	D	E
Calcium (Ca)	0.29	1.80	4.59	4.79	0.15
Magnesium (Mg)	0.12	0.67	2.80	2.22	0.20
Sodium (Na)	0.07	0.28	0.36	7.96	9.35
Potassium (K)	0.02	0.03	0.04	0.46	0.25
Total Cations	0.50	2.78	7.79	15.43	9.95
Bicarbonate (HCO_3)	0.23	1.95	5.56	5.47	9.00
Sulfate (SO_4)	0.20	0.46	1.75	2.52	0.23
Chloride (Cl)	0.06	0.37	0.27	7.90	0.62
Nitrate (NO_3)	0.01	0.00	0.21	0.00	0.01
Total Anions	0.50	2.78	7.79	15.89	9.86

TABLE II. AVERAGE ANALYSES OF RIVER WATER IN THE UNITED STATES

Averages of analyses of dissolved mineral matter in 10-day composites of samples collected daily for one year. From U. S. Geological Survey Professional Paper 135 and Water Supply Papers 496, 638-D, and 889-E.

(Parts per million)

River	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Silica (SiO_2)	9.0	6.6	12	11	...	20	29	15	11	29	9.4	13	14	19
Iron (Fe)	...	0.05	0.25	0.05	0.09	0.39	0.51	0.07	0.13	...	...	0.13	0.06	0.29
Calcium (Ca)	7.4	31	16	4.3	28	19	52	40	32	104	10	73	17	15
Magnesium (Mg)	1.1	7.2	3.9	1.3	5.0	4.1	16	14	8.4	23	6.2	21	3.9	7.0
Sodium (Na)	2.5	6.3	3.7	3.4	11	7.7	36	10	13	112	19	74	8.9	15
Potassium (K)	1.0		1.3	1.2						6.6		4.1		
Bicarbonate (HCO_3)	17	122	60	22	42	72	178	188	111	178	62	176	69	76
Sulfate (SO_4)	12	12	9.7	3.0	53	11	104	18	24	228	29	202	12	13
Chloride (Cl)	2.3	7.7	2.5	2.4	18	3.0	12	1.6	9.7	164	8.6	54	3.2	8.7
Nitrate (NO_3)	...	0.3	0.18	0.3	...	1.2	2.9	1.4	2.5	...	...	3.3	0.48	...
Total Dissolved Solids	42	134	85	41	164	101	346	200	166	791	113	550	97	124
Total Hardness as $CaCO_3$	23	107	56	16	90	64	196	158	114	352	50	269	58	66

(Equivalents per million)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Calcium (Ca)	0.37	1.55	0.80	0.21	1.40	0.95	2.60	2.00	1.60	5.14	0.50	3.64	0.85	0.75
Magnesium (Mg)	0.09	0.59	0.32	0.11	0.41	0.34	1.32	1.15	0.69	1.89	0.51	1.73	0.32	0.58
Sodium (Na)	0.11	0.27	0.16	0.15	0.49	0.33	1.57	0.43	0.57	4.87	0.83	3.22	0.39	0.65
Potassium (K)	0.03		0.03	0.03						0.17		0.10		
Total Cations	0.60	2.41	1.31	0.50	2.30	1.62	5.49	3.58	2.85	12.07	1.84	8.69	1.56	1.98
Bicarbonate (HCO_3)	0.28	2.00	0.98	0.36	0.69	1.18	2.92	3.08	1.82	2.92	1.02	2.88	1.13	1.25
Sulfate (SO_4)	0.25	0.25	0.20	0.06	1.10	0.23	2.17	0.37	0.50	4.65	0.60	4.21	0.25	0.27
Chloride (Cl)	0.07	0.22	0.07	0.07	0.51	0.08	0.34	0.05	0.27	4.63	0.24	1.52	0.09	0.25
Nitrate (NO_3)	...	0.00	0.00	0.01	...	0.02	0.05	0.02	0.04	...	...	0.05	0.01	...
Total Anions	0.60	2.47	1.26	0.50	2.30	1.51	5.49	3.52	2.63	12.19	1.87	8.67	1.48	1.76

1. Androscoggin River, Brunswick, Maine.
2. St. Lawrence River, Ogdensburg, N. Y.
3. James River, Cartersville, Va.
4. Savannah River, Clyo, Ga.
5. Ohio River, Cincinnati, Ohio.
6. Tennessee River, Muscle Shoals, Ala.
7. Missouri River, Ruegg, Mo.
8. Mississippi River, Minneapolis, Minn.
9. Mississippi River, New Orleans, La.
10. Rio Grande, Laredo, Tex.
11. Missouri River, Great Falls, Mont.
12. Colorado River, Grand Canyon, Ariz.
13. Columbia River, Cascade Locks, Wash.
14. Sacramento River, Sacramento, Calif.

TYPICAL ANALYSES OF VARI-

From information supplied mostly by Geological Survey Water-Supply Paper, No. 658 (1932) and from a few other sources.

Numerical values of the analyses are in parts per million (ppm).

	Total dissolved solids	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)
Akron, Ohio	131	....	0.02	31a
Albuquerque, N. Mex.	491a	74	35b	31
Atlanta, Ga.	26	9.0	0.12	3.6
Baltimore, Md.	77a	3.4	0.06	17
Birmingham, Ala.	140	7.8	0.7	17
Bloomington, Ill.	108	6.0	0.0	11
Boston, Mass.	43	2.1	0.12	4.4
Bridgeport, Conn.	56	12	0.3	5.5
Buffalo, N. Y.	147	1.0	0.01	34
Cedar Rapids, Iowa	154	8.3	0.01	28
Chattanooga, Tenn.	76	7.3	Tr	17
Chicago, Ill.	157	6.4	0.2	34
Cincinnati, Ohio	207	....	0.5	34
Cleveland, Ohio	159	3.1	0.24	34
Columbus, Ohio	245	....	0.0	19
Dayton, Ohio	416a	10	0.8	90
Denver, Colo.	202a	7.0	0.11	32
Des Moines, Iowa	362	14	3.5b	75
Detroit, Mich.	119	2.7	0.03	27
Houston, Texas	362	20	0.17	22
Jersey City, N. J.	81	6.5	0.08	13
Los Angeles, Calif. Owens River	302a	....	0.04	27
Los Angeles, Calif. L. A. River	421a	....	0.0	75
Louisville, Ky.	150	4	1.5b	35
Memphis, Tenn.	87	16	0.08	8.6
Miami, Fla.	191	9.0	0.02	35
Minneapolis, Minn.	210	9.7	0.07	44
Nashville, Tenn.	119	20	0.42	26
Newark, N. J.	50	4.8	0.19	7.7
New Haven, Conn. Lake Whitney	94	6.7	0.06	22
New Haven, Conn. Lake Dawson	42	6.7	0.22	6.2

OUS PUBLIC WATER SUPPLIES

Notations: *a*, calculated; *b*, Fe and Al as Fe_2O_3 and Al_2O_3; *v*, includes equivalent of 12 ppm of (CO_3); *w*, includes equivalent of 15 ppm of (CO_3); *y*, includes 10 ppm of (CO_3); *z*, includes 8 ppm of (CO_3); *Tr*, trace.

Magnesium (Mg)	Sodium & Potassium (Na + K)	Bicarbonate radical (HCO_3)	Sulfate radical (SO_4)	Chloride radical (Cl)	Nitrate radical (NO_3)	Total hardness as $CaCO_3$
5.6	4.9a	81	38	3.6	.....	100
19	96	180	130	17	.....	155
1.3	2.7	12	6.6a	2.0	0.86	14
4.1	2.9	61	13	6.0	0.2	59
5.9	Na 19	54	61	2.0	0.45	67
	K 1.3					
12	2.8	54z	36	5.0	0.4	77
1.0	3.9	16	9.8	3.2	0.31	15
0.2	Na 2.9	8.3a	10	3.5	0.1	15
	K 1.1					
8.0	Na 5.7	109	19	14	1.0	118
	K 1.1					
4.3	Na 6.0	36	53	5.0	13	88
	K 2.3					
3.3	4.1a	57	11	4.4	0.56	56
9.7	5.1	146	12	4.5	....	125
6.1a	15a	45	72	22	....	110
8.6	7.5a	104	29	15	....	120
9	42	44y	120	12	10	84
35	7.3	339	83	9.6	13	368
10	Na 23	103	43	31	0.43	121
	K 2.4					
29	20	255	98	6.0	1.5	306
7.2	3.2a	92	19	6.2	....	97
5.8	Na 108	301	7.8	48	0.0	79
	K 1.9					
5.6	Na 3.6	40	22	5.1	1.1	55
	K 1.0					
12	74	215	39	44	....	117
21	46	223	130	39	....	274
7	15	30	45	10	....	85
4.2	Na 15	80	4.4	1.8	0.07	39
	K 1.2					
4.8	Na 12	47	61	20	4.5	107
	K 1.5					
15	4.0	167	36	3.8	0.20	172
3.6	9.6	92	14	2.1	1.2	80
2.4	2.3a	20	12	3.4	0.48	29
3.3	Na 4.0	62	13	7.6	1.6	69
	K 1.8					
1.7	Na 2.9	19	9.7	3.0	0.30	22
	K 0.8					

TYPICAL ANALYSES OF VARI-

	Total dissolved solids	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)
New Haven, Conn. Lake Gaillard	66	2.2	0.12	12
New Orleans, La.	158	7.8	.....	17
New York, N. Y. Catskill	31	2.4	0.14	5.8
New York, N. Y. Croton	73	6.2	0.20	13
New York, N. Y. Ridgewood	134	12	0.77	17
Philadelphia, Pa. Delaware River	63	4.2	0.7	9.8
Philadelphia, Pa. Schuylkill River	194	7.7	0.4	30
Pittsburgh, Pa.	150	3.9	0.2	28
Portland, Ore.	25	3.9	0.13b	2.0
Quincy, Ill.	138	9.3	0.0	23
Saginaw, Mich.	263	5.0	0.0	23
St. Louis, Mo.	228	8.0	2.5b	21
San Francisco, Calif.	248a	8.0	4.3b	53
Sandusky, Ohio	160	0.5	0.07	34.5
Seattle, Wash.	46	6.4	0.90b	5.8
Schenectady, N. Y.	219	6.2	0.05	51
Springfield, Ill.	176	9.2	0.0	17
Stockton, Calif.	380	57	0.3	21
Syracuse, N. Y.	126	6	0.02	34
Tampa, Fla.	149	7.3	0.03	32
Tulsa, Okla.	98a	4.0	0.1	30
Washington, D. C.	130	7.0	2.7b	34
Wilmington, Del.	79	11	0.01	12
Wyandotte, Mich.	106	2.1	0.8b	21
Youngstown, Ohio	178	1.4	0.04	18

KILLING DOSAGE OF COPPER SULFATE FOR FISH

Moore & Kellerman

Fish	Parts per million	Pounds per million gal.
Trout	0.14	1.2
Carp	0.33	2.8
Suckers	0.33	2.8
Catfish	0.40	3.5
Pickerel	0.40	3.5

Fish	Parts per million	Pounds per million gal.
Gold fish	0.50	4.2
Perch	0.67	5.5
Sunfish	1.35	11.1
Black bass	2.00	16.6

OUS PUBLIC WATER SUPPLIES

Magnesium (Mg)	Sodium & Potassium (Na + K)	Bicarbonate radical (HCO_3)	Sulfate radical (SO_4)	Chloride radical (Cl)	Nitrate radical (NO_3)	Total hardness as $CaCO_3$
4.5	Na 4.0 K 1.2	46	13	3.8	0.40	48
7.1	23a	45	43	28	....	72
1.4	Na 1.7 K 0.7	14	9.7	2.0	0.54	20
4.5	Na 3.3 K 1.3	42	17	4.0	1.3	51
6.6	Na 14 K 2.1	38	32	21	10	70
3.4	Na 3.1 K 1.2	22	21	4.0	2.0	38
11	Na 8.5 K 1.5	37	87	9.0	3.2	120
4.9	Na 13	7.8	68	13	0.65	90
0.7	Na 2.9 K 0.9	13	.....	2.4	0.3	8
5	Na 10 K 3.9	61w	43	9.0	3.3	78
12	50	43v	82	70	....	107
7.5	36	48v	94	18	4.9	83
9.1	24	192	34	21	....	170
9.5	5.1	105	31	14	....	125
1.5	2.2a	26	2.0	1.5	0.0	21
16	7.8	128	62	12	0.1	193
16	14	50	66	10	4.4	108
9.9	96a	202	4.9	93	....	93
6.8	Na 2.0 K 1.0	116	15	1.6	1.5	113
5.5	Na 7.3 K 1.0	70	45	10	0.1	103
1.3	4.7	93	7.5	4.5	....	80
1.9	6.8a	79	34	5.2	....	93
4.4	Na 5.6 K 2.0	40	16	5.9	4.5	48
9.1	6.9	92	15	6.5	....	90
8.7	25	35	86	7.5	..	81

ALGAE

CHEMICALS REQUIRED FOR TREATMENT OF DIFFERENT GENERA

From *The Use of Copper Sulfate in Control of Microscopic Organisms*, by Frank E. Hale, Ph. D., copyright 1930 by Nichols Copper Co., reprinted by permission.

Organism-Odor	Copper Sulphate		Chlorine ppm
	Parts per million	Pounds per mil. gals.	
Diatomaceae			
Asterionella‡	0.12*–0.20*	1.0–1.7	0.5*–1.0*
Aromatic, geranium, fishy			
Cyclotella†‡			1.0
Faintly aromatic			
Diatoma†			
Faintly aromatic			
Fragilaria†	0.25	2.1	
Melosira†‡§	0.20*	1.7	2.0
Meridion			
Aromatic			
Navicula†	0.07	0.6	
Nitzchia §	0.50	4.2	
Synedra†‡	0.36*–0.50*	3.0–4.2	1.0
Earthy			
Stephanodiscus	0.33	2.8	
Tabellaria‡	0.12*–0.50*	1.0–4.2	0.5*–1.0
Aromatic, geranium, fishy			
Chlorophyceae			
Cladophora†	0.50	4.2	
Closterium	0.17	1.4	
Coelastrum†	0.05–0.33	0.4–2.8	
Conferva†	0.25	2.1	
Desmidium	2.00	16.6	
Dictyosphaerium‡			0.5*–1.0
Grassy, nasturtium, fishy			
Draparnaldia	0.33	2.8	
Eudorina	10.00	83.0	
Faintly fishy			
Entomophora	0.50	4.2	
Gloeocystis			
Offensive			
Hydrodictyon†	0.10	0.8	
Very offensive			
Microspora	0.40	3.3	
Palmella	2.00	16.6	
Pandorina	10.00	83.0	
Faintly fishy			
Protococcus			1.0
Raphidium	1.00	8.3	
Scenedesmus	1.00*	8.3	
Spirogyra†	0.12	1.0	0.7–1.5
Staurastrum	1.50	12.5	
Tetrastrum			1.0
Ulothrix	0.20*	1.7	
Volvox‡	0.25	2.1	0.3*–1.0
Fishy			
Zygnema	0.50	4.2	
Cyanophyceae			
Anabaena‡	0.12*	1.0	0.5*–1.0

ALGAE

Organism-Odor	Copper Sulphate		Chlorine ppm
	Parts per million	Pounds per mil. gals.	
Anabaena (cont.)			
Moldy, grassy, vile			
Aphanizomenon‡	0.12*–0.50*	1.0–4.2	0.5*–1.0*
Moldy, grassy, vile			
Clathrocystis	0.12*–0.25*	1.0–2.1	0.5*–1.0
Sweet grassy, vile			
Coelosphaerium‡	0.20*–0.33	1.7–2.8	0.5*–1.0
Sweet grassy			
Cylindrospermum	0.12	1.0	
Grassy			
Microcystis	0.20	1.7	
Oscillaria†	0.20–0.50*	1.7–4.2	1.1
Rivularia			
Moldy, grassy			
Protozoa			
Bursaria			
Irish moss, salt marsh, fishy			
Ceratium†‡	0.33	2.8	0.3*–1.0
Fishy, vile, (rusty brown color)			
Chlamydomonas	0.50–1.0	4.2–8.3	
Cryptomonas	0.50	4.2	
Candied violets			
Dinobryon‡	0.18*	1.5	0.3*–1.0
Aromatic, fishy, violets			
Euglena	0.50	4.2	
Glenodinium	0.50*	4.2	
Fishy			
Mallomonas	0.50	4.2	
Aromatic, violets, fishy			
Peridinium	0.50*–2.00	4.2–16.6	
Fishy, like clam shells			
Synura‡	0.12*–0.25*	1.0–2.1	0.3*–1.0
Cucumber, muskmelon, fishy bitter taste			
Uroglena‡	0.05*–0.20*	0.4–1.6	0.3*–1.0
Fishy, oily, cod-liver oil taste			
Crustaceae			
Cyclops†‡§			1.0–3.0
Daphnia†‡§	2.00	16.6	1.0–3.0
Schizomycetes			
Beggiatoa†	5.00	41.5	
Very offensive decayed			
Cladothrix	0.20	1.7	
Crenothrix†‡	0.33–0.5*	2.8–4.2	0.5*
Very offensive decayed medicinal with chlorine			
Lepthothrix†			
Sphaerotilis, natans†	0.40	3.3	
Very offensive decayed			
Thiothrix†‡			0.5*–1.0
Fungus			
Leptomitus	0.40	3.3	
Saprolegnia†	0.18	1.5	

ALGAE

Organism-Odor	Copper Sulphate		Chlorine ppm
	Parts per million	Pounds per mil. gals.	
Miscellaneous			
Blood worms			50.0
Blood worm gnats			3.0
Chara†	0.10–0.50	0.8–4.2	
Nais			1.0
Nitella, flexilis†	0.10	0.8	
Objectionable Potamogeton†	0.30-0.80	*2.5–6.7	

*Dosage successful in New York City's supply.

†These organisms cause trouble other than odor.

‡These organisms have been affected by chlorine producing characteristic odor and in many cases controlled by dosage ranging from 0.3 to 3.0 ppm, depending largely upon the amount of organisms.

§Controlled by excess caustic lime, 5 ppm in the case of diatoms (48 hrs.).

DRINKING WATER STANDARDS

Condensed from Standards adopted by the United States
Treasury Department, February 6, 1946.

As to Bacteriological Quality.

Applications *A1* and *A2* shall govern when ten-milliliter (10 ml) portions are used and applications *B1* and *B2* shall govern when one hundred-milliliter (100 ml) portions are used.

(*A1*) Of all the standard ten-milliliter (10 ml) portions examined per month in accordance with specified procedure, not more than ten (10) per cent shall show the presence of organisms of the coliform group.

(*A2*) Occasionally three (3) or more of the five (5) equal ten-milliliter (10 ml) portions constituting a single standard sample may show the presence of organisms of the coliform group, provided that this shall not be allowable if it occurs in consecutive samples or in more than:

- (*a*) Five (5) per cent of the standard samples when twenty (20) or more samples have been examined per month.
- (*b*) One (1) standard sample when less than twenty (20) samples have been examined per month.

(*B1*) Off all the standard one hundred-milliliter (100 ml) portions examined per month in accordance with the specified procedure, not more than sixty (60) per cent shall show the presence of organisms of the coliform group.

(*B2*) Occasionally all of the five (5) equal one hundred-milliliter portions constituting a single standard sample may show the presence of organisms of the coliform group, provided that this shall not be allowable if it occurs in consecutive samples or in more than:

- (*a*) Twenty (20) per cent of the standard samples when five (5) or more samples have been examined per month.
- (*b*) One (1) standard sample when less than five (5) samples have been examined per month.

As to Chemical and Physical Characteristics.

The turbidity of the water shall not exceed 10 ppm (silica scale), nor shall the color exceed 20 (standard cobalt scale). The water shall have no objectionable taste or odor, and shall not contain an excessive amount of soluble mineral substance, nor excessive amounts of any chemicals employed in treatment.

For waters softened by the lime soda process the total alkalinity produced should not exceed the hardness by more than 35 ppm (calculated as $CaCO_3$).

For chemically treated waters the phenolphthalein alkalinity (calculated as $CaCO_3$) should not be greater than 15 ppm plus 0.4 times the total alkalinity. This requirement limits the permissible *pH* to about 10.6 at 25°C. The normal carbonate alkalinity should not exceed 120 ppm.

DRINKING WATER STANDARDS

Lead (Pb) shall not exceed 0.1 ppm.
Arsenic shall not exceed 0.05 ppm.
Fluorides shall not exceed 1.5 ppm.
Selenium shall not exceed 0.05 ppm.
Chromium VI shall not exceed 0.05 ppm.

Salts of barium, hexavalent chromium, heavy metal glucosides or other substances with deleterious physiological effects shall not be added to the system for water treatment purposes.

The following chemical substances which may be present in natural or treated waters should preferably not occur in excess of the following concentrations where other suitable supplies are available:

Copper (Cu) should not exceed 3.0 ppm.
Zinc (Zn) should not exceed 15 ppm.
Iron (Fe) and manganese (Mn) together should not exceed 0.3 ppm.
Magnesium (Mg) should not exceed 125 ppm.
Chloride (Cl) should not exceed 250 ppm.
Sulfate (SO_4) should not exceed 250 ppm.
Phenolic compounds should not exceed 0.001 ppm in terms of phenol.

Total solids should not exceed 500 ppm for a water of good chemical quality. However, if such water is not available, a total solids content of 1,000 ppm may be permitted.

STABLER'S REACTION COEFFICIENTS

The valence of a radical divided by its atomic or molecular weight.

Positive ions	Reaction Coefficient	Negative ions	Reaction Coefficient
Aluminum, Al	0.1112	Bicarbonate, HCO_3	0.0164
Calcium, Ca	0.0499	Carbonate, CO_3	0.0333
Hydrogen, H	0.9922	Chloride, Cl	0.0282
Iron, Fe''	0.0358	Hydroxide, OH	0.0588
Magnesium, Mg	0.0822	Nitrate, NO_3	0.0161
Potassium, K	0.0256	Sulfate, SO_4	0.0208
Sodium, Na	0.0435		
Alkalinity, $CaCO_3$	0.0200		
Free CO_2, CO_2	0.0454		

The reacting value of a radical, which is identical with the terms "milliequivalent" or "milligram equivalent" of other writers, is obtained by use of the above table; the parts per million of a radical multiplied by its reaction coefficient gives the reacting value of that radical; for example, if a water analysis showed the sample to contain 25 parts per million of magnesium then the reacting value of Mg, written rMg, would be 25×0.0822 or 2.055.

FORMULAS FOR WATER SOFTENING REQUIREMENTS

The terms in the formulas are in parts per million except those expressed as reacting values (r). Abbreviations: Alk—alkalinity as $CaCO_3$; TH—total hardness as $CaCO_3$.

Pounds of lime (90% CaO) required per 1000 gal.

$0.26\ (r\mathrm{Fe}+r\mathrm{Al}+r\mathrm{Mg}+r\mathrm{H}+r\mathrm{HCO_3}+r\mathrm{CO_2})$

or $0.00931\mathrm{Fe}+0.0288\mathrm{Al}+0.0214\mathrm{Mg}+0.258\mathrm{H}+0.00426\mathrm{HCO_3}+0.0118\mathrm{CO_2}$

Other simpler formulas for this computation are:

$0.26\ (r\mathrm{CO_2}+r\mathrm{Mg}+r\mathrm{Alk})$

or $0.26\ [r\mathrm{Na}+r\mathrm{Ca}+2r\mathrm{Mg}+r\mathrm{CO_2}-(r\mathrm{SO_4}+r\mathrm{Cl})]$

or $0.0052\ (4.115\mathrm{Mg}+\mathrm{Alk}+2.27\ \mathrm{CO_2})$

or $(0.44\ \mathrm{Alk}+\mathrm{CO_2})\times 0.0118+[4.115\ \mathrm{Mg}\times 0.0052]$

Pounds of soda ash (58% test or 100% pure) required per 1000 gal.

$0.44\ (r\mathrm{Fe}+r\mathrm{Al}+r\mathrm{Ca}+r\mathrm{Mg}+r\mathrm{H}-r\mathrm{CO_3}-r\mathrm{HCO_3})$

or $0.0157\mathrm{Fe}+0.0489\mathrm{Al}+0.022\mathrm{Ca}+0.0362\mathrm{Mg}+0.437\mathrm{H}-0.0147\mathrm{CO_3}-0.0722\mathrm{HCO_3}$

Other simpler formulas for this computation are:

$0.44\ (r\mathrm{Ca}+r\mathrm{Mg}-r\mathrm{Alk})$

or $0.44\ [(r\mathrm{Ca}+r\mathrm{Mg})-r\mathrm{CO_3}]$

or $0.0088\ (4.115\ \mathrm{Mg}+2.495\ \mathrm{Ca}-\mathrm{Alk})$

or $0.0088\ (\mathrm{TH}-\mathrm{Alk})$

Compiled from *Chemistry of Wood*, by Ritter and Fleck. Forest Products Lab

Species		% Moisture	% Ash	Solubility in Water Cold	Solubility in Water Hot	Ether	1% NaOH	Acetic Acid
Bald cypress	*	5.72	0.67	1.24	1.86	1.52	9.59	0.71
	**	5.01	0.63	3.03	3.24	6.40	12.08	0.34
Balsa *Ochrona lagopus*		6.47	2.12	1.77	2.79	1.23	20.37	5.80
Hickory (Shellbark *Hicoria ovata*		8.49	0.69	4.78	5.57	0.63	19.04	2.51
Incense cedar		5.12	0.34	3.64	5.38	4.31	17.69	0.91
Libocedrus decurrens	*	6.46	0.47	1.92	2.97	0.67	11.16	1.33
	**	7.27	0.30	4.74	7.08	4.78	19.99	0.68
Mesquite *Prosopis juliflora*		5.49	0.54	12.62	15.09	2.30	28.52	2.08
Pignut hickory	*	3.54	0.40	4.91	6.45	0.29	19.11	3.58
Hicoria glabra	**	3.90	0.45	2.07	2.95	0.36	15.10	3.08
Redwood *Sequoia sempervirens*	**	9.68	0.21	7.36	9.85	1.07	20.00	1.08
Tanbark oak *Quercus densiflora*		3.66	0.83	4.10	5.60	0.80	23.96	5.23
Western yellow pine *Pinus ponderosa*		6.42	0.46	4.09	5.05	8.52	20.30	1.09
White ash	*	5.13	0.59	5.53	6.72	1.03	21.85	3.47
Fraxinus americana	**	6.44	0.31	2.18	3.93	0.45	19.28	2.49
White cedar	*	5.81	0.56	2.60	3.39	1.44	11.87	1.14
	**	6.44	0.24	2.37	3.62	1.87	12.78	0.79
White oak	*	7.40	0.47	3.41	4.92	0.56	21.40	2.96
Quercus alba	**	7.35	0.43	6.05	8.38	0.67	24.24	2.78
White pine	*	3.90	0.23	3.55	5.15	5.46	17.16	1.68
	**	2.92	0.42	5.97	7.68	3.62	19.15	1.43
Yellow birch	*	4.60	0.22	1.40	2.04	0.68	18.28	3.05
Betula lutea	**	4.56	0.32	3.46	4.83	0.90	20.83	2.31
Yellow cedar		4.89	0.43	2.47	3.11	2.55	13.41	1.59
Chamaecyparis	*	3.97	0.28	2.13	3.41	1.00	11.72	2.05
hoot Katensis	**	4.00	0.18	2.88	4.12	1.32	12.77	1.53
Yellow poplar	*	4.05	0.44	1.37	2.25	0.20	16.83	3.23
Liriodendendron tulipifera	**	3.84	0.36	1.48	2.48	0.51	17.64	2.81

*Sap wood
**Heart wood

VARIOUS WOODS

oratory, U. S. Dept. Agriculture. See also table: ***Physical Properties of Wood.***

Meth-oxyl	Pento-san	Methyl Pento-san	Cellulose	Lignin	In Cellulose				
					Pento-san	Methyl Pentosan	Alpha Cellulose	Beta Cellulose	Gamma Cellulose
4.67	8.63	3.86	52.90	35.16	6.07	1.75	67.14	16.42	16.45
4.01	7.28	3.93	51.14	32.67	6.09	1.53	67.11	14.35	18.55
5.68	17.65	0.86	54.15	26.50	19.99	1.35	75.64	0.27	24.08
5.63	18.82	0.80	56.22	23.44	21.89	1.41	76.32	2.82	20.35
6.24	10.65	1.35	41.60	37.68	9.08	1.99	46.92	11.67	41.03
5.95	12.08	0.45	49.09	34.73	10.14	1.24	50.69	12.98	36.33
6.21	12.04	0.56	44.53	33.67	11.68	1.31	66.62	11.05	22.33
5.55	13.96	0.70	45.48	30.47	17.75	0.81	76.48	2.35	21.17
5.56	18.18	1.11	56.08	21.87	16.90	1.30	51.55	21.92	26.53
5.79	18.64	1.02	58.81	22.85	16.20	1.39	59.44	23.74	16.82
5.21	7.80	2.75	48.45	34.21	7.40	2.09	78.81	2.95	18.24
5.74	19.59	....	58.03	24.85	22.82	....	56.77	19.92	23.03
4.49	7.35	1.62	57.41	26.65	6.82	1.98	62.10	10.56	30.13
5.18	20.01	2.52	50.05	27.17	19.25	1.60	64.89	20.98	14.08
5.28	19.89	2.36	53.48	27.89	17.05	1.41	53.57	28.90	17.59
5.15	11.22	1.05	55.40	31.00	9.65	1.53	71.48	7.52	21.01
5.05	10.58	1.64	54.81	31.91	8.25	1.45	58.35	23.49	18.17
5.99	22.49	0.92	51.36	31.74	24.78	1.04	60.94	18.95	20.11
5.91	21.95	1.24	50.40	32.02	24.38	0.77	60.15	16.13	23.73
4.16	9.31	2.14	54.25	26.51	6.81	2.09	54.56	17.47	27.97
4.60	8.56	1.00	50.23	26.14	7.12	2.02	57.29	22.42	19.29
5.57	21.83	1.74	57.74	26.23	21.46	1.42	52.28	29.86	17.62
5.37	21.79	1.23	55.91	26.38	21.84	1.08	57.37	24.12	18.52
5.25	7.87	3.42	53.86	31.32	7.30	1.78	62.68	11.06	26.25
4.40	8.47	1.75	58.12	29.03	7.60	2.44	54.61	26.59	18.80
4.81	8.69	1.85	56.08	28.73	7.78	2.73	.....	20.17	.....
5.85	18.60	2.25	58.08	23.47	17.27	1.50	42.23	39.63	18.15
5.95	18.78	2.12	59.52	22.94	16.40	2.09	48.99	31.48	19.54

URINE

Normal Range of Composition

Color: slightly yellow to amber
Quantity: 1000 to 1500 cc./24 hrs.
Specific Gravity: 1.008 to 1.030^{15°
pH: 5.5 to 7.5
Sugar: 0.015%
Nitrogen
  Total: 7 to 20 grams/24 hrs.
  Amino Acid: 0.15 to 0.30 grams/24 hrs.
Urea: 12 to 35 grams/24 hrs.
Ammonia: 0.6 to 1.2 grams/24 hrs.
Creatinine: 0.8 to 2.0 grams/24 hrs.
Creatinine Coefficient: 22 to 30 milligrams creatinine per kg. per day.
Uric Acid: 0.3 to 0.8 grams/24 hrs.
Hippuric Acid: 0.7 grams/24 hrs.
Chlorides (NaCl): 10 to 15 grams/24 hrs.
Phosphorus (P): 1.2 grams/24 hrs.
Sulfur (S)
  Total: 1.2 grams/24 hrs.
  Inorganic: 1.0 grams/24 hrs.
  Ethereal: 0.1 grams/24 hrs.
Sodium (Na): 2.5 to 4.0 grams/24 hrs.
Calcium (Ca): 0.1 to 0.3 grams/24 hrs.
Potassium (K): 1.5 to 2.0 grams/24 hrs.
Magnesium (Mg): 0.1 to 0.2 grams/24 hrs.

BLOOD

Volume* and Normal Range of Composition

pH: 7.35 to 7.45
Sugar: 70 to 120 milligrams/100 cc.
Urea: 24 to 32 milligrams/100 cc.
Nitrogen
  Non-Protein: 25 to 32 milligrams/100 cc.
  Amino Acid: 5 to 8 milligrams/100 cc.
Creatinine: 1 to 2.5 milligrams/100 cc.
Creatine (cells): 6 milligrams/100 cc.
Uric Acid: 2 to 3 milligrams/100 cc.
Chlorides (NaCl): 450 to 500 milligrams/100 cc.
Phosphates (P) (serum): 3 to 7 milligrams/100 cc.
Calcium (Ca) (serum): 9 to 11 milligrams/100 cc.
Cholesterol: 140 to 180 milligrams/100 cc.
CO_2 Combining Power (plasma): 49 to 65 cc./100 cc.

VOLUME	Adult Male:	89.1 cc./kg. body weight 3410 cc./sq. meter body surface
	Adult Female:	84.2 cc./kg. body weight 3075 cc./sq. meter body surface
PLASMA	Adult Male:	51.0 cc./kg. body weight 1958 cc./sq. meter body surface
	Adult Female:	50.5 cc./kg. body weight 1848 cc./sq. meter body surface
HEMOGLOBIN	Adult Male:	16.7 grams/100 cc. blood
	Adult Female:	14.4 grams/100 cc. blood
RED BLOOD CORPUSCLES	Adult Male:	5 to 6 million/cubic millimeter
	Adult Female:	4½ million/cubic millimeter
WHITE BLOOD CORPUSCLES	Adults:	7 to 8 thousand/cubic millimeter
	Children:	10 thousand/cubic millimeter

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*Rowntree, Brown and Roth, *Volume of Blood and Plasma*, published by W. B. Saunders Co., Philadelphia (1929).

A. S. T. M. CLASSIFICATION OF COALS BY RANK

American Society for Testing Materials, Standards, Pt. III, p. 1 (1939); by permission.

Class	Group	Limits of FC or btu mineral-matter-free basis	Requisite physical properties
I. Anthracite	1. Meta-anthracite	Dry FC, 98%	
	2. Anthracite	Dry FC, 92%–98%	
	3. Semianthracite	Dry FC, 86%–92%	Non-agglomerating[a]
II. Bituminous[c]	1. Low volatile bituminous coal	Dry FC, 78%–86%	
	2. Medium volatile bituminous coal	Dry FC, 69%–78%	
	3. High volatile A bituminous coal	Dry FC, <69%; and moist[b] btu, 14,000+[d]	
	4. High volatile B bituminous coal	Moist[b] btu, 13,000–14,000	
	5. High volatile C bituminous coal	Moist btu, 11,000–13,000	Either agglomerating or non-weathering*
III. Subbituminous	1. Subbituminous A coal	Moist btu, 11,000-13,000	Both weathering and non-agglomerating
	2. Subbituminous B coal	Moist btu, 9,500–11,000	
	3. Subbituminous C coal	Moist btu, 8,300–9,500	
IV. Lignitic	1. Lignite	Moist btu, <8.300	Consolidated
	2. Brown coal	Moist btu, <8,300	Unconsolidated

FC = fixed carbon; btu = British thermal units

[a] If agglomerating, classify in low-volatile group of the bituminous class

[b] Moist btu refers to coal containing its natural bed moisture but not including visible water on the surface of the coal.

[c] There may be non-caking varieties in each group of the bituminous class.

[d] Coals having 69% or more fixed carbon on the dry, mineral-matter-free basis shall be classified according to fixed carbon, regardless of btu.

* There are three varieties of coal in the high-volatile C bituminous coal group; viz., variety 1, agglomerating and non-weathering; variety 2, agglomerating and weathering; variety 3, non-agglomerating and non-weathering.

COMPOSITION AND HEATING VALUE OF REPRESENTATIVE COALS

Analysis based on coal "as received."

	Proximate Analysis				Ultimate Analysis					
State and County	%H_2O	%Volatile matter	%Fixed carbon	%Ash	%C	%H	%N	%O	%S	btu per lb
Anthracite Rank										
Ark., Pope	2.07	9.81	78.82	9.3	80.3	3.62	1.47	3.59	1.74	13,702
Colo., Gunnison	2.7	3.32	88.15	5.83	85.4	3.28	1.12	3.59	0.80	14,099
N. Mex., Santa Fe	7.55	7.25	75.88	9.32	....	....	....	....	0.76	12,101
Pa., Schuylkill	3.33	3.27	84.28	9.12	....	....	....	....	0.60	13,351
Pa., Sullivan	3.40	9.34	75.58	11.68	77.9	3.64	0.95	5.07	0.81	13,120
R. I., Providence	4.5	3.0	78.7	13.8	82.4	0.5	0.1	1.8	0.9	11,620
Utah, Washington	7.02	10.30	60.61	22.07	....	....	....	....	4.06	10,408
Va., Pulaski	3.8	9.40	62.20	24.00	....	....	....	....	0.8	10,960
Wash., Lewis	7.4	4.8	52.00	35.80	....	....	....	....	0.74	8,200
Bituminous Rank										
Ala., Bibb	3.21	31.05	59.62	6.28	78.33	5.31	1.40	7.58	1.21	14,140
Ala., Jefferson	2.4	24.44	68.42	4.8	81.73	4.74	1.50	6.54	0.7	14,620
Ala., Shelby	2.31	38.63	51.92	7.2	75.0	5.2	1.0	10.0	0.8	13,650
Alaska, Moose Creek	4.74	35.52	50.91	8.9	67.6	5.3	1.9	15.9	0.3	12,150
Ark., Hartford	2.91	19.33	67.33	10.5	77.4	4.1	1.6	5.3	1.1	13,270
Ark., Huntington	3.22	18.09	69.73	9.0	78.7	4.4	1.6	4.4	1.9	13,700
Colo., Gunnison	4.34	39.72	46.73	9.3	70.6	5.5	1.5	12.7	0.4	12,630
Ill., Christian	13.01	37.04	39.31	10.7	59.8	5.6	1.1	19.1	3.7	10,860
Ill., Franklin	7.30	36.72	47.93	8.05	69.0	5.4	1.6	15.0	1.0	12,160
Ill., Williamson	9.41	33.03	49.05	8.6	67.1	5.2	1.5	16.7	0.9	11,860
Ind., Green	13.52	36.31	42.93	7.3	64.5	5.8	1.5	19.8	1.1	11,540
Ind., Knox	9.52	38.33	41.45	10.9	62.3	5.5	1.0	17.1	3.2	11,540
Ind., Sullivan	14.91	34.34	44.12	6.7	63.8	5.9	1.4	20.9	1.3	11,420
Iowa, Lucas	15.41	30.52	41.52	12.6	55.8	5.7	1.1	21.5	3.2	10,240
Iowa, Polk	13.92	37.01	35.24	14.0	54.7	5.5	0.8	18.8	6.2	10,240
Kans., Cherokee	5.09	34.48	52.22	8.3	71.8	5.2	1.2	10.2	3.3	13,080
Kans., Crawford	3.91	34.22	50.08	11.8	68.8	4.9	1.2	8.7	4.6	12,500
Ky., Christian	9.18	33.72	46.37	10.7	....	....	....	....	3.1	11,680
Ky., Webster	5.37	34.93	50.36	9.3	70.4	5.1	1.6	12.6	1.1	12,500
Md., Allegany	2.22	17.22	69.13	10.9	76.9	4.3	1.9	4.9	1.1	13,430
Md., Allegany	1.18	17.87	73.21	7.7	81.0	4.5	1.9	4.0	1.0	14,190
N. Mex., San Juan	6.76	38.13	43.01	11.9	....	....	....	....	1.3	11,630
Ohio, Columbiana	3.51	36.68	48.89	10.9	69.9	5.2	1.4	8.3	4.3	12,730
Ohio, Jefferson	3.42	36.33	49.58	10.7	69.7	5.2	1.4	8.0	5.1	12,720
Okla., Coal	6.57	38.62	42.89	11.9	62.8	5.0	1.5	14.5	4.3	11,260
Okla., Latimer	3.68	36.82	53.79	5.6	....	....	....	....	0.9	13,630
Okla., Pittsburg	3.78	38.01	50.63	7.6	73.8	5.4	1.8	9.6	1.7	13,280
Pa., Allegheny Upper Freeport Bed	2.65	33.02	51.17	13.2	70.3	5.1	1.2	8.1	2.2	12,816
Pa., Armstrong	3.37	35.49	51.31	9.7	71.4	5.3	1.3	9.1	3.1	13,040
Pa., Armstrong*	1.78	32.81	37.32	28.2	56.9	4.5	1.1	5.6	3.7	10,460
Pa., Bedford	1.61	16.29	70.01	12.1	77.4	4.1	1.4	3.4	1.0	13,810
Pa., Cambria	2.16	22.21	70.33	5.3	....	....	....	....	1.1	14,460
Pa., Cambria	2.51	20.08	71.53	6.1	....	....	....	....	1.9	14,380
Pa., Jefferson	2.59	30.41	59.08	7.9	76.6	5.1	1.2	7.2	2.0	13,860
Pa., Somerset	2.36	17.29	71.41	9.0	78.5	4.3	1.2	4.5	2.5	13,740
Pa., Washington Pittsburgh Bed	1.96	30.55	58.24	9.3	74.4	4.8	1.5	7.9	2.2	13,622
Tex., Webb*	4.41	46.01	30.48	19.0	59.3	5.8	1.2	12.7	2.1	11,070
Va., Montgomery	1.88	14.02	68.88	15.2	75.3	3.6	0.9	4.8	0.5	12,740
Va., Tazewell	3.03	20.28	72.19	4.5	84.0	4.7	1.2	5.2	0.5	14,610
Va., Wise	2.62	33.78	53.63	10.0	73.7	5.1	1.6	8.8	0.9	13,270
Wash., Kittitas	10.29	30.42	43.38	15.9	61.3	5.5	1.5	14.4	1.4	11,010
W. Va., Brook	4.41	37.41	50.07	8.1	72.1	5.3	1.4	10.5	2.6	12,940
W. Va., Fayette Sewell Bed	2.8	23.5	70.2	3.5	82.5	5.0	1.5	7.0	0.5	14,650
Fire Creek Bed	2.87	15.41	76.91	4.8	82.4	5.0	1.5	5.7	0.7	14,521
Eagle or No. 1 Gas Bed	3.3	25.5	66.8	4.4	81.7	5.2	1.5	6.5	0.7	14,500
No. 2 Gas Bed	3.3	28.88	62.72	5.1	79.7	5.3	1.4	7.7	0.8	14,209
W. Va., Grant	3.00	16.71	71.02	9.3	....	....	....	....	2.7	13,590
W. Va., Logan										
Island Creek Bed	1.6	33.70	57.86	6.8	76.7	5.1	1.3	8.9	1.3	13,918
W. Va., M'Dowell Pocahontas No. 3 Bed	2.99	12.65	78.35	6.0	82.9	4.7	1.1	4.8	0.5	14,398

* Cannel coal.

COMPOSITION AND HEATING VALUE OF REPRESENTATIVE COALS

	Proximate Analysis				Ultimate Analysis					
State and County	%H_2O	%Volatile matter	%Fixed carbon	%Ash	%C	%H	%N	%O	%S	btu per lb
W. Va., Mineral	2.39	16.11	65.89	15.6	....	....	....	....	2.5	12,600
W. Va., Ohio	3.02	41.43	45.58	8.1	72.8	5.3	1.4	8.8	3.6	13,200
W. Va., Raleigh Beckley Bed	2.93	14.51	79.42	3.1	84.8	4.8	1.5	5.1	0.6	14,854
Wyo., Lincoln	3.59	38.38	52.51	5.5	74.5	5.3	1.3	12.5	1.0	13,310
Sub-bituminous Rank										
Colo., Weld	24.57	29.78	42.01	3.6	54.8	6.3	1.2	33.8	0.3	9,520
Mont., Carbon	10.49	34.72	43.67	11.2	59.8	5.6	1.3	21.0	1.1	10,550
Wash., Thurston	21.67	34.81	33.30	10.3	49.9	6.3	0.9	32.4	1.2	8,700
Wyo., Lincoln	20.78	35.44	40.56	3.2	57.8	6.3	0.9	31.1	0.7	10,080
Lignitic Rank										
Ark., Ouachita	39.43	26.49	24.37	9.7	36.3	7.0	0.7	45.8	0.49	6,356
Colo., Adams	35.00	27.39	30.23	7.38	....	....	....	....	0.31	6,982
N. D., Ward	36.89	24.91	27.67	10.4	37.4	6.4	0.6	45.0	0.2	6,010
N. D., Williams	42.11	25.00	24.43	8.5	35.2	7.1	0.5	47.5	1.3	5,990
Tex., Wood	33.71	29.25	29.76	7.3	42.5	6.8	0.8	42.1	0.53	7,348
Peat										
Conn., Fairchild	90.31	3.79	1.27	4.63	....	....	....	....	0.08	511
Fla., Lake	82.12	11.75	5.72	0.4	....	....	....	....	0.05	1,886
Me., Knox	90.82	6.07	2.73	0.4	....	....	....	....	0.02	819
Mich., Kalamazoo	66.91	19.04	9.29	4.8	....	....	....	....	0.09	3,024
N. Y., Oswego	54.61	29.15	12.44	3.8	....	....	....	....	0.17	4,104
Wis., Marinette	76.36	10.78	4.66	8.2	....	....	....	....	0.16	1,498

FORMULAS FOR CALCULATING MINERAL-FREE btu AND FIXED CARBON

$$FC = \%\ \text{Fixed carbon} \qquad A = \%\ \text{Ash}$$
$$M = \%\ H_2O \qquad S = \%\ \text{Sulfur}$$

In cases of litigation, coal samples containing more than 1% CO_2 as carbonate must be floated on a heavy liquid to reduce the amount to less than 1%.

The long method (or Parr) formula used only for referee purposes:

$$\%\ \text{Dry, mineral-free}\ FC = \frac{FC - 0.15S}{100 - (M + 1.08A + 0.55S)} \times 100$$

$$\text{Moist, mineral-free}\ btu = \frac{btu - 50S}{100 - (1.08A + 0.55S)} \times 100$$

The short (or A. S. T. M.) approximation formula:

$$\%\ \text{Dry, mineral-free}\ FC = \frac{FC}{100 - (M + 1.1A + 0.1S)} \times 100$$

$$\text{Moist, mineral-free}\ btu = \frac{btu}{100 - (1.1A + 0.1S)} \times 100$$

HEAT OF COMBUSTION OF COAL FROM ANALYSES

The usual formula employed in calculating the heat of combustion of coal from an ultimate analysis is that of Dulong:

$$\text{BTU/pound} = 14{,}544\text{C} + 62{,}028\left(\text{H} - \frac{\text{O}}{8}\right) + 4050\text{S}$$

where C, H, O, and S are the decimal percents of carbon, hydrogen, oxygen, sulfur found on ultimate analysis made on the "as received" basis.

A proximate analysis of coal gives moisture, volatile matter, fixed carbon and ash. It is possible to compute the heat of combustion of coal from the values obtained in a proximate analysis by first finding the percent of carbon, hydrogen and oxygen by means of the formulas below and then substituting in Dulong's formula given above.

The method is as follows:—From the values of a proximate analysis find the percent of volatile matter (V) and fixed carbon *on an ash- and moisture-free basis.* These two values should add up total 100%. Then,

$$\%\text{H} = \%\text{V}\left(\frac{7.35}{\%\text{V}+10} - 0.013\right)$$

$\%\text{N} = 0.07\text{V}$ for anthracite and semi-anthracite coals.
$\%\text{N} = 2.10 - 0.012\text{V}$ for bituminous and lignite coals.
$\%\text{C} = \text{Fixed C} + 0.02\text{V}^2$ for anthracite coals.
$\%\text{C} = \text{Fixed C} + 0.9\,(\text{V} - 10)$ for semi-anthracite coals.
$\%\text{C} = \text{Fixed C} + 0.9\,(\text{V} - 14)$ for bituminous coals.
$\%\text{C} = \text{Fixed C} + 0.9\,(\text{V} - 18)$ for lignite.

Sulfur increases V, therefore the volatile carbon is too high by the extent of the sulfur in the coal.

Example.—A bituminous coal from Jefferson, Pa. gives a proximate anaylsis as follows: moisture, 2.59%; volatile matter, 30.41%; fixed carbon, 59.08%; ash, 7.9%. The %ash plus %moisture $= 7.9 + 2.59 = 10.49$
Therefore,

$$\frac{30.41}{100-10.49} \times 100 = 33.97\% \text{ volatile matter on ash- and moisture-free basis.}$$

$$\frac{59.08}{100-10.49} \times 100 = 66.00\% \text{ fixed carbon on ash- and moisture-free basis.}$$

$$\text{H} = 33.97\left(\frac{7.35}{33.97+10} - 0.013\right) = 5.23\%\text{H}$$

$\text{N} = 2.10 - 0.012 \times 33.97 = 1.69\%\text{N}$
$\text{C} = 66.00 + 0.9\,(33.97 - 14) = 83.97\%\text{C}$
$83.97 \times 0.8951 = 75.16\%\text{C}$ as received
$5.23 \times 0.8951 = 4.68\%\text{H}$ as received
$1.69 \times 0.8951 = 1.51\%\text{N}$ as received
7.9% ash
2.59% moisture
91.84%, therefore $100 - 91.94 = 8.16\%$ oxygen

Then by substitution of the values above in the Dulong formula

$$14{,}544 \times 0.7516 + 62{,}028\left(0.0468 - \frac{0.0816}{8}\right) = 13{,}201 \text{ BTU/pound.}$$

The experimental value reported for this coal was 13,860 BTU/pound.

FLAME TEMPERATURES

Reprinted by permission from "Combustion Flames and Explosions of Gases," by Lewis and von Elbe, published 1938 by Macmillan.

Except as noted otherwise, the flame temperatures listed in the following table were determined by the sodium line-reversal method with a totally colored flame for moist mixtures at room temperature. The values given are the maximum flame temperatures determined for the given combustible or combination of combustibles with inert gas. In a few cases a number of values are given for different mixture compositions. All compositions are given on the dry basis.

The experimental flame temperatures are probably all influenced somewhat by heat losses, excitation lag and intermixing with the surrounding atmosphere. However, these disturbances do not cause excessive discrepancies from the theoretical flame temperatures, and the values may be taken as an approximate indication of the flame temperatures of the mixtures given.

A large number of calculated flame temperatures are to be found in the literature. They are not included in the table because they are generally based on inexact thermochemical data. Similarly, many experimental values have been omitted, since they were determined under specialized and sometimes ill-defined conditions.

Combustible	Diluent	% Combustible	Flame Temp. °C.	Reference
Hydrogen	Air	31.6	2045	1
			2047*	2
	O_2	67.0	2487	3
		73.0	2527	
		78.0	2660	
		82.0	2427	
Hydrogen atoms	.....	....	?3760†	4
Carbon monoxide	Air	20.0	1650‡	5
		25.0	1930‡	
		32.0	2100‡	
		37.0	2000‡	
		45.0	1850‡	
		55.0	1560‡	
	O_2	20.0	1850‡	5
		30.0	2400‡	
		40.0	2680‡	
		60.0	2905‡	
		70.0	2925‡	
		80.0	2805‡	
		90.0	1800‡	
Methane	Air	10.0	1875	1, 6, 7
Ethane	Air	5.8	1895	7
Propane	Air	4.15	1925	6, 7
Butane	Air	3.2	1895	7
iso-Butane	Air	3.2	1900	7
Acetylene	Air	9.0	2325	1
	O_2	18.0	2927	3
		33.0	3007	
		44.0	3137	
		50.0	2927	

*Calculated.

†Estimated for hydrogen torch.

‡Calculated, ± 10° to allow for different H_2O content.

FLAME TEMPERATURES

Combustible	Diluent	% Combustible	Flame Temp. °C.	Reference
Ethylene	Air	7.0	1975	7
Propylene	Air	4.5	1935	7
Butylene	Air	3.4	1930	7
Ammonia	Air	21	1700	8
60% NH_3 + 40% ($3H_2 + N_2$)	Air	26	1745	8
40% NH_3 + 60% ($3H_2 + N_2$)		27.5	1770	
20% NH_3 + 80% ($3H_2 + N_2$)		32.5	1815	
10% NH_3 + 90% ($3H_2 + N_2$)		35.0	1850	
$6H_2 + N_2$	Air	29.5	1960	8
$4H_2 + N_2$		28.7	1925	
$3H_2 + N_2$		28.0	1880	
$H_2 + N_2$		23.0	1675	
$2H_2 + 3N_2$		20.5	1565	
$H_2 + 2N_2$		18.5	1475	
$3CH_4 + O_2$	Air	10.7	2040	1
$4CH_4 + O_2$		10.5	1980	
$5CH_4 + O_2$		10.4	1955	
$7CH_4 + O_2$		10.2	1925	
$19CH_4 + O_2$		10.1	1893	
$9CH_4 + H_2$	Air	10.5	1880	1
$7CH_4 + 3H_2$		11.5	1893	
$3CH_4 + 2H_2$		13.5	1900	
$2CH_4 + 3H_2$		16.5	1916	
$CH_4 + 4H_2$		22.0	1960	
$CH_4 + 9H_2$		24.0	2000	
$9CH_4 + C_2H_2$	Air	9.7	1930	1
$7CH_4 + 3C_2H_2$		9.3	2025	
$3CH_4 + 2C_2H_2$		9.25	2075	
$2CH_4 + 3C_2H_2$		9.1	2165	
$CH_4 + 4C_2H_2$		9.05	2250	
$CH_4 + 9C_2H_2$		9.0	2290	
$5CH_4 + N_2$	Air	11.5	1827	9
$5CH_4 + 2N_2$		13.0	1792	
$5CH_4 + 3N_2$		14.5	1765	
$CH_4 + N_2$		17.5	1727	
$2CH_4 + 3N_2$		21.0	1694	
$5CH_4 + 9N_2$		22.4	1675	
$CH_4 + 2N_2$		24.2	1665	
$20CH_4 + CO_2$	Air	10.35	1850	9
$10CH_4 + CO_2$		10.75	1825	
$5CH_4 + CO_2$		11.5	1797	

FLAME TEMPERATURES

Combustible	Diluent	% Combustible	Flame Temp. °C.	Reference
$10CH_4 + 3CO_2$		12.3	1777	
$5CH_4 + 2CO_2$		13.0	1762	
$2CH_4 + CO_2$		13.8	1752	
$10CO + N_2$	Air	35.9	1915	9
$5CO + N_2$		37.3	1875	
$5CO + 2N_2$		40.0	1810	
$5CO + 3N_2$		42.6	1760	
$5CO + 4N_2$		45.0	1718	
$CO + N_2$		47.3	1675	
$20CO + CO_2$	Air	35.6	1890	9
$10CO + CO_2$		36.5	1850	
$5CO + CO_2$		37.6	1797	
$10CO + 3CO_2$		38.5	1764	
58.5%CO + 41.5%H_2	Air	32.6	2004	9
31.9%CO + 22.5%H_2 + 45.4%N_2	Air	45.0	1718	9
37.0%CO + 27.1%H_2 + 35.9%N_2	Air	41.7	1812	9
50.1%CO + 35.5%H_2 + 14.4%N_2	Air	36.0	1940	9
Pittsburg natural gas	Air	9.0	1950* 1930†	
Mixed coal gas H_2 49.8% CO 11.8 CH_4 25.8 C_2H_6 1.5 Illuminants 4.5 CO_2 2.4 N_2 4.2	Air	17.6	1918	9
Carburated water gas H_2 35.9% CO 23.5 CH_4 9.0 C_2H_6 2.7 Illuminants 10.0 CO_2 3.5 N_2 15.4	Air	18.8	1930	9
"Electrolene" gas H_2 69.7% CO 24.7 CH_4 1.7 CO_2 2.6 N_2 1.3	Air	30.8	1983	9
Anthracite producer gas H_2 16.9% CO 27.6 CH_4 0.9 CO_2 5.1 N_2 49.5	Air	46.7	1663	9

*Calculated: dry mixture.

†Partially colored flame: dry mixture.

FLAME TEMPERATURES

Combustible	Diluent	% Combustible	Flame Temp. °C.	Reference
City gas 550 BTU	O_2	65	2730	3
Natural gas 1025 BTU	O_2	45	2930	3
Mixed natural gas and coke oven gas 808 BTU	O_2	57	2810	3
Carburated water gas 800 BTU	O_2	50	2800	3
Amyl acetate	Air	....	1422*	10

*Diffusion flame. Two color method.

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IGNITION TEMPERATURES OF VARIOUS SUBSTANCES AND LIMITS OF INFLAMMABILITY OF GASES

Name and formula	Ignition temperature at atmospheric pressure				Limits for inflammability in % by volume of gas in air at atmos. press. and ordinary temp.	
	In oxygen		In air			
	°C.	°F.	°C.	°F.	Lower	Upper
Acetaldehyde, CH_3CHO	140	284	185	365	4	57
Acetone, $(CH_3)_2CO$	568	1054	700	1292	2.5	13
Acetylene, C_2H_2	416–440	781–824	406–440	763–824	2.5	82
Amyl alcohol, $C_5H_{11}OH$	390	734	409	768	...	....
Aniline, $C_6H_5NH_2$	530	986	770	1418	...	...
Benzaldehyde, $C_6H_5{\cdot}CHO$	168	334	180	356	...	...
Benzene, C_6H_6	662	1224	740	1364	1.4	5.5
Blast-furnace gas	...	...	....	...	36	65
Blue water gas	...	...	...	...	12	67
Butane, C_4H_{10}	...	...	...	...	1.5	6
n-Butyl alcohol, C_4H_9OH	385	725	450	842	...	...
Butylene, C_4H_8	...	...	...	...	1.7	9
Carbon monoxide, CO	637–658	1179–1216	644–658	1191–1216	6.3	71.2
Coal gas	...	...	...	...	7	21
Coke-oven gas	...	...	...	...	7	21
Cylinder oil	320	608	417	783	...	...
Decane	202	396	463	865	...	...
Ethane	520–630	968–1166	520–630	968–1166	3.3	10.6
Ethyl alcohol, C_2H_5OH	425	797	558	1036	3.7	13.7
Ethyl ether, $(C_2H_5)_2O$	178	352	343	649	1.6	7.7
Ethylene, C_2H_4	500–519	932–966	542–547	1008–1018	3.4	14.1
Gas oil	270	518	336	637	...	...
Glycerol, $C_3H_5(OH)_3$	414	777	500	932	...	...
Hexane, C_6H_{14}	268	514	487	909	1.3	...
Hydrogen, H_2	580–590	1076–1094	580–590	1076–1094	6.2	71.4
Hydrogen sulfide, H_2S	...	...	....	..	4.3	45
Isopropyl alcohol, C_3H_7OH	512	954	590	1094	2.7	...
Kerosene	270	518	295	563	...	...
Methane, CH_4	556–700	1033–1292	650–750	1202–1382	5.8	13.3
Methyl alcohol, CH_3OH	555	1031	...	...	6	36
Pennsylvania crude oil	242	468	316	601	...	...
Pentane	...	...	...	...	1.3	4.9
Phenol, C_6H_5OH	574	1065	715	1319	...	...
Propane, C_3H_8	490–570	914–1058	...	...	2	7
Propyl alcohol, C_3H_7OH	445	833	505	941	2.6	...
Propylene, C_3H_6	...	...	....	...	2.2	9.7
Sugar	378	712	385	725	...	...
Toluene	552	1026	810	1490	1.3	6.8

COMBUSTION CON-

The high (gross) heat value is the value obtained by burning the gas in a Junker's calorimeter, which assumes that the products of combustion are cooled to the initial temperature and includes the heat of condensation of the water formed by the combustion; the low (net) heat value differs from the high (gross) value by the heat of vaporization of water and is calculated from the gross by subtracting the heat of

			B.T.U. per cu. ft., dry, 30 in. pressure			
Name and formula	Mol. wt.	Sp. Gr.	High (gross)		Low (net)	
		Air = 1	32°F.	60°F.	32°F.	60°F.
Acetylene, C_2H_2	26.02	0.8981	1567	1483	1514	1433
Benzene, C_6H_6	78.05	2.694	3933	3722	3774	3577
Butane, C_4H_{10}	58.08	2.005	3445	3261	3180	3010
Butylene, C_4H_8	56.06	1.935	3262	3087	3050	2887
Carbon dioxide, CO_2	44.00	1.519	....	....	....	....
Carbon monoxide, CO	28.00	0.9665	341.0	322.6	341.0	322.6
Ethane, C_2H_6	30.05	1.037	1862	1762	1703	1612
Ethylene, C_2H_4	28.03	0.9676	1734	1641	1631	1541
Hydrogen, H_2	2.02	0.0695	343.0	324.5	290.0	274.5
Hydrogen sulfide, H_2S	34.08	1.177	....	....	....	....
Methane, CH_4	16.03	0.5534	1069	1012	963	912
Naphthalene, $C_{10}H_8$	128.06	......	....	....	....	....
Propane, C_3H_8	44.06	1.521	2652	2509	2440	2309
Propylene, C_3H_6	42.05	1.451	2487	2354	2328	2204
Toluene, C_7H_8	92.06	3.178	4693	4441	4481	4241
Xylene, C_8H_{10}	106.08	3.662	5446	5153	5181	4902
Water, H_2O	18.02	0.6219	....	....	....	....

COMBUSTION CONSTANTS AND COMPOSITION OF

The coal gas, coke-oven gases, oil gas and carburetted water gas contain in addition small amounts of benzene and oxygen. The heat values are calculated from the values as given in the table under COMBUSTION CONSTANTS OF GASES.

	Blast-furnace gas	Blue water gas	Carburetted water gas	Coal gas	Coke-oven gas
% Methane, CH_4	....	....	14.8	34.0	28.5
% Ethane, C_2H_6	....	....	....	....	....
% Propane, C_3H_8	....	....	....	....	....
% Ethylene, C_2H_4	....	....	12.8	6.6	2.9
% Carbon monoxide, CO	26.2	43.4	33.9	9.0	5.1
% Carbon dioxide, CO_2	13.0	3.5	1.5	1.1	1.4
% Hydrogen, H_2	3.2	51.8	35.2	47.0	57.4
% Nitrogen, N_2	57.6	1.3	1.8	2.3	4.2
% Oxygen, O_2	....	....	....	....	0.5
B.T.U. per cu. ft., high (gross) 60°F., 30 in. Hg, satd. H_2O	93	310	578	634	536
B.T.U. per cu. ft., low (net) 60°F., 30 in. Hg, satd. H_2O	91.6	285	529	560	476
Cu. ft. air required per cu. ft. of gas	0.70	2.28	4.85	5.50	4.65
Cu. ft. CO_2 per cu. ft. of gas burned	0.392	0.469	0.758	0.573	0.420
Cu. ft. H_2O per cu. ft. of gas burned	0.032	0.518	0.904	1.282	1.205
Cu. ft. N_2 per cu. ft. of gas burned	0.55	1.81	3.85	4.36	3.71
High (gross) B.T.U. per cu. ft. gas-air mixture	54.7	94.5	98.8	97.5	95.0
Theoretical flame temp., deg. F.	2660	4167	4090	3910	3430

STANTS OF GASES

vaporization of water at 60°F; thus, in the low (net) value the assumption is made that all of the products of combustion with the exception of the water have been cooled to the initial temperature; the flue products are calculated upon air with a composition of 79% nitrogen and 21% oxygen. The flame temperatures are not corrected for dissociation.

B.T.U. per cu. ft., satd. H_2O, 30 in. pressure. High (gross) 60°F.	B.T.U. per cu. ft., satd. H_2O, 30 in. pressure. Low (net) 60°F.	B.T.U. per mole High (gross)	B.T.U. per mole Low (net)	Cu. ft. per cu. ft. fuel gas or mole per mole: Required for combustion O_2	Required for combustion Air	Flue products H_2O	Flue products CO_2	Flue products N_2	Theoretical Flame temp., deg. F.
1456	1396	562,000	543,000	2.5	11.90	1.0	2.0	9.40	4770
3658	3509	1,413,000	1,356,000	7.5	35.70	3.0	6.0	28.20	4110
3204	2955	1,237,000	1,142,000	6.5	30.95	5.0	4.0	24.45	3870
3033	2834	1,171,000	1,095,000	6.0	28.58	4.0	4.0	22.58	4030
.....	.....	....	....	....	.....	...	...	.....	....
317.1	317.1	122,400	122,400	0.5	2.38	...	1.0	1.88	4475
1731	1582	668,300	611,300	3.5	16.67	3.0	2.0	13.17	3820
1613	1514	622,400	584,400	3.0	14.29	2.0	2.0	11.29	4250
318.8	269.1	123,100	104,100	0.5	2.38	1.0	...	1.88	4010
....	....	....	....	1.5	7.14	1.0	1.0, SO_2	5.64	....
995	896	384,000	346,000	2.0	9.52	2.0	1.0	7.52	3750
....	....	2,219,000	2,143,000	12.0	57.10	4.0	10.0	45.00	4100
2465	2266	952,000	876,000	5.0	23.80	4.0	3.0	18.80	3840
2313	2164	893,000	836,000	4.5	21.43	3.0	3.0	16.93	4090
4364	4165	1,685,000	1,609,000	9.0	42.87	4.0	7.0	33.87	4050
5064	4815	1,955,000	1,860,000	10.5	50.00	5.0	8.0	39.50	4010
.....	....	....	....	....	.....	...	...	.....	....

REPRESENTATIVE MANUFACTURED AND NATURAL GASES

The flame temperatures are not corrected for dissociation. The air required, products of combustion, B. T. U. of gas-air mixture and the flame temperature are based upon air with 21% oxygen and 79% nitrogen.

Coke-oven gas	Natural gas, Follansbee, W. Va.	Natural gas residual, Follansbee, W. Va.	Natural gas, McKean Co., Pa.	Natural gas, Sandusky, Ohio	Oil gas	Producer gas
33.9	.....	.....	32.3	83.5	27.0	2.6
.....	31.8	79.4	67.0	12.5	.....	.....
.....	67.7	20.0	.....	.....	.....	.....
5.2	.....	.....	.....	.....	2.7	0.4
6.1	.....	.....	.....	.....	10.6	22.0
2.6	.....	.....	.....	0.2	2.8	5.7
47.9	.....	.....	.....	.....	53.5	10.5
3.7	0.5	0.6	0.7	3.8	3.4	58.8
0.6	.....	.....	.....	.....	.....	.....
600	2220	1868	1482	1047	516	136
538	1970	1711	1350	946	461	128
5.28	21.50	17.97	14.25	10.04	4.25	1.08
0.529	2.666	2.188	1.663	1.087	0.458	0.311
1.260	3.662	3.182	2.756	2.045	1.129	0.165
4.21	17.00	14.21	11.29	7.98	3.39	1.44
95.6	98.6	98.5	97.3	94.7	98.3	65.3
3860	3835	3830	3770	3740	3970	3050

CONSTANTS FOR CER-

Name of gas or vapor	Mol. weight	Spec. Grav. gas or vapor at 60°F. Air = 1.000	Boiling point °F.	Spec. Grav. of liquid at 60°F. Water = 1.000	Spec. heat eq. wts. at const. press. Water = 1.000	Cubic feet per pound 60°F.-30″ Hg	Weight of 1 cubic foot in pounds	Heat of Combustion		
								Gram calories per gram-molecular wt.	B.T.U. per cubic foot	B.T.U. per pound
Acetylene	26.02	0.9056	−112	0.6130	......	14.45	0.0692	310054	1483.0	21449
Air	.....	1.000	......	......	0.2374	13.09	0.0764	....	......	......
Allylene	40.03	1.3823	− 10.3	......	......	9.447	0.10585	467550	2227.1	21040
Ammonia	17.03	0.5971	− 37.3	0.6234	0.5202	22.178	0.04509	90650	432.8	9598
Amylene	70.08	2.4211	+102	0.6511	......	5.41	0.1849	807602	3835.0	20743
Benzene	78.05	2.6953	+176.6	0.8839	0.3754	4.86	0.2059	787993	3741.0	18175
Butane	58.08	2.0100	+ 33	......	......	6.51	0.1535	687203	3269.0	21298
Butylene	56.06	1.2367	+ 23	......	......	6.76	0.1479	650632	3089.0	20891
Carbon dioxide	44.00	1.52909	−108.4	0.8300	0.2163	8.57	0.1167	....	......	......
Carbon disulfide	76.12	2.6298	+114.8	1.2920	0.159	4.965	0.20139	265130	1264.6	6279
Carbon monoxide	28.00	0.96716	−310	......	0.2450	13.55	0.0738	67960	323.0	4369
Crotonylene	54.05	1.8661	+ 81	......	......	6.998	0.14290	593091	2822.6	19752
Cyanogen, CN	26.01	1.8000	− 5.8	0.8600	......	7.258	0.13779	259620	1238.2	8986
Ethane	30.05	1.0494	−128.2	......	......	12.48	0.0801	370456	1778.0	22190
Ethyl alcohol	46.05	1.5894	+172.9	0.7946	1.4534	8.23	0.1215	340494	1617.0	13309
Ethylene	28.03	0.96836	−153.4	......	0.4040	13.53	0.0739	333361	1583.0	21407
Hexane	86.11	2.9721	+160.7	0.6630	......	4.40	0.2271	999220	4744.0	20887
Hydrogen	2.016	0.06960	−423.4	......	3.4090	188.70	0.0053	68415	325.0	61085
Hydrogen cyanide	27.02	0.9348	+ 79.7	0.6967	......	13.968	0.07159	158620	757.0	10575
Hydrogen sulfide	34.08	1.1906	− 79.2	0.9000	0.2423	11.00	0.0909	136701	657.0	7237
Mesitylene	120.09	4.1468	+328.1	0.8583	......	3.149	0.31755	1282310	6108.0	19235
Methane	16.03	0.55450	−263.2	......	0.5920	23.64	0.0423	211933	1008.0	23879
Methyl alcohol	32.03	1.1121	+131.2	0.8027	0.458	11.83	0.0845	182187	865.0	10238
Naphthalene	128.06	4.4230	+424.7	1.1508	......	2.952	0.3387	1230657	5859.0	17298
Nitrogen	28.02	0.9674	−320.1	0.8050	0.2438	13.53	0.0739	....	......	......
Oxygen	32.00	1.1055	−294.5	1.1340	0.2174	11.85	0.0844	....	......	......
Pentane	72.09	2.4905	+ 98.6	0.6263	......	5.26	0.1902	847247	4022.0	21152
Propane	44.06	1.5223	− 38.2	0.6130	......	8.61	0.1162	529205	2513.0	21620
Propylene	42.05	1.4527	− 58.4	......	......	9.02	0.1109	492742	2340.0	21092
Sulfur dioxide	64.06	2.2638	+ 12.6	1.4900	0.1553	5.78	0.1729	......	......	.....
Toluene	92.06	3.1792	+231.8	0.8714	......	4.12	0.2429	934409	4436.0	18270
Water	18.02	0.6217	+212	1.000	0.4805	21.004	0.04761	....	......	.....
m-Xylene	106.08	3.6630	+282.[illegible]	0.8697	......	3.57	0.2800	1084986	5155.0	18410

TAIN GASES AND VAPORS

Cu. ft. per cu. ft. of gas or vapor					Pounds per pound of gas or vapor					Heat of formation constant pressure		
Required for combustion		Products of combustion			Required for combustion		Products of combustion			Calories per gram-molecular weight	B.T.U.	
Air	O_2	CO_2	H_2O	N_2	Air	O_2	CO_2	H_2O	N_2		Per cubic foot	Per pound
11.94	2.5	2.0	1.0	9.45	13.22	3.07	3.38	0.69	10.15	−47770	−227.5	−3300.7
.....	....	....	...	.....	.....	....	.....	....	.....	......	......	....
19.14	4.0	3.0	2.0	15.14	13.85	3.20	3.30	0.90	10.65	−39950	−189.2	−1796.4
3.589	0.75	...	1.5	2.889	6.111	1.412	....	1.588	5.522	+11890	+ 56.7	+1259.0
35.83	7.5	5.0	5.0	28.35	14.72	3.42	3.14	1.29	11.30	+18970	+113.7	+ 614.1
35.83	7.5	6.0	3.0	28.35	13.22	3.07	3.38	0.69	10.15	−12510	− 47.3	− 229.3
31.06	6.5	4.0	5.0	24.57	15.41	3.58	3.03	1.55	11.83	+42450	+202.2	+1317.3
28.67	6.0	4.0	4.0	22.68	14.72	3.42	3.14	1.29	11.30	+10660	+ 50.7	+ 342.6
......	....	.....	.....	.....	......	.....	.....	.....	......	+97266	+463.1	+3979.1
			SO_2					SO_2				
14.355	3.0	1.0	2.0	11.355	5.466	1.263	0.579	1.684	4.203	−26010	−124.0	−616.0
2.39	0.5	1.0	....	1.89	2.45	0.57	1.57	....	1.88	+29000	+138.4	+1869.2
26.32	5.5	4.0	3.0	20.828	14.11	3.26	3.26	1.30	10.85	......	......	....
9.57	2.0	2.0	...	8.57	5.323	1.230	1.692	.....	4.631	−65700	−313.2	−2273.9
16.72	3.5	2.0	3.0	13.23	16.06	3.75	2.93	1.80	12.33	+28560	+136.0	+1713.6
14.33	3.0	2.0	3.0	11.34	8.95	2.08	1.91	1.17	6.87	+58470	+278.5	+2288.0
14.33	3.0	2.0	2.0	11.34	14.72	3.42	3.14	1.29	11.30	− 2710	− 12.9	− 174.2
45.39	9.5	6.0	7.0	35.91	15.20	3.53	3.07	1.46	11.67	+61080	+290.9	+1278.4
2.39	0.5	...	1.0	1.89	34.19	7.94	....	8.94	26.25	......	......	....
5.981	1.25	1.0	0.5	4.781	6.410	1.481	1.63	0.333	5.447	−27480	−131.1	−1832.0
		SO_2					SO_2					
7.17	1.5	1.0	1.0	5.67	6.07	1.41	1.88	0.53	4.66	+ 4740	+ 22.6	+ 250.9
57.42	12.0	9.0	6.0	45.42	13.85	3.20	3.30	0.90	10.65	+ 490	+ 2.3	+ 7.3
9.56	2.0	1.0	2.0	7.56	17.17	3.99	2.74	2.25	13.18	+21750	+103.1	+2435.6
7.17	1.5	1.0	2.0	5.67	6.46	1.50	1.37	1.12	4.96	+51450	+246.4	+2894.0
57.42	12.0	10.0	4.0	45.42	12.984	3.00	3.437	0.563	9.984	......	....	....
......	.....	....	....	......	......	.....	.....	.....	......	......	....	....
......	.....	....	....	......	......	.....	.....	.....	......	......	....	....
38.22	8.0	5.0	6.0	30.24	15.28	3.55	3.05	1.50	11.73	+47850	+227.9	+1196.2
23.89	5.0	3.0	4.0	18.90	15.63	3.63	3.00	1.64	12.00	+35110	+167.2	+1436.3
21.50	4.5	3.0	3.0	17.01	14.72	3.42	3.14	1.29	11.30	+ 3220	+ 15.3	+138.0
......	.....	....	....	......	......	.....	....	.....	......	+71156	+337.3	+1999.1
43.00	9.0	7.0	4.0	34.02	13.47	3.13	3.35	0.78	10.34	− 3520	− 16.7	− 68.8
......	.....	.....	.....	......	......	.....	.....	.....	......	+68360	+327.[illegible]	+6870.4
50.17	10.5	8.0	5.0	39.69	13.65	3.17	3.32	0.85	10.48	....	.....	....

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

See also the table *Corrosion- and Heat-Resistant Alloys.*

The following table has the alloys arranged alphabetically according to the name of the element which predominates. The following abbreviations are employed: A, annealed; C, cold worked; AC, annealed and cold worked; H, hardened; HR, hot rolled. The ultimate strength is given in thousands of pounds per square inch.

Composition %	Trade Name	Sp. Gr.	M. P. °C.	Thermal Expansion ×10⁶	Ultimate Strength
Aluminum					
99.2Al	Aluminum 2S	2.71	660	23.94	12AC
95Al, 5Cu	Lynite, body alloy	.....	650	26	......
94Al, 4Cu, 0.5Mg, 0.5Mn, coated with 99.7+Al	Alclad 17 ST	2.79	538–46	21.96	55
90Al, 10Mg	Magnalium	2.50	600	24	......
70Al, 30Mg	Magnalium	2.00	435	......	......
98Al, 1.25Mn	Aluminum Alloy 3S	2.74	640–55	23.04	16–31 AC
95Al, 5Si	Aluminum-silicon 43	2.58	577–630	21.96	19
Bismuth					
53Bi, 32Pb, 15Sn	Eutectic fusible alloy	......	96	......	......
52Bi, 40Pb, 8Cd	Eutectic fusible alloy	......	91.5	......	......
50Bi, 27Pb, 13Sn, 10Cd	Lipowitz alloy	......	70–2	......	......
50Bi, 25Pb, 12.5Sn, 12.5Cd	Wood's metal	9.7	70–2	......	......
40Bi, 40Pb, 20Sn	Bismuth solder	......	111	......	......
Cerium					
70-3Ce, 17-24Zn, 1.6-6Fe, 0-2.4Al, Mn	Ignition pin alloy	......	......	......	......
61Ce, 37Fe	Ignition pin alloy	......	......	......	......
Cobalt					
56Co, 34-40Cr, 9.2W, 1.2-2C, 0-1Fe	Stellite No. 2	......	......	......	......
55Co, 20-23Cr, 15-20W, 3-5Fe, 1.5-4C	Stellite No. 3	......	......	......	......
40-80Co, 20-35Cr, 0-25W, 0.75-2.5C	Stellite	8.50	1150	14.99	......
Copper					
99.9+Cu	Deoxidized copper	8.50	1082	17.71	32–55
99.9Cu, 0.01P	Deoxidized copper	8.91	1082	17.71	35–55
90Cu, 10Al	Aluminum bronze	7.6	1050	16.5	......
90Cu, 9Al, 1Fe	Resistac	......	1066	......	75
80-90Cu, 8-10Al, 6-7Fe	Ampco Metal	7.2	649	......	60–100
88-96Cu, 2.3-10.5Al, Fe, Sn	Aluminum bronze	7.5–8.2	1038–71	......	......
47Cu, 33Au, 20Ag	8 Carat gold	......	......	......	......
40Cu, 31Au, 19Ag, 10Pd	Palladium gold	......	......	......	......
95Cu, 5Mn	Manganese bronze	8.8	1060	......	......
82Cu, 15Mn, 3Ni	Manganin	8.5	......	......	......
61Cu, 26Mn, 13Al	Magnetic alloy	......	......	......	......
88.5Cu, 5Ni, 5Sn, 1.5Si	Barberite	8.8	1070	......	60
75Cu, 25Ni	Nickel coinage, U.S.A.	......	......	......	

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Composition %	Trade Name	Sp. Gr.	M.P. °C.	Thermal Expansion × 10⁶	Ultimate Strength
Copper					
75Cu, 20Ni, 5Zn	Ambrac A	8.58	1150	16.40	50-130
65Cu, 18Ni, 17Zn	Nickel silver	8.75	1110	18.36	55-110
60Cu, 40Ni	Constantan	8.4	1280	......	......
55Cu, 18Ni, 27Zn	Nickel silver	8.7	1055	......	......
94.8-96Cu, 3-4Si, 1-1.2Mn	Everdur	8.46	1000	16.99	50-145
95.5Cu, 4.3Sn, 0.2P	Phosphor bronze 30	8.91	1050	18.90	45-115
91.6Cu, 8.25Sn, 0.15P	Phosphor bronze 47	8.91	......	......	51-130
90Cu, 10Sn, P trace	Phosphor bronze 209	9.00	......	......	Up to 135
90Cu, 10Sn	Gun metal bronze	8.80	......	......	......
82Cu, 16Sn, 2Zn	Bearing bronze	......	......	......	......
67Cu, 33Sn	Speculum metal	......	......	......	......
90Cu, 10Zn	Red brass	8.80	1050	18.18	37-100
89Cu, 9Zn, 2Pb	Hardware bronze	8.83	1050	18.18	35-60
85Cu, 15 Zn	Red brass	8.75	1030	18.72	43-75
70 Cu, 29Ni, 1Sn	Adnic	......	1205	16.29	113H
70Cu, 29Zn, 1Sn	Admiralty	8.17	935	20.16	50-95
67Cu, 33Zn	Yellow brass	8.40	940	18.50	......
60Cu, 40Zn	Muntz metal	......	840	......	......
60Cu, 25Zn, 15Ni	German silver	......	......	18.40	......
60Cu, 19Zn, 10Al, 6Fe, 5Mn	Hytensl bronze	......	980	......	105
55Cu, 25Zn, 20Ni	Usual German silver	......	......	......	......
Gold					
92Au, 8Cu	Great Britain standard	......	900	......	......
90Au, 10Cu	Coinage gold	17.17	940	......	......
67Au, 8-27Cu, 6-26Ag	16 Carat gold	......	......	......	......
62Au, 13Cu, 11Ag	15 Carat gold	......	......	......	......
58Au, 14-28Cu, 4-28Ag	14 Carat gold	......	......	......	......
50Au, 35Cu, 15Ag	12 Carat gold solder	......	......	......	......
42Au, 38-46Cu, 12-20Ag	10 Carat gold	......	......	......	......
90Au, 10Pd	Palladium or white gold	......	1265	......	......
80Au, 20Pd	Palau	......	1375	......	......
60Au, 40Pt	White, platinum gold	......	1500	......	......
92Au, 4.9Ag, 3.4Cu	22 Carat, dark dental	......	......	......	......
92Au, 4.2Ag, 3.8Cu	22 Carat gold	......	......	......	......
84Au, 8.3-11Ag, 6-8.3Cu	20 Carat gold	......	....	....	....
75Au, 10-20Ag, 5-15Cu	18 Carat gold	......	......	......	......
68-70Au, 25Ag, 5-7.5 Pt or Ni	Platinum substitute, electrical	....	......	......	......
50Au, 33Ag, 17Cu	14 Carat gold solder	......	......	......	......
41 Au, 37Ag, 21Cu, 0.6 brass	10 Carat gold solder	......	......	......	......
40Au, 37Ag, 23Cu	8 Carat gold solder	......	......	......	......
Iridium					
95Ir, 5Pt	....	22.38	......	......	......
Iron					
99.8Fe, 0.11O, 0.025 S, 0.017Mn 0.012C, 0.005P	Armco ingot iron	7.86	1530	......	48

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Composition %	Trade Name	Sp. Gr.	M. P. °C.	Thermal Expansion $\times 10^6$	Ultimate Strength
Iron					
98.5Fe	Wrought iron	7.7	1510	......	48
80Fe, 20Al	Ferro-aluminum	6.30	1480	......	......
99Fe, 1C	Steel	7.83	1430	12.0	......
97Fe, 3C	White cast iron	7.60	1150	......	......
94Fe, 3.5C, 2.5Si	Gray cast iron	7.0	1230	11.2	......
Fe, 30-40Co, 5-9W, 1.5-3Cr, 0.4-0.8C	K. S. Magnet steel	......	......	......	......
Fe, 0.45Cu, 0.07Mo, 0.03C	Molybdenum iron; Toncan copper	7.83	1525	11.99	......
Fe, +10Cr, 0.25C, <0.5Mn	Stainless steel	7.75	1510	......	98-250
90-92Fe, +Cr, 0.4Mn, <0.12C	Stainless steel	7.75	1450	11.00	250
90Fe, +Cr, 0.4Mn, <0.12C	Stainless iron	7.75	1450	11.00	80
88Fe, 16-17Cr, 0.4Mn, 0.1C max.	Stainless iron	......	......	9.99	60-80
86-88Fe, 12-14Cr, 0.3C	Carpenter stainless steel No. 2	7.75	1425	......	260
86-88Fe, 12-14Cr, <0.5 Mn, <0.1C, Ni trace	Defirust rustless iron	7.75	1480	......	80-160
86-88Fe, 12-14Cr, 0.1C	Carpenter stainless steel No. 1	7.78	1490	......	85A-180H
85-89Fe, 10-14Cr, <0.5Mn, <0.13C	Stainless iron	7.78	1490	10.19	80-200
82-86Fe, 12-16Cr, <0.5Ni, <0.05Si, <0.5Mn, <0.12C	Ascoloy 33	7.64	1495	10.89	85
86.7Fe, 12.5Cr, 0.35Mn, 0.35Ni, 0.12C	Sterling stainless steel T	7.75	1430	9.99	125H
86.4Fe, 13.5Cr, 0.1C	Stainless I	7.75	......	10.91	125
84-86Fe, 12.5-14.5Cr, 0.5Mn max., 0.5Si max., 0.5Ni min., 0.12-0.18C	Enduro S 15	7.86	1475	10.89	100A
84-86Fe, 12.5-14.5Cr 0.5 Mn max., 0.5Si max., 0.25Ni, 0.05-0.12C	Enduro S	7.86	1500	10.89	......
85.8Fe, 13.5Cr, 0.35 Mn, 0.35C	Sterling stainless steel A	7.75	1425	10.30	200H
85.6Fe, 14Cr, 0.35C	Stainless A	7.75	......	10.91	100
85Fe, 13-14Cr, 2Ni max., 0.3-0.6Mn, 0.12C max.	Enduro KM 1	7.75	1490	9.99	......
82-84Fe, 16-18Cr, <0.5Mn, C	Duraloy B	7.61	1510	......	100
84.3Fe, 12Cr, 2.15C, 0.75V, 0.75Co	Crocar	......	......	......	103
82-84Fe, 16-18Cr, <0.5Mn, <0.1C, Ni trace	Special defirust rustless iron	7.75	1480	......	80
81-83Fe, 16.5-18.5 Cr, 0.75Si, 0.1C max.	Enduro A	7.64	1510	11.00	75

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Composition %	Trade Name	Sp. Gr.	M. P. °C.	Thermal Expansion $\times 10^6$	Ultimate Strength
Iron					
82.8Fe, 16.5Cr, 0.65C	Stainless B	......	......	......	......
82.5Fe, 16.5Cr, 0.65C, 0.35Mn	Sterling stainless steel B	7.72	1425	10.91	200H
82Fe, 16-18Cr, <0.5 Mn, 0.5Ni, 0.35C	Sweetaloy 16	7.83	1495	11.00	75
79-82Fe, 16-19Cr, <0.5Mn, <0.5Ni, <0.5Si, <0.12C	Ascoloy 66	7.64	......	......	87
79-82Fe, 16.5-18.5Cr, 0.5 Mn max., 0.5-1.25Si max., 0.25Ni max., 0.1C max	Enduro A	7.86	1490	10.80	78A
79-81Fe, 16.5-18Cr, 1-1.1C, 0.75-1.0Si, 0.35-0.5Mn	Delhi hard	7.75	1500	9.99	125A
78.7Fe, 20Cr, 1Cu, 0.3C	Carpenter stainless steel 3	7.70	1475	......	100
71-76Fe, 17-19Cr, 7-10 Ni, 0.05Mn, 0.2C	Defistain rustless iron	7.83	1455	......	90
71-75Fe, 17-19Cr, 8-9 Ni, 0.5Mn, 0.06-0.25C	Midvale V2A	7.89	1450	16.99	90-115
70-75Fe, 25-30Cr, <0.5Mn, 0.25C, Ni trace	Defiheat rustless iron	7.89	1595	......	75-100
Fe, 17-20Cr, 7-10Ni, <0.5Mn, <0.5Si, <0.2C	Allegheny metal	7.85	1430-70	17.30	90A
69-75Fe, 16.5-19.5Cr, 7-10Ni, 0.75Si max., 0.5Mn max., 0.15C max.	Enduro KA2	7.86	1400	15.98	90
74Fe, 18Cr, 8Ni, 0.18C	Stainless N	......	......	18.00	90
71-74Fe, 17.5-19Cr, 8-9Ni, 0.5 Mn, 0.15C max.	Rezistal KA2	7.86	......	15.98	90
73.5Fe, 18Cr, 8Ni, 0.35 Mn, 0.15C	Sterling nirosta steel	7.92	1425	16.99	200C
73Fe, 18Cr, 9Ni, 0.5Mn, C	Duraloy 18-8	7.86	1475	14.99	105-115
70-73Fe, 27-30Cr, 0.5Mn, C	Duraloy A	7.61	1510	......	40-50
72.4Fe, 18Cr, 9.5Ni, 0.1C	Carpenter stainless steel No. 4	7.72	1400	......	89A-100HR
70-72Fe, 17.5-19Cr, 8-9Ni, 2-2.5Si, 0.1-0.2C	Rezistal 2C	7.86	......	15.98	108
68-72Fe, 26-30Cr, <1Mn, <0.6Ni, <0.6Si, <0.25C	Ascoloy 55	7.61	......	10.19	90
70Fe, 28Cr, 0.5Mn, 0.5 Ni, 0.5C	Sweetaloy 19	7.86	1495	11.00	50
70Fe, 19Cr, 9Ni, 1Cu, 1Mo, 0.2C	Stainless U	......	......	18.00	100

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Composition %	Trade Name	Sp. Gr.	M. P. °C.	Thermal Expansion $\times 10^6$	Ultimate Strength
Iron					
69Fe, 18-20Cr, 8-10Ni, 0.5Mn, 0.15C	Sweetaloy 17	7.86	1450	15.98	85
68.1Fe, 20Cr, 7Ni, 4W, 0.35C, 0.5Mn	Midvale HR	8.03	......	......	85-135
60-66Fe, 22-25Cr, 10-13 Ni, <1Mn, <0.5Si, <0.2C	Ascoloy 44	7.9	1400-25	16.20	100A
57-62Fe, 28-30Cr, 8-10 Ni, 1.5Si, 0.5-0.7C, 0.4-0.5Mn	Misco C	7.89	1540	......	82.6
60Fe, 28Cr, 10Ni, 0.5 Mn, 0.35C	Sweetaloy 22	7.97	1495	......	70
50Fe, 50Cr	Ferro-chromium	6.9	1460	......	......
50-54Fe, 25-26Cr, 19-21 Ni, 2-3Si, 0.2C	Rezistal 7	......	......	......	......
85-88Fe, 11-14Mn, 1-1.3C	Rol-Man, manganese steel	......	1290	......	160
86Fe, 13Mn, 1C	Manganese steel	7.81	1510	......	......
50Fe, 50Mn	Ferro-manganese	......	1325	......	......
96.5Fe, 3.5Ni	Nickel steel	.....	1530	......	......
95.1Fe, 3Ni, 1.5Cr, 0.4C	Nickel-chrome steel	......	......	......	......
79Fe, 15Ni, 2.5Cr, 3Si, 0.6C	Durimet D	......	1450	......	75
74.2Fe, 25Ni, 0.8C	Ferro-nickel	8.1	1500	18	......
70.9Fe, 20Ni, 8Cr, 0.75 Mn, 0.4C	Cyclops 17 Metal	8.00	1425-80	......	125
70Fe, 25Ni, 5Si, 0.25C	Durimet A	7.89	1500	......	......
67.8Fe, 32Ni, 0.2C	Ferro-nickel valve steel	8.0	1480	4	......
67Fe, 22Ni, 10Cr, 0.5 Mn, 0.2C	Sweetaloy 18	7.97	1450	18.90	79
63.8Fe, 36Ni, 0.2C	Invar	8.0	1495	0.8	......
57-61Fe, 24-26Ni, 10-12Cr, 4.5-5.5Si, 0.15C	Rezistal 255C	7.81	......	......	116
51-58Fe, 25-28Ni, 13-15Cr, 3-4W, 1-1.5 Mn, 0.4-0.5C	Midvale ATV 3	8.11	......	......	108
57Fe, 25Ni, 15Cr, 0.3C	Pyrasteel	7.89	1450	17.10	80
47-56Fe, 33-39Ni, 10-12 Cr, 1.1-1.8Mn, 0.25-0.35C	Midvale ATV 1	8.06	1450	......	85-100
53-56Fe, 24-26Ni, 17-18 Cr, 2.5Si, 0.15-0.25C	Rezistal 4	7.78	......	16.29	113
53.85Fe, 46Ni, 0.15C	Platinite	8.2	1470	7.5	......
47-52Fe, 34-36Ni, 10-12Cr, 4.5-5.5Si, 0.15C	Rezistal 355C	7.81	......	......	......
Fe, 35-37Ni, 15-17Cr, 1.4-1.6Si, 0.6-0.8Mn, 0.5-0.7C	Standard Misco	7.97	1540	13.50	75
50Fe, 35Ni, 15Cr	Chromax castings	7.81	1480	12.19	60
48Fe, 35Ni, 12Cr, 5Si, 0.25C	Durimet B	7.89	1500	......	100

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Composition %	Trade Name	Sp. Gr.	M. P. °C.	Thermal Expansion $\times 10^6$	Ultimate Strength
Iron					
45Fe, 36Ni, 18Cr, 0.5 Mn, 0.3C	Sweetaloy 20	7.97	1495	......	64
97.6Fe, 2Si, 0.4C	Silicon steel	......	......	......	.....
73-97Fe, 1-24Si, 2-3C, 0.1P, 0.04-0.14S	Meehanite metal	......	......	......	50-65
84.86Fe, 13.5Si, 1C, 0.4 Mn, 0.18P, 0.05S	Tantiron	7.83	1315	......	......
84.3Fe, 14.5Si, 0.85C, 0.35Mn	Duriron	7.00	1265	15.59	14
94.5Fe, 5W, 0.5C	Tungsten steel	......	......	......	......
75Fe, 18W, 6Cr, 0.3V, 0.7C	High speed steel	......	......	......	......
66Fe, 17W, 10Cr 3.5C, 2.5Mo	Cristite 1	7.61	......	15.59	......
Lead					
99.8Pb, 0.2As	Lead for shot	......	......	......	......
94Pb, 6Sb	Battery plate	......	300	......	......
92-94Pb, 6-8Sb	Antimonial lead	11.0	245-90	27.00	3
90Pb, 10Sb	Magnolia	......	270	......	......
82Pb, 15Sb, 3Sn	Type metal	......	......	......	......
75Pb, 19Sb, 5Sn, 1Cu	White metal	9.5	238	......	......
92Pb, 8Cd	Aluminum solder, U.S.P.1,333,666	......	310	......	......
99.93Pb, 0.08Cu	Chemical lead	11.35	327	28.98	1.74
67Pb, 33Sn	Plumber's solder	9.4	275	25.0	......
58Pb, 26Sn, 15Sb, 1Cu	Standard type metal	......	......	......	......
50Pb, 50Sn	Half and half solder	9.4	275	25.0	......
Magnesium					
98.5Mg, 1.5Mn	Dowmetal M	1.76	650	16	......
95.7Mg, 4Al, 0.3Mn	Dowmetal F	1.76	625	16	......
93.7Mg, 6Al, 0.3Mn	Dowmetal E	1.78	610	16	......
91.8Mg, 8Al, 0.2Mn	Dowmetal A	1.80	600	16	......
90Mg, 3-7Al, 2-5Zn, 0.5Mn	Electron	......	......	......	......
89.9Mg, 1.5 Mn	Dowmetal G	1.80	595	16	......
88Mg, 12Al	Dowmetal B	......	575	......	......
88Mg, 8.3Al, 2.0Cu, 1.0 Cd, 0.5Zn, 0.2Mn	Dowmetal D	....	....	....	....
85Mg, 15Al	Dowmetal C	......	590	......	......
91.8Mg, 4Cu, 2Al, 2Cd, 0.2Mn	Dowmetal T	1.82	640	16	......
95Mg, 4-5Zn, 0-0.6Cu	Electron	......	......	......	......
Mercury					
80Hg, 20Bi	Bismuth amalgam	......	90	......	......
70Hg, 30Cu	Dentist amalgam	......	......	......	......
Nickel					
99-99.5Ni (+Co), 0.25-1.0C, 0.25-1.0Si, 0.3-1.0Mn, 0.6-1Fe, 0.25-1Cu	Nickel	8.86	1450	......	65-140

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Composition %	Trade Name	Sp. Gr.	M. P. °C.	Thermal Expansion ×10⁶	Ultimate Strength
Nickel					
Ni-Cr steel with high Si	Elcomet	8.03	......	......	......
80 Ni, 20 Cr	Chromel A	8.4	......	......	......
80 Ni, 20 Cr	Tophet A	8.50	1345	13.00	120
80 Ni, 20 Cr	Nichrome IV	8.50	1390	13.21	110
63 Ni, 21 Cr, 6.5 Cu, 5 Mo, 2 W, 1 Fe, 1 Al, 1 Mn	Illium	......	......	......	......
60 Ni, 25 Cr, 7 Cu	Illium G	8.31	1300	13.50	73
60 Ni, 20 Cr, 10 Fe, 1.75 Mn, 0.5 C	Fireamor	8.00	1330	13.99	60
73 Ni, 17.5 Co, 6.5 Fe, 2.5 Ti, 0.2 Mn	Konel	8.61	1450-1500	10.66	100
90 Ni, 3 Cu, ±10 Si, 1.5 Al	Hastelloy	7.81	1160	11.59	......
60-70 Ni, 25-35 Cu, 1-3 Fe, 0.25-2.0 Mn, 0.02-1.5 Si, 0.3-0.5 C	Monel metal	8.80	1330	......	65-170
60 Ni, 33 Cu, 6.5 Fe	Monel metal	8.90	1360	14	......
75 Ni, 12 Fe, 11 Cr, 2 Mn	Nichrome wire	......	......	......	......
61 Ni, 23 Fe, 16 Cr	Chromel C	8.24	......	......	......
60-62 Ni, 23-26 Fe, 10-11 Cr, 2-2.5 W, 1.2-1.5 Mn, 0.3-0.35 C	Midvale BTG	8.47	1450	......	......
60 Ni, 28 Fe, 12 Cr	Tophet C	8.19	1350	13.70	100
60 Ni, 25 Fe, 15 Cr, 0.7 C	Nichrome castings	8.08	......	12.10	64
60 Ni, 24 Fe, 16 Cr, 0.1 C	Nichrome	8.17	1350	13.70	100
60 Ni, 20 Fe, 20 Mo	Hastelloy A	8.80	1300	10.71	100-120
35 Ni, 17 Fe, 15 Cr, 1.75 Mn, 0.5 C	Zorite	7.92	1300	......	50
Ni, Fe, Mo	Hastelloy C	8.91	1350	......	60
60 Ni, 20 Pt, 10 Pd, 10 V	Palau	......	......	......	......
Palladium					
67 Pd, 33 Ag	Palladium alloy	......	1415	......	......
Platinum					
90 Pt, 10 Ir	Platinum-iridium	21.61	......	8.8	......
80-100 Pt, 0.-20 Rh	Thermocouple rhodium	......	......	8.8	......
Silver					
92.5 Ag, 7.5 Cu	Standard silver	......	920	18	......
90 Ag, 10 Cu	U. S. silver coin	10.3	890	......	......
63 Ag, 30 Cu, 7.5 Zn	Silver solder	......	......	......	......
40 Ag, 40 Sn, 14 Cu, 6 Zn	Bu. Stand. silver solder	......	......	......	......
Tantalum					
99.5 Ta	Tantalum	16.6	2850	6.50	130
Tin					
78 Sn, 9 Al, 8 Zn, 5 Cd	Bu. Stand. SN1 aluminum solder	......	......	......	......

COMPOSITION AND PHYSICAL PROPERTIES OF ALLOYS

Composition %	Trade Name	Sp. Gr.	M. P. °C.	Thermal Expansion ×10⁶	Ultimate Strength
Tin					
90Sn, 10Sb	Brittania metal	......	255	......	......
90Sn, 7Sb, 3Cu	Babbitt metal	......	......	......	......
75Sn, 12.5Sb, 12.5Cu	Antifriction	7.53	233	......	......
85Sn, 6.8Cu, 6Bi, 1.7Sb	Pewter	......	......	......	......
50Sn, 32Pb, 18Cd	Eutectic alloy	......	145	......	......
86Sn, 9Zn, 5Al	Bu. Stand. SN3 aluminum solder	......	......	......	......
69Sn, 29Zn, 2.4Al, 2.4P	Bu. Stand. SN2 aluminum solder	......	......	......	......
41Sn, 28Zn, 3Cu, 0.6Mn, 0.1Al	Aluminum solder, U.S.P. 1,332,899	......	......	......	......
Tungsten					
W, 0.5-0.75ThO_2	Filament tungsten	......	......	......	......
Zinc					
90Zn, 6Al, 4Cu	Geophys. Lab., aluminum solder	......	......	......	......
75Zn, 20Cd, 5Al	Bu. Stand. ZN1, aluminum solder	......	......	......	......
67Zn, 33Cu	Easily fusible solder	......	795	20	......
60Zn, 40Cu	White solder	......	840	21	......
63 Zn, 21Sn, 12Pb, 3.2Cu	Battery plate	......	......	......	......

MELTING POINT AND COMPOSITION OF FUSIBLE ALLOYS

Melting Point Deg. C.	Composition			
	% Bismuth	% Lead	% Tin	% Cadmium
46.9 + 18.1% In	41	22.1	10.6	8.2
66	50	25	12.5	12.5
70*	50	27	13	10
75	27.5	27.5	10	34.5
80	43.8	25	25	6.2
92	52	40	0	8
96	53	32	15	0
100	50	20	30	0
108	42.1	42.1	15.8	0
111	40	40	20	0
117	36.5	36.5	27	0
123	33.3	33.3	33.3	0
130	30.8	38.4	30.8	0
136	0	26.5	59.3	14.2
144.4	0	25	50	25
145	20	40	40	0
155	16	36	48	0
160	11.2	44.4	44.4	0
165	11.4	45.6	43	0
172	12.8	49	38.2	0
178	12.5	50	37.5	0
187	0	31	69	0
200	0	20	80	0
230	0	55.6	44.4	0
265	0	71.4	28.6	0
290	0	87.5	12.5	0

*This alloy (Lipowitz's alloy) and many others can be alloyed with mercury to further reduce the melting point; after melting the alloy and removing the molten mass from the source of heat, the mercury is introduced and the mixture stirred with an iron rod. **CAUTION:** mercury vapors are poisonous.

PHYSICAL AND MECHANICAL PROPERTIES OF CAST METALS

Name	Tensile strength in 1000 lbs. per sq. inch	Yield strength in 1000 lbs. per sq. inch	Elongation % in 2 inches	Brinell Hardness	Weight in lbs. per cu. inch	Pattern maker allowance for shrinkage in inches per ft.
Aluminum alloys:						
Aluminum	12	.....	40	18	0.089	0.203
Alcoa 43	17	9	3	40	0.096	0.125
Alcoa 214	22	12	6	50	0.095	0.125
Alcoa 406	.....	.....	.....	.....	0.099	0.125
Copper alloys:						
Copper	17–20	6–9	40–50	30–40	0.320	0.250
Alcumite	65–70	23–25	30–35	120–140	0.273	0.1875
Ambrac 850	50–115	17–67	2–50	58–160	0.322	0.1875
Ampco 12	55–65	22–27	22–27	109–124	0.279	0.250
Ampco 16	70–80	32–37	18–22	131–156	0.275	0.250
Ampco 18	75–85	33–42	10–14	159–183	0.272	0.250
Ampco 20	80–90	35–43	4–6	212–248	0.268	0.250
Ampco 21	80–95	36–44	3–5	285–311	0.260	0.250
Ampco 22	85–100	37–42	1–4	321–352	0.257	0.250
Beryllium 2%	90–125	85–100	0–4	350–420	0.318	0.1875
Brass (red)	28–30	17–20	16–18	50–55	0.310	0.1875
Brass (yellow)	30–35	.....	25–35	40–50	0.310	0.1875
Bronze acid	39–40	21–22	23–24	65–68	0.310	0.1875
Bronze alumin	67–71	30–36	15–16	111–130	0.27	0.22
Everdur D	55–57	24–26	24–27	95–100	0.294	0.1875
Hills McCarma 45	67–72	30–36	15–16	111–130	0.270	0.22
Hills McCarma 52	92–100	56–57	2–3	217–223	0.310	0.250
Tempalloy	.....	.....	.....	.....	0.295	0.218
Iron alloys:						
Gray iron	20–35	.....	.....	150–200	0.26	0.125
Malleable iron	50–53	32–35	18	115	0.20	0.125
Ni hard	30–40	.....	0	575–750	.....	.....
Meehanite GD (a)	33–38	.....	.....	193	0.257	0.156
Meehanite GC (a)	38–42	.....	.....	207	0.262	0.156
Meehanite GB (a)	42–46	.....	.....	212	0.268	0.156
Meehanite GA (a)	50	.....	.....	223	0.26	0.156
Meehanite GAH (a)	70	.....	.....	250–600	0.26	0.156
Meehanite WA (b)	50	.....	.....	250–321	0.26	0.156
Meehanite WB (b)	38	.....	.....	350–550	0.26	0.156
Meehanite HR (c)	40	.....	.....	300–400	0.26	0.156
Meehanite SC (d)	27	.....	.....	200–300	0.26	0.156
Meehanite HE (d)	30	.....	.....	170–220	0.26	0.156
Meehanite CB (e)	45	.....	.....	187	0.26	0.156
Iron-silicon alloys:						
Durichlor	17	.....	.....	52 (f)	0.255	0.250
Duriron	16	.....	.....	52 (f)	0.255	0.250

(a) For general engineering purposes.
(b) Wear resisting.
(c) Heat resisting 1450° F.
(d) Heat resisting 1450°—1650° F.
(e) Corrosion resisting.
(f) Rockwell.

PHYSICAL AND MECHANICAL PROPERTIES OF CAST METALS

Name	Tensile strength in 1000 lbs. per sq. inch	Yield strength in 1000 lbs. per sq. inch	Elongation % in 2 inches	Brinell Hardness	Weight in lbs. per cu. inch	Pattern maker allowance for shrinkage in inches per ft.
Lead alloys:						
Pure lead	1.6	0.71	68	2.9–3.0	0.41	0.3125
Chemical lead	2.3	.....	52	4.5	0.41	0.3125
Hoyt hard (6% Sb)	4.5	.....	50	7.5	0.39	.....
Tellurium lead	3.0	.....	35	5.4	0.41	.....
6% Antimony lead (+ Te)	4.5	.....	50	7.5	0.39	.....
Magnesium alloys:						
Dowmetal H (as cast)	27	12	4	50	0.066	0.157
Dowmetal H (heat treated)	38	12	6	51	0.066	0.157
Dowmetal H (heat treated and aged)	38	18	2	62	0.066	0.157
Nickel alloys:						
Nickel	55–70	20–30	30–15	100–130	0.319	0.250
Durimet	68–72	30–33	40–50	130	0.282	0.3125
Hastelloy A	69–78	42–45	8–12	155–200	0.318	0.1875
Hastelloy B	75–82	55–57	6–9	190–230	0.334	0.250
Hastelloy C	72–80	45–48	10–15	175–215	0.323	0.250
Hastelloy D	36–41	.....	.....	50–55 (c)	0.282	0.250
Illium G	68	50	30–35	170–220	0.300	0.3125
Illium R	100	50	30–35	215–240	0.300	0.3125
Inconel	80	50	10	200	0.309	0.3125
Monel (regular)	60–80	30–40	40–20	125–150	0.318	0.250
Monel H	70–90	45–65	20–10	170–210	0.310	0.250
Monel S	90–115	70–90	3–1	280–325	0.310	0.250
Pioneer Metal	74	36.5	42	150	0.300	0.250
Steels (cast):						
Carbon	70	36	22	115	0.283	0.250
4–6% Cr; 0.20C	100	80	15	220	0.283	0.250
12–14% Cr; 0.15C	75–100	45–125	8–25	175–325	0.283	0.250
26–30% Cr; 0.25C	60	35	3	170	0.283	0.250
18% Cr; 8 Ni; 0.20C	72.5	32.5	40	150	0.283	0.250
25% Cr; 12 Ni; 0.16C	75	40	30–40	175	0.283	0.250
28% Cr; 10 Ni; 0.20C	80–90	40–50	35–50	187–210	0.283	0.250
18% Cr; 8 Ni; 3 Mo; 0.20C	85	43	47	160	0.283	0.250
35% Ni; 15 Cr; 0.40C	60	40	3	200	0.300	0.250
65% Ni; 15 Cr; 0.50C	60	45	3	170	0.300	0.250

DENSITIES OF VARIOUS PATTERN WOODS IN POUNDS PER CUBIC INCH

These values may be used to calculate estimated weights of castings from pattern equipment.

Red pine	0.021	Honduras mahogany	0.021
Yellow pine	0.019	Nassau mahogany	0.025
White pine	0.016	Spanish mahogany	0.031

CORROSION AND HEAT RESISTANT ALLOYS

ALLOY CASTING INSTITUTE STANDARD DESIGNATIONS AND CHEMICAL COMPOSITION RANGES FOR HEAT AND CORROSION RESISTANT CASTINGS

(Cast Stainless Steels, 1947)

Designations with the initial letter "C" indicate alloys generally used to resist corrosive attack at temperatures <1200° F (649° C); with the initial letter "H" to resist attack where the metal temperature is >1200° F. The second letter represents the nominal Cr-Ni type; the Ni increasing in amount from "A" to "X"; e.g., "F" stands for the 19%Cr-9%Ni, "K" for the 25%Cr-20%Ni, and "W" for the 12%Cr-60% Ni types. Numerals following the letters indicate the *maximum* carbon content of the corrosion resistant alloys; carbon content may also be designated in the heat resistant grades by following the letters with a numeral to indicate the *midpoint* of a ±0.10% carbon range. If special elements are included in the composition they are indicated by the addition of a letter to the symbol; e.g., "CF–8M" is an alloy for corrosion resistant service of the molybdenum-containing 19%Cr-9%Ni type with a maximum carbon content of 0.08%. In addition to the standard grades listed below, letters have been assigned to the nominal Cr-Ni contents for the following compositions which are produced in various modifications for special service: "M," 10%Cr-20%Ni; "N," 20%Cr-25%Ni; "P," 30%Cr-30%Ni; "S," 10%Cr-31%Ni.

Designation	% Composition							
	C	Mn*	Si	P*	S*	Cr	Ni	Other Elements
CA–15	0.15*	1.00	1.50	0.04	0.04	11.5–14	1*	Mo 0.5*§
Ca–40	0.20–0.40	1.00	1.50	0.04	0.04	11.5–14	1*	Mo 0.5*§
CB–30	0.30*	1.00	1.00	0.04	0.04	18–22	2*	....
CC–50	0.50*	1.00	1.00	0.04	0.04	26–30	4*	....
CE–30	0.30*	1.50	2.00	0.04	0.04	26–30	8–11	....
CF–8	0.08*	1.50	2.00	0.04	0.04	18–21	8–11	....
CF–20	0.20*	1.50	2.00	0.04	0.04	18–21	8–11	....
CF–8M	0.08*	1.50	1.50	0.04	0.04	18–21	9–12	Mo 2.0–3.0
CF–12M	0.12*	1.50	1.50	0.04	0.04	18–21	9–12	Mo 2.0–3.0
CF–8C	0.08*	1.50	2.00	0.04	0.04	18–21	9–12	Cb 8 × C†, 1.0*
CF–16F	0.16*	1.50	2.00	0.17	0.04	18–21	9–12	Mo 1.5*, Se 0.20–0.35
CF–16Fa	0.16*	1.50	2.00	0.04	0.20–0.40	18–21	9–12	Mo 0.40–0.80
CG–12	0.12*	1.50	2.00	0.04	0.04	20–23	10–13	....
CH–10	0.10*	1.50	2.00	0.04	0.04	22–26	12–15	....
CH–20	0.20*	1.50	2.00	0.04	0.04	22–26	12–15	....
CK–20	0.20*	1.50	2.00	0.04	0.04	23–27	19–22	....
HC	0.50*	1.00	2.00	0.04	0.04	26–30	4*	Mo 0.5*§
HD	0.50*	1.50	2.00	0.04	0.04	26–30	4–7	Mo 0.5*§
HE	0.20–0.50	2.00	2.00	0.04	0.04	26–30	8–11	Mo 0.5*§
HF	0.20–0.40	2.00	2.00	0.04	0.04	18–23	8–12	Mo 0.5*§
HH	0.20–0.50	2.00	2.00	0.04	0.04	24–28	11–14	Mo 0.5*§, N 0.2*
HI	0.20–0.50	2.00	2.00	0.04	0.04	26–30	14–18	Mo 0.5*§
HK	0.20–0.60	2.00	3.00	0.04	0.04	24–28	18–22	Mo 0.5*§
HL	0.20–0.60	2.00	3.00	0.04	0.04	28–32	18–22	Mo 0.5*§
HT	0.35–0.75	2.00	2.50	0.04	0.04	13–17	33–37	Mo 0.5*§
HU	0.35–0.75	2.00	2.50	0.04	0.04	17–21	37–41	Mo 0.5*§
HW	0.35–0.75	2.00	2.50	0.04	0.04	10–14	58–62	Mo 0.5*§
HX	0.35–0.75	2.00	2.50	0.04	0.04	15–19	64–68	Mo 0.5*§

* Maximum. † Minimum. § Molybdenum not intentionally added.

STAINLESS AND HEAT-RESISTING STEELS

AMERICAN IRON AND STEEL INSTITUTE STANDARD DESIGNATIONS AND CHEMICAL COMPOSITION RANGES

(April 1947)

The chemical composition ranges given in the table are based on ladle analysis. The designations are in use throughout the Industry and serve as a definite means of identification for the different grade classifications.

Designation	% Composition							
	C	Mn*	Si*	P*	S*	Cr	Ni	Other Elements
301	>0.08–0.20	2.00	1.00	0.040	0.030	16.00–18.00	6.00–8.00	....
302	>0.08–0.20	2.00	1.00	0.040	0.030	17.00–19.00	8.00–10.00	....
302B	>0.08–0.20	2.00	2.00–3.00	0.040	0.030	17.00–19.00	8.00–10.00	....
303	0.15*	2.00	1.00	.....	.....	17.00–19.00	8.00–10.00	§
304	0.08*	2.00	1.00	0.040	0.030	18.00–20.00	8.00–11.00	....
305	0.12*	2.00	1.00	0.040	0.030	17.00–19.00	10.00–13.00	....
308	0.08*	2.00	1.00	0.040	0.030	19.00–21.00	10.00–12.00	....
309	0.20*	2.00	1.00	0.040	0.030	22.00–24.00	12.00–15.00	....
310	0.25*	2.00	1.50	0.040	0.030	24.00–26.00	19.00–22.00	....
314	0.25*	2.00	1.5–3.0	0.040	0.030	23.00–26.00	19.00–22.00	....
316	0.10*	2.00	1.00	0.040	0.030	16.00–18.00	10.00–14.00	Mo 2.00–3.00
317	0.10*	2.00	1.00	0.040	0.030	18.00–20.00	11.00–14.00	Mo 3.00–4.00
321	0.08*	2.00	1.00	0.040	0.030	17.00–19.00	8.00–11.00	Ti 5 × C†
347	0.08*	2.00	1.00	0.040	0.030	17.00–19.00	9.00–12.00	Cb 10 × C†
403	0.15*	1.00	0.50	0.040	0.030	11.50–13.00	....	Turbine quality
405	0.08*	1.00	1.00	0.040	0.030	11.50–13.50	....	Al 0.10–0.30
406	0.15*	1.00	1.00	0.040	0.030	12.00–14.00	....	Al 3.50–4.50
410	0.15*	1.00	1.00	0.040	0.030	11.50–13.50	....	....
414	0.15*	1.00	1.00	0.040	0.030	11.50–13.50	1.25–2.50	....
416	0.15*	1.25	1.00	.....	.....	12.00–14.00	....	§
420	>0.15	1.00	1.00	0.040	0.030	12.00–14.00	....	....
430	0.12*	1.00	1.00	0.040	0.030	14.00–18.00	....	....
430F	0.12*	1.25	1.00	.....	.....	14.00–18.00	....	§
431	0.20*	1.00	1.00	0.040	0.030	15.00–17.00	1.25–2.50	....
440A	0.60–0.75	1.00	1.00	0.040	0.030	16.00–18.00	....	Mo 0.75*
440B	0.75–0.95	1.00	1.00	0.040	0.030	16.00–18.00	....	Mo 0.75*
440C	0.95–1.20	1.00	1.00	0.040	0.030	16.00–18.00	....	Mo 0.75*
446	0.35*	1.50	1.00	0.040	0.030	23.00–27.00	....	N 0.25*
501	>0.10	1.00	1.00	0.040	0.030	4.00–6.00	....	...
502	0.10*	1.00	1.00	0.040	0.030	4.00–6.00	....	...

* Maximum. † Minimum. § P, S, Se Min. 0.07; Zr, Mo Max. 0.60. > Over.

ETCHING SOLUTIONS FOR FERROUS ALLOYS

Used to Show	Composition of etching solution	Remarks
For Macroscopic Examination		
Segregations	1 part conc. hydrochloric acid, HCl 1 part water	Use at 100 to 212° F. Etch for ½ hour or until defects are brought out.
Segregations	5 g picric acid, $HOC_6H_2(NO_2)_3$ 100 cc ethyl alcohol, C_2H_5OH	Etch for 4 to 5 hours.
Phosphorus segregations	10 g cuprous ammonium chloride, $CuCl \cdot NH_4Cl \cdot 6H_2O$ 100 cc water	This solution is more easily prepared than are most copper chloride solutions.
Phosphorus segregations	10 g cupric chloride, $CuCl_2$ 40 g magnesium chloride, $MgCl_2$ 20 cc hydrochloric acid, HCl 180 cc water 1000 cc absolute alcohol, C_2H_5OH	Absolute methyl alcohol, CH_3OH, may be used in place of ethyl alcohol.
Variations in crystal structure, and segregations	20 g ammonium persulfate, $(NH_4)_2S_2O_8$ 100 cc distilled water	Use at room temperature. A very good reagent for the purpose indicated.
To reveal the structure of welds and to distinguish between steel and wrought iron	1 part conc. nitric acid, HNO_3 3 parts of water	Use at about 100° F.
For Microscopic Examination		
The general structure of normal iron and steel	4 g picric acid and 95 cc of absolute alcohol, or 5 g picric acid and 100 cc of 95% alcohol, C_2H_5OH	Keep bottle well stoppered when absolute alcohol is used.
The general structure of normal iron and steel	5 cc nitric acid, HNO_3 100 cc of ethyl alcohol, C_2H_5OH	For heat treated steels use a more dilute solution.
To establish the difference between hardened and normal steels	4 parts nitric acid, HNO_3 96 parts iso-amyl alcohol, $C_5H_{11}OH$	
Sorbitic and troostitic constituents	1 part of a 40% solution of nitric acid in acetic anhydride 1 part methyl alcohol, CH_3OH 1 part ethyl alcohol, C_2H_5OH 1 part iso-amyl alcohol, $C_5H_{11}OH$	Colors troostite and troosto-sorbite.

ETCHING SOLUTIONS FOR FERROUS ALLOYS

Used to show	Composition of etching solution	Remarks
Cementite and other carbides, and tungstites	2 g picric acid, $HOC_6H_2(NO_2)_3$ 24.5 g sodium hydroxide, NaOH 73.5 cc water	Use boiling for 5 or 10 minutes. Tungsten carbide is unaffected, but other carbides and tungstides are colored.
Structure of stainless steels	10 g ferric chloride, $FeCl_3$ 30 cc hydrochloric acid water to make total volume 120 cc	May be diluted, and applied gently with a piece of cotton. Time required is less than 30 seconds.
Structure of stainless steels	30 cc hydrochloric acid, HCl 10 cc nitric acid, HNO_3 80 cc glycerol (glycerine)	Use full strength for rapid work, but handle carefully.
Carbides and tungstides in high-speed and tungsten steels	10 g potassium ferricyanide, $K_3Fe(CN)_6$ 10 g potassium hydroxide, KOH 100 cc water	Use hot.
Structure of high-speed steel and tungsten carbide	10 cc commercial hydrogen peroxide, H_2O_2 20 cc of a 10% aqueous sodium hydroxide (NaOH) solution	Use fresh from 10 to 12 minutes. Tungsten carbide is darkened.
Structure of stellite, high-chrome steels, etc.	Use a low electric current through a solution of 0.5 g sodium hydroxide (NaOH) in 100 cc of water.	Use two 4 c.p. lamps in series on a 110-volt D. C. circuit. Cover the specimen with the solution; make contact with one wire at the side and dip the other with the solution moving so as to obtain a uniform etch.

ETCHING SOLUTIONS FOR NON-FERROUS ALLOYS

Metal or Alloy	Composition of etching solution	Remarks
Copper Base Alloys		
Copper or Cu-Al alloys	5 g copper-ammonium chloride 120 cc water Add conc. ammonium hydroxide until the precipitate which forms is redissolved, giving a clear blue color.	Etch from 30 to 60 seconds; this is a very good copper etch.
Copper, brasses, Cu-Al alloys, German silver	A 10% solution of ammonium persulfate, $(NH_4)_2S_2O_8$	Etch from 1 to 2 minutes. Keep the surface of the specimen free from grease.
Copper or brasses	10 cc hydrogen peroxide, H_2O_2 40 cc conc. ammonium hydroxide, NH_4OH	Apply with a swab to the surface of polished specimen. Rub briskly until mirror-like surface is obtained.

ETCHING SOLUTIONS FOR NON-FERROUS ALLOYS

Metal or Alloy	Composition of etching solution	Remarks
Copper Base Alloys		
Brasses (Used for copper products such as sheets, rods, etc.), Cu-Al alloys, German silver	15 cc of a saturated ferric chloride ($FeCl_3$) solution 30 cc concentrated hydrochloric acid, HCl 200 cc water	Use this solution after the ammoniacal peroxide solution above. Dip the specimen into this ferric chloride solution for a few seconds after following the directions above.
Cu-Al alloys	Nitric acid (HNO_3), sp. gr. 1.42	Time for etching is very short. It is difficult to control the intensity of the attack.
Aluminum and Light Alloys		
Al and Al alloys	0.5 to 20% hydrofluoric acid (HF) acid solutions. The aqueous or alcoholic solutions are used.	Etch for about 15 seconds. Remove the black deposit so formed by immersing for a short time in conc. nitric (HNO_3) acid. $CuAl_2$ and $FeAl_3$ are darkened by HF.
Aluminum	45 cc conc. hydrochloric acid, HCl 15 cc conc. nitric acid, HNO_3 15 cc hydrofluoric acid, HF 25 cc hot water	This etch generally requires only a few seconds.
Al alloys	10 cc conc. nitric acid, HNO_3 3 to 4 cc hydrofluoric acid, HF 86 to 87 cc hot water	
Al and Al alloys	10 to 20% aqueous sulfuric acid (H_2SO_4) solution	Heat to 160°F., immerse specimen for a few seconds, quench in cold water. $FeAl_3$ is stained black.
Al and Al alloys	10 cc conc. hydrofluoric acid, HF 15 cc conc. hydrochloric acid, HCl 90 cc water	Etch from 30 to 90 seconds. Reveals grain size very clearly.
Lead, Tin, Zinc and Their Alloys		
Used for zinc	6% chromic acid, 94% nitric acid	Add a few drops of this solution to 100 cc of water before using.
Tin alloys	2% alcoholic nitric acid solution	
Lead alloys	5% aqueous nitric acid solution	

ETCHING SOLUTIONS FOR NON-FERROUS ALLOYS

Metal or Alloy	Composition of etching solution	Remarks
Lead, Tin, Zinc and Their Alloys		
All "white metals"	Hydrochloric acid, either dilute or concentrated, depending upon the composition of the alloy. A 5% solution is best for an alloy rich in zinc.	When a concentrated solution is used, dip the specimen in the acid for a few seconds, wash carefully, and dry.
Alloys rich in zinc or cadmium	1 part iodine 3 parts potassium iodide, KI 10 parts water	
Alloys of lead, tin, antimony, bismuth, and anti-friction metals	5% aqueous solution of silver nitrate, $AgNO_3$	
Antimony and lead alloys, and babbit metal	10 g ferric chloride, $FeCl_3$ 30 cc hydrochloric acid, HCl, sp. gr. 1.19 120 cc water	A good etching solution for the metals named.
Miscellaneous Metals and Alloys		
Nickel and its alloys	50 cc of 70% nitric acid, HNO_3 50 cc of 50% acetic acid, $HC_2H_3O_2$	This is *Merica's solution.* It is very good for cast, cold drawn, and annealed nickel.
Nickel and its alloys	20 to 40 cc of nitric acid, HNO_3 30 to 40 cc of 75% acetic acid, $HC_2H_3O_2$ 30 to 40 cc acetone, $(CH_3)_2CO$	This solution is very similar in action to the one above.
Magnesium and its alloys	2% aqueous nitric acid solution	Etch for about 10 seconds.
Gold, silver, platinum, and other noble metals*	1 part nitric acid, HNO_3 5 parts hydrochloric acid, HCl 6 parts water	Use at about 60°F.
Dow metals (90-96% Mg, 4-12% Al, 0.1-0.3% Mn)	2% aqueous oxalic acid solution, $H_2C_2O_4$	Swab during etching. Rinse with water, then with alcohol, and dry with a blast of warm air.

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* For Au-Cu and Au-Ag alloys it is better to saturate the etching solution with either sodium chloride or ammonium chloride.

MANUFACTURERS' RECOMMENDATIONS FOR THE CORROSION

Chemical and Metallurgical Engineering, 39, 654-5 (1932); Perry, *The Chem-*

No.	Manufacturers Name and Address
1.	American Hard Rubber Co. Butler, N. J.
2.	Amersil New York, N. Y.
3.	Atlantic Tank Corp. N. Bergen, N. J.
4.	B. F. Goodrich Rubber Co. Akron, Ohio.
5.	Bakelite Corp. Bloomfield, N. J.
6.	Carbide & Carbon Chem. Co. New York, N. Y.
7.	Continental-Diamond Fibre Co. Newark, Del.
8.	Corning Glass Works, Corning, N. Y.
9.	DuPont Viscoloid Co. Arlington, N. J.
10.	E. I. DuPont Co. Wilmington, Del.
11.	General Ceramics Co. New York, N. Y.
12.	General Electric Co. Pittsfield, Mass.
13.	General Electric Co. Schenectady, N. Y.
14.	General Plastics, Inc. N. Tonawanda, N. Y.
15.	Glascote Products, Inc. Euclid, Ohio
16.	Goodyear Tire & Rubber Co. Akron, Ohio
17.	Hanovia Chem. & Mfg. Co. Newark, N. J.

PRODUCT	Manufactured by	Acetic acid			Acetic anhydride	Acetone	Aluminum chloride	Aluminum sulfate	Ammonia, anhydrous	Ammonium chloride	Ammonium hydroxide	Ammonium nitrate	Ammonium sulfate	Amyl acetate	Amyl chloride	Aniline	Benzaldehyde	Bromine	Butyl acetate	Calcium chloride	Calcium hypochlorite	Carbon disulfide	Carbon tetrachloride	Carbonic acid	Chloroacetic acid	Chlorine water	Chromic acid	Citric acid	Copper sulfate	Ethyl acetate	Fatty acids	Ferric chloride	Ferric sulfate
		Very dilute	Moderate dilution	Concentrated																													
ASBESTOS-CEMENT																																	
Transite	20					X		X	X		X					X	X					X	X	X									
Transite, ebony impregnated	20	X	X			X		X	X	X	X		X			X	X		X	X				X				X	X			X	X
Transite, W X-41 protected	20	X	X	X	X	X	X	X	X	X	X	X	X							X	X	X	X	X	X	X		X	X		X	X	X
COKE BASE CARBON																																	
Carbon	23	X	X	X		X	X	X		X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Carbon	26																			X	X					X						X	X
CONCRETE																																	
Concrete									X	X	X			X		X	X	X	X	X				X		X				X			
Concrete, treated (*a*)	..	X	X	X	X	X	X	X					X								X	X	X		X		X	X	X		X	X	X
Concrete, lined (*b*)	..											X			X																		
ENAMELS, FUSED SILICA & GLASS																																	
Enameled steel	25	X	X	X	X	X	X	X		X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X
Enameled steel	15	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Amersil	2	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fused silica	17	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Fused silica	13	X	X	X	X	X	X		X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Pyrex, chem. resistant	8	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Vitreosil	30	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
PLASTICS																																	
CELLULOSE ACETATE PLASTIC																																	
Plastacele	9									X														X							X		

CONSTRUCTION

RESISTANT NON-METALLIC MATERIALS OF CONSTRUCTION

ical Engineers' Handbook (1933), McGraw-Hill Co., publisher; by permission.

18. Hauser-Stander Tank Co.
    Cincinnati, O.
19. Haveg Corp.
    Newark, Del.
20. Johns Manville Corp.
    New York, N. Y.
21. Maurice A. Knight
    Akron, Ohio
22. Michigan Pipe Co.
    Bay City, Mich.
23. National Carbon Co.
    Cleveland, O.
24. Naugatuck Chem. Co.
    New York, N. Y.
25. Pfaudler Co.
    Rochester, N. Y.
26. Republic Carbon Co.
    Niagara Falls, N. Y.
27. Resinox Corp.
    New York, N. Y.
28. Spaulding Fibre Co.,
    Tonawanda, N. Y.
29. Stokes & Smith Co.
    Philadelphia, Pa.
30. Thermal Syndicate Ltd.
    Brooklyn, N. Y.
31. Thiokol Corp.
    Yardville, N. J.
32. Toledo Synthetic Products, Inc.
    Toledo, Ohio.
33. U. S. Rubber Co.
    New York, N. Y.
34. U. S. Stoneware Co.
    New York, N. Y.

					Hydrochloric acid										Nitric acid												Sodium hydroxide									Sulfuric acid					Resistant to gases at high temperatures							
Ferrous chloride	Ferrous sulfate	Formaldehyde	Formic acid	Hydrobromic acid	Very dilute	Moderate dilution	Concentrated	3% Hydrogen	100% Peroxide	Iodine	Lactic acid	Magnesium chloride	Magnesium sulfate	Mixed acids	Very dilute	Moderate dilution	Concentrated	Nitrous acid	Oxalic acid	Phenol	Phosphoric acid	Sea water and brine	Sodium bisulfate	Sodium bisulfite	Sodium carbonate	Sodium ferricyanide	Very dilute	Moderate dilution	Concentrated	Sodium hydrosulfite	Sodium hypochlorite	Sodium nitrate	Sodium phosphates	Sodium sulfide	Sodium sulfite	Very dilute	Moderate dilution	Concentrated	Sulfurous acid	Tannic acid	Chlorine	Hydrocarbons	Hydrogen sulfide	Oxides of nitrogen	Oxidizing atmosphere	Reducing atmosphere	Sulfur dioxide	Sulfur trioxide
		X																	X	X		X			X		X	X				X	X	X	X							X	X		X	X		
X	X	X			X	X						X	X		X	X		X	X		X	X			X		X	X				X	X	X	X	X	X		X	X	5		5		5	5	5	5
X	X	X	X	X	X	X					X	X	X		X	X		X	X		X	X	X	X	X		X	X		X	X	X	X	X	X	X	X		X	X	6	6	6	6	6	6	6	6
X	X	X		X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X	X	X
X	X				X	X	X								X	X	X				X	X		X			X	X	X	X	X		X		X	X	X	X	X							X	X	
		X						X	X	X		X							X	X		X			X																	X			X	X		
X	X		X								X		X										X	X		X				X	X	X	X	X	X					X								
				X	X	X	X							X	X	X	X	X			X						X	X	X							X	X	X	X		1		1	1			1	1
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X				X		X	X		X	X	X	X	X	X	3	3		3	3	3	3	3
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X				X	X	X	X		X	X	X	X	X	3	3	3	X	3			3	3
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X								X		X	X	X	X	X	X	X	X	X	X			X	X	X
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X				X	X	X	X	X	X	X	X	X	X	X	2	2	2	2	2	2	2	2
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X				X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
											X	X										X										X																

PRODUCT	Manufactured by	Acetic acid			Acetic anhydride	Acetone	Aluminum chloride	Aluminum sulfate	Ammonia, anhydrous	Ammonium chloride	Ammonium hydroxide	Ammonium nitrate	Ammonium sulfate	Amyl acetate	Amyl chloride	Aniline	Benzaldehyde	Bromine	Butyl acetate	Calcium chloride	Calcium hypochlorite	Carbon disulfide	Carbon tetrachloride	Carbonic acid	Chloroacetic acid	Chlorine water	Chromic acid	Citric acid	Copper sulfate	Ethyl acetate	Fatty acids	Ferric chloride	Ferric sulfate
		Very dilute	Moderate dilution	Concentrated																													
CELLULOSE NITRATE PLASTIC																																	
Pyralin	9	X	X				X	X		X		X	X							X		X	X	X					X		X	X	X
PHENOLIC RESINOIDS																																	
Bakelite	5	X	X			X	X	X		X		X	X	X	X	X	X		X	X		X	X	X	X			X	X	X	X	X	X
Bakelite Dilecto	7	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X		X			X	X	X		X		X	X	X	X	X	X
Durez 1407	14	X	X	X	X		X	X	X	X	X	X	X				X	X		X	X	X		X	X	X			X			X	X
Durez, wood filled	14					X								X	X	X			X				X					X		X	X		
Durite	29	X	X	X	X	X	X	X		X		X	X	X	X		X		X	X	X	X	X	X	X	X		X	X	X	X	X	X
Haveg	19	X	X	X			X	X	X		X		X							X	X		X			X			X		X	X	
Resinox	27	X	X			X	X	X		X		X	X	X	X		X		X	X			X	X	X			X	X	X	X	X	X
Spauldite	23	X	X	X			X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X
Textolite	12	X	X																					X					X				
STYROL RESINOID																																	
Victron	24	X	X	X		X			X	X	X									X													
UREA RESINOID																																	
Plascon	32					X																									X		
VINYL RESINOID																																	
Vinylite	6	X					X	X	X	X	X	X	X							X	X	X	X	X		X	X	X	X		X	X	X
OTHER PLASTICS																																	
Plioform	16	X	X	X							X	X	X							X					X	X		X				X	X
RUBBER AND SUBSTITUTES																																	
Rubber, hard	4	X	X	X	X	X	X	X		X		X	X	X					X	X	X			X	X	X		X	X	X		X	X
Rubber, hard	1	X	X	X	X	X	X	X	X	X	X	X	X							X	X			X		X		X	X			X	X
Rubber, hard (*c*)	33	X	X				X	X	X	X	X	X	X							X	X			X		X		X	X			X	X
Tank-lining material (*d*)	33	X	X	X	X	X	X	X	X	X	X	X								X	X			X		X		X	X			X	X
Rubber, soft	4						X	X		X		X	X							X	X								X			X	X
Rubber, soft	16	X	X					X	X	X	X		X							X				X				X	X			X	X
Du Prene	10	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X		X	X	X	X	X	X
Thiocol	31	X	X	X		X																	X										
CHEMICAL STONEWARE																																	
Stoneware	11	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stoneware	21	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
Stoneware	34	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
WOOD																																	
Cypress	3															X	X														X		
Cypress	18	X	X	X																	X												
Fir	3	X	X	X																													
Fir	18	X	X	X																													
Maple	18	X	X	X																													
Oak, white	3																											X					
Pine, yellow	3																																
Pine	18	X	X	X																													
Redwood	3	X	X	X																											X		
Redwood	22	X	X																	X						X		X	X				

(*a*) With linseed and tung oils, cumar solution, spar varnish, sodium silicate, or bituminous coating. (*b*) With acid-proof brick or tile, lead, rubber, bituminous mastic or other lining. (*c*) Molded and fabricated parts. (*d*) Rubber bonded to metal, storage and process tanks.

| | | | | |Hydrochloric acid| | |Hydrogen Peroxide| | | | | | |Nitric acid| | | | | | | | | | | | |Sodium hydroxide| | | | | | | | |Sulfuric acid| | | | |Resistant to gases at high temperatures| | | | | | | |
Ferrous chloride	Ferrous sulfate	Formaldehyde	Formic acid	Hydrobromic acid	Very dilute	Moderate dilution	Concentrated	3%	100%	Iodine	Lactic acid	Magnesium chloride	Magnesium sulfate	Mixed acids	Very dilute	Moderate dilution	Concentrated	Nitrous acid	Oxalic acid	Phenol	Phosphoric acid	Sea water and brine	Sodium bisulfate	Sodium bisulfite	Sodium carbonate	Sodium ferricyanide	Very dilute	Moderate dilution	Concentrated	Sodium hydrosulfite	Sodium hypochlorite	Sodium nitrate	Sodium phosphates	Sodium sulfide	Sodium sulfite	Very dilute	Moderate dilution	Concentrated	Sulfurous acid	Tannic acid	Chlorine	Hydrocarbons	Hydrogen sulfide	Oxides of nitrogen	Oxidizing atmosphere	Reducing atmosphere	Sulfur dioxide	Sulfur trioxide
X	X				X			X				X	X		X				X			X										X				X			X	X								
X	X	X		X	X	X					X	X	X						X		X	X	X	X	X	X				X		X			X	X	X		X	X		4	4			4	4	
X	X	X	X	X	X	X		X		X	X	X	X						X	X	X	X	X	X	X	X				X		X	X		X	X	X		X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X					X	X	X	X						X	X	X	X		X	X	X	X			X	X	X	X	X	X	X			X	X								
X	X	X	X	X	X	X	X	X			X	X	X		X	X		X	X	X		X	X	X	X	X	X			X	X	X	X	X	X	X	X		X	X		X	X		X	X	X	
X				X	X	X	X	X	X		X	X	X						X		X				X									X		X	X		X	X								
X	X	X	X		X	X		X			X	X	X		X			X	X		X	X	X	X	X							X	X	X	X	X	X		X	X								
X	X	X	X	X	X	X		X		X	X	X	X		X				X	X		X	X	X	X	X	X			X		X	X	X	X	X	X		X	X								
		X			X	X									X							X													X													
			X		X	X	X							X						X			X	X	X		X	X	X							X	X	X										
																											X															X						
X		X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X								
X	X	X	X		X	X	X	X	X		X	X	X						X		X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X			X								
X	X	X	X	X	X	X	X				X	X	X		X			X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X			X								
X	X	X	X	X	X	X	X				X	X	X		X				X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X								
X	X			X	X	X	X	X			X	X			X	X						X	X	X	X	X	X	X	X		X	X	X		X	X	X			X								
X	X	X	X	X	X	X	X	X			X	X	X						X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X								
X	X	X		X	X	X	X					X	X								X	X	X		X	X	X	X			X	X	X	X		X	X			X								
			X		X	X	X			X		X	X	X								X	X		X		X	X					X			X	X	X										
X	X	X	X	X	X	X	X	X		X	X	X	X	X	X			X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X			X		
					X	X	X							X	X			X				X					X									X	X											
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	Y	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X	X
					X	X																X														X	X											
					X	X																														X												
					X	X																														X												
					X	X																														X												
																																								X								
					X	X																														X	X											
					X	X																														X												
																									X																							
					X	X																X			X											X	X		X	X								

(1) If moisture is present. (2) Below 500°C. (3) Not over 200°C. (4) Below charring point.
(5) At 150°F. (6) At 350°F.

PROPERTIES OF MATERIALS OF CONSTRUCTION

Chemical and Metallurgical Engineering, 39, 651-8 (1932); Perry, *The Chemical Engineers' Handbook*, McGraw-Hill Co., publishers; by permission.

GLASS LINED AND ENAMELED STEEL

(A) Coefficients of Heat Transfer for Typical Chemical Enamels.

These coefficients are of course, only relative, and are dependent to a large extent on the amount of agitation of the contained materials. Good agitation may increase values by as much as 20 to 25 per cent. Abbreviations: K is in B. T. U.s per sq. ft. per hour per °F. of temperature difference. K_1 refers to the heat transfer from steam to water being heated, while K_2 refers to the heat transfer from steam to boiling water.

1. Dry dust enamel for very severe chemical service.
    - (a) Pfaudler No. 17, $K_1=60$; $K_2=80$
    - (b) Pfaudler No. 11, $K_1=50$; $K_2=70$
2. Spray enamel for organic acids and less corrosive mineral acids.
    - (a) Pfaudler No. 71, $K_1=125$; $K_2=150$
3. Spray dust enamel for mineral acids in general storage service, usually for equipment of large capacities.
    - (a) Pfaudler No. 186, $K_1=90$; $K_2=100$

(B) Other Physical and Mechanical Properties.

Such physical properties of enamel as the coefficient of expansion, tensile strength, etc., are generally meaningless unless considered in connection with the steel on which the lining is applied. Ability to withstand rapid thermal change is tested in an automatic machine by intermittently heating enamel plates to 450°F. and then dipping them into ice water. However, both temperature and corrosion conditions to be met in each service application should be definitely ascertained and this information supplied to the manufacturer.

CHEMICAL STONEWARE

Ultimate compressive strength	82,000 – 115,000 lbs./in.^{2}
Ultimate tensile strength	1,650 – 4,300 lbs./in.^{2}
Modulus of elasticity	1.05 – 5.95 $\times 10^6$ lbs./in.^{2}
Specific heat	0.2
Thermal conductivity	0.78 – 2.05 B.T.U./ft.^{3}
Linear expansion per °F.	1.9 – 2.3 $\times 10^{-6}$
Ultimate bending strength	5,900 – 12,500 lbs./in.^{2}

GLASS AND FUSED SILICA

These materials are marketed in the form of sheets, tubes and rods.

Properties	Boro-silicate glass	Fused silica, clear	Fused silica, opaque
Thickness	0.01 in and up	0.001 in. and up	0.005 in and up
Transparency, T= Transparent, TL= Translucent, O= Opaque	T, TL	T	TL, O
Specific gravity	2.24	2.20	2.07 – 2.1
Specific volume, in.^{3}/lb.	12.3	12.6	13.4
Tensile strength, lbs./in.^{2}	1×10^4	4×10^3	$4\text{–}8 \times 10^2$
Hardness, 2.5 mm. ball, 25 kg. load, depth in millimeters	0.015	0.0245	....
Thermal expansion, per °C.	0.32×10^{-5} (0–300°C.)	0.049×10^{-5}	$0.053\text{–}0.059 \times 10^{-5}$
Thermal conductivity, cal./sec. cm.°C.	27×10^{-4}	23.7×10^{-4}	$19\text{–}20 \times 10^{-4}$
Specific heat, cal./°C. gram.	0.20	0.25	....
Softening point	1,290°F.	2,600°F.	2,600–2,700°F.
Breakdown voltage, 60 cycle, volts per mil.	1,400 (0.1 in. sample)	410 (¼ in.)	436 (¼ in.)
Dielectric constant, 60 cycle	4.86	3.7	3.7
Refractive index, N_D	1.47	1.459	....

PROPERTIES OF MATERIALS OF CONSTRUCTION

PROPERTIES OF COKE BASE CARBON

Specific gravity	2.00 – 2.15
Apparent density	1.42 – 1.65
Porosity, %	25 – 30
Tensile strength, lbs./in.^{2}	600 – 650
Crushing strength, lbs./in.^{2}	5500 – 9000
Transverse strength, lbs./in.^{2}	2000 – 6000
Thermal conductivity, cal./cm./°C.	0.007– 0.008

Coef. of ther. expan.,°C. (100 – 150°C.)	1.5 – 2 × 10^{-6}
Specific heat, cal./gm./°C. (26 – 282°C.)	0.200 – 0.250
Volatilization point, °F.	6,300–6700
Ash, %	0.5–10.0
Start of oxidation,°F.	625–840
Machining qualities	Good
Available in	Rod, tube, brick, plates, shapes

PROPERTIES OF HARD AND SOFT RUBBER *

Property	Hard rubber	Soft rubber	Linings
Specific gravity	1.12–2	0.97 – 1.25	0.98 – 1.35
Tensile strength, lbs./in.^{2}	1000 – 10000	525 – 600	....
Transverse strength, lbs./in.^{2}	9000 – 15000	....	....
Compression strength, lbs./in.^{2}	2000 – 15000	....	....
Hardness, scleroscope	50 – 80	....	....
Max. temp. for use, °F.	130 – 160	150 – 200	190
Effect of heat	Softens	Softens	Softens
Coef. of linear expansion, 32 – 140°F.	0.000035	0.000036	....
Coef. of heat cond., K in B.T.U.s/ft.^{2}in.°F.	1.07	1.07	....
Resistance to abrasion	....	20 times steel	....
Resistance to tear, lbs./in.^{2}	....	15 – 80	....
Dielectric strength, volts/mm.	25000 – 40000	25000 – 40000	....
Effect of sunlight	Slight discoloration	Cracks	Ages
Effect of aging	Nil	Slight	Tendency to harden at normal temp.
Machining qualities	Good	Can be ground	....
Available forms	Pipe and fittings, tank and pipe linings, misc. forms	Tank linings, hose, misc. forms	Tank, vat, pipe, valve linings for chemical and abrasive protection

VULCANIZED FIBER

Marketed forms	Sheets, tubes and rods
Thickness	0.004 and up
Forming properties	Good
Machining qualities	Good
Colors	Red, brown, white, gray, black, olive
Effect of heat	Stable to charring
Effect of water	Swells and softens. Warps on drying. Not recommended.
Effect of mineral, animal, and vegetable oils	Very slight absorption
Specific gravity	1.2 – 1.5
Specific volume	18.5 – 23 in.^{3}/lb.
Tensile strength	8000 – 16000 lbs./in.^{2}
Breakdown voltage, 60 cycle, $\frac{1}{16}$ inch sample	175 – 500 volts/mil

* See section on synthetic rubbers.

PROPERTIES OF RE-

Type of brick	Chrome	No. 1 Fire clay	Fused alumina	Fused refractory
Typical composition, %	44 Cr_2O_3 16 FeO 15 MgO 15 Al_2O_3 5 SiO_2	42 Al_2O_3 54 SiO_2 2 Flux	90 Al_2O_3 7 SiO_2 3 Flux	75 Al_2O_3 20 SiO_2 3.3 TiO_2
Fusion point, °F.	4000	3050	3500	3360
Load resistance, temp. °F. for 10% shrink at 25 lb.	2600	2700	2800	....
Resistance to spalling in cycles	2	20	4	....
Weight per standard 9 in. brick, lbs.	11.1	7.5	10	10
Porosity in %	....	20–30	20	0.4
Specific heat (60–1200°F.)	0.20	0.23	0.20	0.23–0.255
Relative slag resistance				
Acid steel slag	Poor	Fair	Good	....
Basic steel slag	Good	Poor	Good	....
Mill scale	Good	Poor	Fair	....
Coal ash slag	Fair	Fair	Good	....
Approximate cost per thousand, dollars	250	35–40	1000	1000

ASBESTOS FIBER AND PORTLAND CEMENT

Property	Flat sheets	Corrugated sheets	Pipe	Impregnated material
Sizes	36x48, 42x48, 42x96, all ⅛ to 4 in. thick	42 in. Wide, 3-11 ft. long, ⅜ in. thick	2-36 in. diam. 0-225 lbs./in.^{2} pressure	Same as plain
Temp. limit, °F.	700	700	700	150
Density, lbs./ft.^{3}	125	125	125	128
Water permeability	Low	Low	Very low	Very low
Modulus of rupture, lbs./in.^{2} (Aver.)	3500	3000	....	....
Modulus of elasticity	1,500,000	1,500,000	2,000,000	1,500,000
Electrical resistance — Megohms per inch cube		....	....	4,000,000

FRACTORY MATERIALS

Kaolin	Kaolin refractory insulator	Magnesite	Mulite refractory	Silica	Silicon carbide	Unburned magnesite
45 Al_2O_3 52 SiO_2 1 Flux	45 Al_2O_3 52 SiO_2 1 Flux	85 MgO 7 Fe_2O_3 3 CaO 3 SiO_2	52 Al_2O_3 44 SiO_2 2.5 Flux	96 SiO_2	100 Si	7 Al_2O_3 7 Cr_2O_3 69 MgO 6 Fe_2O_3 4 CaO 7 SiO_2
3200	3200	4000	3300	3050	4000 (dec.)	4000
2900	....	2500	3000	3000	3100	....
20	....	1	25	None	25	5
7.5	1.8	10	7.0	6.5	9	10.4
20	80	....	25	20–30	18	15
0.23	0.23	0.27	0.23	0.23	0.20	....
Fair	Poor	Fair	Good	Good	Good	Good
Poor	Poor	Good	Fair	Poor	Good	Good
Poor	Poor	Good	Fair	Poor	Fair	Good
Fair	Poor	Good	Fair	Fair	Good	Fair
260	170	350	100	40–50	1000	275

PHYSICAL PROPERTIES OF WOOD

See also the table *Composition of Various Woods.*

Wood	Specific gravity	Tensile strength, lb./in.²	Compression strength, lb./in.²	Transverse strength, lb./in.²	Linear expansion, per °F	Hardness
Ash	0.51	....	....	....	.0000053	Hard
Chestnut	0.40	....	....	....	.0000036	Hard
Cypress	0.53	4,400	3,560	....	....	Medium
Elm	0.48	....	....	....	.0000031	Medium
Fir	0.59	3,600	2,400	....	....	Medium
Gum	0.45	....	....	....	....	Medium
Maple	0.49	....	....	....	.0000035	Medium
Oak	0.77	4,400	2,800	4,425	....	Hard
Pine	0.61 to 0.75	5,100	3,420	5,700	....	Hard
Redwood	0.34 to 0.41	4,500	3,400	....	Negligible	Mod. Hard

PROPERTIES OF MATERIALS OF CONSTRUCTION

ACID RESISTANT CEMENTS

For Brick, Metal, Earthenware, Stoneware, and Fused Silica.

	"Acid proof Cement No. 1" Quigley Co., Inc., New York, N.Y.	"Acid proof Cement No. 2" Quigley Co., Inc.	"Acipruf" Chemical Construction Corp., Charlotte, N.C.	"Basolit" Nukem Products Corp., Niagara Falls, N.Y.
Used for	Brick, for chimneys and flues	Brick and tile tank settings, chemical stoneware, fused silica	Brick, chemical and terracotta stoneware, rigid joints	Brick, porcelain, metal, chemical and terracotta stoneware, rigid joints
Composition	....	....	....	Silica-sulfur
Preparation for use	Ready mixed	Ready mixed	Mix with sodium silicate	Heat to 300°F. and pour
How applied	Trowel or dip bricks	Trowel	Trowel, with thin joints. For bell-and-spigot joints, press over asbestos rope	Pour into joints, with or without asbestos rope packing
Resistant to	Hot acid gases	Mineral acids	Mineral acids	Acids, fumes
Temperature range	To 2400°F.	To 1200°F.	To above boiling points of strongest acids	To 200°F.

	"Calktite" U.S. Stoneware Co., Akron, O.	"Carolina" Charlotte Chem. Labs. Inc., Charlotte, N.C.	"Chemical Putty" Charlotte Chem. Labs. Inc., Charlotte, N.C.	"Duralute" U.S.Stoneware Co., Akron, O.
Used for	Brick, bell-and-spigot joints on chemicalstoneware	Brick, chemical and terracotta stoneware, rigid joints	Chemical stoneware, fused silica, Duriron, non-rigid joints	Brick
Composition	Asphaltic base	....	Asbestos base	Asphaltic base
Preparation for use	Heat and pour	Ready mixed	Ready mixed	Heat and pour
How Applied	Pour into brick joints. For stoneware, pour over tamped asbestos wicking	Trowel with thin joints. For bell-and spigot joints, press over asbestos rope.	Press into joints	Pour into brick joints
Resistant to	Acids	Mineral acids	Mineral acids	Acids, alkalis
Temperature range	To 200°F.	To above boiling points of strongest acids	To 250°F.	To 200°F.

	"Duro" Special. Electrochemical Supply and Engineering Co., Paoli, Pa.	"Duro" Standard. Electrochem Supply and Engrg. Co., Paoli, Pa.	"M.A.Knight Acid proof" Maurice A. Knight, Akron, O.	"Portite" U. S. Stoneware Co., Akron, O.
Used for	Brick, metal, glass, stoneware, earthware, fused silica, bell-and-spigot joint	Brick, metal, earthenware, chemical stoneware, fused silica glass	Brick, chemical stoneware	Brick
Composition	....	....	....	Asphaltic base

PROPERTIES OF MATERIALS OF CONSTRUCTION

ACID RESISTANT CEMENTS

	"Duro" Special Electrochemical Supply and EngineeringCo.,Paoli, Pa.	"Duro" Standard Electrochem. Supply and Engrg.Co., Paoli, Pa.	"M. A. Knight Acid proof" Maurice A. Knight, Akron, O.	"Portite" U.S. Stoneware Co., Akron, O
Preparation for use	Mix two ingredients to consistency of thin putty	Mix two ingredients to consistency of thin putty	Mix with sodium silicate to the consistency of cream	Heat and pour
How applied	Trowel, joints thin or thick as desired. Heat to hasten drying	Trowel, thin joints. Heat surfaces before or after joining to hasten drying	Heat bricks to about 150°F. Lay with thin joints	Pour into brick joints
Resistant to	Weak acids, salts, fumes	Strong mineral acids, fumes	Acids	Acids
Temperature range	To 1500°F.	To 1500°F.	To 300°F.	To 200°F.

	"Mineralead" Atlas Mineral Products Co., Merztown,Pa.	"Pre-Mixt" U.S.Stoneware Co. Akron, O.	"S" Brand Silicate Philadelphia Quartz Co., Philadelphia, Pa.	"Thiogrout" Electrochemical Supply and Engineering Co., Paoli, Pa.
Used for	Cast iron	Brick	Brick	Bell-and-spigot joints
Composition	Sulfur base	....	50 quartz, 20 mesh; 50quartz, 100 mesh; 70-100 "S" Brand Silicate	Sulfur base
Preparation for Use	Heat to 270-280°F. and pour	Mix with water to consistency of heavy cream	Mix to consistency of thick cream	Melt and pour
How applied	Pour over jute caulking	Bricks should be warm. Lay with thin joints	Dip bricks, lay with thinnest possible joints	Pack joint with asbestos rope and pour on cement
Resistant to	Solutions with pH under 7	Acids, neutral solutions	Acids, fumes	Weak acids, salts
Temperature range	To 200°F.	To 600°F.	....	To 220°F.

	"U.S.Standard" U.S.Stoneware Co. Akron, O.	"Vitric-10" U. S. Stoneware Co., Akron, O.	"Vitrite-15" U. S. Stoneware Co., Akron, O.	"Vitrobond" Atlas Mineral Product Co., Merztown, Pa.
Used for	Brick	Brick	Brick	Brick, tile
Composition	....	....	....	Sulfur base
Preparation for use	Mix with sodium silicate to consistency of heavy cream	Mix with sodium silicate to consistency of heavy cream	Mix with sodium silicate to consistency of heavy cream	Heat to 265°F. and pour
How applied	Bricks should be warm. Lay with thin joints	Bricks should be warm. Lay with thin joints	Bricks should be warm. Lay with thin joints	Pour into joints
Resistant to	Acids	Acids	Acids	Acids
Temperature range	To 350°F.	To 500°F.	To 500°F.	To 212°F.

PROPERTIES OF MATE-

MECHANICAL, PHYSICAL AND ELECTRI-

Characteristics	Pure, hardened resinoid	Phenolic resinoids				
		Molded			Laminated	
		Wood flour filler	Fabric filler	Asbestos filler	Paper filler	Fabric filler
Marketedforms,S= sheets, T= tubes, R= rods	S, R, castings for machining	Misc. molded forms	Misc. molded forms	Misc. molded forms	S,R,T,and pressed forms	S,R,T, and pressed forms
Molding Qualities	Machined	Excellent	Good	Good	Excellent	Excellent
Molding range, °F.	....	300–450	300–360	300–340	250–325	250–325
lbs./in.^{2}	....	500–2500	3500–5000	1500–2500	1000–2000	1000–2000
Compression ratio, Vol. loose powder/vol. solid	....	2.0–3.5	4.5–7.5	2.3–7.0	....	....
Tendency to unmold	....	None	None	None	None	None
Thickness, inches	0.01 up	0.02 up	0.02 up	0.02 up	0.005 up	0.005 up
Machining qualities	Good	Good	Fair	Fair	Good	Good
Tendency to "cold flow"	None	None	None	None	None	None
Transparency; T= transparent, TL= translucent, O= Opaque	T, TL, O	O	O	O	O	O
Colors and mottles	All Colors	Variety	Natural, darker shades	Natural, darker shades	Natural, dark	Natural, dark
Effect of heat, ... dry moist	Withstands 250°F. Tends to harden and shrink; improved electrical prop.			Withstands constant use at 375°F. Special grade475°F	Withstands 250°F. with slight hardening and shrinkage	
Burning rate	Extremely low			Practically incombustible	Extremely low	
Effects of sunlight and ultra-violet	Slight lowering of surface resistivity and darkening in light colors according to intensity of ultra-violet light.					
Effects of aging	None	None	Improvement in mechanical and electrical properties			
Effects of water, cold	....	None	....	Very resistant	Slight deterioration on long immersion. Effects more rapid	
hot	....		....			
Specific gravity	1.2–1.3	1.3–1.4	1.3–1.4	1.8—2.0	1.3–1.4	1.3–1.4
Specific volume, in.^{3}/lb.	23–21	21–20	21–20	15–14	21–20	21–20

RIALS OF CONSTRUCTION

CAL PROPERTIES OF VARIOUS PLASTICS

Urea-formaldehyde resinoid, molding plastic	Cellulose nitrate	Cellulose acetate		Vinyl resins		Styrol resin	Resin derived from rubber
	Plastic	Plastic	Press powder	Filled	Unfilled		
Molded forms	S,T,R, and misc. forms	S,T, R, and misc. forms	S,T,R, and misc. forms	S,T,R,	S,T,R,	S,T,R,	Misc.
Good	Very good	Fair to good	Fair to good	Good	Good	Thermo-plastic	Good
275–300	190–220	....	....	200–300	200–300	200–350	230–300
2000–10000	2000–5000	....	....	300–2000	300–2000	40–100	1500–3000
3	....	....	2.28–2.84	2.5	2.5	....	1–2.5
None	Low	Low	Med.to high	None	None	None	None
0.02 up	0.005 up	0.005 up	0.02 up	....	....	....	0.01 up
Fair	Good	Fair to good		Good	Good	Good	Good
None	....	Depends on plasticizer		....	....	Slight when uncompounded	Some
T,TL, O	T,TL, O	T, TL, O	TL, O	T, TL, O	T, TL,O	T, TL, O	T, TL, O
Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited	Any color	Unlimited
Slight shrinking	Decomposed at 100–150°C	More stable than cellulose nitrate at 150°C		Slowly darkens at 150°C		Will soften under high heat	Becomes insoluble
Slight swelling							Thermo-plastic
Very low	Very high	Low	Low	Nil	Nil	Compounded material will not support combustion	Medium
None	Discolored and brittle	More stable than cellulose nitrate		....	....	Slight surface oxidation	Slight
None	None in absence of ultra-violet light	Less than cellulose nitrate		None	None	None	None
None	Swelling is very slight	Slight swelling		None below 150°F.		None	None
None up to 30 min. boiling		Attacked		Softens		None	None
1.48–1.55	1.35–1.60	1.27–1.31	1.30–1.63	1.2–2.5	1.23	1.06 (Uncompounded)	1.06–1.35
19–18	20.5–17.3	21.8–21.2	21.3–17.0	20–15	19	Varies	26.1–20.5

MECHANICAL, PHYSICAL AND ELECTRI-

Characteristics	Pure, hardened resinoid	Phenolic resinoids				
		Molded			Laminated	
		Wood flour filler	Fabric filler	Asbestos filler	Paper filler	Fabric filler
Tensile strength, lbs./in.^{2}	"8" test-pc. 5000–11000	A.S.T.M. test 6000–12000	A.S.T.M. test 4500–9000	A.S.T.M. test 5000–10000	6000–20000	8000–12000
Elongation, per cent	....	....	....	....	....	....
Impact strength, Izod	0.5–2.5	1–2.5	10–25	0.5–4.0	5–25	10–65
Modulus of elasticity, lbs./in.^{2}	1,000,000–2,500,000	1,000,000–2,500,000	800,000–1,200,000	1,000,000–2,500,000	500,000–2,000,000	500,000–1,500,000
Hardness, 2.5mm. ball, 25Kg. load, depth in mm.	....	....	....	....	....	....
Thermal expansion, 10^5/°C.	....	....	....	....	2	2
Thermal conductivity, cal./sec.cm.°C.	0.0003–0.0004	0.0004–0.0006	0.0004–0.0006	0.0012–0.002	0.0005–0.0008	0.0005–0.0008
Specific heat, cal./°C.gram.	0.33–0.36	0.30–0.40	0.30–0.40	0.30–0.40	0.30–0.40	0.30–0.40
Softening point, °F.	....	....	....	....	....	....
Electrical resistivity, (volume), at 30°C., ohm cm.	1–1000 × 10^{10}	1–100 × 10^{10}	0.1–10 × 10^{10}	0.01–0.1 × 10^{10} Mica filler 10–1000 × 10^{10}	1–100 × 10^{10}	0.1–1.0 × 10^{10}
Breakdown voltage, 60 cycle, volts per mil	250–700	300–600	200–500	150–400 Mica filler 450–600	500–1300	200–600
Dielectric constant, 60 cycle	....	4.5–8.0	....	....	....	....
Power factor, 60 cycle, %	....	4–20	....	....	....	....
Dielectric constant, R. F.	4.5–7.0	4.5–8.0	4.5–7.0	5–20	4.5–6	4.5–7.0
Power factor, R.F., %	0.5–5.0	1–10	5–10	0.7–2.5 10–20 mica filler	1.5–5	2–8
Refractive index, N_D	1.56–1.70	....	....	....	....	....

CAL PROPERTIES OF VARIOUS PLASTICS

Urea-formaldehyde resinoid, molding plastic	Cellulose nitrate	Cellulose acetate		Vinyl resins		Styrol resin	Resin derived from rubber
	Plastic	Plastic	Press powder	Filled	Unfilled		
5000–6400	4000–10000	5,400	1800–3200	7000	9000	Varies	4500–7000
....	5–30	13	0.2–0.5	....	....	Varies	Very little
0.7–1.2 (Sharpe)	10–11.5	....	0.17–0.62	0.24–1.22	0.2–3.5	Varies	....
....	2,000,000–3,900,000	....	1,100,000–2,900,000	7,500,000	....	Varies	....
....	0.225–0.325	0.225–0.325	....	....	....	Varies	....
....	12–16	....	14–16	....	....	Varies	....
....	0.00031–0.00051	0.00054–0.00063	0.00053–0.00087	....	....	Varies	....
....	0.34–0.38	....	....	....	....	....	....
....	160–195	115–160	162–300	160	150	194 up	160 up
....	0.106–0.32 $\times 10^{10}$	0.30x10^{10}	6.2 $\times 10^{10}$	>10 $\times 10^{10}$	>10000 $\times 10^{10}$	....	....
....	....	....	....	....	....	....	....
300–400	300–780	720	590–620	350–400	400–500	517	....
5–6	7.3–6.7	7.5	7.1–8.4	....	....	2.96	....
1–3	....	7.0	9.1–10.5	....	....	0.03	....
....	6.8	5.3	4.3–5.4	5.0	4.0	2.96	....
....	9.7–7.4	13.7	6.8–10	6.2	1.43	0.03	....
1.6	1.50	1.49–1.50	....	....	....	....	1.60–1.66

PHYSICAL AND THERMAL PROPERTIES

No.	Material	General composition	Commercial construction
1	Air	Still air	....
2	Aluminum foil crumbled	Crumbled foil and air—7 layers per 2.5 in.	Pipe covering
3	Asbestos fiber cements	Asbestos and clay	Cement
4	Asbestos fiber for underground conduit insulation	Willowed asbestos fiber waterproofed	Filling
5	Asbestos millboards	Asbestos pressed	Rigid sheets
6	Asbestos paper	Indented. Has 26 laminations per in.	Pipe covering
7	Asbestos paper	With imbedded sponge particles 40 laminations per in.	Pipe covering and blocks
8	Asbestos paper products	Corrugated air cell type	Pipe covering and sheets
9	Asbestos paper, vitrified	Asbestos paper-treated with vitrifying solution and baked	Pipe covering and sheets
10	Bauxite, monohydrated	Molded with asbestos and clay	Pipe cov.-blocks and bricks
11	Cattle hair	Hair-felted	Blanket flexible
12	Cattle hair	Hair-felted	Blanket flexible
13	Cattle hair and jute	Hair and jute felted	Blanket flexible
14	Cattle hair and other fiber	Confined with building paper	Blanket flexible
15	Corkboard	No artificial binder	Pressed rigid slabs
16	Diatomaceous earth and clay, calcined	Molded and fired	Bricks
17	Diatomaceous earth blocks	Molded with asbestos, magnesia and clay	Pipe covering and blocks
18	Diatomaceous earth bricks	Natural brick cut from earth, heat flow ⊥ to strata	Brick
19	Diatomaceous earth, calcined	Molded and fired	Bricks
20	Diatomaceous earth cements	Mixed with asbestos, magnesia and clay	Cement
21	Diatomaceous earth fillers	Coarse powder	Filler
22	Diatomaceous earth fillers	Fine powder	Filler
23	Fire felt	Long brown asbestos fiber and sodium silicate	Pipe covering and blocks
24	Fire felt	Short white asbestos fiber and sodium silicate	Pipe covering and sheets
25	Insulating boards	Pressed wood pulp	Rigid slabs
26	Insulating boards	Bagasse fiber	Rigid slabs
27	Insulating boards	Licorice roots	Rigid slabs
28	Insulating boards	Pressed wheat straw pulp	Rigid slabs
29	Kapok fiber	Tightly packed	Flexible
30	Magnesia	85% magnesia—15% asbestos	Pipe covering and blocks
31	Portland cement and calcined diatomaceous earth	Mixture of 4 pts. calcined earth to 1 pt. cement by volume	Poured as concrete
32	Rock cork	Rock wool and asphalt binder	Rigid slabs
33	Rock wool	Felted	Blankets
34	Rock wool	Felted with metal jacket	Pipe covering
35	Rock wool	Granulated	Filling
36	Rock wool	Loose	Filling
37	Rock wool	Molded with clay and asbestos	Sheets
38	Rock wool cement	Rock wool and clay	Cement
39	Sheetrock	Gypsum and sawdust	Rigid sheet between heavy papers

RIALS OF CONSTRUCTION

OF HEAT INSULATING MATERIALS*

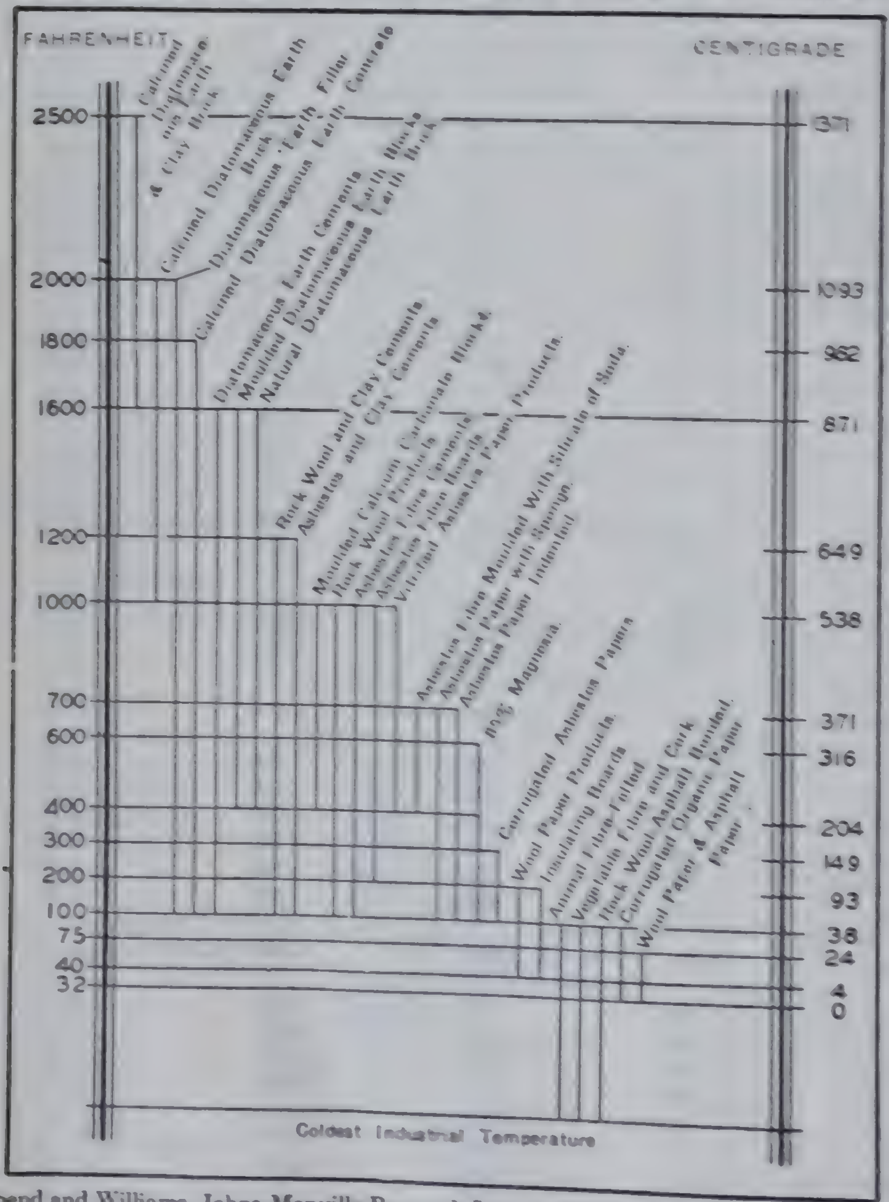
Density, lbs./ft.^{3}	K, B.T.U.s/ hr. ft.^{2} in. °F.	Mean Temp. of sample °F.	Temp. limit for service °F.	Resistance per inch thickness, 1/K	No.
0.08	0.157	32	.....	6.37	1
.....	0.680	500	.....	1.45	2
50.0	1.2	200	1,200	0.83	3
8.5	0.545	300	375	1.83	4
60.5	0.843	86	1000	1.19	5
19.1	0.665	500	700	1.50	6
30.0	0.590	500	700	1.71	7
13.7	0.632	200	300	1.58	8
21.6	1.20	300	700	0.83	9
33.0	1.20	1,600	1,600	0.83	10
9.25	0.272	60	100	3.68	11
16.88	0.247	86	.....	4.05	12
6.17	0.245	60	100	4.08	13
18.72	0.2702	86	.....	3.70	14
7.0	0.27	.....	.....	3.71	15
42.3	2.25	1,600	2,500	0.44	16
26.0	1.06	1,600	1,600	0.94	17
27.7	0.92	1,600	1,600	1.09	18
33.0	2.12	1,600	2,000	0.47	19
30.0	0.735	400	1,600	1.36	20
20.0	0.98	1,600	1,600	1.02	21
17.2	0.89	1,600	1,600	1.12	22
20.4	0.685	500	700	1.46	23
39.6	1.30	500	1,000	0.77	24
17.0	0.356	90	200	2.81	25
17.5	0.363	90	200	2.76	26
16.1	0.340	81	200	2.94	27
14.5	0.365	90	200	2.74	28
.....	0.341	78	100	2.93	29
14.5	0.548	400	600	1.83	30
61.8	2.80	1,600	1,800	0.36	31
15.6	0.328	86	100	3.05	32
8.2	0.408	300	1,000	2.45	33
19.4	0.532	400	1,000	1.88	34
9.42	0.285	156	1,000	3.51	35
10.0	0.270	90	1,000	3.70	36
15.2	0.384	200	1,000	2.60	37
30.0	1.02	500	1,200	0.98	38
60.7	1.40	90	.....	0.715	39

*See also the table: Heat Conductivity of Commercial Insulators.

PHYSICAL AND THERMAL PROPERTIES

No.	Material	General composition	Commercial construction
1	Spun glass	Fine glass fibers, ⊥ to heat flow	Blanket
2	Thermax	Shredded wool and cement	Rigid sheet
3	Wool paper and hair	Laminated	Pipe covering
4	Wool paper products	Laminated wool felt	Solid pipe covering
5	Wool paper products	Indented wool felt	Pipe covering
6	Wool paper products	Wool paper and asphalt saturated paper — alternated	Pipe covering

* TEMPERATURE RANGE AND LIMIT CHART OF INSULATING MATERIALS



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*Townshend and Williams, Johns-Manville Research Lab., published in *Chem. and Met. Eng.* 39, 219 (1932); reprinted by permission.

OF CONSTRUCTION
OF HEAT-INSULATING MATERIALS

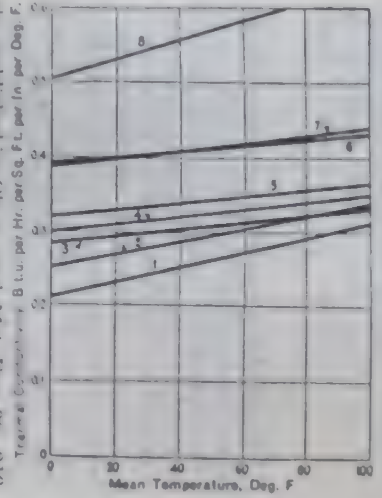
Density, lbs. ft.³	K, B.T.U.s/hr ft.² in.°F.	Mean Temp of sample °F.	Temp. limit for service, °F.	Resistance per inch thickness; 1/K	No.
5.56	0.510	400	1,000	1.96	1
24.2	0 46	72	200	2.07	2
15.6	0 308	50	100	3.25	3
24.5	0.452	120	200	2.21	4
15.0	0.337	120	200	2.97	5
31.7	0.460	112	200	2.17	6

* VARIATION IN CONDUCTIVITY OF TYPICAL INSULATING MATERIALS

Low Temperature Materials

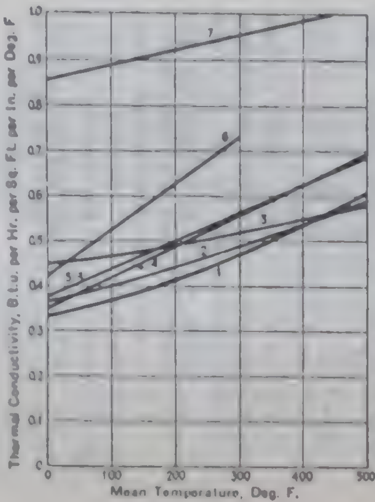
No.	Type of Material	Average Density Lb. Cu.Ft	Average Thermal Conductivity Engineering Units at 20 Deg. Mean	at 100 Deg. Mean
1	Hair felt	10 0	0 227	0.318
2	Rock wool with asphalt binder	14 5	0 267	0 337
3	Rock wool, blown	10.0	0.295	0.335
4	Vegetable cork*	12 5	0 311	0.350
5	Rigid insulating boards	16 1	0 329	0 365
6	Coarse diatomite powder … …	20.0	0 400	0.435
7	Solid rag felt ….	24.5	0 398	0.441
8	Coarsely shredded wood with magnesite cement	25 8	0 528	0 632

*International Critical Tables, vol. 2, p. 315.



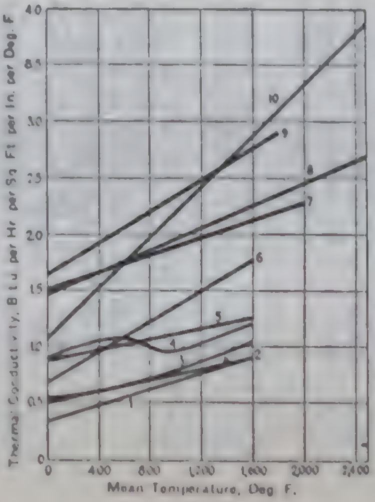
Medium Temperature Materials

No.	Type of Material	Average Thermal Conductivity Engineering Units at 100 Deg. Mean	at 500 Deg. Mean
1	Rock wool pipe covering …. ………	0.38	0.61
2	Laminated asbestos pipe and sponge particles … ……	0.40	0.59
3	85% magnesia …	0 47	0 58
4	Crumpled aluminum foil …………	0.42	0.68
5	Molded asbestos fiber and sodium silicate	0.44	0.69
6	Air-cell type pipe covering …………	0.52	At 300 deg. mean 0 73
7	Insulating cement …	0.87	1.02



High Temperature Materials

No.	Type of Material	Average Density Lb. Cu.Ft.	Average Thermal Conductivity Engineering Units at 400 Deg. Mean	at 1600 Deg. Mean
1	Diatomic powder	17.2	0.48	0.89
2	Solid diatomite heat flow perpendicular to strata …..	27.7	0.61	0.92
3	Molded diatomite with binder	26.0	0.61	1.06
4	Monohydrated bauxite with binder …… ..	33.0	1.04	1.20
5	Solid diatomite heat flow parallel to strata ….. ..	27 7	0 97	1.27
6	Clay with cork granules, fired.	29 8	0.92	1 77
7	Diatomite brick fired ………	38 0	1 65	2.12
8	Diatomite brick with binder, fired	42.3	1.65	2.25
9	Diatomite with Portland cement, fired	61 8	1 94	2 80
10	Clay with cork granules, fired .	36 0	1 53	2 87



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FLOW MEASUREMENT

From Information Furnished by Members of the Technical Staff of
The Bailey Meter Co., Cleveland, Ohio

Nomenclature.—

C = Coefficient of Discharge; unit: a ratio.

W_h = Rate of flow; unit: pounds per hour.

ρ = Density of flowing fluid; unit: pounds per cubic foot.

ρ'_f = Density of dry air at 29.92 inches of mercury pressure and at the actual (experimental) temperature; unit: pounds per cubic foot.

ρ'_a = Density of saturated steam vapor at 60°F.; unit: pounds per cubic foot.

G_f = Specific gravity of air or gas under actual (experimental) conditions referred to air at 29.92 inches of mercury pressure and 60°F. as unity; unit: a ratio.

H = Differential head; unit: inches of water.

H_1 = Differential head; unit: inches of mercury.

h = Differential head; unit: inches of flowing fluid.

d_1 = Diameter of pipe; unit: inches.

d_2 = Diameter of orifice; unit: inches.

S = Saturation of air or gas mixture with moisture in per cent divided by 100, under actual (experimental) conditions.

p'_f = Pressure of saturated steam at actual (experimental) temperature; unit: inches of mercury.

p_f = Observed absolute pressure (equal to barometric reading plus gage reading in inches of mercury); unit: inches of mercury.

One of the most convenient methods for measuring the flow of fluids through a conduit, is by means of a head meter. In the head meter, a primary element is placed in the flowing fluid to produce a pressure difference or *differential head* which the secondary element then uses as an indication of the rate of flow. The primary element produces the differential head either by constricting the flow (orifice, venturi tube, flow nozzle, weir, etc.) or by measuring the impact of the flowing fluid (pitot tube). The secondary element consists of some form of manometer for measuring the differential head produced by the primary element.

If the flow is to be measured accurately, the flowing fluid must be free from turbulence, such as would be produced by obstructions and bends in the piping too near the orifice location, and must not be a pulsating flow as would be produced by reciprocating engines, pumps, and certain types of blowers. The flowing fluid must also be non-viscous unless corrections are applied, corrections which are beyond the scope of this short presentation. In general, at least, a length equal to 20 diameters of straight pipe without valves or fittings should precede the primary element location.

Manometers.—Manometers usually consist of two glass tubes connected at the bottom. The differential pressures are connected to the tops of the glass tubes. The glass tubes are usually filled half full with a liquid and the difference between the levels will give the *differential*. Liquids commonly used in manometers are: water (sp. gr. 1.00); carbon tetrachloride (sp. gr. 1.60); acetylene tetrabromide (sp. gr. 2.96); and mercury (sp. gr. 13.56). Since differentials are usually expressed in inches of water, it is necessary to convert measurements with other liquids to the corresponding head of water. This is done by multiplying the differential head of the liquid by its specific gravity. If the liquid in the gauge is under a column of the liquid whose flow is being measured, the specific gravity of the flowing liquid must be subtracted from the specific gravity of the gage liquid. If, for example, the flow of water (sp. gr. = 1) is being measured by a mercury manometer (sp. gr. = 13.56), then

$$H_1(13.56-1)=H$$

The weight of gases can usually be neglected except at high pressures.

Orifices.—One of the simplest of

the primary elements used to produce a throttling action is the *orifice plate.* It consists of a thin disc of stainless steel or monel metal in the center of which is a hole smaller in diameter than the inside of the pipe with which it is to be used. The maximum reduction in pressure produced by this throttling action is at a point, downstream from the orifice plate, called the *vena contracta.* The position of the vena contracta with a given orifice is practically the same for all rates of flow. Since the pressure is partially restored after passing the vena contracta, it is desirable to make the downstream connection to the manometer as near the vena contracta as possible.

The outside diameter of the orifice plate should fit snugly inside the bolt circle of the pipe flange so that the orifice hole will be concentric with respect to the pipe diameter. For use in pipes of six inches or less in diameter, the orifice plate should be $\frac{1}{16}$ inch in thickness; for pipe diameters from 6 inches up to 15 inches the orifice plate should be at least $\frac{1}{8}$ inch in thickness. It is essential that the inside of the orifice hole be smooth and free from burrs. The upstream edge must be sharp and square, and the downstream side should have a 45° bevel to $\frac{1}{32}$ inch edge thickness.

The connections to the orifice should be made by means of $\frac{1}{2}$ inch pipe nipples. These nipples should be filed flush with the inside of the pipe and must, under no conditions, project into the flowing stream. The upstream connection should be made about one pipe diameter from the orifice plate. The downstream connection should be at the vena contracta. If an easily condensed gas or vapor (e. g., steam) is being measured, a reservoir for collecting condensate (water) must be placed on each nipple. Each reservoir should hold about 20 or 30 cubic inches of condensed liquid, and these reservoirs must be so mounted that the liquid level is exactly at the same height in both, otherwise a false differential will be created.

Selection and Calculation of the Proper Size of Orifice.—The general formula for calculating orifices is:

$$W_h = 360 \times (d_2)^2 \times C \sqrt{\frac{H\rho}{1-\left(\frac{d_2}{d_1}\right)^4}}$$

These formulas do not take into account the compressibility of the gas nor the thermal expansion of the orifice plate but are sufficiently accurate for most practical applications. Since W_h, d_2, and H are variables, it is necessary to assign values to two of these factors in order to solve the equation. The diameter of the orifice hole d_2 is usually selected so as to give the maximum H when the flow W_h is at the maximum. H is, therefore, selected before starting the design of the orifice. It is desirable to make H as large as practical for more accurate reading if the differential is to be read by means of a U-tube manometer. If a flow meter is to be used, the H will usually be the maximum head for which the flow meter is designed. H is also limited in some instances by the pressure loss that can be tolerated, as is the case when measuring flows under low pressures. The pressure loss due to the orifice may be calculated from curve No. 3 on per cent differential head lost.

The most practical method for calculating an orifice is by trial since it eliminates solving a fourth degree equation. A value for d_2 is arbitrarily chosen, then from the orifice ratio d_2/d_1, a value for C is found from curves No. 2 on discharge coefficients. These values are then placed in the equation and the equation is solved for W_h. If an approximate value for the maximum flow through the pipe line is known, the value for d_2 is altered until the desired value for W_h is secured.

When the orifice is in operation, of course, the values for d_1, d_2, C, and ρ are constant so long as the state of the fluid does not differ from that for which the orifice was designed. These factors are then multiplied together to give a new constant by which the instantaneous value for H as read from the manometer or meter may be multiplied to give the rate of flow per hour at that instant. This is done by writing equation No. 1 (see below) in this form:

$$W_h=\left[(360)\times(d_2)^2\times(C)\times\sqrt{\frac{1}{1-\left(\frac{d_2}{d_1}\right)^4}}\times\sqrt{\rho}\,\right]\times\sqrt{H}$$

The terms enclosed within the brackets being the constant for the orifice.

The desirability for designing an orifice to give the maximum differential head will be appreciated when it is realized that the differential head developed by a flow through an orifice is a square root relationship, so that if an orifice, for example, has twice the necessary capacity, it will develop only one-fourth the head otherwise obtainable. If no estimate of the maximum flow is available, it may be necessary to design and build a trial orifice and from trial tests run with this orifice sufficient data can be secured from which an orifice of correct proportions can be designed.

Example.—The flow of water through a 6 inch pipe is estimated to be 180,000 pounds per hour. What should be the diameter of the orifice hole if used with a 10 inch manometer? Where should the downstream tap be located? What is the pressure loss due to the orifice at maximum flow? What is the flow through the 6 inch pipe when an orifice, designed for the conditions mentioned above, produces a 5 inch differential on the mercury manometer? The water (sp. gr. $=1$) to be measured is at a temperature of 60°F., and therefore $\rho=62.4$; the manometer to be used has a maximum range of 10 inches of mercury (sp. gr. 13.56), or $H=10(13.56-1)=125.6$ inches of water.

For a trial a 3 inch orifice hole may be assumed. The ratio, d_2/d_1, will then be $3.00/6.00=0.50$. From curve No. 2 it will be found that for a 0.50 ratio and a 6 inch pipe, C is 0.608. These values are then substituted in equation No. 1, and grouping the values which are constants gives the following:

$$W_h=\left[(360)\times(3)^2\times(0.608)\sqrt{\frac{1}{1-\left(\frac{3.00}{6.00}\right)^4}}\times\sqrt{62.4}\,\right]\times\sqrt{125.6}$$

$$=16{,}100\times\sqrt{125.6}$$

$$=180{,}100 \text{ pounds per hour.}$$

From curve No. 1 it will be found that for a 0.50 ratio, the downstream connection should be 0.6 diameters from the orifice plate to bring its position at the middle of the vena contracta; *i. e.*, $0.6\times6=3.6$ inches, and the minimum distance allowable is $0.4\times6=2.4$ inches, and the maximum distance allowable is $0.75\times6=4.5$ inches.

The pressure loss due to the orifice is calculated by multiplying H by a constant as read from curve No. 3. Thus, in the example given above, the pressure lost with a 0.50 ratio is 0.72 of the head which at the maximum flow is: $(0.72)\times(125.6)=90.5$ inches of water, or since (inches of water) $\div 27.72=$ pounds per square inch, the pressure loss due to the orifice when 180,000 pounds per hour is flowing through the pipe will be: $90.5\div27.72=3.26$ pounds per square inch.

The rate of flow for 5 inches of mercury differential is calculated as follows:

$$H=5\times(13.56-1)=62.8 \text{ inches of water}$$

$$W_h=16{,}100\times\sqrt{62.8}$$

$$=127{,}400 \text{ pounds per hour.}$$

ORIFICE FORMULAS

For liquids:

$$(1)\quad W_h=(360)\times(d_2)^2\times(C)\times\sqrt{\frac{(\rho)\times(H)}{1-\left(\frac{d_2}{d_1}\right)^4}}$$

For dry gases under actual (experimental) conditions of temperature and pressure:

$$(2)\quad W_h=(360)\times(d_2)^2\times(C)\times\sqrt{\frac{(\rho_f)\ (G_f)\ (H)}{1-\left(\frac{d_2}{d_1}\right)^4}}$$

For wet gases under actual (experimental) conditions of temperature and pressure:

$$(3)\quad W_h=(360)\times(d_2)^2\times(C)\times\sqrt{\frac{[\rho'_f\times G_f(p_f-p'_f)+(\rho'_a)\ \ (S)]\,H}{1-\left(\frac{d_2}{d_1}\right)^4}}$$

PITOT TUBE FORMULAS

Two common types of pitot tubes are the *combined impact reverse*, and the *combined impact static*. In the combined impact reverse one opening faces upstream and the other opening downstream. In the combined impact

PITOT TUBE FORMULAS

static one opening faces upstream and the second opening faces normal to the direction of the flow.

Combined impact reverse type:

$$(4)\quad W_h = (255) \times (d_1)^2 \times \sqrt{(\rho) \times \left(\frac{h}{12}\right)}$$

Combined impact static type:

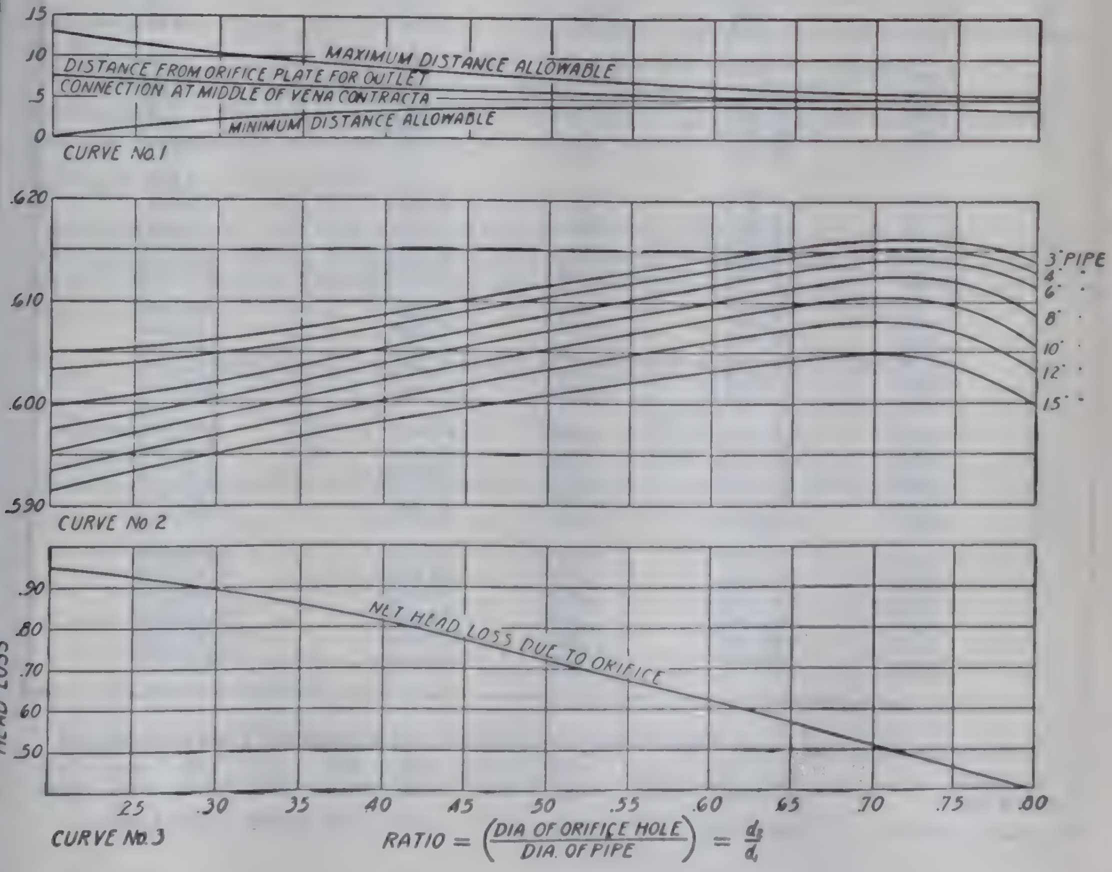
$$(5)\quad W_h = (353) \times (d_1)^2 \times \sqrt{(\rho) \times \left(\frac{h}{12}\right)}$$

V-NOTCH WEIR FORMULA

$$(6)\quad W_h = (1946) \times (C) \times \left(\tan \frac{\alpha}{2}\right) \times h^{2.48}$$

The values of C (coefficient of discharge) for various angles of the notch (α) are:

when $\alpha = 30°$	then $C = 0.5930$
$= 45°$	$= 0.5820$
$= 60°$	$= 0.5785$
$= 75°$	$= 0.5785$
$= 90°$	$= 0.5815$



CONCENTRIC ORIFICE COEFFICIENTS

NICHROME RESISTANCE WIRE

Reprinted from Catalog R-28 Driver-Harris Company by Permission.

Specific resistance 675 ohms per circular mil-foot at 20°C. (68°F.)

No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20° C (68°F.)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Pound Bare Wire
1	.289	.0081	231.0	4.33	.035
2	.258	.0101	184.0	5.43	.054
3	.229	.0128	145.0	6.90	.090
4	.204	.0162	115.0	8.70	.139
5	.182	.0203	92.0	10.9	.218
6	.162	.0257	73.0	13.7	.356
7	.144	.0325	57.0	17.5	.560
8	.1285	.0408	45.0	22.2	.910
9	.114	.0519	36.0	27.8	1.44
10	.102	.0649	29.0	34.5	2.20
11	.091	.0815	23.0	43.5	3.52
12	.081	.102	18.0	55.6	5.67
13	.072	.130	14.0	69.9	9.08
14	.064	.164	11.0	88.5	14.51
15	.057	.207	9.2	109	22.5
16	.051	.259	7.2	139	36.0
17	.045	.333	5.6	179	59.6
18	.040	.421	4.42	226	95.1
19	.036	.520	3.58	279	145
20	.032	.659	2.83	353	232
21	.0285	.831	2.24	446	370
22	.0253	1.055	1.77	565	590
23	.0226	1.321	1.41	709	936
24	.0201	1.670	1.12	893	1,491
25	.0179	2.106	.89	1,123	2,365
26	.0159	2.669	.70	1,429	3,814
27	.0142	3.347	.56	1,786	5,977
28	.0126	4.251	.44	2,273	9,662
29	.0113	5.286	.35	2,857	15,102
30	.0100	6.750	.276	3,623	24,455
31	.0089	8.521	.219	4,566	38,906
32	.0080	10.546	.177	5,650	59,584
33	.0071	13.390	.139	7,194	96,327
34	.0063	17.006	.110	9,091	154,601
35	.0056	21.524	.087	11,490	247,310
36	.0050	27.000	.069	14,490	391,230
37	.0045	33.333	.056	17,860	595,327
38	.0040	42.187	.045	22,220	937,395
39	.0035	55.102	.034	29,410	1,620,500
40	.0031	70.239	.025	40,000	2,809,500
	.00275	89.256	.021	47,600	4,248,600
	.0025	108.000	.017	58,900	6,361,200
	.00225	133.333	.014	71,500	9,533,000
	.002	168.750	.011	91,000	15,356,000
	.00175	220.408	.008	125,000	27,551,000
	.0015	300.000	.006	166,666	50,000,000

Factors to be used in determining resistance at elevated temperatures

Temp. Cent.	20	100	200	300	400	500	600	700	800	900	1000
Temp. Fahr.	68	212	392	572	752	932	1112	1292	1472	1652	1832
Resistance in Ohms	1.000	1.006	1.029	1.047	1.057	1.072	1.077	1.082	1.088	1.095	

NICHROME RESISTANCE WIRE

SUGGESTIONS ON DESIGN OF NICHROME HEATING ELEMENTS

Reprinted from Catalog R-28, Driver-Harris Company by Permission.

The table below gives the size of "Nichrome" suggested for a given number of watts at 110 volts. The sizes are selected to operate at approximately 1500°F. in open coils and are suitable for electric irons, toasters, hot plates, space heaters, etc.

NICHROME WIRE. 110 VOLTS

Watts	Amperes	B. & S. Size	Ohms 75° F	Length	
250	2.27	25	43.6	21 Ft.	2 Ins.
300	2.72	24	36.4	22	0
350	3.2	23	31.0	24	0
400	3.64	23	27.2	21	0
450	4.10	22	24.1	23	5
475	4.32	22	23.0	22	4
500	4.55	22	21.8	21	0
550	5.0	21	19.8	24	5
575	5.23	21	18.9	23	2
600	5.46	21	18.1	22	4
615	5.6	20	17.7	27	6
640	5.82	20	17.0	26	6
660	6.0	20	16.5	25	8
700	6.36	20	15.6	24	4
750	6.81	19	14.5	28	5

For voltages other than 110 divide the number of watts required at the given voltage by the voltage factor below. Select the nearest number of watts in the 110 volt table, multiply the length in 110 volt table by the voltage factor. Suppose an electric iron takes 550 watts and the supply voltage is 100. Factor for 100 volts is .91 and $\frac{550}{.91} = 605$ watts.

Nearest value in 110 volt table is 600 watts which requires 22′ 4″ of size 21 wire. This gives the size to be used on 110 volts, but the length should be 0.91×22′4″ or 20′4″. The winding for 550 watts, 100 volts would then be 20′4″ of size 21 "Nichrome" wire.

VOLTAGE FACTORS ON BASIS OF 110 VOLTS

Voltage	100	120	150	200	220	240	32
Factor	.91	1.09	1.36	1.82	2.0	2.18	0.29

ADVANCE RESISTANCE WIRE

Reprinted from Catalog R-28, Driver-Harris Company by Permission.

Specific resistance 294 ohms per circular mil-foot at 20°C. (68°F.). The change of resistance with change of temperature is negligible. Thermal E.M.F. against copper is approximately 0.043 milli-volts per degree Centigrade, between 0°C. and 100°C.

No. B. & S.	Diam. in Inches	Ohms Per Ft. at 20°C. (68°F.)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Pound Bare Wire
1	.289	.003	253.0	3.95	.0136
2	.258	.004	201.0	4.98	.0217
3	.229	.005	159.0	6.29	.0346
4	.204	.007	126.0	7.94	.0549
5	.182	.008	100.0	10.0	.0874
6	.162	.011	79.0	12.7	.139
7	.144	.014	63.0	15.9	.221
8	.1285	.017	50.0	20.0	.351
9	.114	.022	39.0	25.6	.559
10	.102	.028	32.0	31.3	.888
11	.091	.035	25.0	40.0	1.41
12	.081	.044	20.0	50.0	2.246
13	.072	.056	15.7	63.7	3.573
14	.064	.071	12.4	80.6	5.678
15	.057	.090	9.8	102.0	9.03
16	.051	.113	7.8	128.0	14.36
17	.045	.145	6.2	161.0	22.83
18	.040	.184	4.9	204.0	36.29
19	.036	.226	3.9	256.0	57.71
20	.032	.287	3.1	323.0	91.74
21	.0285	.362	2.5	400.0	145.9
22	.0254	.460	1.9	526.0	232.0
23	.0226	.575	1.5	667.0	369.0
24	.0201	.725	1.2	833.0	586.6
25	.0179	.919	0.97	1,031.0	932.9
26	.0159	1.162	0.77	1,299.0	1,483
27	.0142	1.455	0.61	1,639.0	2,358
28	.0126	1.850	0.48	2,083.0	3,749
29	.0113	2.300	0.38	2,632.0	5,964
30	.0100	2.940	0.30	3,334.0	9,470
31	.0089	3.680	0.24	4,167.0	15,075
32	.0080	4.600	0.19	5,263.0	23,970
33	.0071	5.830	0.15	6,667.0	38,110
34	.0063	7.400	0.12	8,333.0	60,620
35	.0056	9.360	0.095	10,530.0	96,340
36	.0050	11.760	0.076	13,160.0	153,240
37	.0045	14.550	0.060	16,667.0	243,650
38	.0040	18.375	0.047	21,276.0	388,360
39	.0035	24.100	0.038	26,316.0	616,000
40	.0031	30.593	0.028	35,714.0	1,092,500
	.00275	38.888	0.021	47,600.0	1,850,000
	.0025	46.400	0.017	58,900.0	2,730,000
	.00225	58.103	0.014	71,500.0	4,150,000
	.002	72.500	0.011	91,000.0	6,600,000
	.00175	96.078	0.008	125,000.0	12,000,000
	.0015	130.666	0.006	166,666.0	21,600,000

Factors to be used in determining resistance at elevated temperatures

Temp. Centigrade	20	100	200	300	400	500	600°
Temp. Fahrenheit	68	212	392	572	752	932	1112°
Resistance in Ohms	1.000	1.002	1.002	1.001	1.005	1.017	1.037

MANGANIN RESISTANCE WIRE

Reprinted from Catalog R-28, Driver-Harris Co. by Permission.

Specific resistance 290 ohms per circular mil-foot at 20°C. (68°F.). Temperature coefficient over the range of 15° to 35°C. (59° to 95°F.), with the peak of the curve at 25°C. (77°F.), will be between .00002 and .000005 per degree C. Thermal E. M. F. against copper not over 0.003 millivolts per degree centigrade, between 0°C. and 100°C.

No. B & S.	Diam. in Inches	Ohms Per Ft. at 20°C. (68°F)	Weight Per 1000 Ft. Bare Wire Pounds	Feet Per Pound Bare Wire	Ohms Per Pound Bare Wire
15	.057	.089	9.2	109.0	9.70
16	.051	.110	7.2	139.0	15.29
17	.045	.142	5.6	179.0	25.4
18	.040	.180	4.42	226.0	40.6
19	.036	.218	3.58	279.0	60.82
20	.032	.282	2.83	353.0	99.5
21	.0285	.356	2.24	446.0	158
22	.0254	.452	1.77	565.0	255
23	.0226	.567	1.41	709.0	402
24	.0201	.717	1.12	893.0	704
25	.0179	.905	0.89	1,123.0	1,016
26	.0159	1.147	0.70	1,429.0	1,639
27	.0142	1.438	0.56	1,786.0	2,568
28	.0126	1.825	0.44	2,273.0	4,148
29	.0113	2.270	0.35	2,857.0	6,485
30	.0100	2.899	0.276	3,623.0	10,503
31	.0089	3.661	0.219	4,566.0	16,716
32	.0080	4.531	0.177	5,656.0	25,627
33	.0071	5.753	0.139	7,194.0	41,387
34	.0063	7.304	0.110	9,091.0	66,400
35	.0056	9.234	0.087	11,490.0	106,098
36	.0050	11.599	0.069	14,490.0	168,069
37	.0045	14.352	0.056	17,860.0	256,326
38	.0040	18.120	0.045	22,220.0	402,626
39	.0035	23.767	0.034	29,410.0	698,987
40	.0031	32.220	0.025	40,000.0	1,288,800

ALLOWABLE CARRYING CAPACITIES OF COPPER WIRE AND CABLE

(*Regulations of the Nat'l Board of Fire Underwriters*)

No. AWG	Circular Mils	Amperes		Circular Mils	Amperes	
		Rubber Insulation	Varnished Cambric Insulation		Rubber Insulation	Varnished Cambric Insulation
18	1,624	3	4	250,000	250	300
16	2,583	6	8	300,000	275	330
14	4,107	15	18	350,000	300	360
12	6,530	20	25	400,000	325	390
10	10,380	25	30	450,000	362	435
8	16,510	35	40	500,000	400	480
6	26,250	50	60	600,000	450	540
4	41,740	70	85	700,000	500	600
2	66,370	90	110	800,000	550	660
1	83,690	100	120	1,000,000	650	780
0	105,500	125	150	1,250,000	750	900
00	133,100	150	180	1,500,000	850	1020
000	167,800	175	210	1,750,000	950	1140
0000	211,600	225	270	2,000,000	1050	1260

DIAMETER, WEIGHTS AND RESISTANCE OF COPPER WIRE

Courtesy General Electric Co.

No. AWG	Diameter Mils	Area Circular Mils	Weight Bare Wire		Resistance at 25° C (77°F)		
			Pounds per 1000 Ft.	Pounds per Mile	Ohms per 1000 Ft.	Ohms per Mile	Feet per Ohm
0000	460.	211,600	640.5	3382.	0.05091	0.2688	19,643.
000	410.	167,800	508.0	2682.	0.06419	0.3389	15,579.
00	365.	133,100	402.8	2127.	0.08097	0.4275	12,350.
0	325.	105,600	319.7	1688.	0.1019	0.5380	9,814.
1	289.	83,500	252.7	1334.	0.1290	0.6811	7,752.
2	258.	66,560	201.5	1064.	0.1618	0.8543	6,180.
3	229.	52,440	158.7	838.	0.2054	1.0845	4,869.
4	204.	41,620	126.0	665.	0.2588	1.3665	3,864.
5	182.	33,120	100.2	529.	0.3253	1.718	3,074.
6	162.	26,240	79.43	419.4	0.4105	2.167	2,436.
7	144.	20,740	62.78	331.5	0.5194	2.742	1,925.
8	128.	16,380	49.60	261.89	0.6574	3.471	1,521.
9	114.	13,000	39.35	207.77	0.8286	4.375	1,207.
10	102.	10,400	31.48	166.21	1.036	5.470	965.2
11	90.7	8,226	24.90	131.47	1.309	6.912	763.9
12	80.8	6,529	19.76	104.33	1.650	8.712	606.1
13	72.0	5,180	15.68	82.79	2.080	10.98	480.7
14	64.1	4,109	12.44	65.68	2.621	13.84	381.5
15	57.1	3,260	9.866	52.09	3.304	17.45	302.6
16	50.8	2,581	7.812	41.25	4.174	22.04	239.5
17	45.3	2,052	6.213	32.81	5.249	27.72	190.5
18	40.3	1,624	4.914	25.95	6.636	35.04	150.7
19	35.9	1,288	3.900	20.59	8.361	44.2	119.6
20	32.0	1,024.	3.099	16.36	10.52	55.6	95.1
21	28.5	812.3	2.459	12.98	13.26	70.0	75.4
22	25.3	640.1	1.937	10.23	16.83	88.9	59.4
23	22.6	510.8	1.546	8.16	21.09	111.4	47.4
24	20.1	404.0	1.223	6.46	26.66	140.8	37.45
25	17.9	320.4	0.9697	5.12	33.63	177.6	29.71
26	15.9	252.8	0.7650	4.04	42.57	224.8	23.48
27	14.2	201.6	0.6101	3.220	53.45	282.2	18.71
28	12.6	158.8	0.4806	2.540	67.84	358.2	14.74
29	11.3	127.7	0.3866	2.043	84.35	445.4	11.85
30	10.0	100.0	0.3027	1.600	107.8	569.2	9.28
31	8.9	79.2	0.2398	1.267	136.0	718.1	7.36
32	8.0	64.0	0.1937	1.024	168.2	888.1	5.94
33	7.1	50.4	0.1526	0.806	213.6	1128.	4.68
34	6.3	39.7	0.1201	0.635	271.1	1431.	3.69
35	5.6	31.4	0.09493	0.501	342.5	1808.	2.919
36	5.0	25.0	0.07568	0.3994	431.7	2279.	2.315
37	4.5	20.3	0.06130	0.3235	532.1	2809.	1.880
38	4.0	16.0	0.04843	0.2555	671.5	3546.	1.488
39	3.5	12.3	0.03708	0.1958	872.3	4606.	1.147
40	3.1	9.6	0.02909	0.1536	1128.	5956.	0.888

TEMPERATURE CORRECTIONS

(*Based on A. I. E. E. Standards*)

Temperature Coefficient of Resistance. At a temperature of 25°C the "constant mass" temperature coefficient of resistance of standard annealed copper, measured between potential points rigidly fixed to the wire is 0.00385 or 1/259.5 per Centigrade degree. Resistance values of copper wire given in tables at 25°C may be corrected for any temperature by means of the following formula—$Rt = R_{25}[1+0.00385\,(t-25)]$, where Rt is the resistance in ohms at a temperature t°C; R_{25} is the resistance in ohms at 25°C; and, t is the temperature of wire in degrees Centigrade.

STANDARD CALIBRATION TABLES FOR THERMOCOUPLES

The following tables represent arbitrary reference curves which show fairly well the relation between E. M. F. and temperature and consequently should be used with an appropriate correction curve which must be determined for any individual thermocouple by means of a calibration at three or more fixed temperature points. Such a correction curve is constructed by plotting ΔE the difference between the observed E. M. F. at a known temperature and the E. M. F. for this same temperature (as read from the table) against the standard E. M. F. given in the table. The corrected E. M. F. for any temperature is then obtained by subtracting algebraically ΔE as read from the correction curve from the observed E. M. F., before converting the latter into a temperature as read from the table. The tables which follow are for a fixed (or cold) junction maintained at 0°C. If this fixed junction is not at 0°C. but at some other temperature which is very near to 0°C. a correction should be applied as follows: $E_h = E_o + E$ where E_o is the observed E. M. F., E is the E. M. F. corresponding to the temperature of the fixed junction and E_h is the desired E. M. F. corrected for the temperature at which the fixed junction is being maintained. In the tables which follow the E. M. F. values are expressed in millivolts and the temperatures in degrees centigrade.

PLATINUM — PLATINUM (90%), RHODIUM (10%) THERMOCOUPLE

Standard range 630° — 1083°C; applicability range 0°—1754°C. Computed from values given in Int. Crit. Tables, Vol. 1, p. 57.

°C	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0.00	0.06	0.11	0.17	0.24	0.30	0.36	0.43	0.50	0.57
100°	0.64	0.72	0.79	0.87	0.95	1.02	1.10	1.18	1.26	1.35
200°	1.43	1.52	1.60	1.69	1.78	1.86	1.95	2.04	2.13	2.22
300°	2.31	2.40	2.50	2.59	2.68	2.77	2.87	2.96	3.05	3.15
400°	3.24	3.34	3.44	3.53	3.63	3.73	3.82	3.92	4.02	4.12
500°	4.22	4.31	4.41	4.51	4.61	4.71	4.82	4.92	5.02	5.12
600°	5.22	5.32	5.43	5.53	5.63	5.74	5.84	5.94	6.05	6.16
700°	6.26	6.37	6.47	6.58	6.68	6.79	6.89	7.00	7.11	7.22
800°	7.33	7.44	7.55	7.66	7.77	7.88	7.99	8.10	8.21	8.32
900°	8.43	8.54	8.66	8.77	8.89	9.00	9.11	9.22	9.34	9.46
1000°	9.57	9.68	9.80	9.92	10.03	10.15	10.27	10.38	10.50	10.62
1100°	10.74	10.86	10.98	11.10	11.21	11.33	11.45	11.57	11.69	11.31
1200°	11.93	12.05	12.17	12.29	12.41	12.53	12.65	12.77	12.89	13.01
1300°	13.13	13.25	13.37	13.49	13.61	13.73	13.85	13.97	14.09	14.21
1400°	14.33	14.45	14.58	14.70	14.82	14.94	15.06	15.19	15.31	15.43
1500°	15.55	15.67	15.79	15.91	16.03	16.15	16.27	16.39	16.51	16.63
1600°	16.75	16.87	16.99	17.11	17.23	17.35	17.47	17.59	17.71	17.83
1700°	17.95	18.07	18.19	18.31	18.43	18.55	.....	.....	.....	.....

CHROMEL—ALUMEL THERMOCOUPLE

Bu. Standards Research Papers Nos. 767, 768, 1278.

°C	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0	0.00	.40	.80	1.20	1.61	2.02	2.43	2.85	3.26	3.68
100	4.10	4.51	4.92	5.33	5.73	6.13	6.53	6.93	7.33	7.73
200	8.13	8.53	8.93	9.34	9.74	10.15	10.56	10.97	11.38	11.80
300	12.21	12.62	13.04	13.45	13.87	14.29	14.71	15.13	15.55	15.97
400	16.39	16.82	17.24	17.66	18.08	18.50	18.93	19.36	19.78	20.21
500	20.64	21.07	21.49	21.92	22.34	22.77	23.20	23.62	24.05	24.48
600	24.90	25.33	25.75	26.18	26.60	27.03	27.45	27.87	28.29	28.72
700	29.14	29.56	29.98	30.40	30.82	31.23	31.65	32.07	32.48	32.90
800	33.31	33.71	34.12	34.53	34.94	35.35	35.75	36.16	36.56	36.96
900	37.36	37.76	38.16	38.56	38.96	39.35	39.75	40.14	40.53	40.92
1000	41.31	41.70	42.08	42.47	42.86	43.24	43.62	44.00	44.38	44.76
1100	45.14	45.52	45.89	46.27	46.64	47.01	47.38	47.75	48.12	48.48
1200	48.85	49.21	49.57	49.94	50.29	50.65	51.00	51.36	51.71	52.06

* At −10° and −20°C., −0.39 and −0.77 milli-volts, resp.

STANDARD CALIBRATION TABLES FOR THERMOCOUPLES

COPPER—CONSTANTAN THERMOCOUPLE

Calculated from values given in Int. Crit. Tables, Vol. 1, p. 58.

°C	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
−200°	−5.53	−5.68	−5.83	.....	.....	.....	.....	.....	.....	.....
−100°	−3.35	−3.62	−3.89	−4.14	−4.38	−4.60	−4.82	−5.02	−5.20	−5.37
−0°	0.00	−0.38	−0.75	−1.11	−1.47	−1.81	−2.14	−2.46	−2.77	−3.06
+0°	0.00	0.40	0.81	1.23	1.65	2.08	2.51	2.95	3.39	3.84
100°	4.30	4.76	5.23	5.71	6.20	6.70	7.20	7.71	8.22	8.74
200°	9.27	9.81	10.36	10.91	11.47	12.03	12.60	13.16	13.73	14.31
300°	14.89	15.47	16.06	16.65	17.24	17.84	18.44	19.04	19.65	20.25

PLATINUM—PLATINUM (87%), RHODIUM (13%) THERMOCOUPLE

Values taken from Bulletin No. 325 of Charles Engelhard, Inc., New York.

°C	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
0°	0.00	0.06	0.12	0.18	0.25	0.31	0.38	0.45	0.52	0.60
100°	0.67	0.75	0.83	0.90	0.99	1.07	1.15	1.23	1.32	1.40
200°	1.49	1.58	1.67	1.76	1.85	1.94	2.03	2.12	2.21	2.30
300°	2.40	2.49	2.59	2.68	2.77	2.87	2.98	3.08	3.19	3.29
400°	3.40	3.51	3.61	3.72	3.82	3.93	4.04	4.15	4.25	4.36
500°	4.47	4.58	4.69	4.81	4.92	5.03	5.14	5.26	5.37	5.49
600°	5.60	5.72	5.83	5.95	6.06	6.18	6.30	6.42	6.53	6.65
700°	6.77	6.89	7.01	7.13	7.25	7.37	7.49	7.62	7.74	7.87
800°	7.99	8.12	8.24	8.37	8.49	8.62	8.75	8.88	9.00	9.13
900°	9.26	9.39	9.52	9.66	9.79	9.92	10.05	10.18	10.32	10.45
1000°	10.58	10.72	10.85	10.99	11.21	11.26	11.40	11.54	11.67	11.81
1100°	11.95	12.09	12.23	12.38	12.52	12.66	12.80	12.94	13.09	13.23
1200°	13.37	13.52	13.66	13.81	13.95	14.10	14.25	14.40	14.54	14.69
1300°	14.84	14.99	15.14	15.30	15.45	15.60	15.75	15.90	16.06	16.21
1400°	16.36	16.52	16.67	16.83	16.98	17.14	17.30	17.46	17.61	17.77
1500°	17.93	18.09	18.25	18.42	18.58	18.74	18.90	19.06	19.23	19.39
1600°	19.55	19.71	19.88	20.04	20.21	20.37	.....	.....	.....	.....

IRON—CONSTANTAN THERMOCOUPLE

Values taken from Bulletin No. 325 of Charles Engelhard, Inc., New York.

°C	0°	50°
0°	0.00	2.61
100°	5.28	8.01
200°	10.77	13.54
300°	16.30	19.06
400°	21.83	24.61
500°	27.41	30.24
600°	33.13	36.11
700°	39.19	42.33
800°	45.48	48.66
900°	51.83	55.00
1000°	58.17	61.33
1100°	64.50	67.67
1200°	70.84	.....
.....	.....	.....

FIXED POINTS FOR THERMOMETER CALIBRATION

Abbreviations: B, boiling point at 760 mm of mercury pressure; C, condensing point; F, freezing point; I, inversion point; M, melting point; p, pressure in millimeters of mercury; t, temperature in centigrade of boiling point at normal pressure; T, transition point; VP, vapor pressure; †, base point used in defining the Standard Working Scale (Int. Crit. Tables) by E. F. Mueller.

Substance	Point	Deg. C Thermodynamic scale	Pressure corrections and conditions
Hydrogen	B	−252.75	$+0.0044(p-760)$
Nitrogen	VP	−195.80	$+0.0109(p-760)$
Liquid oxygen †	VP	−183.00	$+0.0126(p-760) - 0.0000065(p-760)^2$
Isopentane	F	−159.6	....
Methylcyclohexane	F	−126.3	....
Ether	rapid F or slow M	−116.3	....
Carbon disulfide	F	−111.6	....
Toluene	F	−95.1	....
Ethyl acetate	F	−83.6	....
Carbon dioxide (solid) †	VP	−78.51	$+0.01595(p-760) - 0.000011(p-760)^2$
Chloroform	F	−63.5	....
Chlorobenzene	F	−45.2	....
Mercury †	F	−38.87	....
Carbon tetrachloride	F	−22.9	....
Ice †	M	0.000	....
Sodium chromate	T	19.525	$Na_2CrO_4\cdot 10H_2O$
Sodium sulfate	T	32.384	$Na_2SO_4\cdot 10H_2O$
p-Toluidine	M	45	....
α-Naphthylamine	M	50	....
Sodium bromide	T	50.674	$NaBr\cdot 2H_2O$
Manganese chloride	T	58.089	$MnCl_2\cdot 4H_2O$
Chloroform	B	61.3	....
Ethyl alcohol	B	78.26	$+0.034(p-760)$
Benzene	B	80.0	$+0.043(p-760)$
Naphthalene	M	80.8	....
Steam †	C	100.000	$+0.0367(p-760) - 0.000023(p-760)^2$
Benzoic acid	M	122.5	....
Chlorobenzene	B	132	$+0.050(p-760)$
m-Xylene	B	138.8	$+0.050(p-760)$
Aniline	B	184.51	$+0.051(p-760)$
Salicylic acid	M	159.8	....
o-Toluidine	B	199.7	$+0.058(p-760)$
Nitrobenzene	B	210.9	....
Anthracene	M	216	....
Naphthalene	C	217.96	$+0.2075(t+273.1)\cdot \log_{10}(p/760)$
Tin	F	231.85	....
Quinoline	B	237.5	....
Carbazole	M	246	....
Anthraquinone	M	285	....
Diphenylamine	B	302	....
Benzophenone	C	305.9	$+0.194(t+273.1)\cdot \log_{10}(p/760)$
Cadmium	F	320.9	....
Lead	F	327.4	....

FIXED POINTS FOR THERMOMETER CALIBRATION

Substance	Point	Deg. C Thermodynamic scale	Pressure corrections and conditions
Mercury	B	356.9	
Potassium dichromate	M	397.5	
Zinc	F	419.45	
Sulfur †	C	444.60	$+0.0909(p-760)-0.000048\,(p-760)^2$
Potassium sulfate	I	583.0	
Antimony †	F	630.5	Approximately; to be determined with resistance thermometer.
Sodium chloride-sodium sulfate (30.5% NaCl + 69.5% Na_2SO_4)	M	637.0	
Aluminum (99.85%)	F	658.9	
Potassium chloride	M	770.3	
Sodium chloride	M	800.4	
Sodium sulfate	M	884.7	
Silver †	F	960.5	In a reducing atmosphere.
Gold †	F	1063	
Potassium sulfate	M	1069.1	
Copper	F	1083	In a reducing atmosphere.
Lithium metasilicate	M	1202	
Diopside	M	1395	
Nickel	M or F	1452	
Cobalt	M or F	1490	
Palladium	F	1555±2	
Anorthite	M	1555	
Platinum	M	1755±6	
Alumina	M	2000	
Tungsten	M	3370±30	

CHANGES IN CALIBRATION

Direct comparison with standard instruments or with a number of fixed points is more accurate than calibration between just a few fixed points over a wide range. Mercury and glass do not expand uniformly with rise in temperature the expansion accelerating with rise in temperature, and in the case of glass this varies with different varieties. Usually thermometers are calibrated for use in a vertical position and when such instruments are used in a horizontal position the readings are too high because of the difference in pressure exerted by the mercury column on the mercury contained in the bulb. This error (E), which is most pronounced with long thermometers, must be determined empirically at points along the temperature scale. For angles Θ (between the horizontal and vertical positions) the correction at the same temperature is $E \times \sin \Theta$. Thermometers are also subject to changes in readings caused by several conditions. Glass is subject to contraction over a number of years thus causing higher readings with lapse of time. After a thermometer has experienced a rise in temperature there is a lapse of time before the glass attains the volume corresponding to that temperature and if kept at a high temperature for long periods the ice point and the boiling point may be permanently lowered. Exposure to high temperatures for long periods may also cause a permanent change due to distillation of the mercury to the top of the stem, although this distillation is minimized with gas filled thermometers. Use of a thermometer in a vacuum may cause low readings. See also section on *Correction for Emergent Stem.*

CORRECTION FOR EMERGENT STEM OF LIQUID-IN-GLASS THERMOMETERS

When a thermometer which has been standardized for total immersion is used with a part of the liquid column at a temperature below that of the bulb, the reading is low and a correction must be applied. For this correction the following formula is employed.:

$$T_c = T_o + f \times l \times (T_o - T_m)$$

where T_c = corrected temperature

T_o = observed temperature

l = length of column in degrees above the surface of the liquid the temperature of which is being taken

T_m = mean temperature of mercury (or other thermometer liquid) column; i. e., the temperature of the middle point of the mercury (or other liquid) column as read from another thermometer

f = correction factor as given in the table below. In calculating the emergent stem correction for thermometers containing organic liquids (alcohol, pentane, toluene) it is sufficient to use the approximate value, $f = 0.001$. In such thermometers the value of f is practically independent of the kind of glass.

CORRECTION FACTORS FOR MERCURY-IN-GLASS THERMOMETERS

Tm °C.	Values of f for various glasses				
	Corning 0041	Corning 8800	Corning 8810	Jena 16 III	Jena 59 III
50	0.000157	0.000166	0.000156	0.000158	0.000164
150	0.000159	0.000167	0.000157	0.000158	0.000165
250	0.000163	0.000168	0.000161	0.000161	0.000170
350	0.000168	0.000173	0.000166	....	0.000177
450	....	0.000180	0.000174	....	0.000187
500	....	....	....	....	0.000195

BOILING POINT CORRECTION *

To correct for small differences in barometric pressure the following formula is employed:

$$T_c = T_o + 0.043 (760 - P)$$

where T_c = corrected boiling point.

T_o = observed boiling point.

P = atmospheric pressure in millimeters of mercury.

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* This formula is applicable only to liquids having particular boiling points and of particular types such as a hydrocarbon, an ether, an aldehyde, a ketone, an ester, or a halogen derivative but only if the compound boiled at 85° C.

CORRECTION OF BOILING POINT TEMPERATURE AT VARIOUS PRESSURES TO NORMAL PRESSURE*

(760 mm., 29.92 in. Hg)

U. S. P. XI METHOD

Pressure of Hg in		Correction °C.	Pressure of Hg in		Correction °C.
Inches	Mm.		Inches	Mm.	
28.06	712.7	+1.75	28.72	729.5	+1.13
.07	.9	1.74	.73	.8	1.12
.08	713.2	1.73	.74	730.0	1.11
.09	.5	1.72	.75	.3	1.10
.10	.7	1.71	.76	.5	1.10
.11	714.0	1.70	.77	.8	1.09
.12	.2	1.69	.78	731.0	1.08
.13	.5	1.68	.79	.27	1.07
.14	.7	1.67	.80	.52	1.06
.15	715.0	1.66	.81	.77	1.05
.16	.3	1.65	.82	732.03	1.04
.17	.5	1.64	.83	.28	1.03
.18	.8	1.64	.84	.54	1.02
.19	716.0	1.63	.85	.79	1.01
.20	.3	1.62	.86	733.04	1.00
.21	.6	1.61	.87	.29	0.99
.22	.8	1.60	.88	.55	.98
.23	717.1	1.59	.89	.80	.97
.24	.3	1.58	.90	734.06	.96
.25	.6	1.57	.91	.31	.95
.26	.8	1.56	.92	.56	.94
.27	718.1	1.55	.93	.82	.93
.28	.3	1.54	.94	735.08	.92
.29	.6	1.53	.95	.33	.91
.30	.8	1.52	.96	.58	.90
.31	719.1	1.51	.97	.84	.89
.32	.3	1.50	.98	736.10	.88
.33	.6	1.50	.99	.35	.88
.34	.8	1.49	29.00	.60	.87
.35	720.1	1.48	.01	.85	.86
.36	.3	1.47	.02	737.11	.85
.37	.6	1.46	.03	.36	.84
.38	.8	1.45	.04	.62	.83
.39	721.1	1.44	.05	.87	.82
.40	.4	1.43	.06	738.12	.81
.41	.7	1.42	.07	.38	.80
.42	.9	1.41	.08	.63	.79
.43	722.2	1.40	.09	.89	.78
.44	.4	1.39	.10	739.14	.77
.45	.7	1.38	.11	.39	.76
.46	.9	1.37	.12	.65	.75
.47	723.2	1.37	.13	.90	.74
.48	.4	1.36	.14	740.16	.73
.49	.7	1.35	.15	.41	.72
.50	.9	1.34	.16	.67	.71
.51	724.2	1.33	.17	.92	.70
.52	.4	1.32	.18	741.17	.69
.53	.7	1.31	.19	.43	.69
.54	.9	1.30	.20	.68	.68
.55	725.2	1.29	.21	.94	.67
.56	.4	1.28	.22	742.19	.66
.57	.7	1.27	.23	.44	.65
.58	.9	1.26	.24	.70	.64
.59	726.2	1.25	.25	.95	.63
.60	.4	1.24	.26	743.20	.62
.61	.7	1.24	.27	.46	.61
.62	.9	1.23	.28	.71	.61
.63	727.2	1.22	.29	.97	.60
.64	.4	1.21	.30	744.22	.59
.65	.7	1.20	.31	.49	.58
.66	.9	1.19	.32	.74	.57
.67	728.2	1.18	.33	.99	.57
.68	.4	1.17	.34	745.24	.56
.69	.7	1.16	.35	.49	.55
.70	729.0	1.15	.36	.74	.54
.71	.3	1.14	.37	746.00	.53

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* See also explanation following A.S.T.M. Method on following page.

CORRECTION OF BOILING POINT TEMPERATURES

Pressure of Hg in		Correction °C.	Pressure of Hg in		Correction °C.
Inches	Mm.		Inches	Mm.	
29.38	746.25	+0.52	29.74	755.39	+0.17
.39	.50	.51	.75	.65	.16
.40	.76	.50	.76	.90	.15
.41	747.02	.49	.77	756.15	.14
.42	.27	.48	.78	.41	.13
.43	.52	.47	.79	.66	.12
.44	.77	.46	.80	.92	.11
.45	748.03	.45	.81	757.17	.10
.46	.29	.44	.82	.42	.09
.47	.54	.43	.83	.67	.08
.48	.79	.42	.84	.93	.07
.49	749.05	.41	.85	758.19	.07
.50	.30	.40	.86	.44	.06
.51	.55	.39	.87	.69	.05
.52	.80	.38	.88	.94	.04
.53	750.05	.37	.89	759.20	.03
.54	.32	.36	.90	.46	.02
.55	.57	.35	.91	.72	.01
.56	.82	.34	.92	.97	.00
.57	751.08	.33	.93	760.23	−.01
.58	.33	.32	.94	.48	−.02
.59	.58	.31	.95	.73	−.02
.60	.84	.30	.96	.98	−.03
.61	752.09	.29	.97	761.24	−.04
.62	.34	.28	.98	.49	−.05
.63	.60	.27	.99	.74	−.06
.64	.85	.26	30.00	762.00	−.07
.65	753.11	.25	.01	.25	−.08
.66	.36	.24	.02	.50	−.09
.67	.61	.23	.03	.76	−.10
.68	.87	.22	.04	763.01	−.11
.69	754.12	.21	.05	.26	−.12
.70	.38	.21	.06	.5	−.13
.71	.63	.20	.07	.8	−.14
.72	.88	.19	.08	764.0	−.15
.73	755.14	.18	.09	.3	−.16

CORRECTION OF BOILING POINT TEMPERATURE AT VARIOUS PRESSURES TO NORMAL PRESSURE (760 mm. Hg)

A. S. T. M. METHOD*

In the *A. S. T. M. Standards on Petroleum Products and Lubricants*, September 1937, page 96, the Sydney Young equation is used for calculating the proper correction to the observed boiling point. In this equation the temperature range as well as the pressure is considered. The Sydney Young equation is as follows:

For Centigrade scale: $C_c = 0.00012\ (760 - P)\ (273 + t_c)$,
For Fahrenheit scale: $C_f = 0.00012\ (760 - P)\ (460 + t_f)$,

in which C_c and C_f are, respectively, corrections to be made on the observed temperatures t_c or t_f, and P is the actual barometric pressure in millimeters of mercury.

The table below is a convenient approximation of the corrections as calculated from the equations above. These approximations will suffice for ordinary work. For more precise work, the correction should be calculated using the Sydney Young equation and the temperature when 50% of the material has boiled. A new correction should be made for each variation of more than 10°C. or 18°F.

**See also explanation on following page.*

CORRECTION OF BOILING POINT TEMPERATURES

Boiling Point		Correction for Each One mm. Difference in Pressure*	
t_c in °C.	t_f in °F	C_c in °C.	C_f in °F.
10–30	50–86	0.035	0.063
30–50	86–122	.038	.068
50–70	122–158	.040	.072
70–90	158–194	.042	.076
90–110	194–230	.045	.081
110–130	230–266	.047	.085
130–150	266–302	.050	.089
150–170	302–338	.052	.094
170–190	338–374	.054	.098
190–210	374–410	.057	.102
210–230	410–446	.059	.106
230–250	446–482	.062	.111
250–270	482–518	.064	.115
270–290	518–554	.066	.119
290–310	554–590	.069	.124
310–330	590–626	.071	.128
330–350	626–662	.074	.132
350–370	662–698	.076	.137
370–390	698–734	.078	.141
390–410	734–770	.081	.145

* To be added in case barometric pressure is below 760 mm., to be subtracted in case the pressure is above 760 mm.

As pointed out by Hoyt, *Jour. Chem. Ed.* 11, 405 (1934), the Sydney Young equation is applicable only to non-polar substances with low dielectric constants such as the hydrocarbons for which it was proposed by the *A. S. T. M.*; *cf*. preceding table. For other types of compounds a more exact value can be obtained by use of the following equations and constants:

For Centigrade scale: $C_c = K(760 - P)(273 + t_c)$.
For Fahrenheit scale: $C_f = K(760 - P)(460 + t_f)$,

where the value of the constant K is for:

Hydrocarbons	0.000125	Esters	0.000121
Halogen derivatives	0.000125	Ketones	0.000121
Ethers	0.000125	Amines	0.000118
Aldehydes	0.000125	Alcohols	0.000100

The variation in the case of acids is too wide to permit of a single value for K.

The U.S.P. (XI) Method applies only to alcohol boiling at 77°C. It does not apply to any alcohol other than ethanol although it could apply to hydrocarbons and other non-polar compounds if they boiled normally at 23°C.

CALCULATION OF BOILING POINTS OF ORGANIC COMPOUNDS

Cf. Kinney, *Jour. Am. Chem. Soc. 60, 3032 (1938); Ind. Eng. Chem. 32, 559 (1940).*

Boiling points of organic compounds may be calculated from their structures as follows: Obtain the molecular *B.P.N.* by adding together the appropriate boiling point numbers (*b.p.n.*) for the various atoms and structural groupings given in Table I. From the *B.P.N.* obtain the B.P. (boiling point in degrees Centigrade) using Table II.

Certain rules must be followed in applying the data:

1. The *b.p.n.'s* of 0.8 and 1.0 are applied to the carbon and hydrogen atoms, respectively, of the longest aliphatic chain in the molecule. It is essential that the longest aliphatic chain be used as the base because the boiling point is dependent, in part, upon this factor.
2. All groups or atoms attached to this chain are assigned *b.p.n.'s* as indicated in Table I.
3. With many atoms and groups the position of the group, or the presence of other groups, alters the *b.p.n.* These, as far as are known, are given in Table I.

Example: To calculate the boiling point of 1-methyl-4-(1-methylethyl)-1-cyclopentene, $(CH_3)_2$: $CH \cdot \underline{CH \cdot CH_2 \cdot C(CH_3){:}CH \cdot CH_2}$.

Carbon in the longest aliphatic chain (2 × 0.8)	1.6
Hydrogen in the longest aliphatic chain (4 × 1.0)	4.0
Methyl radical attached to the aliphatic chain	3.05
Carbon in the cyclopentene ring (5 × 0.8)	4.0
Hydrogen in the cyclopentene ring (6 × 1.0)	6.0
B.P.N. for the 5-membered ring	2.5
B.P.N. for the ethylenic linkage, type $R_2C{:}CHR$	2.3
Methyl attached to the cyclopentene ring	3 05
Calculated *B.P.N.*, sum of the items above	26.50
Calculated B.P., from Table II	142.5°C.
Observed B.P.	143.1°C.

Example: To calculate the boiling point of 2,8-dimethyl-5-nonanone, $[(CH_3)_2CH \cdot CH_2 \cdot CH_2]_2CO$.

Carbon in the longest aliphatic chain (9 × 0.8)	7.2
Hydrogen in the longest aliphatic chain (16 × 1.0)	16.0
Two methyl radicals (2 × 3.05)	6.1
One carbonyl oxygen, type RCH_2COCH_2R	7.5
Calculated *B.P.N.*, sum of the items above	36 8
Calculated B.P., from Table II	222.5°C.
Observed B.P.	226.0°C.

TABLE I.

ATOMIC AND GROUP BOILING POINT NUMBERS.

Carbon, in the main chain	0.8
Hydrogen, attached to the main chain	1.0
Radicals, saturated, attached to the main chain or to cyclic rings	
Methyl	3.05
Ethyl	5.5
Propyl	7.0
Butyl	9.7
2,2-Dimethyl grouping	−0.4
Two or three alkyls attached to adjacent carbons of saturated main chains of 6 carbons or less	+0.5
Four or more alkyls attached to adjacent carbons of saturated main chains of 6 carbons or less	+1.0

Type of olefinic linkage	
$CH_2{=}CH_2$	1.2
$RCH{=}CH_2$	1.5
$RCH{=}CHR$	1.9
$R_2C{=}CHR$	2.3
$R_2C{=}CR_2$	2.8
Radicals, unsaturated, attached to main chain	
Methylene	4.4
Ethylidene	7.0
Vinyl	5.4
Propylidene	9.0
Butylidene	10.4
Type of acetylenic linkage	
$HC{\equiv}CH$	4.0
$RC{\equiv}CH$	4.4
$RC{\equiv}CCH_3$	5.4
$RC{\equiv}CR$	4.8

ATOMIC AND GROUP BOILING POINT NUMBERS (Continued)

Type of diolefin	
Allenes	4.8
Conjugated, normal values of double bonds plus	0.8
Not conjugated, normal values of double bonds only	
Type of triolefin	
All bonds conjugated, normal values of double bonds plus	2.4
Two bonds conjugated, normal values of double bonds plus	0.8
No conjugation, normal values of double bonds only	
Type of diacetylene	
1,3-Diacetylenes, normal values of triple bonds only	
All other conjugated, normal values of triple bonds plus	3.0
No conjugation, normal values of triple bonds only	
Type of enyne	
Conjugated, normal values of bonds plus	0.8
No conjugation, normal values of bonds only	
Type of dienyne	
Conjugated, normal values of bonds plus	2.4
No conjugation, normal values of bonds only	
Cyclic radicals: Add 0.8 for each carbon, 1.0 for each hydrogen, the normal values of any unsaturated linkages, and the following values for the ring:	
Cyclo-propyl, -butyl, -pentyl, -hexyl, respectively	2.1, 2.3, 2.5, 2.7
Cyclo-heptyl, -octyl, etc., (add 0.5 for each additional CH_2 in the ring)	3.4, 3.9, etc.
Alcohol —OH	
RCH_2OH	10.8
R_2CHOH	8.8
R_3COH	6.8
Ether —O—	
RCH_2OCH_3, R_2CHOCH_3, R_3COCH_3	2.9
RCH_2OCH_2R, R_2CHOCH_2R, R_3COCH_2R	2.0
$R_2CHOCHR_2$, R_3COCHR_2	1.1
R_3COCR_3	(0.2?)
Aldehyde =O	
RCH_2CHO	8.2
R_2CHCHO	7.6
R_3CCHO	7.0
Ketone =O	
RCH_2COCH_3	8.0
$R_2CHCOCH_3$, RCH_2COCH_2R	7.5
R_3CCOCH_3, $R_2CHCOCH_2R$	7.0
R_3CCOCH_2R, $R_2CHCOCHR_2$	6.5
R_3CCOCH_2R	(6.0?)
R_3CCOCR_3	(5.5?)
Ester —OO—	
RCH_2COOCH_3, CH_3COOCH_2R	8.5
$R_2CHCOOCH_3$, RCH_2COOCH_2R, $HCOOCHR_2$, $CH_3COOCHR_2$	7.6
$R_3CCOOCH_3$, $R_2CHCOOCH_2R$, $RCH_2COOCHR_2$, $HCOOCR_3$, CH_3COOCR_3	6.7
$R_3CCOOCH_2R$, $R_2CHCOOCHR_2$, RCH_2COOCR_3	5.8
$R_3CCOOCHR_2$, $R_2CHCOOCR_3$	4.9
$R_3CCOOCR_3$	4.0
Acid —COOH	
RCH_2COOH	19.3
$R_2CHCOOH$	18.6
R_3CCOOH	17.9
Amine, primary —NH_2	
RCH_2NH_2	7.3
R_2CHNH_2	6.2
R_3CNH_2	5.1
Amine, secondary —NH—	
RCH_2NHCH_3	5.0
$R_2CHNHCH_3$, RCH_2NHCH_2R	4.0
R_3CNHCH_3, $R_2CHNHCH_2R$	3.5
R_3CNHCH_2R, $R_2CHNHCHR_2$	3.0
Amine, tertiary =N—	
$RCH_2N(CH_3)_2$	2.0
$R_2CHN(CH_3)_2$, $(RCH_2)_2NCH_3$	1.5
$R_3CN(CH_3)_2$, $(R_2CH)_2NCH_3$, $(RCH_2)_3N$	1.25
Cyanide —CN	
RCH_2CN	14.0
R_2CHCN	12.8
R_3CCN	11.6
Isocyanide —NC	
RCH_2NC	12.2
R_2CHNC	11.1
R_3CNC	10.0

TABLE II.

MOLECULAR BOILING POINT NUMBERS AND THEIR BOILING POINTS.

Calculated from the formula: $B.P. = 230.14\sqrt[3]{B.P.N.} - 543$

B. P. N.	B. P., ° C.	Av. Increase per 0.1 Unit, ° C.
5	−149.5	2.50
6	−124.5	2.18
7	−102.7	2.00
8	−82.7	1.84
9	−64.3	1.71
10	−47.2	1.60
11	−31.2	1.51
12	−16.1	1.43
13	−1.8	1.35
14	+11.7	1.29
15	24.6	1.23
16	36.9	1.19
17	48.8	1.14
18	60.2	1.10
19	71.1	1.06
20	81.7	1.03
21	92.0	0.99
22	101.9	0.96
23	111.5	0.94
24	120.9	0.90
25	129.9	0.89
26	138.8	0.86
27	147.4	0.85
28	155.9	0.82
29	164.1	0.80
30	172.1	0.79
31	180.0	0.76
32	187.6	0.76
33	195.2	0.74
34	202.6	0.73
35	209.9	0.70
36	216.9	0.70
37	223.9	0.68
38	230.7	0.68
39	237.5	0.66
40	244.1	0.65
41	250.6	0.64
42	257.0	0.63
43	263.3	0.62
44	269.5	0.61
45	275.6	0.60
46	281.6	0.59
47	287.5	0.59
48	293.4	0.58
49	299.2	0.57
50	304.9	0.56
51	310.5	0.55
52	316.0	0.54
53	321.5	0.55
54	326.9	0.53
55	332.2	0.53
56	337.5	0.52
57	342.7	0.52
58	347.9	0.50
59	352.9	0.51
60	358.0	0.50
61	363.0	0.49
62	367.9	0.49
63	372.8	0.48
64	377.6	0.47
65	382.3	0.47
66	387.0	0.48
67	391.8	0.45
68	396.3	0.47
69	401.0	0.45
70	405.5	0.45
71	410.0	

BOILING POINTS AT VARIOUS PRESSURES COX CHART METHOD

Cf. Cox, *Ind. Eng. Chem. 15, 592 (1923)*; Davis, *ibid. 17, 735 (1925)*; Calingaert and Davis, *ibid. 17, 1287 (1925)*.

A Cox chart, of the family to which a compound belongs, may be used to obtain the boiling point at any pressure, or the vapor pressure at any temperature. By drawing a straight line through the boiling point at 760 mm. and the infinite point, a curve is obtained which gives the relationship between the temperature and the vapor pressure. To construct a Cox chart, the ordinates for pressure values are laid off logarithmically with the aid of a log scale on a slide rule. The formula $T = 230.1Y \div (37.17 - Y)$ is used for spacing of the temperature values on the abscissa. Drawn in this manner, a Cox chart can be applied to any family of compounds or to any single compound. The sample chart shown on the following page shows curves for the vapor pressures of five compounds belonging to the alkyl benzene family with the infinite point at 1500°C. and 2×10^6mm. The five curves are representative of five compounds with normal boiling points at 80°, 110°, 210°, 260°, and 290°C. respectively. A size of chart which is satisfactory is 56 inches high and 38.75 inches wide with pressures from 0.1 mm. to 10^7mm. The values of T cover the range from −100°C. to +10,000°C., the 0° point being 17.25 inches from the left side or −100° point of the chart.

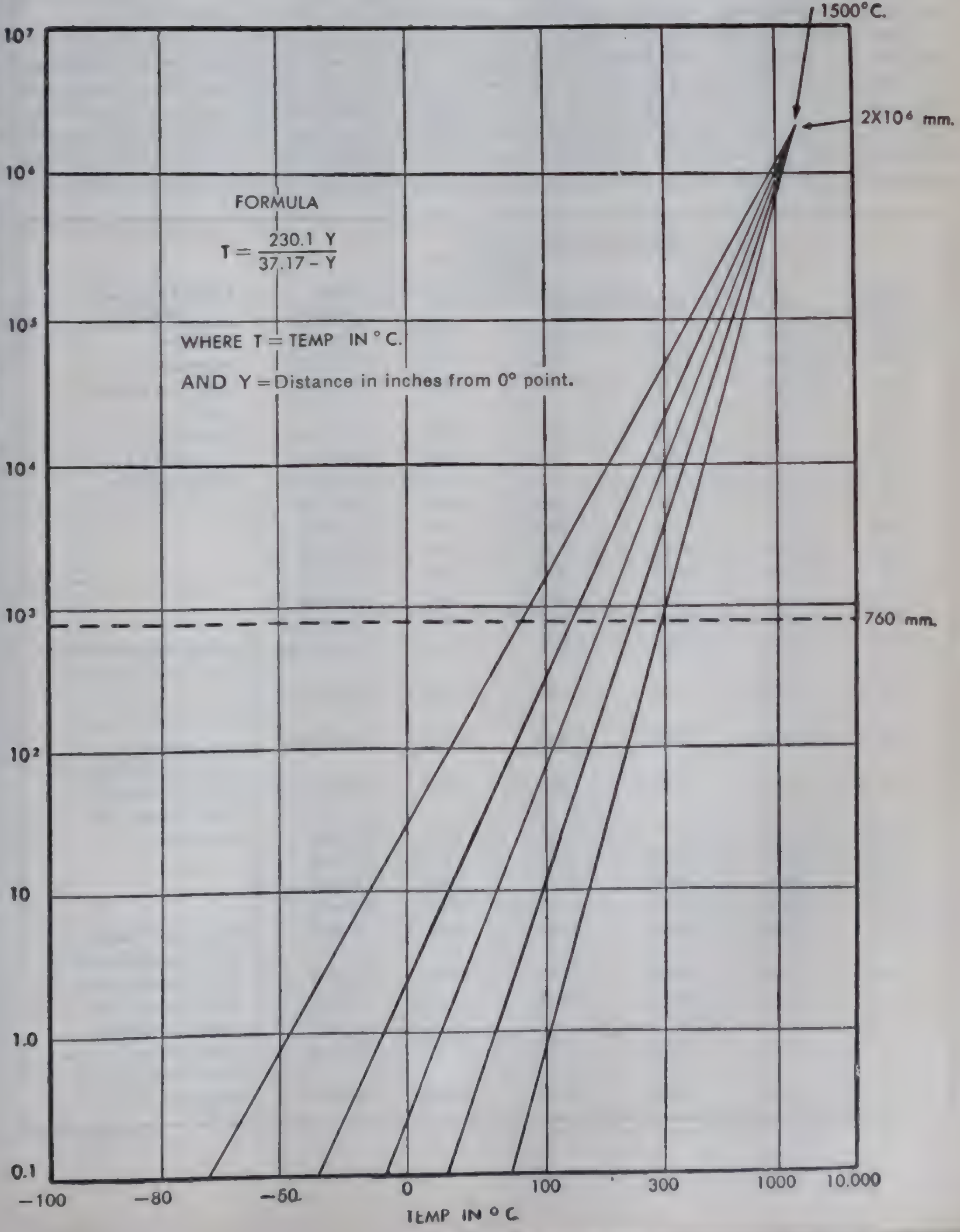
Some compounds, *e.g.*, the amyl alcohols, do not come within the family where they should belong. In general, aromatic compounds seem to lie in families on the Cox chart to a much greater degree than do aliphatic compounds.

COX CHART FAMILY	Infinite Point	
	°C.	10^6mm. Hg
(1) *Aliphatic hydrocarbons* The series C_nH_{2n+2}; also pinene, camphene, and limonene	1240	1.3
(2) *Aliphatic halides* Mono- and poly-halogen derivatives of the series C_nH_{2n+2} and C_nH_{2n}, except acetylene tetrachloride	1390	1.43
(3) *Aliphatic alcohols and ketones* The lower members of the alcohol series $C_nH_{2n+2}O$ and $C_nH_{2n}O$. The saturated ketones of the series $C_nH_{2n}O$; unsaturated ketones apparently are exceptions	610	1.5
(4) *Aliphatic acids and esters* The saturated acids of the series $C_nH_{2n}O_2$ where $n < 7$, and the esters $C_nH_{2n}O_2$ where $n < 6$	520	0.24
(5) *Aliphatic esters* The saturated esters of the series $C_nH_{2n}O_2$ where $n > 5$; also acetoacetic ester; *iso*-butyl oxalate; benzyl, linalyl, bornyl, and menthyl acetates; bornyl propionate and *n*-butyrate; methyl, ethyl, *n*-propyl, and *iso*-butyl benzoates; methyl salicylate	1100	1.1
(6) *Aliphatic acids* The saturated acids of the series $C_nH_{2n}O_2$ where $n > 6$ and the unsaturated acids of the series $C_nH_{2n-2}O_2$ from $n = 4$ to $n = 11$; also chloroacetic and benzoic acids	1100	4.2
(7) *Alkyl benzenes* The series C_nH_{2n-6}, C_nH_{2n-8}, and their ring halogen derivatives	1500	2.0
(8) *Phenols* The series $C_nH_{2n-6}O$ and *m*-chlorophenol	1900	9.0
(9) *Aromatic alcohols* The series $C_nH_{2n-6}O$ and their ring halogen derivatives	3300	20.0
(10) *Anilines* The series $C_nH_{2n-5}N$ and their ring halogen derivatives; also benzylamine	1300	2.3

COX CHART FAMILY (Continued)

	Infinite Point	
	°C.	10^6mm. Hg
(11) *Naphthalenes* The series C_nH_{2n-12} and their ring halogen derivatives; the alkyl naphthalenes, their unsaturated derivatives, and their ring halogen compounds	1320	1.0
(12) *N-alkyl primary amines* The series $C_nH_{2n+2}N$	1125	14.0
(13) *The nitro paraffins* The series $C_nH_{2n+1}NO_2$	1350	20.0

COX CHART



FUSING POINTS AND COMPO-

Information furnished by The Standard Pyrometric Cone Co., Columbus, O.

The fusing point values given in the table below have only a relative or theoretical value, being a summarized outline of determinations made by the U. S. Bu. of Standards (*Jour. Am. Ceramic Soc.* 9, 70 (1926) and are approximate values given to the nearest 5°C from the average of many determinations; therefore, between any two cones there may be an error of ±5°C. The values apply only when the cones are heated in kilns where the gases are normally oxidizing and free from oxides of sulfur. If the cones show a hardening of the surface ("skin effect") because of exposure to kiln gases with lack of oxygen, small corrections must be made. Kilns rich in sulfur oxides because of the fuel employed or wares which give off sulfur dioxide may cause appreciable variation in fusing points. Fusion of a cone is said to have been attained when the tip touches the base upon which the cone has been set.

From what has been stated above it is evident that pyrometric cones are not intended as a means of measuring temperature. **Their sole purpose is to serve as a guide in the firing of ceramic wares.** Since both the cones and the wares are composed of ceramic materials they are similarly affected by variable conditions within the kiln, and are thus a more reliable guide for firing than any device which indicates only one of these variables, namely the temperature. When cones behave erratically, they indicate abnormal kiln conditions which in many instances affect the

Cone Number	Fusion Temperature When Heated				Color Scale	Heat Treatment Range
	Slowly 20°C. per hr.		Rapidly 150°C. per hr.			
	°C.	°F.	°C.	°F.		
022	585	1085	605	1121	Dull red	Jewelers'
021	595	1103	615	1139	Dull red	enamels
020	625	1157	650	1202	Dull red	Aluminum melts 658°C.
019	630	1166	660	1220	Dull red	Potters' decorating kilns; bright gold fire
018	670	1238	720	1328	Dull red	
017	720	1328	770	1418	Dull red	
016	735	1355	795	1463	Dull red	
015	770	1418	805	1481	Dull red	
014	795	1463	830	1526	Dull red	
013	825	1517	860	1580	Dull red	
012	840	1544	875	1607	Dull red	
011	875	1607	905	1661	Cherry red	
010	890	1634	895	1643	Cherry red	Silver melts 961°C. Gold melts 1063°C.
09	930	1706	930	1706	Cherry red	
08	945	1733	950	1742	Cherry red	Common red clay products:—bricks, drain tiles, flower pots, soft roofing tiles, fire proofing
07	975	1787	990	1814	Cherry red	
06	1005	1841	1015	1859	Orange	
05	1030	1886	1040	1904	Orange	
04	1050	1922	1060	1940	Orange	
03	1080	1976	1115	2039	Orange	
02	1095	2003	1125	2057	Yellow	Shale and No. 2 fire clay products:—bricks, sewer pipe, terra cotta, hard tiles for roofing and flooring, stoneware pottery and
01	1110	2030	1145	2093	Yellow	
1	1125	2057	1160	2120	Yellow	
2	1135	2075	1165	2129	Yellow	
3	1145	2093	1170	2138	Yellow	soft porcelain

SITION OF PYROMETRIC CONES

ware unfavorably. Cones in series should go over seriatim otherwise something is wrong with the firing conditions. Although fusion temperatures of cones are affected by sulfur oxides and since the majority of ceramic wares are fired with sulfurous fuel (or the ware itself contains sulfides or sulfates), nevertheless it does not follow that cones are not satisfactory under these conditions. A factory selects by trial a cone which has a satisfactory end point for its ware and since all the cones used by it go through this sulfur treatment, so far as that factory is concerned all have practically the same relative end points.

Series Classification—The *Soft* or *Decorating* series begins with No. 022, softening at dull red heat and runs through to No. 011, the temperature range between numbers being approximately 30°C or 54°F. Of these, No. 017 represents the temperature usually employed for liquid bright gold, and most overglaze colors for pottery and glass are made to work best at this heat. These cones contain lead and are quite sensitive to reducing gases; they should be used only in muffle kilns or where they cannot come in contact with flames. The *Low* temperature series includes Nos. 010 to 01 and is used chiefly for firing red burning clay products and soft glazes. The *Intermediate* temperature series includes Nos. 1 to 20 and is used chiefly for firing buff and white clay products and hard glazes. The *High* temperature series includes Nos. 23 to 42 and is used chiefly for firing and testing refractory materials.

Composition in Parts by Weight								
Na_2O	K_2O	CaO	Fe_2O_3	PbO	Al_2O_3	SiO_2	B_2O_3	Cone No.
0.5	...	....	....	0.5	....	2.00	1.0	022
0.5	....	....	....	0.5	0.1	2.20	1.0	021
0.5	....	....	....	0.5	0.2	2.40	1.0	020
0.5	....	....	....	0.5	0.3	2.60	1.0	019
0.5	....	....	....	0.5	0.4	2.80	1.0	018
0.5	....	....	....	0.5	0.5	3.00	1.0	017
0.5	....	....	....	0.5	0.55	3.10	1.0	016
0.5	....	....	....	0.5	0.6	3.20	1.0	015
0.5	....	....	....	0.5	0.65	3.30	1.0	014
0.5	....	....	....	0.5	0.7	3.40	1.0	013
0.5	....	....	....	0.5	0.75	3.50	1.0	012
0.5	....	....	....	0.5	0.8	3.60	1.0	011
....	0.3	0.7	0.2	....	0.3	3.50	0.50	010
....	0.3	0.7	0.2	....	0.3	3.55	0.45	09
....	0.3	0.7	0.2	....	0.3	3.60	0.40	08
....	0.3	0.7	0.2	....	0.3	3.65	0.35	07
....	0.3	0.7	0.2	....	0.3	3.70	0.30	06
....	0.3	0.7	0.2	....	0.3	3.75	0.25	05
....	0.3	0.7	0.2	....	0.3	3.80	0.20	04
....	0.3	0.7	0.2	....	0.3	3.85	0.15	03
....	0.3	0.7	0.2	....	0.3	3.90	0.10	02
....	0.3	0.7	0.2	....	0.3	3.95	0.05	01
....	0.3	0.7	0.2	....	0.3	4	....	1
....	0.3	0.7	0.1	....	0.4	4	....	2
....	0.3	0.7	0.05	....	0.45	4	....	3

FUSING POINTS AND COMPO-

Cone Number	Fusion Temperature When Heated: Slowly 20°C. per hr. °C.	Slowly 20°C. per hr. °F.	Rapidly 150°C. per hr. °C.	Rapidly 150°C. per hr. °F.	Color Scale	Heat Treatment Range
4	1165	2129	1190	2174	Yellow	Albany slip melts
5	1180	2156	1205	2201	Yellow	
6	1190	2174	1230	2246	Yellow	
7	1210	2210	1250	2282	Yellow	Commercial white feldspar melts
8	1225	2237	1260	2300	White	
9	1250	2282	1285	2345	White	China, porcelain, abrasive wheels, electrical porcelain, fire bricks
10	1260	2300	1305	2381	White	
11	1285	2345	1325	2417	Brlnt. white	
12	1310	2390	1335	2435	Brlnt. white	
13	1350	2462	1350	2462	Brlnt. white	
14	1390	2534	1400	2552	Brlnt. white	
15	1410	2570	1435	2615	Brilliant white	Spark plugs, high tension electrical porcelain
16	1450	2642	1465	2669	Brlnt. white	
17	1465	2669	1475	2687	Brlnt. white	
18	1485	2705	1490	2714	Brlnt. white	
19	1515	2759	1520	2768	Brlnt. white	
20	1520	2768	1530	2786	Dazzling white	Chrome and silica bricks; fusion tests of No. 2 fire brick.
	When heated at 100°C. per hr.					
	Deg. C.		Deg. F.			
23	1580		2876		Dzlng. white	
26	1595		2903		Dzlng. white	No. 2 fire brick melts
27	1605		2921		Dzlng. white	
28	1615		2939		Dzlng. white	
29	1640		2984		Dzlng. white	
30	1650		3002		Dzlng. white	
31	1680		3056		Dzlng. white	
32	1700		3092		Dzlng. white	No. 1 fire brick melts
33	1745		3173		Dzlng. white	
34	1760		3200		Dzlng. white	Fusion tests of No. 1 fire brick
35	1785		3245		Dzlng. white	
36	1810		3290		Dzlng. white	
37	1820		3308		Dzlng. white	
38	1835		3335		Dzlng. white	Fusion tests of bauxite, alumina and synthetic refractories
39*	1865		3389		Dzlng. white	
40*	1885		3425		Dzlng. white	
41*	1970		3578		Dzlng. white	
42*	2015		3659		Dzlng. white	Alumina melts

* Heated at 600°C. per hr.

SITION OF PYROMETRIC CONES

Composition in Parts by Weight								Cone No.
Na_2O	K_2O	CaO	Fe_2O_3	PbO	Al_2O_3	SiO_2	B_2O_3	
....	0.3	0.7	....	....	0.5	4	....	4
....	0.3	0.7	....	....	0.5	5	....	5
....	0.3	0.7	....	....	0.6	6	....	6
....	0.3	0.7	....	....	0.7	7	....	7
....	0.3	0.7	....	....	0.8	8	....	8
....	0.3	0.7	....	....	0.9	9	....	9
....	0.3	0.7	....	....	1.0	10	....	10
....	0.3	0.7	....	....	1.2	12	....	11
....	0.3	0.7	....	....	1.4	14	....	12
....	0.3	0.7	....	....	1.6	16	....	13
....	0.3	0.7	....	....	1.8	18	....	14
....	0.3	0.7	....	....	2.1	21	....	15
....	0.3	0.7	....	....	2.4	24	....	16
....	0.3	0.7	....	....	2.7	27	....	17
....	0.3	0.7	....	....	3.1	31	....	18
....	0.3	0.7	....	....	3.5	35	....	19
....	0.3	0.7	....	....	3.9	39	....	20
....	0.3	0.7	....	....	5.4	54	....	23
....	0.3	0.7	....	....	7.2	72	....	26
....	0.3	0.7	....	....	20.0	200	....	27
....	....	....	....	....	1.0	10	....	28
....	....	....	....	....	1.0	8	....	29
....	....	....	....	....	1.0	6	....	30
....	....	....	....	....	1.0	5	....	31
....	....	....	....	....	1.0	4	....	32
....	....	....	....	....	1.0	3	....	33
....	....	....	....	....	1.0	2.5	....	34
....	....	....	....	....	1.0	2	....	35
....	....	....	....	....	1.0	1.5	....	36
....	....	....	....	....	1.0	1.25	....	37
....	....	....	....	....	1.0	1.00	....	38
Cones Nos. 39, 40, 41 and 42 were heated at 600°C. per hour.					1.0	0.75	....	39
					1.0	0.50	....	40
					1.0	0.05	....	41
					1.0	0.00	....	42

A SHORT GLOSSARY OF CERAMIC TERMS

Compiled by F. C. SMITH, B. S. (Chem. Eng.) and R. O. HUMMEL
of The Harshaw Chemical Co., Cleveland, Ohio.

Albany slip, a natural glaze burning brown to black.

Anneal, to relieve strains by heat.

Bait, a device for grabbing glass prior to drawing.

Belleek, a soft translucent ivory porcelain, usually very thin.

Bisque (body), unglazed, fired clayware.

Blunging, a mechanical mixing of clay or slip with water, and separating from sand and pebbles; washing.

Body stain, cf. *ceramic colors.*

Bone china, a china made with a body containing bone ash.

Casing, coating one piece of glass with another while hot.

Casting (pottery), forming pottery by pouring slip into a porous mold; e. g. in plaster of Paris.

Casting (glass), pouring glass from a crucible to a plate; flat glass.

Ceramic, clay or siliceous products hardened by the action of heat.

Ceramic colors—

- **Body stains,** colors used in the body.
- **Engobe,** colors used in a slip over a body or between the body and the glaze.
- **Glass colors,** fusible colors fired over glassware.
- **Glaze stains,** colors used in the glaze.
- **Lustres,** organic solutions of metals which when applied to pottery and fired give iridescent metallic films.
- **Overglaze,** fusible colors fired over glazed ware.
- **Underglaze,** color applied over the body before glazing.

China, translucent vitrified glazed opaque ware, body usually vitrified before glazing.

Cloisonne (enamel), colored vitrified enamel on a metal base in which the different colors are separated by metal strips.

Cloisonne ware, colored pottery in which the different colored glazes are separated by a narrow line of hard black glaze.

Colors, cf. *ceramic colors.*

Cones, pyramid shaped fusible bodies of progressive softening order, employed as a guide in determining the finishing point of the ceramic kiln.

Continuous furnace or lehr, a furnace or lehr in which the firing takes place in a continuous operation.

Copper heads, copper colored spots in ground coat enamel.

Cords, variations in the density of glass.

Crackle (Craquelle), cracks in glaze due to crazing and which are sometimes produced intentionally.

Cranny, the sharp edge of a marver.

Crawl, a grouping of glaze, slip, or enamel during drying or firing, generally due to fineness of particles.

Crazing, the development of fine cracks caused by excessive contraction of a glaze or enamel.

Decalcomania, designs produced on enamels, pottery, or glass by transferring to them vitreous colors on paper and then firing.

Deflocculation, a dispersion of particles and agglomerates resulting in thinning the suspension; an excess of electrolytes; long; sol.

Devitrification, the crystallization of a vitreous material.

Dipping, an application of glaze or enamel by immersion and allowing the excess to drain off.

Draw, absorption of glaze by an unglazed surface nearby during firing.

Dunting, splitting of claywares due to silica inversion.

Egg shell, incomplete vitrification; cf. *devitrification.*

Enamel, a fusible vitreous coating for metals or claywares at low temperatures; an opaque coating.

Enamel frit, cf. *frit.*

Encaustic tile, a variety of tile having an inlaid design of a different color from that of the body of the tile; the term is now sometimes used to designate any dry pressed tile with a colored slip.

Engobe, cf. *ceramic colors.*

Faience, a general term covering "colored clay bodies glazed"; named after the town of Faenza, Italy.

Fining, removing small gas bubbles from molten glass; planing.

Firing racks, refractory racks or boxes for holding ware while firing.

Fishscaling, small fish-scale shaped chips jumping or chipping from enamel.

Flashing, coating a piece of glass with a thin layer of colored glass while hot.

Flocculation, the agglomeration of particles by the addition of electrolytes to give a proper consistency for dipping, casting, or spraying, setting-up; short; thickening.

Flux, a material or mixture having a low melting point; the first to fuse at a definite temperature.

Frit, any fused substance or mixture quenched; enamel frit; glaze frit.

Gathering, the collecting of glass on a blow-pipe.

Glass colors, cf. *ceramic colors.*

Glaze, vitrifiable coating for brick, bisque, porcelain, or pottery, or stoneware body.

Glaze frit, cf. *frit.*

Glaze stain, cf. *ceramic colors.*

Glory hole, a furnace for reheating glass.

Glost, a term applied to glazed ware.

Glost kiln, a kiln for firing glaze.

Graining, the application and firing of a net work of one colored enamel or glaze over another colored enamel or glaze to imitate a natural wood or marble finish.

Green ware, formed but unfired pottery.

Grog, crushed bisque fire-brick, saggers, crucibles, or calcined clay.

Hacking, a stacking of claywares without the aid of stilts or saggers.

Hairlines, the fine lines appearing in fired enamel.

Intermittent kiln or lehr, a furnace or lehr that is loaded, fired, allowed to cool and unloaded; intermittent charges.

Jacks, cf. *stilts.*

Jigger, a machine for shaping pottery by means of a rotating mold and a profile tool.

Jumpers, small chips of enamel that jump from finished surface.

Kiln, a furnace or oven for firing pottery.

Lehr, a furnace for annealing or decorating glass.

Lustres, cf. *ceramic colors.*

Majolica, a rather general term for a colored, enameled, clay body; named after the Island of Majorca.

Marver, a polished stone or steel plate for working glass while blowing.

Monkey pots, small crucibles for experimental glass melts.

Mosaic, the union of pieces of colored glass, stone, tile, etc. to form an artistic design, laid in metal, cement, etc.

Muffle furnace or kiln, a furnace or kiln so constructed that the space in which the ware is fired does not come in contact with fire or furnace gases.

Overglaze, cf. *ceramic colors.*

Parison, glass on the blow-pipe ready for final blowing.

Pin, cf. *stilts.*

Pin holes, holes left by the bursting of a blister during firing.

Planing, cf. *fining.*

Porcelain, a vitrified ware, generally translucent, made by one firing only.

Pot, a container for smelting.

Potters' wheel, a wheel for rotating plastic clay in forming ware by hand.

Pottery, a term commonly used to include all articles made of clay, or clay and mineral mixtures, and hardened by fire; in present usage the term does not include structural, refractory, or glass wares, or insulators.

Pugging, the intimate wet mixing of body constituents.

Punty, a tool upon which glass shapes are handled.

Pyrometric cone, cf. *cones.*

Refractory, having resistance to melting or fusion; a ware that does not fuse under 1500°C.

Saggers, refractory containers in which pottery is stacked for firing.

Seeds, the small bubbles in glass.

Seger cones, cf. *cones.*

Semi-vitreous china, semi-porous china.

Setters, a refractory support in which chinaware, tile, etc. are placed for firing. This ware is supported on its own base or its contour rests on sand, no stilts being used.

Setting-up, cf. *flocculation.*

Sherds (shords), broken saggers and bisque.

Shiners, shiny spots in enamel caused by fish-scaling or jumpers.

Shivering, a glaze or enamel expanding excessively on firing; chips.

Shords, cf. *sherds.*

Short, cf. *flocculation.*

Slip, a siliceous material (clay, glaze, engobe, or enamel) in aqueous suspension.

Slushing, the application of a heavy-bodied enamel or glaze by dipping and shaking off the excess.

Spalling, a disintegration on the surface of refractories, due to continued expansion and contraction, or to the formation of salts and the swelling of salts in service.

Spitout, a glaze defect conceded to be due to moisture in the body and which appears on refiring to the decorating temperature.

Spurs, cf. *stilts*.

Stilts, refractory pieces for supporting or separating ware in saggers during burning; various shapes are known as pins, jacks, spurs, or thimbles, etc.

Stones, refractory lumps in glass.

Tank, a furnace for smelting glass.

Tearing, cracks appearing in enamel during drying.

Terracotta, buff burned porous clayware used for interior and exterior decoration; sometimes glazed in colors.

Thickening, cf. flocculation.

Thimbles, cf. *stilts*.

Throwing, hand-forming pottery on a potter's wheel.

Tile, a fired clay body, white or colored, glazed or unglazed, porous or vitrified, in structural shapes; varieties are named according to method of manufacture and use; e.g. drain, encaustic, floor, hollow, mosaic, quarry, wall, etc.

Underglaze, cf. *ceramic colors*.

Watermark, discoloration of enameled or glazed ware after firing caused by an accumulation of soluble salts during drying.

COMMONLY USED CERAMIC MATERIALS *

Trade Name, Formula and % Yield Weight

Material	Formula	Form. Wt.	% Yield Weight
Adularia	$K_2O \cdot Al_2O_3 \cdot 6SiO_2$	556.49	K_2O 16.92, Al_2O_3 18.31, SiO_2 64.75
Albite	$Na_2O \cdot Al_2O_3 \cdot 6SiO_2$	524.29	Na_2O 11.82, Al_2O_3 19.44, SiO_2 68.73
Alum (ammonium)	$Al_2(SO_4)_3 \cdot (NH_4)_2SO_4 \cdot 24H_2O$	906.64	Al_2O_3 11.24
Alum (potassium)	$Al_2(SO_4)_3 \cdot K_2SO_4 \cdot 24H_2O$	948.76	K_2O 9.93, Al_2O_3 10.75
Alum (sodium)	$Al_2(SO_4)_3 \cdot Na_2SO_4 \cdot 24H_2O$	916.56	Na_2O 6.76, Al_2O_3 11.12
Andalusite	$Al_2O_3 \cdot SiO_2$	162.00	Al_2O_3 62.93, SiO_2 37.07
Anorthite	$CaO \cdot Al_2O_3 \cdot 2SiO_2$	278.14	CaO 20.16, Al_2O_3 36.65, SiO_2 43.19
Apatite	$(CaF)Ca_4(PO_4)_3 \pm Cl$	......	Variable
Barium carbonate	$BaCO_3$	197.37	BaO 77.70
Barytes	$BaSO_4$	233.42	BaO 65.70
Bauxite	$Al_2O_3 \cdot 2H_2O$	137.97	Al_2O_3 73.88
Beryl	$3BeO \cdot Al_2O_3 \cdot 6SiO_2$	537.36	BeO 13.97, Al_2O_3 18.97, SiO_2 67.06
Blanc-fixe	$BaSO_4$	233.42	BaO 65.70
Blue vitriol	$CuSO_4 \cdot 5H_2O$	249.69	CuO 31.86, Cu_2O 28.66
Borax	$Na_2B_4O_7 \cdot 10H_2O$	381.43	B_2O_3 36.52, Na_2O 16.25
Borax (anhyd.)	$Na_2B_4O_7$	201.27	B_2O_3 69.20, Na_2O 30.80
Boric acid	H_3BO_3	61.84	B_2O_3 56.30
Calcite	$CaCO_3$	100.09	CaO 56.03
Celestite	$SrSO_4$	183.69	SrO 56.42
Chile niter	$NaNO_3$	85.01	Na_2O 36.46
China clay	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	258.09	Al_2O_3 39.50, SiO_2 46.54
Chromite	$FeO \cdot Cr_2O_3$	223.87	FeO 32.09, Cr_2O_3 67.91
Cobalt carbonate	$CoCO_3$	118.95	CoO 63.00
Cobalt hydrate	$Co(OH)_2$	92.96	CoO 80.61
Cobalt sulfate	$CoSO_4 \cdot 7H_2O$	281.11	CoO 26.66
Cobalto-cobaltic oxide	Co_3O_4	240.82	CoO 93.36
Colemanite	$2CaO \cdot 3B_2O_3 \cdot 5H_2O$	411.16	CaO 27.28, B_2O_3 50.81
Copper carbonate (basic)	$CuCO_3 \cdot Cu(OH)_2$	221.11	CuO 71.95, Cu_2O 64.71
Copper sulfate	$CuSO_4 \cdot 5H_2O$	249.69	CuO 31.86, Cu_2O 28.66
Copperas	$FeSO_4 \cdot 7H_2O$	278.03	Fe_2O_3 28.72
Cryolite	$3NaF \cdot AlF_3$	209.96	Na_2O 44.29, Al_2O_3 24.28, F 54.30
Cyanite	$Al_2O_3 \cdot SiO_2$	162.00	Al_2O_3 62.93, SiO_2 37.07
Diaspore	$Al_2O_3 \cdot H_2O$	119.96	Al_2O_3 84.98
Diopside	$CaO \cdot MgO \cdot 2SiO_2$	216.52	CaO 25.90, MgO 18.62, SiO_2 55.48
Dolomite	$CaCO_3 \cdot MgCO_3$	184.42	CaO 30.41, MgO 21.86
English chalk	$CaCO_3$	100.09	CaO 56.03
Epsom salts	$MgSO_4 \cdot 7H_2O$	246.50	MgO 16.36
Fluorite (fluorspar)	CaF_2	78.08	CaO 71.82, F 48.67
French chalk	$3MgO \cdot 4SiO_2 \cdot H_2O$	379.22	MgO 31.90, SiO_2 63.35
Gibbsite	$Al_2O_3 \cdot 3H_2O$	155.99	Al_2O_3 65.35
Gypsum	$CaSO_4 \cdot 2H_2O$	172.18	CaO 32.57
Ilmenite	$FeO \cdot TiO_2$	151.75	FeO 47.35, TiO_2 52.65
Lead chromate	$PbCrO_4$	323.22	PbO 69.06, Cr_2O_3 23.52
Lead disilicate	$PbO \cdot 2SiO_2$	343.33	PbO 65.01, SiO_2 34.99
Lead oxide (red)	Pb_3O_4	685.63	PbO 97.67
Leucite	$K_2O \cdot Al_2O_3 \cdot 4SiO_2$	436.37	K_2O 21.59, Al_2O_3 23.36, SiO_2 55.05
Lithium carbonate	Li_2CO_3	73.89	Li_2O 40.44
Limestone	$CaCO_3$	100.09	CaO 56.03
Limonite	$2Fe_2O_3 \cdot 3H_2O$	373.45	Fe_2O_3 85.53
Magnesite	$MgCO_3$	84.33	MgO 47.81
Magnetite	Fe_3O_4	231.55	Fe_2O_3 103.45
Manganese carbonate	$MnCO_3$	114.94	MnO 61.71
Manganese sulfate	$MnSO_4 \cdot 4H_2O$	223.05	MnO 31.80
Marble	$CaCO_3$	100.09	CaO 56.03
Marcasite	FeS_2	119.97	Fe_2O_3 66.56
Mullite	$3Al_2O_3 \cdot 2SiO_2$	425.94	Al_2O_3 71.80, SiO_2 28.20
Nickel carbonate	$NiCO_3$	118.70	NiO 62.92
Nickel sulfate	$NiSO_4 \cdot 6H_2O$	262.85	NiO 28.42
Niter	KNO_3	101.10	K_2O 46.58
Orthoclase	$K_2O \cdot Al_2O_3 \cdot 6SiO_2$	556.49	K_2O 16.92, Al_2O_3 18.31, SiO_2 64.75
Pearl ash	K_2CO_3	138.20	K_2O 68.16
Plaster of Paris	$CaSO_4 \cdot \frac{1}{2}H_2O$	145.15	CaO 38.64

* Commonly used materials having approximately 100% yield are not listed

COMMONLY USED CERAMIC MATERIALS

Material	Formula	Form. Wt.	% Yield Weight
Pyrolusite	MnO_2	86.93	MnO 81.59
Potassium dichromate	$K_2Cr_2O_7$	294.21	K_2O 32.02, Cr_2O_3 51.67
Tungstic acid	H_2WO_4	249.94	WO_3 92.79
Siderite	$FeCO_3$	115.86	Fe_2O_3 68.92
Soda ash	Na_2CO_3	106.00	Na_2O 58.48
Sodium dichromate	$Na_2Cr_2O_7 \cdot 2H_2O$	298.05	Na_2O 20.80, Cr_2O_3 51.00
Sodium nitrate	$NaNO_3$	85.01	Na_2O 36.46
Vanadate (ammonium, meta)	NH_4VO_3	116.99	V_2O_5 77.74
White lead	$2PbCO_3 \cdot Pb(OH)_2$	775.67	PbO 86.33
Willemite	$2ZnO \cdot SiO_2$	222.82	ZnO 73.05, SiO_2 26.95
Witherite	$BaCO_3$	197.37	BaO 77.70
Wallastonite	$CaO \cdot SiO_2$	116.14	CaO 48.29, SiO_2 51.71
Zircon	$ZrO_2 \cdot SiO_2$	183.28	ZrO_2 67.23, SiO_2 32.77

MELTING POINTS OF SOME COMPOUNDS IN COMMON USE IN CERAMICS

Compiled by F. C. SMITH, B. S. (Chem. Eng.) and R. O. HUMMEL
of The Harshaw Chemical Co., Cleveland, Ohio.

The compounds in the table below are arranged according to increasing melting points. The melting points are values selected from those reported in the *International Critical Tables* or in the *Jour. Amer. Ceramic Soc.* The values followed by an E are for eutectics.

Melting Point °C.	Formula
415 E	77.6PbO, 6.1B_2O_3, 16.3SiO_2
532 E	88.0PbO, 12.0SiO_2
570 E	24.2Na_2O, 35.2B_2O_3, 40.6SiO_2
650 E	60.8PbO, 7.1Al_2O_3, 31.45SiO_2
655 E	23.7K_2O, 37.2B_2O_3, 39.1SiO_2
746±10	$2PbO \cdot SiO_2$
750 E	76.5BaO, 23.5B_2O_3
766±10	$PbO \cdot SiO_2$
780 E	55.0K_2O, 45.0SiO_2
800 E	50$K_2O \cdot B_2O_3$, 50$Na_2O \cdot B_2O_3$
800 E	17.5Na_2O, 5.4Al_2O_3, 77.1SiO_2
830 E	51.5Na_2O, 48.5SiO_2
860 E	18.4Na_2O, 81.6SiO_2
870 E	17.4K_2O, 5.2Al_2O_3, 77.4SiO_2
874±2	$Na_2O \cdot 2SiO_2$
880E	17.5K_2O, 82.5SiO_2
888±10	PbO
948	$Li_2O \cdot SiO_2$
976	$K_2O \cdot SiO_2$

Melting Point °C.	Formula
980	$K_2O \cdot 2TiO_2$
995 E	35CaO, 65B_2O_3
1010	$2Li_2O \cdot SiO_2$
1041	$K_2O \cdot 2SiO_2$
1070 E	47.5CaO, 52.5B_2O_3
1088±2	$Na_2O \cdot SiO_2$
1100±10	$Na_2O \cdot Al_2O_3 \cdot 6SiO_2$
1157 E	84.3 albite, 15.7CaO
Cone 3 E	71.5 feldspar, 8.6$CaCO_3$, 7.7 kaolin, 12.2 flint
Cone 4 E	42.1 potash feldspar, 17.7$CaCO_3$, 13.0 hydrous kaolin, 27.2 flint
1242±2	$CdO \cdot SiO_2$
Cone 6 E	69 albite, 29 microcline
Cone 6 E	35-40BaO, 10.0Al_2O_3, 50-55SiO_2
1248±5	$Na_2O \cdot Al_2O_3$; nephelite
Cone 7 E	67.0($Al_2O_3 \cdot 2SiO_2$), 33.0CaO
Cone 8 E	90.0 potash feldspar, 10.0 kaolin
1261 E	98.3 orthoclase, 1.7CaO

MELTING POINTS OF SOME COMPOUNDS IN COMMON USE IN CERAMICS

Melting Point °C.	Formula
1271 E	98.6 orthoclase, 1.4MgO
1273 ±5	$MnO_2 \cdot SiO_2$
1284 ±5	$Na_2O \cdot 2CaO \cdot 3SiO_2$
Cone 9 E	90.0 microcline, 10.0 quartz
Cone 10 E	74.4 ($Al_2O_3 \cdot SiO_2$), 25.6CaO
Cone 10 E	30MgO, 30 kaolin, 40 quartz
Cone 10 E	31 MgO, 13Al_2O_3, 56SiO_2
d1355 ±5	$3CaO \cdot Al_2O_3 \cdot SiO_2$
Cone 12 E	20.0MgO, 20.0Al_2O_3, 60.0SiO_2
Cone 12-13 E	50ZnO, 20Al_2O_3, 30SiO_2
1358	46.5 SrO, 53.5 SiO_2
1360 E	50.8ZnO, 14.45Al_2O_3, 35.75SiO_2
1374	47.0BaO, 53.0SiO_2
1388 ±5	$Li_2O \cdot Al_2O_3 \cdot 2SiO_2$
1391 ±2	$CaO \cdot MgO \cdot 2SiO_2$
1400 ±3	$Li_2O \cdot Al_2O_3 \cdot 4SiO_2$
1436	37.0CaO, 63.0SiO_2
1437	65.0BaO, 35.0SiO_2
1437 ±2	$ZnO \cdot SiO_2$
1450	62.9BaO, 37.1SiO_2
1455	54.5CaO, 45.5SiO_2
1458 ±2	$2CaO \cdot MgO \cdot 2SiO_2$
1475*	58.2CaO, 41.8SiO_2
1475	55.5CaO, 44.5SiO_2
1509 ±3	$2ZnO \cdot SiO_2$
1526 ±2	$Na_2O \cdot Al_2O_3$ (carnegietite
1540	48.2CaO, 51.8SiO_2
1545	65.5SrO, 34.5SiO_2
1550 ±2	$CaO \cdot Al_2O_3 \cdot 2SiO_2$

*Dissociates

**In vacuo

Melting Point °C.	Formula
1550 ±10	$\alpha K_2O \cdot Al_2O_3 \cdot 2SiO_2$
1551	74.5BaO, 25.5SiO_2
1570	65CaO, 35SiO_2
1578	63.2SrO, 36.8SiO_2
1590 ±2	$2CaO \cdot Al_2O_3 \cdot SiO_2$
1604	71.8BaO, 28.2SiO_2
>1625	$Li_2O \cdot Al_2O_3$
1650	$Na_2O \cdot Al_2O_3$
>1650**	MnO
1692	Ce_2O_3
>1700	$BaO \cdot Al_2O_3 \cdot 2SiO_2$
>1700	$SrO \cdot Al_2O_3 \cdot 2SiO_2$
>1755	$BeO \cdot SiO_2$
>1775	$\beta K_2O \cdot Al_2O_3 \cdot 2SiO_2$
1810 ±10	$3Al_2O_3 \cdot 2SiO_2$***
1890 ±20	$2MgO \cdot SiO_2$
1900****	73.6CaO, 26.4SiO_2
1923 ±10	BaO
1975	ZnO
1990 ±20	Cr_2O_3
2050 ±10	αAl_2O_3
2065	67.5CaO, 32.5SiO_2
2135 ±20	$MgO \cdot Al_2O_3$
2240****	SiC
2400 ±50	BeO
2550	$ZrO_2 \cdot SiO_2$
2550-3000	ZrO_2
>2790	ThO_2
2800	MgO

***Deforms: liquid + Al_2O_3

****Dissociates

SILICON DIOXIDE INVERSION TABLE

Compiled from the values given in the *International Critical Tables*, published by McGraw-Hill Book Co., New York, and Mellor: *A Comprehensive Treatise on Inorganic and Theoretical Chemistry*, published by Longmans, Green and Co., New York.

Crystalline Variety	Inversion Temperature, °C.
αQuartz	Stable to 575
βQuartz	Stable to 870 ±10
β_2 Tridymite	Stable to 1470 ±10
βCristobalite	Melts at 1625-1710
αTridymite	Stable to 117

Crystalline Variety	Inversion Temperature, °C.
β_1 Tridymite	Stable to 163
β_2 Tridymite	Stable to 1470
βCristobalite	Melts at 1625
αCristobalite	Stable to 225
βCristobalite	Melts at 1625

COEFFICIENTS OF CUBICAL EXPANSION FOR VARIOUS SOLIDS

The following are average values over the range from room temperature to the melting point expressed in change of volume per unit volume per degree Centigrade. The values for those substances preceded by a dagger (†) are values used in commercial practice; values for the other substances listed are those determined by Winkelmann and Schott, and Mayer and Havas. See also the table *Coefficients of Cubical Expansion for Liquids and Solutions.*

Substance	Coef. $\times 10^7$
AlF_3	4.4
Al_2O_3	5.0
As_2O_5	2.0
B_2O_3	0.1
BaO	3.0
†$BaCO_3$	2.33
BeO	4.7
CaF_2	2.5
CaO	5.0
†$CaCO_3$	2.80
†$Ca_3(PO_4)_2$	3.62
CeO_2	4.2
CoO	4.4
†Co_3O_4	4.11

Substance	Coef. $\times 10^7$
Cr_2O_3	5.1
CuO	2.2
Fe_2O_3	4.0
†H_3BO_3	0.06
K_2O	8.5
†KNO_3	4.65
Li_2O	2.0
MgO	0.1
†$MgCO_3$	0.05
MnO_2	2.2
Na_3AlF_6	7.4
†$Na_2B_4O_7$	3.15
†$Na_2B_4O_7 \cdot 10H_2O$	1.67
†Na_2CO_3	5.85

Substance	Coef. $\times 10^7$
NaF	7.4
†$NaNO_3$	3.65
Na_2O	10.0
*$NaSbO_3$	4.6
NiO	4.0
P_2O_5	2.0
PbO	4.2
Sb_2O_5	3.6
SiO_2	0.8
SnO_2	2.0
ThO_2	6.3
TiO_2	4.1
ZnO	1.8
ZrO_2	2.1
* Calculated	

BALL MILL SPEEDS

For the mathematics of the ball mill, see E. W. Davis, *Am. Inst. Min. and Met. Eng.* Vol. 61 (1920), and Haultain and Dyer, *Canadian Inst. Min. and Met.*, June 1922.

Diameters being equal the efficient speed of a ball mill depends upon the size and amount of the pebbles or balls, slippage between the lining of the mill and the charge (consistency), and the size of the charge.

In general practice the ball mill is first half filled with balls or pebbles, and then half as much enamel or glaze is added, and the required water if it is to be wet ground.

The speeds in the table given below are an average covering a large variety of materials and conditions.

Inside Diameter of Ball Mill in Feet	Speed of Ball Mill in RPM*
8.0	12 to 14
7.5	16 to 18
6.0	17 to 20
5.0	20 to 23
4.5	22 to 24
4.0	23 to 27

Inside Diameter of Ball Mill in Feet	Speed of Ball Mill in RPM*
3.5	25 to 28
3.0	26 to 30
2.5	30 to 38
2.0	35 to 40
1.5	40 to 53
1.0	42 to 55
Laboratory mills	50 to 85

*For dry mills use the higher values.

FORMULAS FOR CALCULATING PHYSICAL PROPERTIES OF CERAMIC MATERIALS

Reprinted from 1928 *Standards Report Amer. Ceramic Society*, by permission.

1. DETERMINATION OF WATER IN CERAMIC MATERIALS

Dry a 200 gram sample to constant weight at 110-50°C.

$$\% \, H_2O = \frac{W-D}{W} \times 100$$

W = weight of material received
D = weight of material after drying to constant weight

2. DETERMINATION OF TOTAL LINEAR DRY AND FIRED SHRINKAGE

Green bar size 2½″×4½″×9″; gauge marks 8″ apart
Fire to 1400°C. in not less than 5 hrs.; natural cooling

$$\% \text{ Shrinkage} = \frac{Lw-Lb}{Lw} \times 100$$

Lw = length of specimen in plastic state
Lb = length of specimen after firing to 1400°C.

3. DETERMINATION OF WATER OF PLASTICITY

$$T = \frac{Wp-Wd}{Wd} \times 100$$

T = % water of plasticity
Wp = weight of plastic test piece
Wd = weight of dry test piece

4. DETERMINATION OF SHRINKAGE WATER

$$t_1 = \frac{Vp-Vd}{Wd} \times 100$$

t_1 = % shrinkage water

Vp = plastic volume in cc.
Vd = dry volume in cc.
Wd = dry weight in grams

5. DETERMINATION OF PORE WATER

$t_2 = T - t_1$
t_1 = % shrinkage water
t_2 = % pore water
T = % water of plasticity

6. DETERMINATION % VOLUME SHRINKAGE

$$b = \frac{Vp-Vd}{Vd} \times 100$$

b = % volume shrinkage
Vp = plastic volume
Vd = dry volume

7. DETERMINATION OF LINEAR SHRINKAGE

$$a = 100\left(\sqrt[3]{1+\frac{b}{100}}-1\right)$$

a = % linear shrinkage

FORMULAS FOR CALCULATING PHYSICAL PROPERTIES OF CERAMIC MATERIALS

8. DETERMINATION OF THE TRUE SPECIFIC GRAVITY

$$Gt = \frac{w - p}{(w - p) - (w_2 - w_1)}$$

Gt = true specific gravity
w = weight of stoppered pycnometer and sample
p = weight of stoppered pycnometer
w_1 = weight of stoppered pycnometer filled with water
w_2 = weight of stoppered pycnometer sample and water

9. DETERMINATION OF APPARENT POROSITY

$$P = \frac{Sf - Wf}{Vf} \times 100$$

P = % apparent porosity
Sf = weight of saturated fired test piece in grams
Wf = weight of fired test piece in grams
Vf = volume of fired test piece in cc.

10. DETERMINATION OF VOLUME CHANGE

$$b_1 = \frac{Vd - Vf}{Vd} \times 100$$

b_1 = % volume change
Vd = volume of the dry test piece in cc.

11. DETERMINATION OF APPARENT SPECIFIC GRAVITY

$$G = \frac{Wf}{Vf - (Sf - Wf)}$$

G = apparent specific gravity

12. DETERMINATION OF BULK SPECIFIC GRAVITY

$$Gb = \frac{Wf}{Vf}$$

Gb = bulk specific gravity

13. DETERMINATION OF MODULUS OF RUPTURE

$$M = \frac{3PL}{2bd^2}$$

M = modulus of rupture in kg./sq. cm.
P = breaking load in kg. (read to nearest 0.1 kg.)
L = distance between knife edges in cm.
b = breadth of bar in cm.
d = depth of bar in cm.

14. DETERMINATION OF TRANSVERSE STRENGTH

$$M = \frac{8PL}{\pi d^3}$$

M = modulus of rupture
P = load in pounds at rupture
L = distance between supports
d = diameter of specimen in inches
$\pi = 3.1416$

FORMULAS FOR CALCULATING PHYSICAL PROPERTIES OF CERAMIC MATERIALS

SHRINKAGE CONVERSION TABLES

For a complete explanation of the following tables, the reader is referred to the original paper by WESTMAN, Jour. Am. Ceramic Soc. 11, No. 9, p. 715, (1928). Copyright by A. E. R. Westman, reprinted by permission.

Relations Between Linear and Volume Change

Nature of change	Percentage basis	Equations* for converting Volume change to linear change	Equations* for converting Linear change to volume change	Percentage basis	Nature of change
Expansion	Initial values	$a=100\left[\sqrt[3]{\frac{b}{100}+1}-1\right]$	$b=100\left[\left(\frac{a}{100}+1\right)^3-1\right]$	Final values	Contraction (or shrinkage)
	Final values	$a=100\left[\sqrt[3]{\frac{b}{100}-1}+1\right]$	$b=100\left[\left(\frac{a}{100}-1\right)^3+1\right]$	Initial values	

Conversion of Percentage Basis

Nature of change in size	Equations* for converting Percentage of initial value to final value	Equations* for converting Percentage of final value to initial value
Expansion	$c=\frac{100d}{100+d}$	$d=\frac{100c}{100-c}$
Contraction	$c=\frac{100d}{100-d}$	$d=\frac{100c}{100+c}$

Calculation of Design Factors, Combination of Changes

Nature of changes	Percentage basis	Equation* for calculating resultant per cent change	Percentage basis	Nature of changes
Both expansions	Initial values	$Z=X+Y+\frac{XY}{100}$	Final values	Both contractions (or shrinkages)
	Final values	$Z=X+Y-\frac{XY}{100}$	Initial values	

*In the equations, a = % linear change, b = % volume change, c = % change based on final value, and d = % change based on initial value; substitutions are to be made arithmetically. Z = % resultant change or overall change, X = % change in first process (e.g. drying), and Y = % change in second process (e.g. firing); if X and Y are percentages of final values, Z will be a percentage of the final value.

SHRINKAGE CONVERSION TABLE

TABLE I

Four Figure Table for Converting:

(1) Volume Drying Shrinkage (per cent of plastic volume) to Linear Drying Shrinkage (per cent of plastic length),

(2) Volume Firing Shrinkage (per cent of unfired or dry volume) to Linear Firing Shrinkage (per cent of unfired or dry length), and

(3) Volume Expansion (per cent of final volume) to Linear Expansion (per cent of final length).

Per cent volume change	Per cent volume change										Differences
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
	Per cent linear change										
0	0.000	0.033	0.067	0.100	0.134	0.167	0.200	0.234	0.267	0.301	.034
1	0.334	0.368	0.402	0.435	0.469	0.503	0.536	0.570	0.604	0.638	.034
2	0.672	0.705	0.739	0.773	0.806	0.840	0.874	0.908	0.942	0.976	.034
3	1.010	1.044	1.078	1.112	1.146	1.181	1.215	1.249	1.283	1.317	.034
4	1.352	1.386	1.420	1.455	1.489	1.523	1.558	1.592	1.626	1.661	.034
5	1.695	1.730	1.764	1.799	1.834	1.868	1.903	1.937	1.972	2.007	.035
6	2.041	2.076	2.111	2.146	2.181	2.216	2.251	2.285	2.320	2.355	.035
7	2.390	2.425	2.460	2.495	2.530	2.565	2.600	2.636	2.671	2.706	.035
8	2.741	2.776	2.812	2.847	2.882	2.918	2.953	2.988	3.023	3.059	.035
9	3.095	3.130	3.166	3.201	3.237	3.273	3.308	3.344	3.380	3.415	.036
10	3.451	3.487	3.523	3.559	3.594	3.630	3.666	3.702	3.738	3.774	.036
11	3.810	3.846	3.882	3.918	3.954	3.990	4.027	4.063	4.099	4.135	.036
12	4.172	4.208	4.244	4.281	4.317	4.354	4.390	4.426	4.463	4.500	.036
13	4.536	4.572	4.609	4.646	4.683	4.719	4.756	4.793	4.830	4.866	.037
14	4.903	4.940	4.977	5.014	5.051	5.088	5.125	5.162	5.199	5.236	.037
15	5.273	5.310	5.348	5.385	5.422	5.459	5.497	5.534	5.571	5.609	.037
16	5.646	5.684	5.721	5.759	5.797	5.834	5.872	5.909	5.947	5.984	.037
17	6.022	6.060	6.098	6.136	6.174	6.212	6.249	6.287	6.325	6.363	.038
18	6.401	6.439	6.477	6.515	6.553	6.592	6.630	6.668	6.706	6.745	.038
19	6.783	6.822	6.860	6.899	6.937	6.975	7.014	7.052	7.091	7.130	.038
20	7.168	7.207	7.246	7.284	7.323	7.362	7.401	7.440	7.479	7.518	.039
21	7.557	7.596	7.635	7.674	7.713	7.752	7.791	7.831	7.870	7.909	.039
22	7.949	7.988	8.027	8.067	8.106	8.146	8.185	8.225	8.265	8.304	.039
23	8.344	8.383	8.423	8.463	8.503	8.543	8.582	8.622	8.662	8.702	.040
24	8.742	8.782	8.822	8.862	8.903	8.943	8.983	9.023	9.063	9.104	.040
25	9.144	9.184	9.225	9.265	9.306	9.346	9.387	9.428	9.468	9.509	.040
26	9.550	9.590	9.631	9.672	9.713	9.754	9.795	9.836	9.877	9.918	.040
27	9.959	10.00	10.04	10.08	10.12	10.16	10.21	10.25	10.29	10.33	.040
28	10.37	10.41	10.45	10.50	10.54	10.58	10.62	10.66	10.71	10.75	.040
29	10.79	10.83	10.87	10.91	10.96	11.00	11.04	11.08	11.13	11.17	.040
30	11.21	11.25	11.29	11.34	11.38	11.42	11.46	11.51	11.55	11.59	.040
31	11.63	11.68	11.72	11.76	11.81	11.85	11.89	11.93	11.98	12.02	.04
32	12.06	12.11	12.15	12.19	12.23	12.28	12.32	12.37	12.41	12.45	.04
33	12.50	12.54	12.58	12.63	12.67	12.72	12.76	12.80	12.85	12.89	.04
34	12.93	12.97	13.02	13.07	13.11	13.15	13.20	13.24	13.29	13.33	.04
35	13.38	13.42	13.47	13.51	13.55	13.60	13.64	13.69	13.74	13.78	.04
36	13.82	13.87	13.91	13.96	14.00	14.05	14.09	14.14	14.18	14.23	.04
37	14.27	14.32	14.36	14.41	14.46	14.50	14.55	14.59	14.64	14.68	.05
38	14.73	14.78	14.82	14.87	14.91	14.96	15.01	15.05	15.10	15.14	.05
39	15.19	15.24	15.28	15.33	15.38	15.42	15.47	15.52	15.56	15.61	.05
40	15.66	15.70	15.75	15.80	15.84	15.89	15.94	15.99	16.03	16.08	.05
41	16.13	16.18	16.23	16.27	16.32	16.37	16.41	16.46	16.51	16.56	.05
42	16.60	16.65	16.70	16.75	16.80	16.84	16.89	16.94	16.99	17.04	.05
43	17.09	17.14	17.18	17.23	17.28	17.33	17.38	17.43	17.48	17.53	.05
44	17.57	17.62	17.67	17.72	17.77	17.82	17.87	17.92	17.97	18.02	.05
45	18.07	18.12	18.17	18.22	18.27	18.32	18.37	18.42	18.47	18.52	.05
46	18.57	18.62	18.67	18.72	18.77	18.82	18.87	18.92	18.97	19.02	.05
47	19.07	19.12	19.18	19.23	19.28	19.33	19.38	19.43	19.48	19.53	.05
48	19.59	19.64	19.69	19.74	19.79	19.84	19.90	19.95	20.00	20.05	.05
49	20.10	20.16	20.21	20.26	20.31	20.37	20.42	20.47	20.52	20.58	.05
50	20.63	20.68	20.74	20.79	20.84	20.90	20.95	21.00	21.06	21.11	.05

SHRINKAGE CONVERSION TABLE
TABLE II

Four Figure Table for Converting:

(1) Volume Drying Shrinkage (per cent of dry volume) to Linear Drying Shrinkage (per cent of dry length),

(2) Volume Firing Shrinkage (per cent of fired volume) to Linear Firing Shrinkage (per cent of fired length), and

(3) Volume Expansion (per cent of initial volume) to Linear Expansion (per cent of initial length).

Per cent volume change	Per cent volume change										Differences
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
	Per cent linear change										
0	0.000	0.033	0.067	0.100	0.133	0.166	0.200	0.233	0.266	0.299	.033
1	0.332	0.365	0.398	0.431	0.464	0.497	0.530	0.563	0.596	0.629	.033
2	0.662	0.695	0.728	0.761	0.794	0.826	0.859	0.892	0.925	0.957	.033
3	0.990	1.023	1.055	1.088	1.121	1.153	1.186	1.218	1.251	1.283	.033
4	1.316	1.348	1.381	1.413	1.446	1.478	1.510	1.543	1.575	1.607	.032
5	1.640	1.672	1.704	1.736	1.769	1.801	1.833	1.865	1.897	1.929	.032
6	1.961	1.993	2.025	2.057	2.089	2.121	2.153	2.185	2.217	2.249	.032
7	2.281	2.313	2.345	2.376	2.408	2.440	2.472	2.503	2.535	2.567	.032
8	2.599	2.630	2.662	2.693	2.725	2.757	2.788	2.820	2.851	2.883	.032
9	2.914	2.946	2.977	3.009	3.040	3.071	3.103	3.134	3.165	3.196	.031
10	3.228	3.259	3.291	3.322	3.353	3.384	3.415	3.446	3.478	3.509	.031
11	3.540	3.571	3.602	3.633	3.664	3.695	3.726	3.757	3.788	3.819	.031
12	3.850	3.881	3.912	3.943	3.973	4.004	4.035	4.066	4.097	4.127	.031
13	4.158	4.189	4.219	4.250	4.281	4.311	4.342	4.373	4.403	4.434	.031
14	4.464	4.495	4.525	4.556	4.586	4.617	4.647	4.678	4.708	4.739	.030
15	4.769	4.799	4.830	4.860	4.890	4.921	4.951	4.981	5.011	5.042	.030
16	5.072	5.102	5.132	5.162	5.192	5.222	5.253	5.283	5.313	5.343	.030
17	5.373	5.403	5.433	5.463	5.493	5.523	5.553	5.583	5.612	5.642	.030
18	5.672	5.702	5.732	5.762	5.791	5.821	5.851	5.881	5.910	5.940	.030
19	5.970	6.000	6.029	6.059	6.088	6.118	6.148	6.177	6.206	6.236	.030
20	6.266	6.295	6.325	6.354	6.384	6.413	6.443	6.472	6.501	6.531	.029
21	6.560	6.590	6.619	6.648	6.678	6.707	6.736	6.765	6.795	6.824	.029
22	6.853	6.882	6.911	6.940	6.970	6.999	7.028	7.057	7.086	7.115	.029
23	7.144	7.173	7.202	7.231	7.260	7.289	7.318	7.347	7.376	7.405	.029
24	7.434	7.463	7.491	7.520	7.549	7.578	7.607	7.635	7.664	7.693	.029
25	7.722	7.750	7.779	7.808	7.836	7.865	7.894	7.922	7.951	7.980	.029
26	8.008	8.037	8.065	8.094	8.122	8.151	8.179	8.208	8.236	8.265	.028
27	8.293	8.322	8.350	8.378	8.407	8.435	8.463	8.492	8.520	8.548	.028
28	8.577	8.605	8.633	8.661	8.690	8.718	8.746	8.774	8.802	8.831	.028
29	8.859	8.887	8.915	8.943	8.971	8.999	9.027	9.055	9.083	9.111	.028
30	9.139	9.167	9.195	9.223	9.251	9.279	9.307	9.335	9.363	9.391	.028
31	9.418	9.446	9.474	9.502	9.530	9.557	9.585	9.613	9.641	9.668	.028
32	9.696	9.724	9.751	9.779	9.807	9.834	9.862	9.890	9.917	9.945	.027
33	9.972	10.00	10.02	10.05	10.08	10.11	10.14	10.16	10.19	10.22	.03
34	10.25	10.27	10.30	10.33	10.36	10.38	10.41	10.44	10.47	10.49	.03
35	10.52	10.55	10.58	10.60	10.63	10.66	10.68	10.71	10.74	10.77	.03
36	10.79	10.82	10.85	10.87	10.90	10.93	10.96	10.98	11.00	11.03	.03
37	11.06	11.09	11.12	11.14	11.17	11.20	11.23	11.25	11.28	11.31	.03
38	11.33	11.36	11.39	11.41	11.44	11.47	11.49	11.52	11.55	11.57	.03
39	11.60	11.63	11.65	11.68	11.71	11.74	11.76	11.79	11.82	11.84	.03
40	11.87	11.90	11.92	11.95	11.98	12.00	12.03	12.05	12.08	12.11	.03
41	12.13	12.16	12.19	12.21	12.24	12.27	12.29	12.32	12.35	12.37	.03
42	12.40	12.43	12.45	12.48	12.50	12.53	12.56	12.58	12.61	12.64	.03
43	12.66	12.69	12.71	12.74	12.77	12.79	12.82	12.85	12.87	12.90	.03
44	12.92	12.95	12.98	13.00	13.03	13.05	13.08	13.11	13.13	13.16	.03
45	13.19	13.21	13.24	13.26	13.29	13.31	13.34	13.37	13.39	13.42	.03
46	13.44	13.47	13.50	13.52	13.55	13.57	13.60	13.62	13.65	13.68	.03
47	13.70	13.73	13.75	13.78	13.81	13.83	13.86	13.88	13.91	13.93	.03
48	13.96	13.99	14.01	14.04	14.06	14.09	14.11	14.14	14.17	14.19	.03
49	14.22	14.24	14.27	14.29	14.32	14.34	14.37	14.39	14.42	14.44	.03
50	14.47	14.50	14.52	14.55	14.57	14.60	14.62	14.65	14.67	14.70	.03

SHRINKAGE CONVERSION TABLE

TABLE III

Four Figure Table for Converting:

(1) Drying Shrinkage (per cent of plastic size) to Drying Shrinkage (per cent of dry size),

(2) Firing Shrinkage (per cent of unfired or dry size) to Firing Shrinkage (per cent of fired size), and

(3) Expansion (per cent of final size) to Expansion (per cent of initial size).

Unconverted percentage	Unconverted percentage										Differences
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
	Converted percentage										
0	0.00	0.100	0.200	0.301	0.402	0.503	0.604	0.705	0.806	0.908	.101
1	1.010	1.112	1.215	1.317	1.420	1.523	1.626	1.729	1.833	1.937	.103
2	2.041	2.145	2.249	2.354	3.459	3.564	2.670	2.775	2.881	2.987	.105
3	3.093	3.199	3.306	3.413	3.520	3.627	3.734	3.842	3.950	4.058	.107
4	4.167	4.275	4.384	4.493	4.603	4.712	4.822	4.932	5.042	5.152	.110
5	5.263	5.374	5.485	5.597	5.708	5.820	5.932	6.045	6.157	6.270	.112
6	6.383	6.496	6.610	6.724	6.838	6.952	7.066	7.181	7.296	7.411	.114
7	7.527	7.643	7.759	7.875	7.991	8.108	8.225	8.342	8.460	8.578	.117
8	8.696	8.814	8.932	9.051	9.170	9.290	9.409	9.529	9.649	9.769	.119
9	9.890	10.01	10.13	10.25	10.38	10.50	10.62	10.74	10.86	10.99	.12
10	11.11	11.23	11.36	11.48	11.61	11.73	11.86	11.98	12.11	12.23	.12
11	12.36	12.49	12.61	12.74	12.87	12.99	13.12	13.25	13.38	13.51	.13
12	13.64	13.77	13.90	14.03	14.16	14.29	14.42	14.55	14.68	14.81	.13
13	14.94	15.07	15.21	15.34	15.47	15.61	15.74	15.87	16.01	16.14	.13
14	16.28	16.41	16.55	16.69	16.82	16.96	17.10	17.23	17.37	17.51	.14
15	17.65	17.79	17.92	18.06	18.20	18.34	18.48	18.62	18.76	18.91	.14
16	19.05	19.19	19.33	19.47	19.62	19.76	19.90	20.05	20.19	20.34	.14
17	20.48	20.63	20.77	20.92	21.07	21.21	21.36	21.51	21.65	21.80	.15
18	21.95	22.10	22.25	22.40	22.55	22.70	22.85	23.00	23.15	23.30	.15
19	23.46	23.61	23.76	23.92	24.07	24.22	24.38	24.53	24.69	24.84	.15
20	25.00	25.16	25.31	25.47	25.63	25.79	25.94	26.10	26.26	26.42	.16
21	26.58	26.74	26.90	27.06	27.23	27.39	27.55	27.71	27.88	28.04	.16
22	28.21	28.37	28.53	28.70	28.87	29.03	29.20	29.37	29.53	29.70	.17
23	29.87	30.04	30.21	30.38	30.55	30.72	30.89	31.06	31.23	31.41	.17
24	31.58	31.75	31.93	32.10	32.28	32.45	32.63	32.80	32.98	33.16	.18
25	33.33	33.51	33.69	33.87	34.05	34.23	34.41	34.59	34.77	34.95	.18
26	35.14	35.32	35.50	35.69	35.87	36.05	36.24	36.43	36.61	36.80	.19
27	36.99	37.17	37.36	37.55	37.74	37.93	38.12	38.31	38.50	38.70	.19
28	38.89	39.08	39.26	39.47	39.66	39.86	40.06	40.25	40.45	40.65	.20
29	40.85	41.04	41.24	41.44	41.64	41.84	42.05	42.25	42.45	42.65	.20
30	42.86	43.06	43.27	43.47	43.68	43.88	44.09	44.30	44.51	44.72	.21
31	44.93	45.14	45.35	45.56	45.77	45.99	46.20	46.41	46.63	46.84	.21
32	47.06	47.28	47.49	47.71	47.93	48.15	48.37	48.59	48.81	49.03	.22
33	49.25	49.48	49.70	49.93	50.15	50.38	50.60	50.83	51.06	51.29	.23
34	51.52	51.75	51.98	52.21	52.44	52.67	52.91	53.14	53.37	53.61	.23
35	53.85	54.08	54.32	54.56	54.80	55.04	55.28	55.52	55.76	56.01	.24
36	56.25	56.49	56.74	56.99	57.23	57.48	57.73	57.98	58.23	58.48	.25
37	58.73	58.98	59.24	59.49	59.74	60.00	60.26	60.51	60.77	61.03	.26
38	61.29	61.55	61.81	62.07	62.34	62.60	62.87	63.13	63.40	63.67	.26
39	63.93	64.20	64.47	64.74	65.02	65.29	65.56	65.84	66.11	66.39	.27
40	66.67	66.94	67.22	67.50	67.79	68.07	68.35	68.63	68.92	69.20	.28
41	69.49	69.78	70.07	70.36	70.65	70.94	71.23	71.53	71.82	72.12	.29
42	72.41	72.71	73.01	73.31	73.61	73.91	74.22	74.52	74.83	75.13	.30
43	75.44	75.75	76.06	76.37	76.68	76.99	77.30	77.62	77.94	78.25	.31
44	78.57	78.89	79.21	79.53	79.86	80.18	80.51	80.83	81.16	81.49	.32
45	81.82	82.15	82.48	82.82	83.15	83.49	83.82	84.16	84.50	84.84	.34
46	85.19	85.53	85.87	86.22	86.57	86.92	87.27	87.62	87.97	88.32	.35
47	88.68	89.04	89.39	89.75	90.11	90.48	90.84	91.20	91.57	91.94	.36
48	92.31	92.68	93.05	93.42	93.80	94.17	94.55	94.93	95.31	95.69	.38
49	96.08	96.46	96.85	97.24	97.63	98.02	98.41	98.81	99.20	99.60	.39
50	100.0	100.4	100.8	101.2	101.6	102.0	102.4	102.8	103.3	103.7	.4

SHRINKAGE CONVERSION TABLE

TABLE IV

Four Figure Table for Converting:

(1) Drying Shrinkage (per cent of dry size) to Drying Shrinkage (per cent of plastic size),

(2) Firing Shrinkage (per cent of fired size) to Firing Shrinkage (per cent of unfired or dry size), and

(3) Expansion (per cent of initial size) to Expansion (per cent of final size).

Unconverted percentage	Unconverted percentage										Differences
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	
	Converted percentage										
0	0.000	0.100	0.200	0.299	0.398	0.498	0.596	0.695	0.794	0.892	.099
1	0.990	1.088	1.186	1.283	1.381	1.478	1.575	1.672	1.768	1.865	.097
2	1.961	2.057	2.153	2.248	2.344	2.439	2.534	2.629	2.724	2.818	.095
3	2.913	3.007	3.101	3.195	3.288	3.382	3.475	3.568	3.661	3.754	.093
4	3.846	3.939	4.031	4.123	4.215	4.306	4.398	4.489	4.580	4.671	.091
5	4.762	4.853	4.943	5.033	5.123	5.213	5.303	5.393	5.482	5.571	.090
6	5.660	5.749	5.838	5.927	6.015	5.103	6.191	6.279	6.367	6.455	.088
7	6.542	6.629	6.716	6.803	6.890	6.977	7.063	7.149	7.236	7.322	.087
8	7.407	7.493	7.579	7.664	7.749	7.834	7.919	8.004	8.088	8.173	.085
9	8.257	8.341	8.425	8.509	8.592	8.676	8.759	8.842	8.925	9.008	.083
10	9.091	9.173	9.256	9.338	9.420	9.502	9.584	9.666	9.747	9.829	.082
11	9.910	9.991	10.07	10.15	10.23	10.31	10.39	10.47	10.55	10.63	.08
12	10.71	10.79	10.87	10.95	11.03	11.11	11.19	11.27	11.35	11.43	.08
13	11.50	11.58	11.66	11.74	11.92	11.89	11.97	12.05	12.13	12.20	.08
14	12.28	12.36	12.43	12.51	12.59	12.66	12.74	12.82	12.89	12.97	.08
15	13.04	13.12	13.19	13.27	13.34	13.42	13.49	13.57	13.64	13.72	.08
16	13.79	13.87	13.94	14.02	14.09	14.16	14.24	14.31	14.38	14.46	.07
17	14.53	14.60	14 68	14.75	14.82	14.89	14.97	15.04	15.11	15.18	.07
18	15.25	15.33	15.40	15.47	15.54	15.61	15.68	15.75	15.82	15.90	.07
19	15.97	16.04	16.11	16.18	16.25	16.32	16.39	16.46	16.53	16.60	.07
20	16.67	16.74	16.81	16.87	16.94	17.01	17.08	17.15	17.22	17.29	.07
21	17.36	17.42	17.49	17.56	17.63	17.70	17.76	17.83	17.90	17.97	.07
22	18.03	18.10	18.17	18.23	18.30	18.37	18.43	18.50	18.57	18.63	.07
23	18.70	18.76	18.83	18.90	18.96	19.03	19.09	19.16	19.22	19.29	.07
24	19.35	19.42	19.48	19.55	19.61	19.68	19.74	19.81	19.87	19.94	.06
25	20.00	20.06	20.13	20.19	20.26	20.32	20.38	20.45	20.51	20.57	.06
26	20.63	20.70	20.76	20.82	20.89	20.95	21.01	21.07	21.14	21.20	.06
27	21.26	21.32	21.38	21.45	21.51	21.57	21.63	21.69	21.75	21.81	.06
28	21.87	21.94	22.00	22.06	22.12	22.18	22.24	22.30	22.36	22.42	.06
29	22.48	22.54	22.60	22.66	22.72	22.78	22.84	22.90	22.96	23.02	.06
30	23.08	23.14	23.20	23.25	23.31	23.37	23.43	23.49	23.55	23.61	.06
31	23.66	23.72	23.78	23.84	23.90	23.95	24.01	24.07	24.13	24.18	.06
32	24.24	24.30	24.36	24.41	24.47	24.53	24.59	24.64	24.70	24.76	.06
33	24.81	24.87	24.92	24.98	25.04	25.09	25.15	25.21	25.26	25.32	.06
34	25.37	25.43	25.48	25.54	25.60	25.65	25.71	25.76	25.82	25.87	.06
35	25.93	25.98	26.04	26.09	26.14	25.20	26.25	26.31	26.36	26.42	.05
36	26.47	26.52	26.58	26.63	26.69	26.74	26.79	26.85	26.90	26.95	.05
37	27.01	27.06	27.11	27.17	27.22	27.27	27.33	27.38	27.43	27.48	.05
38	27.54	27.59	27.64	27.69	27.75	27.80	27.85	27.90	27.95	28.01	.05
39	28.06	28.11	28.16	28.21	28.26	28.32	28.37	28.42	28.47	28.52	.05
40	28.57	28.62	28.67	28.72	28.77	28.83	28.88	28.93	28.98	29.03	.05
41	29.08	29.13	29.18	29.23	29.28	29.33	29.38	29.43	29.48	29.53	.05
42	29.58	29.63	29.68	29.73	29.78	29.82	29.87	29.92	29.97	30.02	.05
43	30.07	30.12	30.17	30.22	30.26	30.31	30.36	30.41	30.46	30.51	.05
44	30.56	30.60	30.65	30.70	30.75	30.80	30.84	30.89	30.94	30.99	.05
45	31.03	31.08	31.13	31.18	31.22	31.27	31.32	31.37	31.41	31.46	.05
46	31.51	31.55	31.60	31.65	31.69	31.74	31.79	31.83	31.88	31.93	.05
47	31.97	32.02	32.07	32.11	32.16	32.20	32.25	32.30	32.34	32.39	.05
48	32.43	32.48	32.52	32.57	32.61	32.66	32.71	32.75	32.80	32.84	.05
49	32.89	32.93	32.98	33.02	33.07	33.11	33.16	33.20	33.24	33.29	.04
50	33.33	33.38	33.42	33.47	33.51	33.55	33.60	33.64	33.69	33.73	.04

SIEVES AND SCREENS

The following terms are often employed in reporting the results of a screen analysis.

Cumulative Per Cent is the term employed to express the percentage of the total amount of a material which would remain on a testing sieve if only one sieve were used for testing the entire sample; to obtain the **cumulative weight,** it is necessary to add the weight of all of the material which remains on sieves coarser than the one in question to the amount remaining on the sieve in question. When such data is plotted as a curve, each point on the curve represents the *total* material that would be retained if only the one sieve represented by that particular point were used in the sieve analysis.

Effective Size is a term customarily employed in specifications for filtration sands; effective size is measured by that opening in millimeters which will just pass 10% of a representative sample of sand.

Uniformity Co-efficient is the numerical value obtained by dividing the sieve opening (in millimeters) which will pass 60% of the sample by the sieve opening (in millimeters) which will just pass 10% of the sample.

TYLER STANDARD SCREEN SCALE SIEVES

The W. S. Tyler Co., Cleveland, Ohio

Meshes per Lineal		Sieve Opening		Wire Diameter	
inch	cm.	inch	mm.	inch	mm.
2.5	0.98	0.312	7.92	0.088	2.24
3	1.18	0.263	6.68	0.070	1.78
3.5	1.38	0.221	5.61	0.065	1.65
4	1.57	0.185	4.70	0.065	1.65
5	1.97	0.156	3.96	0.044	1.12
6	2.36	0.131	3.33	0.036	0.914
7	2.76	0.110	2.79	0.0328	0.833
8	3.15	0.093	2.36	0.032	0.813
9	3.54	0.078	1.98	0.033	0.838
10	3.94	0.065	1.65	0.035	0.889
12	4.72	0.055	1.40	0.028	0.711
14	5.51	0.046	1.17	0.025	0.635
16	6.30	0.0390	0.991	0.0235	0.597
20	7.87	0.0328	0.833	0.0172	0.437
24	9.45	0.0276	0.701	0.0141	0.358
28	11.02	0.0232	0.589	0.0125	0.318
32	12.60	0.0195	0.495	0.0118	0.300
35	13.78	0.0164	0.417	0.0122	0.310
42	16.54	0.0138	0.351	0.0100	0.254
48	18.90	0.0116	0.295	0.0092	0.234
60	23.62	0.0097	0.246	0.0070	0.178
65	25.59	0.0082	0.208	0.0072	0.183
80	31.50	0.0069	0.175	0.0056	0.142
100	39.37	0.0058	0.147	0.0042	0.107
115	45.28	0.0049	0.124	0.0038	0.097
150	59.06	0.0041	0.104	0.0026	0.066
170	66.93	0.0035	0.089	0.0024	0.061
200	78.74	0.0029	0.074	0.0021	0.053
250	98.43	0.0024	0.061	0.0016	0.041
270	106.3	0.0021	0.053	0.0016	0.041
325	128.0	0.0017	0.043	0.0014	0.036

U. S. SIEVE SERIES

U. S. Bu. Standards, Standard Screen Series, 1919

Sieve No.	Meshes per Lineal inch	Meshes per Lineal cm.	Sieve Opening inch	Sieve Opening mm.	Wire Diameter inch	Wire Diameter mm.	% Tolerance in Average Opening	% Tolerance in Maximum Opening	% Tolerance in Wire Diameter
2.5	2.58	1	0.315	8.00	0.073	1.85	1	10	5
3	3.03	1.2	0.265	6.73	0.065	1.65	1	10	5
3.5	3.57	1.4	0.223	5.66	0.057	1.45	1	10	5
4	4.22	1.7	0.187	4.76	0.050	1.27	1	10	5
5	4.98	2	0.157	4.00	0.044	1.12	1	10	5
6	5.81	2.3	0.132	3.36	0.040	1.02	1	10	5
7	6.80	2.7	0.111	2.83	0.036	0.92	1	10	5
8	7.89	3	0.0937	2.38	0.0331	0.84	2	10	5
10	9.21	3.5	0.0787	2.00	0.0299	0.76	2	10	5
12	10.72	4	0.0661	1.68	0.0272	0.69	2	10	5
14	12.58	5	0.0555	1.41	0.0240	0.61	2	10	5
16	14.66	6	0.0469	1.19	0.0213	0.54	2	10	5
18	17.15	7	0.0394	1.00	0.0189	0.48	2	10	5
20	20.16	8	0.0331	0.84	0.0165	0.42	3	25	5
25	23.47	9	0.0280	0.71	0.0146	0.37	3	25	5
30	27.62	11	0.0232	0.59	0.0130	0.33	3	25	5
35	32.15	13	0.0197	0.50	0.0114	0.29	3	25	5
40	38.02	15	0.0165	0.42	0.0098	0.25	3	25	5
45	44.44	18	0.0138	0.35	0.0087	0.22	3	25	5
50	52.36	20	0.0117	0.297	0.0074	0.188	4	40	10
60	61.93	24	0.0098	0.250	0.0064	0.162	4	40	10
70	72.46	29	0.0083	0.210	0.0055	0.140	4	40	10
80	85.47	34	0.0070	0.177	0.0047	0.119	4	40	10
100	101.01	40	0.0059	0.149	0.0040	0.102	4	40	10
120	120.48	47	0.0049	0.125	0.0034	0.086	4	40	10
140	142.86	56	0.0041	0.105	0.0029	0.074	5	60	15
170	166.67	66	0.0035	0.088	0.0025	0.063	5	60	15
200	200	79	0.0029	0.074	0.0021	0.053	5	60	15
230	238.10	93	0.0024	0.062	0.0018	0.046	5	60	15
270	270.26	106	0.0021	0.053	0.0016	0.041	5	60	15
325	323	125	0.0017	0.044	0.0014	0.036	5	60	15

BRITISH STANDARD SCREEN SCALE SIEVES

British Engineering Standards Association

Meshes per Lineal inch	Meshes per Lineal cm.	Sieve Opening inch	Sieve Opening mm.	Wire Diameter inch	Wire Diameter mm.	Wire Standard Gauge	Tolerance Average Aperture ±%	Approx. Screening Area
5	1.97	0.1320	3.35	0.068	1.73	15.5	3	44
6	2.36	0.1107	2.81	0.056	1.42	17	3	44
7	2.76	0.0949	2.41	0.048	1.22	18	3	44
8	3.15	0.0810	2.06	0.044	1.12	18.5	3	42
10	3.94	0.0660	1.68	0.034	0.864	20.5	3	44
12	4.72	0.0553	1.40	0.028	0.711	22	3	44
14	5.51	0.0474	1.20	0.024	0.610	23	3	44
16	6.30	0.0395	1.00	0.023	0.584	23.5	3	40
18	7.09	0.0336	0.853	0.022	0.559	24	5	36
22	8.66	0.0275	0.699	0.018	0.457	26	5	36
25	9.84	0.0236	0.599	0.0164	0.417	27	5	35
30	11.81	0.0197	0.500	0.0136	0.345	29	5	36
36	14.17	0.0166	0.422	0.0112	0.284	31.5	5	36

BRITISH STANDARD SCREEN SCALE SIEVES

Meshes per Lineal		Sieve Opening		Wire			Tolerance Average Aperture	Approx. Screening Area
				Diameter		Standard Gauge		
inch	cm.	inch	mm.	inch	mm.		±%	
44	17.32	0.0139	0.353	0.0088	0.224	34.5	5	38
52	20.47	0.0116	0.295	0.0076	0.193	36	6	37
60	23.62	0.0099	0.251	0.0068	0.173	37	6	35
72	28.35	0.0083	0.211	0.0056	0.142	38.5	6	36
85	33.47	0.007	0.178	0.0048	0.122	40	6	35
100	39.37	0.006	0.152	0.004	0.102	42	6	36
120	47.24	0.0049	0.124	0.0034	0.086	43.5	6	35
150	59.06	0.0041	0.104	0.0026	0.066	45.5	8	37
170	66.93	0.0035	0.089	0.0024	0.061	46	8	35
200	78.74	0.003	0.076	0.002	0.051	47	8	36
240	94.49	0.0026	0.066	0.0016	0.041	48	8	38

CERAMIC EQUIVALENT WEIGHTS

Based Upon the International Atomic Weights of 1933.
Compiled by F. C. SMITH, B. S. (Chem. Eng.) and R. O. HUMMEL
of The Harshaw Chemical Co., Cleveland, Ohio.

Abbreviations used in the table:

anhyd., anhydrous
atm., atmosphere of pressure
d., decomposition
diss., dissociation
$-H_2O$, loss of 1 mole water
monocl., monoclinic
m. p., melting point
–O, loss of 1 atom of oxygen
RO, base equivalent
R_2O_3, amphoteric equivalent
RO_2, acid equivalent
subl., sublimes
<, below or less than
>, above or greater than

Mineral or Compound	Formula	Formula Weight	Equivalent Weight			Melting Point °C.
			RO	R_2O_3	RO_2	
Albite (soda feldspar)	$Na_2O\cdot Al_2O_3\cdot 6SiO_2$	524.29	524.29	524.29	87.38	1100±
Alum (ammonium)	$Al_2(SO_4)_3\cdot(NH_4)_2SO_4\cdot 24H_2O$	906.63	.....	906.63	.....	94
Alum (potash)	$Al_2(SO_4)_3\cdot K_2SO_4\cdot 24H_2O$	948.75	948.75	948.75	.....	92
Alum (soda)	$Al_2(SO_4)_3\cdot Na_2SO_4\cdot 24H_2O$	916.55	916.55	916.55	.....	61
Alumina	Al_2O_3	101.94	.....	101.94	.....	2050
Aluminum fluoride	AlF_3	83.97	.....	167.94	55.98	1040
hydrate (hydroxide)	$Al_2O_3\cdot 3H_2O$	155.99	.....	155.99	.....	2050
sulfate	$Al_2(SO_4)_3\cdot 18H_2O$	666.40	.....	666.40	.....	d87
sulfate (anhyd.)	$Al_2(SO_4)_3$	342.12	.....	342.12	.....	d770
Andalusite	$Al_2O_3\cdot SiO_2$	162.00	.....	162.00	162.00	.....
Anorthite (calcium feldspar)	$CaO\cdot Al_2O_3\cdot 2SiO_2$	278.14	278.14	278.14	139.07	1550
Antimony pentoxide	Sb_2O_5	323.52	.....	323.52	.....	−O, 450 −2O, 1060
tetroxide	Sb_2O_4	307.52	.....	307.52	.....	−O,1060
trioxide	Sb_2O_3	291.52	.....	291.52	.....	652
sulfide (needle)	Sb_2S_3	339.70	.....	339.70	.....	550
Apatite	$3CaO\cdot P_2O_5$	310.28	103.43	.....	310.28	1670
Arsenous oxide	As_2O_3	197.86	.....	197.86	.....	subl.
Barium carbonate	$BaCO_3$	197.36	197.36	.....	.....	d900
chloride	$BaCl_2\cdot 2H_2O$	244.31	244.31	.....	.....	$-2H_2O$, 100° m.p.962

CERAMIC EQUIVALENT WEIGHTS

Mineral or Compound	Formula	Formula Weight	Equivalent Weight			Melting Point °C.
			RO	R_2O_3	RO_2	
chloride (anhyd.)	$BaCl_2$	208.27	208.27	.....	.....	962
chromate	$BaCrO_4$	253.37	253.37	506.74	.....	.....
fluoride	BaF_2	175.36	175.36	.....	175.36	1280
fluosilicate	$BaSiF_6$	279.42	279.42	.....	SiO_2 279.42; 2F 93.14	.....
hydroxide	$Ba(OH)_2 \cdot 8H_2O$	315.50	315.50	.....	.....	$-8H_2O$, 550 m.p. 78
oxide	BaO	153.36	153.36	.....	.....	1923
selenite	$BaSeO_3$	264.56	264.56	.....	264.56	d.
sulfate (barytes)	$BaSO_4$	233.42	233.42	.....	.....	d1580
Beryllium oxide	BeO	25.02	25.02	.....	.....	2450 ± 50
Beryl	$3BeO \cdot Al_2O_3 \cdot 6SiO_2$	537.36	179.12	537.36	89.56	1410
Bismuth oxide	Bi_2O_3	466.00	.....	466.00	.....	860
sub-nitrate.	$BiO \cdot NO_3 \cdot H_2O$	305.02	.....	610.04	.....	d260
Bone ash	imp. $Ca_3(PO_4)_2$	.....	.....	.....	.....	.....
Borax	$Na_2O \cdot 2B_2O_3 \cdot 10H_2O$	381.43	381.43	190.71	.....	75
Borax (anhyd.)	$Na_2O \cdot 2B_2O_3$	201.27	201.27	100.63	.....	741
Boric acid	$B_2O_3 \cdot 3H_2O$	123.69	.....	123.69	.....	d185 $-1\frac{1}{2}H_2O$,300
oxide (anhyd.)	B_2O_3	69.64	.....	69.64	.....	577
Cadmium carbonate	$CdCO_3$	172.41	172.41	.....	.....	d <500
oxide	CdO	128.41	128.41	.....	.....	d900-1000
selenide	$CdSe$	191.61	191.61	.....	191.61	<1350
sulfate	$3CdSO_4 \cdot 8H_2O$	769.53	256.51	.....	.....	tr. 42
sulfate (anhyd.)	$CdSO_4$	208.47	208.47	.....	.....	1000
sulfide	CdS	144.47	144.47	.....	.....	$1750^{100\text{atm}}$
Calcium borate	$2CaO \cdot 3B_2O_3 \cdot 5H_2O$	411.16	205.58	137.05	.....	.....
carbonate	$CaCO_3$	100.08	100.08	.....	.....	d825
chloride	$CaCl_2 \cdot 6H_2O$	219.09	219.09	.....	.....	30
chloride (anhyd.)	$CaCl_2$	110.99	110.99	.....	.....	772
fluoride	CaF_2	78.08	78.08	.....	78.08	1330
fluosilicate	$CaSiF_6$	182.14	182.14	.....	SiO_2 182.14; 2F 60.71	d.
hydroxide	$Ca(OH)_2$	74.10	74.10	.....	.....	$-H_2O$, 580
oxide	CaO	56.08	56.08	.....	.....	2572
phosphate (ortho)	$3CaO \cdot P_2O_5$	310.28	103.43	310.28	.....	1670
silicate	$CaO \cdot SiO_2$	116.14	116.14	.....	116.14	1540+
sulfate (gypsum)	$CaSO_4 \cdot 2H_2O$	172.17	172.17	.....	.....	$-1\frac{1}{2}H_2O$, 128 $-2H_2O$, 163
sulfate (plaster)	$CaSO_4 \cdot \frac{1}{2}H_2O$	145.15	145.15	.....	.....	$-\frac{1}{2}H_2O$, 163
sulfate (anhyd.)	$CaSO_4$	136.14	136.14	.....	.....	monocl. 1450
Celestite	$SrSO_4$	183.69	183.69	.....	.....	d1580
Cerium oxide	CeO_2	172.13	.....	.....	172.13	1950
China clay	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	258.09	.....	258.09	129.05	1755 ±
Chromic acid	CrO_3	100.01	.....	200.02	.....	d190
fluoride	$CrF_3 \cdot 9H_2O$	271.15	.....	542.30	180.77	.....
oxide (green)	Cr_2O_3	152.02	.....	152.02	.....	1900
sulfate	$Cr_2(SO_4)_3 \cdot 18H_2O$	716.48	.....	716.48	.....	$-12H_2O$, 100
Chromite	$FeO \cdot Cr_2O_3$	223.86	223.86	223.86	223.86	2180
Cobaltous acetate	$Co(CH_3CO_2)_2 \cdot 4H_2O$	249.05	249.05	498.10	.....	$-4H_2O$,140
carbonate	$CoCO_3$	118.94	118.94	237.88	.....	d100
chloride	$CoCl_2 \cdot 6H_2O$	237.95	237.95	475.90	.....	$-6H_2O$,110

CERAMIC EQUIVALENT WEIGHTS

Mineral or Compound	Formula	Formula Weight	Equivalent Weight			Melting Point °C.
			RO	R_2O_3	RO_2	
Cobaltous nitrate	$Co(NO_3)_2 \cdot 6H_2O$	291.05	291.05	582.10	.....	<100
oxide	CoO	74.94	74.94	149.88	.....	d1800
cobaltic oxide (blk.)	Co_3O_4	240.82	80.27	160.54	.....	.....
phosphate (anhyd.)	$Co_3(PO_4)_2$	366.86	122.29	244.58	.....	.....
sulfate	$CoSO_4 \cdot 7H_2O$	281.11	281.11	562.22	.....	96.8
sulfate (anhyd.)	$CoSO_4$	155.00	155.00	310.00	.....	d830
Copperas	$FeSO_4 \cdot 7H_2O$	278.01	278.01	556.02	.....	$-7H_2O$, 300 m.p. 64
Cupric acetate	$Cu(CH_3CO_2)_2 \cdot H_2O$	199.63	199.63	.....	.....	d240
carbonate (basic)	$CuCO_3 \cdot Cu(OH)_2$	221.16	110.58	.....	.....	d.
chloride	$CuCl_2 \cdot 2H_2O$	170.52	170.52	.....	.....	$-2H_2O$, 110 m. p. d.
nitrate	$Cu(NO_3)_2 \cdot 6H_2O$	295.68	295.68	.....	.....	$-HNO_3$, 170 $-3H_2O$, 26.4
oxide (black)	CuO	79.57	79.57	.....	.....	d1026
sulfate	$CuSO_4 \cdot 5H_2O$	249.71	249.71	.....	.....	$-5H_2O$, 250 d650
Cuprous oxide (red)	Cu_2O	143.14	143.14	.....	.....	$-O$,1800 m.p. 1235
Cryolite	$3NaF \cdot AlF_3$	209.96	139.98	419.92	2F,69.98	1000
Cornwall stone (aprx.)	$RO \cdot 2\frac{1}{2}Al_2O_3 \cdot 20SiO_2$	.....	.....	.....	.....	.....
Dolomite	$CaCO_3 \cdot MgCO_3$	184.40	*	.....	.....	.....
Feldspar (potash)	$K_2O \cdot Al_2O_3 \cdot 6SiO_2$	556.50	556.50	556.50	92.75	1250 ±
Feldspar (soda)	$Na_2O \cdot Al_2O_3 \cdot 6SiO_2$	524.29	524.29	524.29	87.38	1100 ±
Feldspar (lime)	$CaO \cdot Al_2O_3 \cdot 2SiO_2$	278.14	278.14	278.14	139.61	1550
Ferric chloride	$FeCl_3 \cdot 6H_2O$	270.30	**	.....	.....	37
hydroxide	$Fe(OH)_3$	106.86	***	.....	.....	$-1\frac{1}{2}H_2O$, 500
oxide (red)	Fe_2O_3	159.68	****	.....	.....	d1560
Ferrous-ferric oxide (black, magnetic)	$FeO \cdot Fe_2O_3$	231.52	77.17	154.34	.....	d1538
Ferrous oxide	FeO	71.84	71.84	143.68	.....	1420
sulfate	$FeSO_4 \cdot 7H_2O$	278.01	278.01	556.02	.....	$-7H_2O$, 300 m.p. 64
Flint	SiO_2	60.06	.....	.....	60.06	1600 to 2230
Fluorspar	CaF_2	78.08	78.08	.....	78.08	1330
Gypsum	$CaSO_4 \cdot 2H_2O$	172.17	172.17	.....	.....	$-1\frac{1}{2}H_2O$,128 $-2H_2O$, 163
Kaolin	$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	258.09	.....	258.09	129.05	1755 to 1790
Lead acetate	$Pb(CH_3CO_2)_2 \cdot 3H_2O$	379.31	379.31	.....	.....	$-3H_2O$, 75
borate	$PbO \cdot B_2O_3 \cdot H_2O$	310.88	310.88	310.88	.....	$-H_2O$, 160
carbonate	$PbCO_3$	267.22	267.22	.....	.....	d315
carbonate (basic)	$2PbCO_3 \cdot Pb(OH)_2$	775.68	258.56	.....	.....	d400
chloride	$PbCl_2$	278.13	278.13	.....	.....	501
chromate	$PbCrO_4$	323.23	232.23	646.46	.....	844
oxide (litharge)	PbO	223.22	223.22	.....	.....	888
oxide (red)	Pb_3O_4	685.66	228.55	.....	.....	d500
bi-silicate	$PbO \cdot 2SiO_2$	343.34	343.34	171.67	.....	.....
sulfate	$PbSO_4$	303.28	303.28	.....	.....	1170
sulfide (galena)	PbS	239.28	239.28	.....	.....	1120
Lithium carbonate	Li_2CO_3	73.88	73.88	.....	.....	618
oxide	Li_2O	29.88	29.88	.....	.....	subl. <1000
Lime	CaO	56.08	56.08	.....	.....	2570
Magnesium carbonate	$MgCO_3$	84.32	84.32	.....	.....	d350
chloride	$MgCl_2 \cdot 6H_2O$	203.33	203.33	.....	.....	d118
hydroxide	$Mg(OH)_2$	58.34	58.34	.....	.....	d.

*$CaCO_3$ 100.08; $MgCO_3$ 84.32

**FeO 270.30; Fe_2O_3 540.60

***FeO 106.86; Fe_2O_3 213.72

****FeO 79.84; Fe_2O_3 159.68

CERAMIC EQUIVALENT WEIGHTS

Mineral or Compound	Formula	Formula Weight	Equivalent Weight			Melting Point °C.
			RO	R_2O_3	RO_2	
Magnesium oxide	MgO	40.32	40.32	.....	.....	2800
silicate (talc)	$3MgO·4SiO_2·H_2O$	379.22	126.41	.....	94.80	.....
sulfate	$MgSO_4·7H_2O$	246.49	246.49	.....	.....	d70
Manganese carbonate	$MnCO_3$	114.93	114.93	.....	.....	d.
dioxide (black)	MnO_2	86.93	86.93	.....	.....	−O,535
oxide (green)	MnO	70.93	70.93	.....	.....	1650
sulfate (anhyd.)	$MnSO_4$	150.99	150.99	.....	.....	700
Manganic oxide (brown)	Mn_2O_3	157.86	78.93	.....	.....	−O,1080
Manganous-manganic oxide (red)	Mn_3O_4	228.79	76.26	.....	.....	1705
Molybdic acid	$H_2MoO_4·H_2O$	180.03	.....	.....	180.03	−H_2O, 70
Molybdic trioxide	MoO_3	144.00	.....	.....	144.00	795
Neodymium oxalate	$Nd_2(C_2O_4)_3·10H_2O$	732.70	.....	.....	732.70	d400
oxide	Nd_2O_3	336.54	336.54	.....	.....	1900 ±
Nickel carbonate	$NiCO_3$	118.69	118.69	.....	.....	d.
chloride	$NiCl_2·6H_2O$	237.70	237.70	.....	.....	d.
chloride (anhyd.)	$NiCl_2$	129.60	129.60	.....	.....	.....
sulfate	$NiSO_4·7H_2O$	280.86	280.86	.....	.....	−H_2O, 6103
sulfate (anhyd.)	$NiSO_4$	154.75	154.75	.....	.....	−SO_3, 840
oxide (black)	Ni_2O_3	165.38	165.38	.....	.....	to NiO, 600
oxide (green)	NiO	74.69	74.69	.....	.....	to Ni_2O_3, 400
Orthoclase	$K_2O·Al_2O_3·6SiO_2$	556.50	556.50	556.50	92.75	1170
Phosphorus pentoxide	P_2O_5	142.04	.....	.....	142.04	subl.
Potassium carbonate	$K_2CO_3·2H_2O$	174.23	174.23	.....	.....	−$2H_2O$,100-200
Potassium carbonate (pearl ash)	K_2CO_3	138.20	138.20	.....	.....	891
chloride	KCl	74.56	74.56	.....	.....	790
chromate	K_2CrO_4	194.21	194.21	388.42	.....	975
dichromate	$K_2Cr_2O_7$	294.22	294.22	294.22	.....	398
nitrate (salt peter)	KNO_3	101.11	101.11	.....	.....	tr. 129;d400
oxide	K_2O	94.20	94.20	.....	.....	.....
silicate	$K_2O·SiO_2$	154.26	154.26	.....	154.26	976
Quartz	SiO_2	60.06	.....	.....	60.06	1600 to 2230
Rutile	TiO_2	79.90	.....	.....	79.90	d1640
Selenium	Se_8	633.60	.....	.....	79.20	50 to 217
dioxide	SeO_2	111.20	.....	.....	111.20	subl. 317
Silica	SiO_2	60.06	.....	.....	60.06	1600 to 2230
Silicon carbide	SiC	40.06	.....	.....	40.06	*diss. 2240
Sodium aluminate	$Na_2O·Al_2O_3$	163.93	163.93	163.93	.....	1650
antimonate	$Na_2O·Sb_2O_5$	385.51	385.51	385.51	.....	.....
bicarbonate	$NaHCO_3$	84.00	84.00	.....	.....	−H_2CO_3, 270
carbonate (crystals)	$Na_2CO_3·10H_2O$	286.15	286.15	.....	.....	−H_2O, 100
carbonate (anhyd.)	Na_2CO_3	105.99	105.99	.....	.....	851
chloride	$NaCl$	58.45	58.45	.....	.....	804
chromate	$Na_2CrO_4·10H_2O$	342.16	342.16	684.32	.....	20
dichromate	$Na_2Cr_2O_7·2H_2O$	298.05	298.05	298.05	.....	−$2H_2O$, 100
fluoride	NaF	42.00	84.00	.....	84.00	992
fluosilicate	Na_2SiF_6	188.05	188.05	.....	**	980
nitrate	$NaNO_3$	85.01	170.01	.....	.....	308
oxide	Na_2O	61.99	61.99	.....	.....	.....
phosphate, di-	$Na_2HPO_4·12H_2O$	358.21	358.21	.....	716.42	35
phosphate, tri-	$Na_3PO_4·12H_2O$	380.20	253.46	.....	760.40	d73
selenide	Na_2Se	125.19	125.19	.....	125.19	>875

*Formation at 1840°C.

**SiO_2 188.05; 2F 62.68

CERAMIC EQUIVALENT WEIGHTS

Mineral or Compound	Formula	Formula Weight	Equivalent Weight			Melting Point °C.
			RO	R_2O_3	RO_2	
Sodium selenite	$Na_2O \cdot SeO_2$	173.19	173.19	.....	173.19	.....
silicate	$Na_2O \cdot SiO_2$	122.05	122.05	.....	122.05	1088
silicate, di-	$Na_2O \cdot 2SiO_2$	182.11	182.11	.....	91.06	.....
sulfate (anhyd.)	Na_2SO_4	142.05	142.05	.....	.....	884
uranate**	Na_2UO_4	348.13	348.13	.....	348.13	.....
uranyl carbonate**	$2Na_2CO_3 \cdot UO_2CO_3$	542.13	271.06	.....	542.13	d.
Stannic chloride	$SnCl_4$	260.53	.....	.....	260.53	30
oxide (tin oxide)	SnO_2	150.70	.....	.....	150.70	1127
Stannous chloride	$SnCl_2 \cdot 2H_2O$	225.65	.....	.....	225.65	38
Strontium carbonate	$SrCO_3$	147.63	147.63	.....	.....	$1497^{60 atm.}$
oxide	SrO	103.63	103.63	.....	.....	2430
sulfate (celestite)	$SrSO_4$	183.69	183.69	.....	.....	d1580
Tin oxide	SnO_2	150.70	.....	.....	150.70	1127
Titanium dioxide	TiO_2	79.90	.....	.....	79.90	d1640
Uranium oxide	U_3O_8	842.42	.....	.....	842.42	d.
trioxide	UO_3	286.14	.....	.....	286.14	d.
Vanadium pentoxide	V_2O_5	181.90	.....	.....	181.90	800
Zinc carbonate	$ZnCO_3$	125.38	125.38	.....	.....	$-CO_2$, 300
oxide	ZnO	81.38	81.38	.....	.....	>1800
selenite	$ZnO \cdot SeO_2$	192.58	192.58	.....	192.58	.....
Zirconium oxide	ZrO_2	123.22	.....	.....	123.22	2700
silicate	$ZrO_2 \cdot SiO_2$	183.28	183.28	.....	183.28	2550
Zirconia	ZrO_2	123.22	.....	.....	123.22	2700

**Position of this oxide depends upon acid-base ratio; status questionable.

INDEX OF REFRACTION

The index of refraction of air, 1.000294, is so near unity that it is commonly used as a more convenient standard than vacuum. After measurement of the index of a substance in any medium, as air, its index in a vacuum may be computed, being equal to the index as obtained by measurement multiplied by the index (measured in a vacuum) of the medium used.

Index of refraction varies inversely with the wave length of light employed, being greater for violet than for red light. This variation is known as *dispersion* and is greater (in general) for liquids than for solids. The yellow light of sodium (D) is commonly employed as an approximate mean value for all parts of white light. Other wave lengths which have been used in determinations of refractive index are those corresponding to certain spectrum lines of some of the elements and are indicated by the symbols of the elements or by the letters A', C, D, E, F, G', and H which are the Fraunhofer designations. The wave lengths most commonly employed are:

$\mathrm{Ca} = (H) = 3968\text{Å} = 396.8m\mu = 0.3968 \times 10^{-4}\text{cm.}$
$\mathrm{H}\gamma = (G') = 4340\text{Å} = 434.0m\mu = 0.4340 \times 10^{-4}\text{cm.}$
$\mathrm{H}\beta = (F) = 4861\text{Å} = 486.1m\mu = 0.4861 \times 10^{-4}\text{cm.}$
$\mathrm{Tl} = \ldots. = 5350\text{Å} = 535.0m\mu = 0.5350 \times 10^{-4}\text{cm.}$
$\mathrm{Hg} = \ldots. = 5791\text{Å} = 579.1m\mu = 0.5791 \times 10^{-4}\text{cm.}$
$\mathrm{He} = (E) = 5876\text{Å} = 587.6m\mu = 0.5876 \times 10^{-4}\text{cm.}$
$\mathrm{Na} = (D) = 5893\text{Å} = 589.3m\mu = 0.5893 \times 10^{-4}\text{cm.}$
$\mathrm{H}\alpha = (C) = 6563\text{Å} = 656.3m\mu = 0.6563 \times 10^{-4}\text{cm.}$
$\mathrm{Li} = (Red) = 6708\text{Å} = 670.8m\mu = 0.6708 \times 10^{-4}\text{cm.}$
$\mathrm{A} = \ldots. = 7594\text{Å} = 759.4m\mu = 0.7594 \times 10^{-4}\text{cm.}$
$\mathrm{K}\alpha = (A') = 7699\text{Å} = 769.9m\mu = 0.7699 \times 10^{-4}\text{cm.}$

The index of refraction is lowered by raising the temperature. This thermal variation of index is considerable in many liquids and negligible (affecting only the 4th or 5th decimal place) in crystals. Pressure plays a noticeable role only with gases.

Optically all substances may be classified as follows:

- Isotropic Group
  - Liquids
  - Isometric system solids
- Anisotropic Group
  - Uniaxial
    - Tetragonal, Hexagonal — Positive or Negative
  - Biaxial
    - Orthorhombic, Monoclinic, Triclinic — Positive or Negative

References.—The data in the following tables of refractive indices of solids have been collected mainly from the following sources:—

Winchell: *The Microscopic Characters of Artificial Inorganic Solid Substances or Artificial Minerals*, 2d edition (1931). Published by John Wiley and Sons, Inc., New York.

Larsen and Berman: *The Microscopic Determination of the Nonopaque Minerals*, 2d edition (1934). U. S. Geological Survey, Bull. 848, Washington, D. C.

Fry: *Tables for the Microscopic Identification of Inorganic Salts*, U. S. Department of Agriculture, Bull. 1108 (1922), Washington, D. C.

International Critical Tables, Vols. I and VII. Published by McGraw-Hill Book Co., New York.

ISOTROPIC GROUP (SOLIDS*)

Isotropic substances transmit light with equal velocity in all directions (isoaxial) and include gas, liquid, amorphous materials such as resins and glasses, and isometric crystals. In the table below most of the substances are isometric; a considerable number are amorphous and therefore rather variable and indefinite in their chemical composition and all their properties; a few, which are included also in their proper birefracting group, are birefracting, but their birefringence is so weak or uncertain as to make them easily mistaken for isotropic substances.

Arrangement. The substances are arranged in the order of increasing values of refractive index.

Substance	Ref. Ind. n_D	Substance	Ref. Ind. n_D
NaF	1.3258	$CsGa(SO_4)_2\cdot12H_2O$	1.4650
$3NaF\cdot3LiF\cdot2AlF_3$	1.339	$CsIn(SO_4)_2\cdot12H_2O$	1.4652
K_2SiF_6	1.34–39	$KGa(SO_4)_2\cdot12H_2O$	1.4653
KF	1.352	$RbGa(SO_4)_2\cdot12H_2O$	1.4658
$(NH_4)_2SiF_6$	1.3696	$NH_4In(SO_4)_2\cdot12H_2O$	1.4664
K_2SiF_6	1.39 ±	$NH_4Ga(SO_4)_2\cdot12H_2O$	1.4684
LiF	1.3915	$RbV(SO_4)_2\cdot12H_2O$	1.469
RbF	1.396	$2Na_3AsO_4\cdot NaF\cdot19H_2O$	1.4693
K_3HfF_7	1.403	NaH	1.470
$Al_2O_3\cdot6SiO_2\cdot18 \pm H_2O$ (?)	1.403	$NaAlSi_2O_6\cdot H_2O$	1.472
K_3ZrF_7	1.408	$CaTi(SO_4)_2\cdot12H_2O$	1.4736
$SiO_2\cdot H_2O$ (Opal)	1.41	BaF_2	1.475
KCN	1.410	$NH_4V(SO_4)_2\cdot12H_2O$	1.475
$SiCl_4$	1.412	$CsV(SO_4)_2\cdot12H_2O$	1.478
$K_2Zn(CN)_4$	1.413	CsF[a]	1.48
$K_2Cd(CN)_4$	1.413	$Na_2O\cdot CaO\cdot3Al_2O_3\cdot9SiO_2\cdot8H_2O$	1.48
$(NH_4)_3HfF_7$	1.426	SiO_2[b]	1.480
$(Na_2,Mg)F_2\cdot3Al(F,OH)_3\cdot2H_2O$	1.427	$KAl(SeO_4)_2\cdot12H_2O$	1.4801
$(NH_4)_3ZrF_7$	1.433	$CsCr(SO_4)_2\cdot12H_2O$	1.4810
CaF_2	1.4339	$KCr(SO_4)_2\cdot12H_2O$	1.4814
$(Y,Er,Ce)F_3\cdot5CaF_2\cdot H_2O$	1.434	$RbCr(SO_4)_2\cdot12H_2O$	1.4815
SrF_2	1.438	$KFe(SO_4)_2\cdot12H_2O$	1.4817
$NaAl(SO_4)_2\cdot12H_2O$	1.4388	$RbFe(SO_4)_2\cdot12H_2O$	1.4823
$BaCa_2(C_3H_5O_2)_6$ (Propionate)	1.444	$CsMn(SO_4)_2\cdot12H_2O$	1.483 ±
$Na_3PO_4\cdot10H_2O$	1.450	$3Na_2O\cdot3Al_2O_3\cdot6SiO_2\cdot2NaCl$	1.483
$2Na_3PO_4\cdot NaF\cdot19H_2O$	1.4519	$CsFe(SO_4)_2\cdot12H_2O$	1.4838
$NaCN$	1.452	$NH_4Cr(SO_4)_2\cdot12H_2O$	1.4842
KH	1.453	$NH_4Fe(SO_4)_2\cdot12H_2O$	1.485
$NH_3(CH_3)Al(SO_4)_2\cdot12H_2O$	1.454	SiO_2[c]	1.486
$2Na_2SO_4\cdot NaCl\cdot NaF$	1.454	$Na_2O\cdot Al_2O_3\cdot4SiO_2\cdot2H_2O$	1.487
$KAl(SO_4)_2\cdot12H_2O$	1.4564	$NaAlSi_3O_8$ (Glass)	1.4891
$RbAl(SO_4)_2\cdot12H_2O$	1.4566	KCl	1.4904
$NaC_4H_7O_4$ (Diacetate)	1.457	$RbCl$	1.4936
$(Ca_3,Y_2)F_6$	1.457	$5Na_2O\cdot3Al_2O_3\cdot6SiO_2\cdot2SO_3$	1.495
$K_2Hg(CN)_4$	1.458	$5(Na_2,Ca)O\cdot3Al_2O_3\cdot6SiO_2\cdot2SO_3$	1.495
$CaAl(SO_4)_2\cdot12H_2O$	1.4586	$LiAlSi_4O_{10}$ (Glass)	1.495
SiO_2 (Glass)	1.4588	$TlAl(SO_4)_2\cdot12H_2O$	1.4975
B_2O_3 (Glass)	1.459	$3Na_2O\cdot3Al_2O_3\cdot6SiO_2\cdot2Na_2S$	1.50 ±
$NH_4Al(SO_4)_2\cdot12H_2O$	1.4594	$2NaCl\cdot7KCl$	1.500
$RbTi(SO_4)_2\cdot12H_2O$	1.462_{Li}	$NaU(C_2H_3O_2)_3$	1.501
$RbIn(SO_4)_2\cdot12H_2O$	1.4638	$RbRh(SO_4)_2\cdot12H_2O$	1.501 ±
$NaK(CN)_2$	1.465	$KAlSi_2O_6$	1.501 ±

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* See also special table for liquids.

[a] Lower temp. phase.

[b] Ignited gel.

[c] Metacristobalite.

INDEX OF REFRACTION—ISOTROPIC

Substance	Ref. Ind. n_D	Substance	Ref. Ind. n_D
$2NaCl \cdot 5KCl$	1.503	$MgSiO_3$ (Glass)	1.5801
$TlGa(SO_4)_2 \cdot 12H_2O$	1.5067	$CsBr$	1.582
$RbFe(SeO_4)_2 \cdot 12H_2O$	1.5070	$Sr(NO_3)_2$	1.5878
$CsRh(SO_4)_2 \cdot 12H_2O$	1.5077	$Sr(NO_2)_2 \cdot H_2O$	1.589
$3Na_2O \cdot 2MgO \cdot 4CO_2 \cdot SO_3$	1.508	$NaBrO_3$[a]	1.5943
$KAlSiO_4$ (Glass)	1.508	$[(CH_3)_3N]_2H_2PtCl_6$	1.6000
$2NaCl \cdot 3KCl$	1.5085	Na_2CaSiO_4	1.60
$K_2O \cdot Al_2O_3 \cdot 4SiO_2$	1.509	$Ca_3Al_2O_6 \cdot 6H_2O$	1.604
$NaAlSiO_4$ (Glass)	1.510	$BaSi_2O_5$ (Glass)	1.606
$NH_4Rh(SO_4)_2 \cdot 12H_2O$	1.5103	GeO (Glass)	1.607
$CsFe(SeO_4)_2 \cdot 12H_2O$	1.5116	$5CaO \cdot 3Al_2O_3$	1.608–13
$Mg(BrO_3)_2 \cdot 6H_2O$	1.5136	$2Fe_2O_3 \cdot P_2O_5 \cdot 2SO_3 \cdot 2H_2O$	1.61 ±
$TlV(SO_4)_2 \cdot 12H_2O$	1.514	$3NiO \cdot CO_2 \cdot H_2O$	1.61 ±
$NaCl \cdot KCl$	1.514	$NaBrO_3$[b]	1.617
$NaCl \cdot Na_2CO_3 \cdot MgCO_3$	1.5144	$GeBr_4$	1.6269
$Na_2B_4O_7$ (Glass)	1.5147	$CaSiO_3$ (Glass)	1.6280
$NaClO_3$	1.5151	$Ca_2Al_2SiO_7$ (Glass)	1.638
$4NaCl \cdot 3KCl$	1.518	$ThSiO_4 \cdot 4H_2O$	1.638
$LiAlSi_2O_6$ (Glass)	1.519	NH_4Cl[c]	1.639
$3NaCl \cdot 2KCl$	1.519	$Ca_2MgSi_2O_7$ (Glass)	1.641
$CaCl_2$	1.52	$NaBr$	1.6412
$K_3Cu(CN)_4$	1.522 ±	$CsCl$	1.6418
$TlCr(SO_4)_2 \cdot 12H_2O$	1.5228	NH_4Cl[d]	1.6426
$2Na_3VO_4 \cdot NaF \cdot 19H_2O$	1.5230	$(NH_4)_2FeCl_4$	1.6439
$2NaCl \cdot KCl$	1.523	Li_2O	1.644
$K_2Be_3Si_4O_{12}$	1.523	RbI	1.6474
$TlFe(SO_4)_2 \cdot 12H_2O$	1.5237	$SrCl_2$	1.6499
$2Cs_2O \cdot 2Al_2O_3 \cdot 9SiO_2 \cdot H_2O$	1.525	Al_2O_3[e]	1.65–9
$3NaCl \cdot KCl$	1.528	$ZnSiO_3$ (Glass)	1.650
$Na_3VO_4 \cdot 10H_2O$	1.5305	$FeSiO_3 \cdot nH_2O$	1.650–4
$K_2SO_4 \cdot 2MgSO_4$	1.5329	K_2SnCl_6	1.6574
$5NaCl \cdot KCl$	1.533	$Ca_4P_2O_9$	1.660 ±
$CsCl$	1.534	CsI	1.661
Amber (Succinite)	1.535 ±	$Ca_5Al_6O_{14}$ (Glass)	1.662
$7NaCl \cdot KCl$	1.536	$LiCl$	1.662
$K_2Ni(COS)_4$	1.54 ±	KI	1.6670
$K_2Al_2SiO_6$	1.540	$CaO \cdot Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	1.67
$LiAlSiO_4$	1.541	$MgAl_2O_4$ (Glass)	1.67–8
$NaCl$	1.5443	$K_2O \cdot 2Al_2O_3 \cdot 3B_2O_3$	1.69
$Zn(BrO_3)_2 \cdot 6H_2O$	1.5452	Al_2O_3[e]	1.69–65
Li_2SiO_3 (Glass)	1.548	Al_2O_3[f]	1.696
$TlRh(SO_4)_2 \cdot 12H_2O$	1.5480	$CsBr$	1.6984
$Co(ClO_4)_2 \cdot 6H_2O$	1.55 ±	$MnSiO_3$ (Glass)	1.700
$Ni(ClO_4)_2 \cdot 6H_2O$	1.55 ±	NH_4I	1.7031
$RbBr$	1.5528	$3MgO \cdot Al_2O_3 \cdot 3SiO_2$	1.705
KBr	1.5594	$3CaO \cdot Al_2O_3$	1.710
CdF_2	1.56	$Ca_3Al_2O_6$	1.710–5
$Cr_2(SO_4)_3 \cdot 18H_2O$	1.564	NH_4Br	1.7108
$3NiO \cdot CO_2 \cdot H_2O$	1.57 ±	$MgAl_2O_4$	1.718–23
$Na_4CaSi_3O_9$	1.571	$Ca_3Al_2Si_3O_{12}$	1.735
$Ba(NO_3)_2$	1.572	MgO	1.7364
$K_4CaSi_3O_9$	1.572	$3AuCl_3 \cdot 3AgCl \cdot 8NH_4Cl$	1.74 ±
$CaAl_2Si_2O_8$ (Glass)	1.5755	$UO_2 \cdot ThO_2 \cdot PbO \cdot 4SiO_2 \cdot 4H_2O$	1.74 ±
CsF	1.578	As_2O_3	1.755
$SiBr_4$	1.579	$MgAl_2O_4(+9\%\ MgFe_2O_4)$	1.76

[a] See also *n* 1.617
[b] See also *n* 1.5943
[c] See also *n* 1.6426
[d] See also *n* 1.639
[e] Ignited gel.
[f] High temp. phase.

INDEX OF REFRACTION—ISOTROPIC

Substance	Ref. Ind. n_D	Substance	Ref. Ind. n_D
NaI	1.7745	$Fe_2O_3 \cdot nH_2O$	2.15±
$ZnO \cdot Al_2O_3$	1.780	BaS	2.155
$CoAl_2O_4$	1.78+	MnO	2.16
$Pb(NO_3)_2$	1.7815	$FeCr_2O_4$	2.16
$LiBr$	1.784	ZnS (Glass?)	2.18–.25
CsI	1.7876	ThO_2	2.20
$CsCl \cdot HgCl_2$	1.791	$4AgI \cdot CuI$	2.20
$FeO \cdot Al_2O_3$	1.80±	$5CaO \cdot 2TiO_2 \cdot 3Sb_2O_5$	2.20
$(NH_4)_2PtCl_6$	1.8	$2AgCl \cdot 2AgBr \cdot AgI$	2.20
$3MnO \cdot Al_2O_3 \cdot 3SiO_2$	1.80	$SrSe$	2.22
$3FeO \cdot Al_2O_3 \cdot 3SiO_2$	1.801	$TlCl$	2.247
$ZnAl_2O_4$	1.805	$AgBr$	2.252
$3MnO \cdot Al_2O_3 \cdot 3SiO_2$	1.811	MgS	2.268
K_2PtCl_6	1.825±	$BaSe$	2.271
$5CaO \cdot 3Sb_2O_5$	1.83	$CaSe$	2.274
$3FeO \cdot Al_2O_3 \cdot 3SiO_2$	1.830	$ZnFe_2O_4$	2.31_{Li}
CaO	1.837	CuI	2.345
$3CaO \cdot Cr_2O_3 \cdot 3SiO_2$	1.838	ZnS*	2.3682
$MnO_2 \cdot H_2O$	1.862(?)	NiO	2.37
$3CuO \cdot CuCl_2 \cdot 3H_2O$	1.864±	$MgFe_2O_4$	2.39_{Li}
SrO	1.870	$CdFe_2O_4$	2.39_{Li}
$3CaO \cdot Fe_2O_3 \cdot 3SiO_2$	1.895	$SrTe$	2.408
LiI	1.955	C (Diamond)	2.4173
$CuCl$	1.973	$TlBr$	2.4–.8
BaO	1.98	$MgSe$	2.42+
S (Glass)	2.0–2.9	$BaTe$	2.44
SbO_2	2.0	CdO	2.49_{Li}
$Fe_2O_3 \cdot nH_2O$	2.0–2.2	$CaTe$	2.5
$HgO \cdot 2HgCl_2$	2.001	MnS_2	2.69_{Li}
$2Bi_2O_3 \cdot 3SiO_2$	2.05	MnS	2.70_{Li}
$PbO \cdot CuCl_2 \cdot H_2O$	2.05	Cu_2O	2.705
$AgCl$	2.071	$5Cu_2S \cdot 2ZnS \cdot 2Sb_2S_3$	$>2.72_{Li}$
Sb_2O_3	2.087	$5Cu_2S \cdot 2ZnS \cdot 2As_2S_3$	$>2.72_{Li}$
$10PbO \cdot 3As_2O_5 \cdot 3H_2O$	2.09(?)	TlI	2.78
SnI_4	2.106	Se (Glass)	2.92
SrS	2.107	$ZnTe$	3.56
$CuBr$	2.116	Si	3.736
P (yellow)	2.1168	PbS	3.912
CaS	2.137		

*Low temp. phase. High temp. phase is uniaxial positive.

INDEX OF REFRACTION

ANISOTROPIC GROUP—UNIAXIAL

Uniaxial crystals have two refractive indices, one of the rays vibrating parallel to the optic axis and another at right angles to this direction. The ordinary ray is indicated by the symbol ω and the extraordinary ray by the symbol ϵ. If $\epsilon > \omega$ in a uniaxial substance, the substance is optically positive; if the reverse is true, negative. Uniaxial crystals may be considered simply as a small group of biaxials in which β is equal to α for a positive crystal, and to γ for a negative one.

The greater part of the substances of this group are tetragonal or hexagonal, but some that are strictly biaxial but with nearly zero axial angle are included here as well as in their proper biaxial group. A considerable proportion of these biaxial substances with nearly uniaxial optical properties have also nearly hexagonal form.

Arrangement. The substances are listed in the order of increasing values of the ω index.

Abbreviations. Hex., hexagonal; Tetr., tetragonal; Trig., trigonal; Rhomb., rhombohedral.

UNIAXIAL POSITIVE SUBSTANCES

Substance	System	ω_D	ϵ_D
H_2O (Ice)	Hex.	1.3090	1.3104
$MgSiF_6 \cdot 6H_2O$	Trig.	1.3439	1.3602
$MnSiF_6 \cdot 6H_2O$	Trig.	1.3570	1.3742
$FeSiF_6 \cdot 6H_2O$	Rhomb.	1.3638	1.3848
MgF_2	Tetr.	1.378	1.390
$CoSiF_6 \cdot 6H_2O$	Trig.	1.3817	1.3872
$ZnSiF_6 \cdot 6H_2O$	Trig.	1.3824	1.3956
$CoF_2 \cdot 5HF \cdot 6H_2O$	Trig.	1.384	1.399
$NaCNO$	Hex.	1.389	1.627
$NiSiF_6 \cdot 6H_2O$	Trig.	1.3910	1.4066
$NiF_2 \cdot 5HF \cdot 6H_2O$	Trig.	1.392	1.408
$CaCu(C_2H_3O_2)_4 \cdot 6H_2O$	Tetr.	1.436	1.478
$Na_2SO_4 \cdot NaF$	Hex.	1.436	1.439
$Na_3PO_4 \cdot 12H_2O$	Trig.	1.4458	1.4524
CuS [a]	Hex.	1.45	......
$K_2S_2O_6$	Trig.	1.4550	1.5153
$Rb_2S_2O_6$	Trig.	1.4565	1.5068
$Na_3AsO_4 \cdot 12H_2O$	Trig.	1.4589	1.4669
$CuO \cdot SiO_2 \cdot 2H_2O$	......	1.46 ±	1.57
$Na_2B_4O_7 \cdot 5H_2O$	Rhomb.	1.461	1.474
$LiKSO_4$	Hex.	1.4715	1.4721
$UO_2(C_2H_3O_2)_2 \cdot NH_4C_2H_3O_2$	Tetr.	1.481	1.493
$(NH_2)_2CO$ (Urea)	Tetr.	1.484	1.602
$SrCa_2(C_3H_5O_2)_6$ (Propionate)	Tetr.	1.487	1.496
$2Na_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 7H_2O$	Hex.	1.490	1.502
$K_3Na(SO_4)_2$	Trig.	1.4901	1.4996
$Na_3VO_4 \cdot 12H_2O$	Trig.	1.5095	1.5232
$Na_2O \cdot Al_2O_3 \cdot 9SiO_2 \cdot 2NaF$	Hex.	1.518	1.522
$2MgO \cdot Al_2O_3 \cdot 2MgCl_2 \cdot 8H_2O$	Trig.	1.52	1.55
$LiAlSi_2O_6$ (α-Phase)	Tetr.	1.521	......
$Cs_2S_2O_6$	Trig.	1.5230	1.5438
$C_{10}H_{13}OH$ (Thymol)	Hex.	1.525	1.609
$Ca_2Pb(C_3H_5O_2)_6$ (Propionate)	Tetr.	1.527	1.539
$C_7H_{14}O_6$ [b] (β-Methylglucoside)	......	1.529	1.513

[a] Covellite.

[b] Indices indicate negative.

INDEX OF REFRACTION—UNIAXIAL POSITIVE

Substance	System	ω_D	ϵ_D
$Na_3VO_4 \cdot 10H_2O$ (Hex. phase)	Hex.	1.5398	1.5475
SiO_2 (Quartz or low temp. phase)	Hex.	1.5442	1.5533
$C_{15}H_{26}O$ (Guajol)	......	1.545	1.548
$CaSO_4 \cdot 0.5H_2O$	Hex. (?)	1.55	1.57
$CsNO_3$	Hex.	1.55	1.56
$CaCO_3$ (Least stable phase)	Hex.	1.550	1.650
$ZrOCl_2 \cdot 8H_2O$[a]	Tetr.	1.552	1.563
$3Na_2SO_4 \cdot Fe(SO_4)_3 \cdot 6H_2O$	Trig.	1.558	1.613
$MgO \cdot H_2O$	Trig.	1.559	1.580
$3Na_2O \cdot Fe_2O_3 \cdot 6SO_3 \cdot 6H_2O$	Trig.	1.559	1.627
$Al_2O_3 \cdot 2SiO_2 \cdot 4H_2O$	Tetr.	1.560	1.580
$MgPt(CN)_4 \cdot 7H_2O$	Tetr.	1.5608	1.91
$La_2(SO_4)_3 \cdot 9H_2O$	Hex.	1.564	1.569
$MgO \cdot B_2O_3 \cdot 3H_2O$	Tetr.	1.565	1.575
$CH_3OC_6H_4OH$ (Guaiacol)	Hex.	1.569	1.666
$CaO \cdot 2CeOF \cdot 3CO_2$	Trig.	1.5690	1.6700
$K_2O \cdot 3Al_2O_3 \cdot 4SO_3 \cdot 6H_2O$	Trig.	1.572	1.592
$2Fe_2O_3 \cdot P_2O_5 \cdot 12H_2O$	Hex.	1.582	1.645
$Al_2O_3 \cdot 2SO_3$	Trig.	1.583	1.602
$MgCl_2 \cdot SnCl_4 \cdot 6H_2O$	Trig.	1.5885	1.5970
$FeCl_2 \cdot 3KCl \cdot NaCl$	Trig.	1.589	1.590
$4KCl \cdot MnCl_2$	Trig.	1.59	......
$C_6H_{15}SP$ (Triethyl phosphinesulfide)	......	1.590	1.650
$4KCl \cdot CdCl_2$	Trig.	1.5906	1.5907
Li_2SiO_3	Trig.	1.591	1.611
$SrSiO_3$	Hex.	1.599	1.637
$C_{12}H_{11}O_2NS$ (Benzenesulfanilide)	......	1.600	1.649
$CaNCN$	Rhomb.	1.60	1.59
K_2CaSiO_4	Hex.	1.600	1.605
$CdCl_2 \cdot 4NH_4Cl$	Trig.	1.6038	1.6042
$Na_5Fe(SiO_3)_4$	Hex.	1.609	1.625
$CaSiO_3$	Hex.	1.6150	1.6360
$3CaO \cdot 5Al_2O_3$	Tetr. (?)	1.617	1.652
KIO_4	Tetr.	1.6205	1.6479
$CuO \cdot UO_3 \cdot P_2O_5 \cdot 8H_2O$	Tetr.	1.623	1.625
$KAg(CN)_2$	Trig.	1.625	1.63
$2SrO \cdot 3Al_2O_3 \cdot 2P_2O_5 \cdot 7H_2O$	Trig.	1.629	1.639
$2CaO \cdot MgO \cdot 2SiO_2$	Tetr.	1.631	1.638
$PbS_2O_6 \cdot 4H_2O$	Trig.	1.6351	1.6531
K_2PtCl_4	Tetr.	1.64	1.67
$(NH_4)_3PdCl_3SO_3 \cdot H_2O$	Trig.	1.643	......
$KReO_4$	Tetr.	1.643	1.673
$CuO \cdot SiO_2 \cdot H_2O$	Trig.	1.644	1.697
$Sr_5Cl(PO_4)_3$	Hex.	1.650	1.655
Be_2SiO_4	Trig.	1.654	1.668
$2PbO \cdot 3Al_2O_3 \cdot 2P_2O_5 \cdot 7H_2O$	Hex.	1.654	1.676
$4NH_3 \cdot IrCl_3 \cdot H_2O$	Trig.	1.6576	1.6666
$Sr_5Cl(PO_4)_3$	Hex.	1.658	1.664
$C_6H_5COCOC_6H_5$ (Benzil)	Rhomb.	1.6588	1.6784
$4CaO \cdot B_2O_3 \cdot As_2O_5 \cdot 4H_2O$	Tetr.	1.662	1.663
$3Al_2O_3 \cdot Ce_2O_3 \cdot 2P_2O_5 \cdot 6H_2O$	Trig.	1.680 ±	1.685
$AgCN$	......	1.685 ±	1.94
$ZnCl_2$	......	1.687	1.713
$2ZnO \cdot SiO_2$[b]	Trig.	1.691	1.719
$CeOF \cdot CO_2$	Hex.	1.717	1.817

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[a] Int. Crit. Tab. gives —, with ω1.563 and ϵ1.552

[b] Int. Crit. Tab. gives 1.694 and 1.723

INDEX OF REFRACTION—UNIAXIAL POSITIVE

Substance	System	ω_D	ϵ_D
BeO	Hex.	1.719	1.733
$Y_2O_3 \cdot P_2O_5$	Tetr.	1.721	1.816
$20CuO \cdot SO_3 \cdot 2CuCl_2 \cdot 20H_2O$	Hex.	1.724	1.746
$K_3Na(CrO_4)_2$	Trig.	1.7278	1.7361
$20CuO \cdot Bi_2O_3 \cdot 5As_2O_5 \cdot 22H_2O$	......	1.730	1.810
$2Fe_2O_3 \cdot PbO \cdot 3SO_3 \cdot 4H_2O$	Hex.	1.755	1.82
$BaO \cdot TiO_2 \cdot 3SiO_2$	Hex.	1.757	1.804
$4(NH_4)_2O \cdot Mn_2O_3 \cdot 13MoO_3 \cdot 9H_2O$	Rhomb.	1.757	1.819
SeO_2	......	>1.76	......
$Tl_2(d-C_4H_4O_6)$	Trig.	1.768	1.812
$AgBrO_3$	Tetr.	1.8466	1.920
$4CaO \cdot 5PbO \cdot PbCl_2 \cdot 6SiO_2$	Hex.	1.945	1.971
$5MnO \cdot SiO_2 \cdot As_2O_3 \cdot H_2O$	Hex.	1.96	......
$CaWO_4$	Tetr.	1.9200	1.9365
$ZrO_2 \cdot SiO_2$	Tetr.	1.936	1.991
Hg_2Cl_2	Tetr.	1.9733	2.6559
$CaMoO_4$	Tetr.	1.974	1.984
SnO_2 (Most stable phase; cassiterite)	Tetr.	1.9968	2.0929
ZnO	Hex.	2.004	2.020
$Y_2(MoO_4)_3$	Tetr.	2.03	......
$PbO \cdot PbCl_2 \cdot CO_2$	Tetr.	2.114	2.140
$PbO \cdot 2PbCl_2$	Hex.	2.13	2.21
AgI	Hex.	2.218	2.229
ZnS (α; high temp. phase)	Hex.	2.356	2.378
Cr_2O_3	Rhomb.	2.5 ±	......
CdS	Hex.	2.506	2.529
HgS (Metastable phase)	Trig.	2.58	2.82
TiO_2	Tetr.	2.616	2.903
SiC	Trig.	2.654	2.697
Al_4C_3	Hex.	2.70*	2.75*
HgS (Stable phase; cinnabar)	Hex.	2.854	3.201
Se	Trig.	3.00	4.04

* At 700mμ

UNIAXIAL NEGATIVE SUBSTANCES

Substance	System	ω_D	ϵ_D
Na_2SiF_6	Hex.	1.312	1.309
$2NaF \cdot AlF_3$	Tetr.	1.349	1.342
$(NH_4)_2SiF_6$*	Hex.	1.406	1.391
$CuSiF_6 \cdot 6H_2O$	Trig.	1.4092	1.4080
$CaCl_2 \cdot 6H_2O$	Trig.	1.417	1.393
$KAl(SO_4)_2 \cdot 12H_2O$	Hex. (?)	1.456	1.429
$3CaO \cdot Al_2O_3 \cdot 3CaSO_4 \cdot 31H_2O$	Hex.	1.464	1.458
$(NH_4)_3ScF_6$	Tetr.	<1.47	......
$BeSO_4 \cdot 4H_2O$	Tetr.	1.4720	1.4395
$LiKSO_4$	Hex.	1.4723	1.4717
$BeO \cdot Be(C_2H_5SO_4)_2 \cdot 4H_2O$	Tetr.	1.473	1.435
K_2TiF_6	Trig.	1.475	......
$11Na_2O \cdot 9SO_3 \cdot 2CO_2 \cdot KCl$	Hex.	1.481	1.461
$La(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.482	1.473
$Ce(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.482	1.474
$Pr(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.486	1.479

*Formed by evaporation at 5°C.

INDEX OF REFRACTION—UNIAXIAL NEGATIVE

Substance	System	ω_D	ϵ_D
$Nd(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.487	1.479
SiO_2 (β-Cristobalite)	Tetr.	1.487	1.484
$6CaO \cdot Al_2O_3 \cdot 3SO_3 \cdot 33H_2O$	Hex.	1.488	1.474
$Er(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.490	1.480
$Sm(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.490	1.481
$Gd(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.490	1.482
$Na_2SO_4 \cdot MgSO_4 \cdot 2.5H_2O$	Tetr.	1.490	1.471
$Y(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.493	1.480
$Eu(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.494	1.484
$Dy(C_2H_5SO_4)_6 \cdot 18H_2O$	Hex.	1.495	1.480
$(NH_4)_3UO_2F_5$	Tetr.	1.495	1.490
$CoSO_4 \cdot 6H_2O$	Tetr.	1.495	1.460
$CaO \cdot Al_2O_3 \cdot 3SiO_2 \cdot 5H_2O$	Trig.	1.496	1.491
$C_{10}H_{20}O$ (*l*-α-Menthol)	......	1.497	1.476
$C_3H_{12}O_3N_6$ (Guanidine carbonate)	Tetr.	1.496	1.486
$Sr(OH)_2 \cdot 8H_2O$	Tetr.	1.499	1.476
$3CaO \cdot Al_2O_3 \cdot CaSO_4 \cdot 12H_2O$	Hex.	1.504	1.488
$3CaO \cdot CO_2 \cdot SO_3 \cdot SiO_2 \cdot 15H_2O$	Hex.	1.507	1.468
$2MgO \cdot MgF_2 \cdot 3CaF_2$	Hex.	1.509	1.486
KH_2PO_4	Tetr.	1.5095	1.4684
$NiSO_4 \cdot 6H_2O$	Tetr.	1.5109	1.4873
$6MgO \cdot Al_2O_3 \cdot CO_2 \cdot 12H_2O$	Hex.	1.512	1.498
$CaCl_2 \cdot 2MgCl_2 \cdot 12H_2O$	Trig.	1.520	1.512
$K_3Cu(CN)_4$	Trig.	1.5215	......
$Mg_2Al_4Si_5O_{18}$[a] (α-phase)	......	1.522	1.519
$3Mg(NO_3)_2 \cdot 2La(NO_3)_3 \cdot 24H_2O$	Trig.	1.5220	1.5150
$NH_4H_2PO_4$	Tetr.	1.5246	1.4792
$3Mg(NO_3)_2 \cdot 2Ce(NO_3)_3 \cdot 24H_2O$	Trig.	1.5249	1.5176
$3Mg(NO_3)_2 \cdot 2Pr(NO_3)_3 \cdot 24H_2O$	Trig.	1.5255	1.5182
$3Mg(NO_3)_2 \cdot 2Nd(NO_3)_3 \cdot 24H_2O$	Trig.	1.5266	1.5192
$Ca_3Al_2O_6 \cdot 12H_2O$	Hex.	1.527	1.505
$Mg_2Al_4Si_5O_{18}$[a] (α-phase)	......	1.528	1.524
$3CaO \cdot Al_2O_3 \cdot CaSO_4 \cdot 6H_2O$	Hex. (?)	1.529–35	1.510–27
$ZnSeO_4 \cdot 6H_2O$	Tetr.	1.5291	1.5039
$SrS_2O_6 \cdot 4H_2O$	Trig.	1.5296	1.5252
$(C_2H_4O)_4$ (Metaldehyde)	Tetr.	1.530	1.430
$RbAlSiO_4$	Hex.	1.530	1.526
$K_2CO_3 \cdot CaCO_3$	Hex.	1.530	1.48 ±
$LiAlSiO_4$	Hex.	1.531	......
$K_2O \cdot 4CaO \cdot 2Al_2O_3 \cdot 24SiO_2 \cdot H_2O$	Hex.	1.532	1.529
$KAlSiO_4$ (β-phase)	Hex.	1.532	1.527
$Ba(ClO_4)_2 \cdot 3H_2O$	Hex.	1.5330	1.5323
$6ZnO \cdot 3Al_2O_3 \cdot 2SO_3 \cdot 18H_2O$	Hex.	1.534	1.514
$SrCl_2 \cdot 6H_2O$	Rhomb.	1.5364	1.4866
$K_2O \cdot 8CaO \cdot 16SiO_2 \cdot 16H_2O$	Tetr.	1.537	1.535
$NaAlSiO_4$ (β-phase or low temp. phase)	Hex.	1.537	1.533
$Ca_3Al_2O_6 \cdot 8H_2O$	Hex.	1.538	1.520
$NaLiCO_3$	Hex.	1.538	1.406
$Al_2O_3 \cdot C_{12}O_9 \cdot 18H_2O$ (Mellite)	Tetr.	1.539	1.511
$ZnCl_2 \cdot 6NH_3$	Hex.	1.539	1.530 (?)
$NiSeO_4 \cdot 6H_2O$	Tetr.	1.5393	1.5125
CH_3CONH_2 (Acetamide)*	Hex.	1.54	1.46
$6MgO \cdot Fe_2O_3 \cdot CO_2 \cdot 12H_2O$	Hex.	1.540	1.510
$Na_2O \cdot Al_2O_3 \cdot 2SiO_2$	Hex.	1.542	1.538
$6MgO \cdot Cr_2O_3 \cdot CO_2 \cdot 12H_2O$	Hex.	1.542	1.516

[a] Stable >925 to 1150°C.

*Stable modification.

INDEX OF REFRACTION—UNIAXIAL NEGATIVE

Substance	System	ω_D	ϵ_D
$Li_2O \cdot Al_2O_3 \cdot 2SiO_2$	Hex.	1.545	......
$(CH_2OHCHOH)_2$ (*dl*-Erythritol)	Tetr.	1.544	1.521
$K_2SO_4 \cdot Al_2(SO_4)_3$	Hex.	1.545	1.533 ±
$Na_2CO_3 \cdot CaCO_3$	Hex.	1.547	1.504
$K_8CaSi_{10}O_{25}$	Hex.	1.548	1.537
$CaS_2O_5 \cdot 4H_2O$	Trig.	1.5496	1.54 ±
$3NaAlSiO_4 \cdot CaCO_3$	Hex.	1.550	1.519
$Co(ClO_4)_2 \cdot 6H_2O$	Hex.	1.55 ±	......
$Ni(ClO_4)_2 \cdot 6H_2O$	Hex.	1.55 ±	......
$3NaAlSiO_4 \cdot CaCO_3$	Hex.	1.550	1.519
$3CaO \cdot Al_2O_3 \cdot CaCl_2 \cdot 10H_2O$	Hex.	1.550	1.535
$CaS_2O_6 \cdot 4H_2O$	Trig.	1.5516	1.5414
$C_4H_8O_2Cl_2$ (Dichlorobutylene glycol)	......	1.554	1.515
$HfOCl_2 \cdot 8H_2O$	......	1.557	1.543
$C_5H_{12}O_4$ (Pentaerythritol)	Tetr.	1.559	1.548
$AlCl_3 \cdot 6H_2O$	Trig.	1.560	1.507
$4AlCl_3 \cdot 3Al_2O_3 \cdot 3SO_3 \cdot 36H_2O$	Trig.	1.560	1.495
$ZrOCl_2 \cdot 8H_2O^a$	Tetr.	1.563	1.552
Na_2SO_3	Hex.	1.565	1.515
$3CaO \cdot CaF_2 \cdot 3SiO_2 \cdot 2H_2O$	Trig.	1.565	1.560
$FeCl_2$	Hex.	1.567	......
KH_2AsO_4	Tetr.	1.5674	1.5179
$Ca(OH)_2$	Hex.	1.574	1.545
$3MnO \cdot 4SiO_2 \cdot 4H_2O$	Hex.	1.576	1.546
$NH_4H_2AsO_4$	Tetr.	1.5766	1.5217
$C_{34}H_{50}O_2$ (Cholesterol benzoate)	......	1.579	1.540
$NaH(UO_2)_2P_2O_8 \cdot 7.3H_2O$	......	1.580 ±	......
$3BeO \cdot Al_2O_3 \cdot 6SiO_2$	Hex.	1.580	1.574
$C_{11}H_{11}ON_2Br$ (4-Bromoantipyrine)	......	1.581	1.493
$NaNO_3$	Trig.	1.5874	1.3361
$2NiO_2 \cdot 3SiO_2 \cdot 2H_2O$	Hex.	1.59 ±	1.56
$K_2CO_3 \cdot MgCO_3$	Hex.	1.597	1.47
$Cu(UO_2)_2P_2O_8 \cdot 8 \pm H_2O$	Tetr. (?)	1.598	1.586
$Ca(UO_2)_2P_2O_8 \cdot 7H_2O$	Tetr.	1.600	1.590
$6CaO \cdot Al_2O_3 \cdot 2P_2O_5 \cdot 5H_2O$	Hex. (?)	1.601	1.591
$Cu(UO_2)_2P_2O_8 \cdot 6H_2O$	Tetr. (?)	1.608	......
$PtCl_2 \cdot 4NH_3 \cdot nH_2O$	Tetr.	1.612	1.607
$2CaO \cdot 2BeO \cdot 3SiO_2 \cdot NaF$	Tetr.	1.612	1.593
(Ce, La, Di) F_3	Hex.	1.613	1.607
$Ba(UO_2)_2P_2O_8 \cdot 6H_2O$	Tetr. (?)	1.613	1.604
$(NH_4)_4Fe(CN)_6 \cdot 2NH_4Cl \cdot 3H_2O$	Trig.	1.6198	1.5922
$7CaO \cdot 2P_2O_5 \cdot CO_2 \cdot 0.5H_2O$	Hex.	1.620 ±	1.609
$Sr_5F(PO_4)_3$	Hex.	1.621	1.619
$BaO \cdot FeO \cdot 4SiO_2$	Tetr.	1.621	1.619
$Na_2O \cdot 3CaO \cdot P_2O_5{}^b$	Hex. (?)	1.623	1.620
$3UO_3 \cdot As_2O_5 \cdot 12H_2O$	Tetr. (?)	1.627	1.582
$8MnO \cdot 7SiO_2 \cdot 5H_2O$	....	1.632	1.602
$Ca_5F(PO_4)_3$	Hex.	1.6325	1.629 ±
$C_6H_4(OH)_2$ (Hydroquinone)	Hex.	1.633	1.626
$10CaO \cdot 3P_2O_5$	Hex.	1.633	1.629
$3Ca_3P_2O_8 \cdot CaCO_3$	Hex.	1.635	1.626
$CaCuSi_4O_{10}$	Tetr.	1.6354	1.6053
$2KCl \cdot CuCl_2 \cdot 2H_2O^c$	Tetr.	1.637	1.615
$CaO \cdot CaCl_2$	Hex.	1.638	1.634
$BaF_2 \cdot BaCl_2$	Tetr.	1.640	1.633

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[a] Winchell gives this + with ϵ1.563 and ω1.552

[b] Found only in meteorites.

[c] Some specimens are orthorhombic and biaxial.

INDEX OF REFRACTION—UNIAXIAL NEGATIVE

Substance	System	ω_D	ϵ_D
$Al_2O_3 \cdot B_2O_3$	Hex.	1.640	......
$Ca_5ClP_3O_{12}$	Hex.	1.642	1.637
$CuO \cdot 2UO_3 \cdot As_2O_5 \cdot 8H_2O$ (?)	Tetr.	1.643	1.623
$3Sr_3P_2O_8 \cdot SrCO_3$	Hex.	1.644	1.638
$Hg(CN)_2$	Tetr.	1.645	1.492
$C_6H_5CNBrCN$ (Bromobenzylcyanide)	....	1.646	1.642
$2KCl \cdot CuCl_2$	Tetr.	1.647	1.612
$10MgO \cdot 6B_2O_3 \cdot 3H_2O$	....	1.650	1.575
$SrCl_2 \cdot SrF_2$	Tetr.	1.651	1.627
$Fe_2O_3 \cdot P_2O_5 \cdot 6H_2O$	....	1.655	1.645
$CaCO_3$[a] (Calcite)	Trig.	1.6585	1.4864
Al_2O_3	Hex.	1.67-8	1.63-5
$PtCl_2 \cdot 2NH_3 \cdot 4(PtCl_2 \cdot 4NH_3)$	Tetr.	1.666	1.658
$Ca_5ClP_3O_{12}$	Hex.	1.6668	1.666 ±
$BaF_2 \cdot 3Ba_3P_2O_8$	Hex.	1.669	1.665
$Ca_2Al_2SiO_7$	Tetr.	1.669	1.658
$(NH_4)_2CuCl_4 \cdot 2H_2O$	Tetr.	1.670	1.645
$Ca_2FeSi_2O_7$	Tetr.	1.670	1.658
$MgCl_2$	Hex.	1.675	1.59
$4(NH_4)_2S_2O_8 \cdot AgBr \cdot NH_4Br$	Tetr.	1.6769	1.6294
$V_2O_4 \cdot CaO \cdot P_2O_5 \cdot 5H_2O$[b]	Tetr.	1.680	1.655
$BaO \cdot 2CaO \cdot 3SiO_2$	Hex. (?)	1.681	1.668
$CaO \cdot MgO \cdot 2CO_2$	Trig.	1.681	1.500
$3Ba_3P_2O_8 \cdot BaCO_3$	Hex.	1.691	1.683
$AlClO \cdot 6CuO \cdot 9H_2O$	Trig.	1.694	1.641
$C_6H_{12}O_4N_2S_2$ (*l*-Cystine)	Hex.	1.700	1.640
$MgCO_3$	Trig.	1.700	1.509
$Ba_5ClP_3O_{12}$	Hex.	1.701	1.699
$12MnO \cdot 9SiO_2 \cdot As_2O_3 \cdot 7H_2O$	Hex. (?)	1.704	1.679
$9CaO \cdot 3As_2O_5 \cdot CaF_2$	Hex.	1.706	1.698
$Na_4Zr_2Si_3O_{12}$	Trig.	1.715	1.692
$C_6H_5COC_6H_4CH_3$ (Phenyl *p*-tolylketone)	....	1.717	1.563
$MnO \cdot H_2O$	Trig.	1.723	1.681
Ca-Al-silicate[c]	....	1.730	1.726
$LiNO_3$	Trig.	1.735	1.435
$CuCl_2 \cdot 2NH_4Cl \cdot 2H_2O$	Tetr.	1.744	1.724
$Ce_2O_3 \cdot 3CO_2 \cdot BaF_2$	Hex.	1.760	1.577
Al_2O_3	Trig.	1.768	1.760
$Fe_2(SO_4)_3$ (Stable >130°C.)	Rhomb.	1.770	1.760
$Na_2O \cdot 2Al_2O_3 \cdot Sb_2O_5$	Hex.	1.772	1.770
$BaAg_2Cs_3(NCS)_7$	Tetr.	1.7761	1.6788
$Cs_3Tl_2Cl_9$	Hex.	1.784	1.774
$K_2PtI_2(NO_2)_2 \cdot 2H_2O$	Tetr.	1.7909	1.6527
$7(Fe,Mg)O \cdot 3Fe_2O_3 \cdot 4SiO_2 \cdot 8H_2O$	Trig. (?)	1.80	......
$Fe_2O_3 \cdot WO_3 \cdot 6H_2O$	Hex.	1.80	1.72
CHI_3 (Iodoform)	Hex.	1.800	1.750
$BaCu_2Cs_3(NCS)_7$	Tetr.	1.8013	1.6882
Ag_2HPO_4	Trig.	1.8036	1.7983
$2(Pb,Mg)O \cdot 3Fe_2O_3 \cdot 4SiO_2 \cdot 8H_2O$	Hex.	1.815	1.761
$3Fe_2O_3 \cdot 4SO_3 \cdot 9H_2O$	Rhomb.	1.816	1.728
$MnCO_3$	Trig.	1.817	1.597
$ZnCO_3$	Trig.	1.818	1.618
$K_2O \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O$	Trig.	1.820	1.715
$NaYSiO_4$	Hex.	1.832	1.804
$Na_2O \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O$	Trig.	1.832	1.750

[a] Most stable, low temp. phase.

[b] Alters to a biaxial hydrate.

[c] As found in Portland cement clinker.

INDEX OF REFRACTION—UNIAXIAL NEGATIVE

Substance	System	ω_D	ϵ_D
$CuO\cdot PbO\cdot Fe_2O_3\cdot 2SO_3\cdot 4H_2O$	Hex.	1.85	......
$SrCu_2Cs_3(NCS)_7$	Tetr.	1.8535	1.6982
$CoCO_3$	Hex.	1.855	1.60
$NaLaSiO_4$	Hex.	1.867	1.840
$KLaSiO_4$	Hex.	1.867	1.840
$6CaO\cdot 4Fe_2O_3\cdot 3As_2O_5\cdot 9H_2O$ (?)*	......	1.870	1.792
$6CaO\cdot 3Fe_2O_3\cdot 2As_2O_5\cdot 9H_2O$	Hex.	1.87	1.85
$LiLaSiO_4$	Hex.	1.870	1.843
$FeCO_3$	Trig.	1.875	1.633
$PbO\cdot 3Fe_2O_3\cdot 4SO_3\cdot 6H_2O$	Trig.	1.875	1.784
$CaLa_2Si_2O_8$	Hex.	1.880	1.874
$NaPrSiO_4$	Hex.	1.889	1.861
$NaNdSiO_4$	Hex.	1.889	1.861
$NaSmSiO_4$	Hex.	1.898	1.867
$Ag_2O\cdot 3Fe_2O_3\cdot 4SO_3\cdot 6H_2O$	Hex.	1.898	1.815
$CaNd_2Si_2O_8$	Hex.	1.903	1.897
$2PbO\cdot 3Fe_2O_3\cdot P_2O_5\cdot 2SO_3\cdot 6H_2O$	Trig.	1.93	......
$Pb_3(PO_4)_2$	Hex.	1.9702	1.9364
C (Graphite)	Trig.	2.0 ±	......
$Pr_2(MoO_4)_3$	Tetr.	2.006 ±	......
$3MnO\cdot As_2O_3$	Trig.	2.01	1.99
$Bi_2O_3\cdot 3H_2O$ (?)	Hex.	2.01	1.82
$Nd_2(MoO_4)_3$	Tetr.	2.023	2.021
$5PbCl_2\cdot 4CuO\cdot 6H_2O$	Tetr.	2.03	2.00
$Ce_2(MoO_4)_3$ (Stable >900°C.)	Tetr.	2.04	2.028
$4PbCl_2\cdot 4CuO\cdot 5H_2O$	Tetr.	2.041	1.926
$9PbCl_2\cdot 8CuO\cdot 3AgCl\cdot 9H_2O$	Tetr.	2.05	2.03
$3PbO\cdot 2SiO_2$	Trig.	2.07	2.05
$Pb_3(OH)_2(CO_3)_2$ (White lead pigment)	Hex.	2.09	1.94
$Bi_2O_3\cdot CO_2$	......	2.13	1.94
$H_2K_2TeI_2O_{10}\cdot 2H_2O$	Trig.	2.142	2.030
$9PbO\cdot 3As_2O_5\cdot PbCl_2$	Hex.	2.16	2.13
PbO_2	Tetr.	2.229	......
$2ZnO\cdot 2Mn_2O_3\cdot H_2O$	Tetr.	2.26 ±	2.10
$PbO\cdot WO_3$	Tetr.	2.269	2.182
$9PbO\cdot 3As_2O_3\cdot PbCl_2$	Hex.	2.295	2.285
$(Mg,Fe)O\cdot TiO_2$	Trig.	2.31	1.95
$ZnO\cdot Mn_2O_3$	Tetr.	2.34	2.14
$9PbO\cdot 3V_2O_5\cdot PbCl_2$	Hex.	2.354	2.299
$PbO\cdot MoO_3$	Tetr.	2.40	2.28
Mn_3O_4	Tetr.	2.46Li	2.15Li
$MnO\cdot TiO_2$	Trig.	2.481	2.210
TiO_2	Tetr.	2.554	2.493
$CaO\cdot Fe_2O_3$	......	2.58	2.43
AsI_3	Trig.	2.59 ±	2.23 ±
$AgAsS_2$ (Low temp. phase)	Trig.	2.6Li	......
PbO	Tetr.	2.665	2.535
HgI_2	Tetr.	2.748	2.455
SbI_3 (Low temp. phase)	Trig.	2.78 ± Li	2.36 ± Li
$3Ag_2S\cdot As_2S_3$	Trig.	3.088	2.792
Fe_2O_3	Hex.	3.22	2.94

*Int. Crit. Tab. gives $3CaO\cdot 2Fe_2O_3\cdot 2As_2O_5\cdot 6H_2O$

INDEX OF REFRACTION

ANISOTROPIC GROUP—BIAXIAL

Biaxial crystals have three refractive indices, two lying in one plane and the third in another plane of the particle. These indices are indicated by α, β, γ for the least, intermediate and the greatest index respectively of the substance. If $\gamma-\beta>\beta-\alpha$ the crystal is optically positive; if the reverse is true, negative. The indices α, β, γ have directions of vibration X, Y, Z respectively. The greater part of the substances of this group are chiefly orthorhombic, monoclinic or triclinic.

Arrangement. The substances are listed in the order of increasing values of the β index.

Abbreviations. Ax. pl., axial plane; a, front and rear crystal axis; b, right and left crystal axis; c, vertical crystal axis; Lg., large; Mon., monoclinic; Mod., moderate; Ortho., orthorhombic; r, red light; $r>v$ (or $r<v$) signifies that the optic axial angle in red light is greater than (or less than) the optic axial angle in violet light; Sm., small; Tric., triclinic; $2V$, the true axial angle between the optic axes; X, Y, and Z, the vibration directions of the fastest, the intermediate, and the slowest ray respectively; $\wedge$, angle, for example $Z\wedge c$ is the angle between Z and c; 100, 010, 110, etc., the Miller symbols of crystal faces and forms; =, to indicate parallel, for example $X=a$ signifies X parallel to a; $\perp$, perpendicular. In monoclinic crystals the extinction angle is commonly measured from the vertical axis c to X, Y, or Z; if this angle lies in the obtuse angle β it is considered positive (+), but if this angle is in the acute angle β between a and c, it is negative (−).

BIAXIAL POSITIVE SUBSTANCES

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$NaF \cdot AlF_3$	Mon.	......	1.339	......	$2V=43°$ $r<v$	Ax. pl. $\perp 010$; $Z\wedge c=-43°54'$
$KF \cdot 2H_2O$	Mon. (?)	1.345 ±	1.352	1.363 ±	$2V=$ Lg.	....
$KH_2Mg_2B_{11}O_{20} \cdot 6H_2O$ (?)	Mon.	......	1.354	......	....	Ax. pl. $\perp 010$; $Z\wedge c=64°45'$
$NaF \cdot CaF_2 \cdot AlF_3 \cdot H_2O$	Mon.	1.411	1.413	1.420	$2V=76°$ $r<v$ weak	$X=b$; $Z\wedge c=69°$
$NaH_2PO_3 \cdot 2.5H_2O$	Mon.	1.4193	1.4309	1.4493	$2V=77°38'$ $r<v$ weak	Ax. pl. 010; $Z\wedge c=-54°33'$
NH_4LiSO_4	Orth.	......	1.437 Li	......	$2V=37°$ ±	Ax. pl. 010; $Z=b$
$(Ca,K_2,Na_2)O \cdot Al_2O_3 \cdot 6SiO_2 \cdot 6H_2O$	Orth.	1.438	1.44	1.452	....	....

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$Na_2O \cdot (NH_4)_2O \cdot P_2O_5 \cdot 9H_2O$	Mon. (?)	1.439	1.441	1.469	2V = 36° r > v strong	Z = *b*; Y ∧ *c* = 30°
$NH_4NaHPO_4 \cdot 4H_2O$	Mon.	1.439	1.442	1.469	2V = 35°34′ r > v strong	Ax. pl. nearly ⊥ 010; Z nearly ⊥ 001
$Na_2HPO_4 \cdot 7H_2O$	Mon.	1.4412	1.4424	1.4526	2V = 38°50′ r > v	Ax. pl. ⊥ 010; Z ∧ *c* = −72°
$Na_2HPO_4 \cdot 5H_2O$	Orth.	......	1.4434	......	2V = 44°7′	Ax. pl. 001; Z = *a*
$Na_2CrO_4 \cdot 4H_2O$	Mon.	1.321	1.447	1.561	....	Ax. pl.*; X ∧ elong. = 10°
$5K_2O \cdot (NH_4)_2O \cdot 6SO_3$	....	1.447	1.448	1.459	2V = 36° r > v strong	....
$NH_4B_5O_8 \cdot 4H_2O$	Orth.	1.44	1.45 ±	1.485	2V = 32°	Ax. pl. 010; Z = *b*
$Na_4P_2O_7 \cdot 10H_2O$	Mon.	1.4499	1.4525	1.4604	2V = 60°29′	Ax. pl. ⊥ 010; Z ⊥ 101
$Na_2SiO_3 \cdot 5H_2O$	Tric.	1.447 ±	1.454 ±	1.467 ±	2V = Mod.	....
$Na_2SiO_3 \cdot 9H_2O$	Orth.	1.451	1.455 ±	1.460	2V = 90° ±	Ax. pl. 010; Z = *c*
$NaClO_4$	Orth.	1.4606	1.4617	1.4730	2V = Sm.	....
$K_2SO_4 \cdot MgSO_4 \cdot 6H_2O$	Mon.	1.4607	1.4629	1.4755	2V = 47°54′ r > v weak	Ax. pl. 010; Z ∧ *c* = 103°38′ Z ∧ *a* = 1°10′
$Al_2O_3 \cdot SO_3 \cdot 9H_2O$	Mon	1.459	1.464	1.470	2V = Lg.	X = elong.
K_2ZrF_6	Mon.	1.454	1.465	1.498	2V = 60°	Ax. pl. ⊥ 010; Z ∧ *c* = 45°
$Na_2HAsO_4 \cdot 7H_2O$	Mon.	1.4622	1.4658	1.4782	2V = 57°7′ r > v weak	Ax. pl. ⊥ 010; Z ∧ *c* = −65°
$NH_4NaHAsO_4 \cdot 4H_2O$	Mon.	1.4649	1.4663	1.4791	2V = 38°	Ax. pl. 010; Z ∧ *c* = 18°
$K_2S_2O_8$	Tric.	1.4609	1.4669	1.5657	2V = 29°32′	....
$Rb_2Mg(SO_4)_2 \cdot 6H_2O$	Mon.	1.4672	1.4689	1.4779	2V = 48°46′ r > v	Ax. pl. 010; Z ∧ *c* = −68°46′; Z ∧ *a* = 5°15′
SiO_2 (Tridymite)**	Orth.	1.469	1.469	1.473	2V = 35°	Ax. pl. 100 below 117°C.
$Na_2CO_3 \cdot 2Na_2SO_4$	Orth.	1.463	1.469	1.480	2V = Mod.	Ax. pl. 001; X = *a*
$MgCO_3 \cdot 5H_2O$	Mon.	1.457	1.470	1.508	2V = 60°37′	Ax. pl. ⊥ 010; Z ∧ *c* = Sm.
$RbClO_4$	Orth.	1.4692	1.4701	1.4731	2V = 55°4′ r > v weak	Ax. pl. 100; Z = *b*

*010 for $\lambda < 645 m\mu$; ⊥010 for $\lambda > 645 m\mu$; uniaxial + for $\lambda = 645 m\mu$.
**Stable between 870° and 1470°C.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$Na_2SiO_3 \cdot 6H_2O$	Mon.	1.465	1.473	1.485	2V = 75° ±	Ax. pl. ⊥010; Z ⊥010; $X \wedge c = 22^\circ$
$RbHSO_4$	Orth.	......	1.473	......	2V = 55°52′ r < v weak	Ax. pl. 010; $X = c$
NH_4HSO_4	Orth.	1.463	1.473	1.510	2V = 60° ±	Ax. pl. 010; $Z = c$
$(NH_4)_2SO_4 \cdot MgSO_4 \cdot 6H_2O$	Mon.	1.4716	1.4730	1.4786	2V = 51°11′ r > v weak	Ax. pl. 010; $Z \wedge c = 94^\circ 58'$; $Z \wedge a = 12^\circ 8'$
$KClO_4$	Orth.	1.4731	1.4737	1.4769	2V = 49°48′ r > v	Ax. pl. 100; $Z = b$
$KCl \cdot MgCl_2 \cdot 6H_2O$	Orth.	1.467	1.474	1.496	2V = 70° r < v	$Z = a$; $X = c$
$Al_2(SO_4)_3 \cdot 16H_2O$*	Mon.	1.474	1.476	1.483	2V = 69°	$X = b$; $Z \wedge c = 42^\circ$
Na_2SO_4	Orth.	1.471	1.477	1.484	2V = 83°35′ r > v weak	Ax. pl. 001; $Z = a$; $X = b$; $Y = c$
$FeSO_4 \cdot 7H_2O$	Mon.	1.4713	1.4782	1.4856	2V = 85°27′ r > v weak	Ax. pl. 010; $Z \wedge c = -62^\circ 28'$; $Y = b$
$(Zn, Fe)SO_4 \cdot 7H_2O$**	Orth. (?)	1.4709	1.4785	1.4867	2V = 78°48′	....
$K_2Si_4O_9$	Mon. (?)	1.477	1.479	1.482	2V = Lg.	....
$(Fe, Cu)SO_4 \cdot 7H_2O$	Mon.	1.472	1.479	1.487	2V = Lg. weak	Ax. pl. 010; $X \wedge c = 22^\circ$; $Y = b$
$CuSO_4 \cdot 7H_2O$ (Unstable)	Mon.	1.47	1.48	1.49	....	Ax. pl. 010; Z near a; $Y = b$; X near c
$5MgO \cdot Al_2O_3 \cdot 6SiO_2 \cdot 4H_2O$	....	1.480	1.48 [a]	1.507	2V = Sm.	Z = elong.
$KHSO_4$	Mon. (?)	1.475	1.480	1.487	2V = Lg.	$Z \wedge$ elong. = 33°
$Rb_2SO_4 \cdot MnSO_4 \cdot 6H_2O$	Mon.	1.4767	1.4807	1.4907	2V = 67°5′ r > v weak	Ax. pl. 010; $Z \wedge c = -73^\circ 3'$
$K_2Fe(SO_4)_2 \cdot 6H_2O$	Mon.	1.4759	1.4821	1.4969	2V = 67°7′ r < v weak	Ax. pl. 010; $Z \wedge c = 101^\circ 57'$; $Z \wedge a = 2^\circ 35'$
$Na_4P_2O_6 \cdot 10H_2O$	Mon.	1.4777	1.4822	1.5036	2V = 48°56′ r > v weak	Ax. pl. 010; $Z \wedge c = -39^\circ 30'$
NH_4ClO_4	Orth.	1.4818	1.4833	1.4881	2V = 69°54′ r > v	Ax. pl. 001; $Z = b$

*Int. Crit. Tab. gives $18H_2O$.

**Zn:Fe 2:1

[a] Int. Crit. Tab. gives β 1.52.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$K_2SO_4 \cdot ZnSO_4 \cdot 6H_2O$	Mon.	1.4775	1.4833	1.4969	$2V = 68°14'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = 100°18'$; $Z \wedge a = 4°30'$
$(NH_4)_2Mn(SO_4)_2 \cdot 6H_2O$	Mon.	1.4801	1.4840	1.4913	$2V = 69°49'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 97°47'$
$Rb_2Cd(SO_4)_2 \cdot 6H_2O$	Mon.	1.4798	1.4848	1.4948	$2V = 72°26'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 105°53'$; $Z \wedge a = 0°0'$
$Cs_2Mg(SO_4)_2 \cdot 6H_2O$	Mon.	1.4857	1.4858	1.4916	$2V = 16°25'$	Ax. pl. 010; $Z \wedge c = -43°17'$
$K_2SO_4 \cdot CuSO_4 \cdot 6H_2O$	Mon.	1.4836	1.4864	1.5020	$2V = 46°32'$ $r < v$	Ax. pl. 010; $Z \wedge c = -71°27'$ $Y = b$; $X \wedge c = 19°$
$K_2SO_4 \cdot CoSO_4 \cdot 6H_2O$	Mon.	1.4807	1.4865	1.5004	$2V = 68°41'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 100°5'$; $Z \wedge a = 4°50'$
$Rb_2Fe(SO_4)_2 \cdot 6H_2O$	Mon.	1.4815	1.4874	1.4977	$2V = 73°21'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = -72°51'$
$NaAl(SO_4)_2 \cdot 6H_2O$	Mon. (?)	1.484	1.488	1.499	$2V = 60°$	Ax. pl. and $Z \perp$ 010; $Y \wedge c = 30° \pm$
$Rb_2Zn(SO_4)_2 \cdot 6H_2O$	Mon.	1.4833	1.4884	1.4975	$2V = 73°33'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = -73°17'$
$(NH_4)_2Cd(SO_4)_2 \cdot 6H_2O$	Mon.	1.4847	1.4887	1.4959	$2V = 72°51'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 101°27'$
$Rb_2S_2O_8$	Mon.	1.4812	1.4888	1.5719	$2V = 35°4'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 26°30'$
$Na_2H_2P_2O_6 \cdot 6H_2O$	Mon.	1.4855	1.4897	1.5041	$2V = 57°20'$	Ax. pl. 010; $Z \wedge c = 35°17'$
$AlF_3 \cdot H_2O$	Orth.	1.473	1.490	1.511	$2V = 85°$ $r < v$ strong	$Y = a$; $Z = c$
$Rb_2Cu(SO_4)_2 \cdot 6H_2O$	Mon.	1.4886	1.4906	1.5036	$2V = 44°42'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = -63°32'$
$MgSO_4 \cdot 4H_2O$	Mon.	1.490	1.491	1.497	$2V = 50°$ $r > v$	Ax. pl. and $Z \perp 010$; $X \wedge c = 81°$
$(NH_4)_2Fe(SO_4)_2 \cdot 6H_2O$	Mon.	1.4870	1.4915	1.4989	$2V = 76°52'$ $r > v$ weak	Ax. pl. 010; $X \wedge c = 98°42'$
$K_2Ni(SO_4)_2 \cdot 6H_2O$	Mon.	1.4836	1.4916	1.5051	$2V = 75°16'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = 98°42'$ $Z \wedge a = 6°18'$

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$Rb_2Co(SO_4)_2\cdot 6H_2O$	Mon.	1.4859	1.4916	1.5014	2V = 75°11′ r > v weak	Ax. pl. 010; Z ∧ *c* = 106°1′; Z ∧ *a* = 0°
$NaKC_4H_4O_6\cdot 4H_2O$	Orth.	1.492	1.493	1.496	2V = 69°40′	Ax. pl. 010; Z = *a*
$(NH_4)_2Zn(SO_4)_2\cdot 6H_2O$	Mon.	1.4888	1.4930	1.4994	2V = 79° r < v weak	Ax. pl. 010; Z ∧ *c* = 96°59′ Z ∧ *a* = 9°53′
K_2SO_4	Orth.	1.4935	1.4947	1.4973	2V = 67°20′ r > v weak	Ax. pl. 100; Z = *c*; X = *b*
NH_4PO_3	Mon.	1.490	1.495	1.505	2V = Lg.	....
$Na_2S_2O_6\cdot 2H_2O$	Orth.	1.4820	1.4953	1.5185	2V = 75°14′ r < v strong	Ax. pl. 010; Z = *a*
$(NH_4)_2Co(SO_4)_2\cdot 6H_2O$	Mon.	1.4902	1.4953	1.5032	2V = 82°9′ r < v weak	Ax. pl. 010; Z ∧ *c* = 96°19′
$Co_3Sm_2(NO_3)_{12}\cdot 24H_2O$	....	1.495	1.496	1.504	....	....
$Rb_2Ni(SO_4)_2\cdot 6H_2O$	Mon.	1.4895	1.4961	1.5052	2V = 82°0′ r > v weak	Ax. pl. 010; Z ∧ *c* = 102°38′; Z ∧ *a* = 3°23′
$Cs_2Mn(SO_4)_2\cdot 6H_2O$	Mon.	1.4946	1.4966	1.5025	2V = 59°57′ r > v weak	Ax. pl. 010; Z ∧ *c* = −64°33′
$UO_2(NO_3)_2\cdot 6H_2O$	Orth.	....	1.4967	1.555(?)	2V = 44° r < v weak	Ax. pl. 010; Z = *c*
$CaO\cdot Al_2O_3\cdot 6SiO_2\cdot 5H_2O$	Mon.	1.498	1.499	1.505	2V = 34° ± r > v	Z = *b*; Y ∧ *c* = 6° ±
$K_2Mg(SeO_4)_2\cdot 6H_2O$	Mon.	1.4969	1.4991	1.5139	2V = 39°38′ r > v weak	Ax. pl. 010; Z ∧ *c* = 101°18′; Z ∧ *a* = 3°0′
$KCl\cdot MgCl_2\cdot 6H_2O$	Orth.	......	1.4992	......	2V = 69°51′	Ax. pl. 010; Z = *c*
$K_2Si_2O_5\cdot H_2O$	....	......	1.50 ±	......	2V = Sm.	....
$K_2SiO_3\cdot H_2O$	....	......	1.50 ±	......	2V = Sm.	....
$2K_2SiO_3\cdot H_2O$	Orth. (?)	......	1.50 ±	......	2V = Lg.	....
$CaSO_4$*	Mon. (?)	1.50	1.50	1.56	....	....
$Zn(C_2H_5CO_2)_2$ (Propionate)	Mon.	1.480	1.500	1.530	....	....
$Cs_2Cd(SO_4)_2\cdot 6H_2O$	Mon.	1.4975	1.5000	1.5062	2V = 67°53′ r > v weak	Ax. pl. 010; Z ∧ *c* = −63°4′; Z ∧ *a* = 9°45′

*High temp. phase.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$(NH_4)_2Ni(SO_4)_2 \cdot 6H_2O$	Mon.	1.4949	1.5007	1.5081	2V = 86°33′ r < v weak	Ax. pl 010; Z ∧ *c* = 93°12′
$(NH_4)_2S_2O_8$	Mon.	1.4981	1.5016	1.5866	2V = 24° r < v mod.	Ax. pl. 010; Z ∧ *c* = 26°45′
NH_4MgPO_4	Orth.	......	1.502	......	....	Ax. pl. 001; Z = *b*
$NaH_2AsO_4 \cdot 2H_2O$	Orth.	1.4794	1.5021	1.5265	2V = 88°50′ r < v weak	Ax. pl. 010; Z = *c*
$2CaO \cdot UO_2 \cdot 4CO_2 \cdot 10H_2O$	Orth.	1.499	1.503	1.538	2V = 42° r > v	X = *a*
$CaF_2 \cdot 2Al(F,OH)_3 \cdot H_2O$	Mon.	1.501	1.503	1.510	2V = 63° r > v strong	Y = *b*; Z ∧ *c* = −50°
$Rb_2Mg(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5011	1.5031	1.5135	2V = 47°3′ r > v weak	Ax. pl. 010; Z ∧ *c* = −73°36′; Z ∧ *a* = 1°10′
$Cs_2Fe(SO_4)_2 \cdot 6H_2O$	Mon.	1.5003	1.5035	1.5094	2V = 74°51′ r > v weak	Ax. pl. 010; Z ∧ *c* = −61°43′; Z ∧ *a* = 11°25′
$Na_2O \cdot 2CaO \cdot 5B_2O_3 \cdot 16H_2O$	Mon.	1.491	1.504	1.520	2V = Mod.	X = *b*
$Cs_2Zn(SO_4)_2 \cdot 6H_2O$	Mon.	1.5022	1.5048	1.5093	2V = 74°11′ r > v weak	Ax. pl. 010; Z ∧ *c* = −59°4[illegible]′; Z ∧ *a* = 13°15′
$Na_2O \cdot 2CaO \cdot 3Al_2O_3 \cdot 9SiO_2 \cdot 8H_2O$	Mon.	1.505	1.505	1.506	2V = 86° r > v strong	Y = *b*; Z near *c*
$(NH_4)_2ZnCl_4$	Orth.	......	1.5055	......	2V = 53°48′ r > v weak	Ax. pl. 001; Z = *a*
$Cs_2Cu(SO_4)_2 \cdot 6H_2O$	Mon.	1.5048	1.5061	1.5153	2V = 43°24′ r < v weak	Ax. pl. 010; Z ∧ *c* = −47°3′; Z ∧ *a* = 26°47′
$CaC_8H_{10}O_{10} \cdot 6H_2O$ (Acid malate)	Orth.	1.493	1.507	1.545	....	Ax. pl. 100; Z = *c*
$MgCl_2 \cdot 6H_2O$	Mon.	1.494	1.507	1.528	2V = 79° r > v	X = *b*; Y = 9.5°
$Na_2S_2O_3 \cdot 5H_2O$	Mon.	1.4886	1.5079	1.5360	2V = 80°46′ r < v	Ax. pl. and Z ⊥ 010; X ∧ *c* = −41°30′
$2Na_2O \cdot Al_2O_3 \cdot 6SiO_2 \cdot H_2O$	Tric.	1.504	1.508	1.545	2V = 39°	Z = *c* (?)

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$KAlSi_2O_6$ (β-phase)	Orth. (?)	1.508	1.508	1.509	2V = Sm.	....
$Cs_2Co(SO_4)_2 \cdot 6H_2O$	Mon.	1.5057	1.5085	1.5132	2V = 81°34′	Ax. pl. 010; $Z \wedge c = -63°52'$; $Z \wedge a = 9°0'$
$K_2Cd(SO_4)_2 \cdot 1.5H_2O$	Mon.	......	1.509_{Li}	......	2V = 64°	Ax. pl. and $Z \perp 010$; $X \wedge c = -69°15'$
$(NH_4)_2Mg(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5070	1.5093	1.5169	2V = 54°47′ r > v weak	Ax. pl. 010; $Z \wedge c = 90°13'$; $Z \wedge a = 16°14'$
$Na_2CO_3 \cdot CaCO_3 \cdot 2H_2O$	Orth.	1.5043	1.5093	1.5751	2V = 31°26′	Ax. pl. 001; $Z = b$; $X = a$
$3Na_2O \cdot 2SiO_2 \cdot 11H_2O$ (?)	Orth.	1.504	1.510	1.524	2V = 65° ±	Ax. pl. 010; $X = a$
$Li_2O \cdot Al_2O_3 \cdot 8SiO_2$	Mon.	1.504	1.510	1.516	2V = 83°34′ r > v	Ax. pl. and $Z \perp 010$; $X \wedge a = -5° \pm$; $Z = b$
$3MgO \cdot 2SiO_2 \cdot 2H_2O$	Orth.	1.508	1.512	1.522	2V = Lg.	$Z = c$; $X = b$
$K_2Mn(SO_4)_2 \cdot 1.5H_2O$	Mon.	......	1.512	......	2V = 61°48′ r < v	Ax. pl. $\perp 010$; $X \wedge c = 100°$
$Cs_2Ni(SO_4)_2 \cdot 6H_2O$	Mon.	1.5087	1.5129	1.5162	2V = 87°21′ r < v weak	Ax. pl. 010; $Z \wedge c = -65°53'$
Rb_2SO_4	Orth.	1.5131	1.5133	1.5144	2V = 33°0′	Ax. pl.* 001 < 50°C.; $Z = a$
$Ca(HCO_2)_2$	Orth.	1.510	1.514	1.578	2V = 26°47′	Ax. pl. 010; $Z = a$
$Rb_2Mn(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5094	1.5140	1.5258	2V = 66°2′ r < v weak	Ax. pl. 010; $Z \wedge c = 103°7'$
$Th(SO_4)_2 \cdot 8H_2O$	Mon.	......	1.5168	......	2V = 76°20′ r < v weak	Ax. pl. 010; $Z \wedge c = 65°$
$Cs_2Mg(SeO_4)_2 \cdot 6H_2O$**	Mon.	1.5178	1.5179	1.5236	2V = 18°35′	Ax. pl. 010; $Z \wedge c = -53°13'$; $Z \wedge a = 20°30'$
$2CaO \cdot P_2O_5 \cdot H_2O$[a]	Tric.	1.600	1.614	1.631	2V = Lg.	r > v weak ....
$2MgO \cdot P_2O_5 \cdot 8H_2O$	Orth.	1.514	1.518	1.533	2V = 45° r < v	$X = a$; $Z = c$
$2Al_2O_3 \cdot SO_3 \cdot 10H_2O$	Orth.	1.516	1.518	1.533	2V = 48° r > v	$Z = c$; X = elong.

*010 > 50°C.

**Uniaxial at 78°C. for Na light.

[a] Int. Crit. Tab. gives $\alpha 1.515$; $\beta 1.518$; $\gamma 1.525$.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$K_2Zn(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5121	1.5181	1.5335	$2V = 66°15'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 99°9'$; $Z \wedge a = 5°3'$
$K_2Fe(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5095	1.5182	1.5345	$2V = 64°18'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 100°27'$
$Rb_2Cu(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5153	1.5183	1.5318	$2V = 53°11'$	Ax. pl. 010; $Z \wedge c = -66°55'$
$K_2Co(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5135	1.5195	1.5358	....	Int. Crit. Tab. gives these values.
$MgHPO_4 \cdot 3H_2O$	Orth.	......	1.5196	......	$2V = 44°47'$	Ax. pl. 010; $Z = c$
$5MgO \cdot Al_2O_3 \cdot 6SiO_2 \cdot 4H_2O$	....	1.480	1.48*	1.507	$2V =$ Sm.	$Z =$ elong.
$RbNO_3$	Orth.	1.51	1.52	1.524	$2V =$ Sm. $r > v$	Ax. pl. 010; $Z = c$
$Sr_2Cu(HCO_2)_4 \cdot 8H_2O$	Tric.	1.500	1.520	1.580	$2V = 72°4'$	....
$3MgO \cdot P_2O_5 \cdot 8H_2O$	Mon.	1.510	1.520	1.543	$2V = 71°$ $r < v$ weak	$Y = b$; $Z \wedge c = 29°$
$Rb_2Fe(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5133	1.5200	1.5328	$2V = 73°32'$ $r > v$ weak	Ax. pl. 001; $Z \wedge c = 103°37'$
$(NH_4)_2Mn(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5160	1.5202	1.5288	$2V = 70°23'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 93°22'$
K_2SiO_3	....	1.520	1.521 ±	1.528	$2V = 35° \pm$	$r < v$
$K_2Co(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5158	1.5218	1.5380	$2V = 62°19'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 98°54'$
$Rb_2Zn(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5162	1.5222	1.5331	$2V = 75°8'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = 103°13'$; $Z \wedge a = 2°3'$
$CaSO_4 \cdot 2H_2O$	Mon.	1.5205	1.5226	1.5296	$2V = 58°5'$ $r > v$	Ax. pl. 010; $Z \wedge c = 52°30'$; $Y = b$
$(NH_4)_2SO_4$	Orth.	1.5209	1.5230	1.5330	$2V = 52°12'$ $r > v$ weak	Ax. pl. 010; $Z = a$; $X = c$
$K_3Cr(CN)_6$	Mon.	1.5221	1.5244	1.5373	$2V = 46°$	Ax. pl. 010; $Z \wedge c = 0° \pm$
$Ca(meso\text{-}C_4H_4O_6) \cdot 3H_2O$**	....	1.470	1.525	1.555	....	Ax. pl. 010
$Na_6Si_2O_7$	....	1.524	1.525	1.529	....	....
$2Na_2O \cdot Fe_2O_3 \cdot 4SO_3 \cdot 7H_2O$	Orth.	1.508	1.525	1.586	$2V = 58°$ $r > v$ strong	$Z = c$; $Y = b$

*Int. Crit. Tab. gives 1.52.

**Stated to be +; indices indicate negative.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$NaCaB_5O_9 \cdot 5H_2O$	Mon.	1.515	1.525	1.544	$2V = 73°$ $r > v$	Ax. pl. 010; $Z \wedge c = -12°$; $Y = b$
$Rb_2Co(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5199	1.5256	1.5369	$2V = 73°37'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = 102°50'$
$K_2O \cdot 4MgO \cdot 11B_2O_3 \cdot 18H_2O$	Mon.	1.508	1.526	1.550	$2V = 81°$	$Y = b$; $Z \wedge c = 65°$
$NaHSO_3$	....	1.474	1.526	1.685±	$2V = 65° \pm$	....
$(NH_4)_2Cd(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5206	1.5260	1.5352	$2V = 76°31'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 96°0'$
$K_2UO_2(SO_4)_2 \cdot 2H_2O$	Orth.	1.5144	1.5266	1.5705	$2V = 60°$	Ax. pl. 100; $X = c$
$4MgO \cdot 3CO_2 \cdot 4H_2O$*	Mon.	1.523	1.527	1.545	2V = Med.	$Z = b$; $Y \wedge c = 43°$
$K_2Ni(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5181	1.5272	1.5427	$2V = 72°48'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 96°59'$
$Cs_2Mn(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5250	1.5279	1.5338	$2V = 68°49'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = -67°49'$
$(NH_4)_2Fe(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5216	1.5280	1.5381	$2V = 77°44'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = 95°24'$
$Na_2O \cdot Al_2O_3 \cdot 6SiO_2$	Tric.	1.525	1.529	1.536	$2V = 74°$	$r < v$ weak
$LiNH_4(dl\text{-}C_4H_4O_6) \cdot H_2O$	Mon.	......	1.529	.....	$2V = 81°42'$	Ax. pl. 010; $Z \wedge c = 76°30'$
$2MgO \cdot Fe_2O_3 \cdot 4SO_3 \cdot 15H_2O$	Mon.	1.522	1.529	1.577	$2V = 41°$ $r > v$	$X = b$; $Z \wedge c = -12°$
$Rb_2Ni(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5198	1.5291	1.5390	$2V = 82°13'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = 99°59'$
$Na_4Fe(CN)_6 \cdot 12H_2O$	Mon.	1.5193	1.5295	1.5436	$2V = 81°25'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = 74°$; $Y > X > Z$
$Cs_2Cu(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5282	1.5298	1.5394	$2V = 48°26'$ $r < v$ weak	Ax. pl. 010; $Z \wedge c = -52°48'$
$2CaO \cdot As_2O_5 \cdot 8H_2O$	Tric.	1.525	1.53	1.550	$r < v$	Z *ca.* b; Ax. pl. $\wedge c = 69°30'$
$4MgO \cdot 3CO_2 \cdot 4H_2O$**	Mon.	1.527	1.530	1.540	2V = Med.	$Z = b$; $Y \wedge c = 43°$
$Ca_3C_{12}H_{10}O_{14} \cdot 4H_2O$ (citrate)	....	1.515	1.530	1.580	....	....
Na_4SiO_4 (High temp. phase)	....	1.524	1.530	1.537	....	....
$KHSi_2O_5$	Orth.	1.495	1.530	1.535	$2V = 40° \pm$	Ax. pl. 001; $Z = a$

*Int. Crit. Tab. gives $\alpha 1.527$; $\beta 1.530$; $\gamma 1.540$ and orth.

**Indices also given as $\alpha 1.523$; $\beta 1.527$; $\gamma 1.545$.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$(NH_4)_2Zn(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5240	1.5300	1.5385	2V = 82°7′ r < v weak	Ax. pl. 010; Z ∧ *c* = 93°24′; Z ∧ *a* = 12°50′
$MgO \cdot Fe_2O_3 \cdot 3SO_3 \cdot 13H_2O$	Mon.	1.527	1.532	1.583	....	....
$BaS_2O_6 \cdot 4H_2O$	Mon.	......	1.532	......	2V = 87°	Ax. pl. ⊥010 nearly 201; Z = *b*; X ∧ c = −45°
$(NH_4)_2Co(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5261	1.5327	1.5417	2V = 82°14′ r < v weak	Ax. pl. 010; Z ∧ c = 92°23′
$Na_6Be_6Si_{14}O_{37}$	Orth.	1.532	1.533	1.545	2V = 38°	....
$BaCd(HCO_2)_4 \cdot 2H_2O$	Mon.	......	1.533	......	2V = 67°36′	Ax. pl. ⊥010; Z ∧ *c* = −46°23′
$MgCl_2 \cdot 2CdCl_2 \cdot 12H_2O$	Orth.	1.49 ±	1.5331	1.5769	2V = Lg. r < v weak	Ax. pl. 100; Z = *c*
$CaO \cdot MgO \cdot 3B_2O_3 \cdot 6H_2O$	Mon.	1.523	1.534	1.570	2V = Lg. r < v	Y = *b*; X ∧ *c* = 33°
$Ca_3C_{12}H_6O_{12}$ (aconitate)	....	1.515	1.535	1.575	....	....
$Ca(d\text{-}C_4H_4O_6) \cdot 4H_2O$ (?)	Orth.	1.525	1.535 (?)	1.550	....	....
$KBr \cdot MgBr_2 \cdot 6H_2O$	Orth.	......	1.535	......	2V = 87°	Ax. pl. 001; Z = *b*
$MgSO_4 \cdot H_2O$	Mon.	1.523	1.535	1.586	2V = 57° r > v	Ax. pl. 010; Z ∧ *c* = 76°25′
$Cs_2Fe(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5306	1.5352	1.5414	2V = 82°47′ r > v weak	Ax. pl. 010; Z ∧ *c* = 68°56′
$Cs_2Zn(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5326	1.5362	1.5412	2V = 83°6′ r > v weak	Ax. pl. 010; Z ∧ *c* = −68°3′; Z ∧ *a* = 5°46′
$(NH_4)_2Ni(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5285	1.5370	1.5460	2V = 86°21′ r < v weak	Ax. pl. 100; Z ∧ *c* = 92°0′
$3NH_4Cl \cdot ZnCl_2$	Orth.	......	1.538	......	2V = 46°10′ r > v weak	Ax. pl. 001; Z = *a*
K_2SeO_4	Orth.	1.5352	1.5390	1.5446	2V = 76°53′ r < v	Ax. pl. 100; Z = *c*
$Cs_2Co(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5354	1.5399	1.5453	2V = 86°48′ r > v weak	Ax. pl. 010; Z ∧ *c* = −70°37′
CaS_4O_6	....	1.535 ±	1.540 ±	1.675 ±	2V = 32° ±	....

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	n_α	n_β	n_γ	Axial Angle and Dispersion	Optical Orientation
$Na_2O \cdot 2BaO \cdot 6SiO_2 \cdot H_2O$	Orth.	1.544	1.544	1.546	2V = 23° r > v	Z = b, Y = a
$2CaO \cdot P_2O_5 \cdot 5H_2O$	Mon.	1.539	1.545	1.551	2V = 86°	Z = b
$Na_2O \cdot 2BaO \cdot 6SiO_2 \cdot H_2O$	Mon.	1.545	1.546	1.551	2V = 30° r > v	Y = b, Z ∧ c = −58°40′
$2Fe_2O_3 \cdot 5SO_3 \cdot 17(?)H_2O$*	Orth.	1.531	1.546	1.597	2V = 63°	Ax. pl. 010, Z = c
$(Nd,Pr)_2(SO_4)_3 \cdot 8H_2O$	Mon.	1.5392	1.5479	1.5552	2V = 84°16′	Z = b
$Y_2(SO_4)_3 \cdot 8H_2O$	Mon.	1.5433	1.5490	1.5755	2V = 42°43′ r < v	Ax. pl. ⊥010, Z ca. ⊥001
$Pr_2(SO_4)_3 \cdot 8H_2O$	Mon.	1.5399	1.5494	1.5607	2V = 85°27′	Ax. pl. ⊥010, Z = b, X ca. ⊥001
$H_2Al_2Si_4O_{12}$	Mon. (?)	1.543	1.55	1.585		
$Al_2O_3 \cdot 3H_2O$**			1.55			
$Li_2Si_2O_5$	Orth.	1.547	1.550	1.558	2V = 55° ±	
$Nd_2(SO_4)_3 \cdot 8H_2O$	Mon.	1.5413	1.5505	1.5621	2V = 83°57′	Ax. pl. ⊥010, Z = b, X ca. ⊥001
$K_3Rh(CN)_6$	Mon.	1.5498	1.5513	1.5634	2V = 29°1′	Ax. pl. 010, Z ∧ c = 6°
$Sm_2(SO_4)_3 \cdot 8H_2O$	Mon.	1.5427	1.5519	1.5629	2V = 85°46′ r > v weak	Ax. pl. ⊥010, Z = b, X ca. ⊥001
$Na_2WO_4 \cdot 2H_2O$	Orth.	1.5526	1.5533	1.5695 ±	2V = 29°	Ax. pl. 100, Z = b
Rb_2SeO_4	Orth.	1.5515	1.5537	1.5582	2V = 68°58′ r > v weak	Ax. pl. 100, Z = c
$K_3Mn(CN)_6$	Mon.	1.5527	1.5547	1.5716	2V = 47°53′	Ax. pl. 010, Z ∧ c = 0° ±
$CuC_4H_4O_5 \cdot 3H_2O$ (Malate)	Orth.	1.545	1.555	1.575		Ax. pl. 010, Z = a
$CaC_2O_4 \cdot H_2O$	Mon.	1.491	1.555	1.650	"2V = 84°"	"Z = b, Z ∧ c = 31°"
$FeO \cdot Al_2O_3 \cdot P_2O_5 \cdot 6H_2O$	Tric.	1.551	1.555	1.562	2V = 37° r > v mod.	Z emerges on 010
$Fe_2O_3 \cdot 4SO_3 \cdot 9H_2O$	Orth.	1.533	1.555	1.635	2V = Sm.	Ax. pl. 100, X = c, Z = b
$FeO \cdot Al_2O_3 \cdot P_2O_5 \cdot 5H_2O$[b]	Tric.	1.554	1.558	1.573	2V = Mod.	
$Al_2O_3 \cdot P_2O_5 \cdot 4H_2O$	Orth.	1.551	1.558	1.582	2V = 63°	r < v slight, Z = c
$CaB_2O_4 \cdot 6H_2O$	Mon. (?)	1.545 ±	1.560 ±	1.605 ±	2V = 60° ±	
$Li_2S_2O_6 \cdot 2H_2O$	Orth.	1.5487	1.5602	1.5788	2V = 78°16′	Ax. pl. 001, Z = a

*Int. Crit. Tab. gives $18H_2O$.

**Pptd. from aq. soln. and dried with alcohol and ether.

[a] Int. Crit. Tab. gives 2V = 88°; Ax. pl. 010, Z ∧ c = −64°17′.

[b] Int. Crit. Tab. gives $11H_2O$.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$(NH_4)_2SeO_4$*	Mon.	1.5607	1.5630	1.5846	2V = 37°54′ r < v weak	Ax. pl. ⊥010; Z∧c = 113°11′
$2KNO_2 \cdot Cd(NO_2)_2$	Orth.	1.556	1.565	1.608	2V = 48°	Ax. pl. 100; Z = c
$Na_2O \cdot ZrO_2 \cdot 6SiO_2 \cdot 3H_2O$	Orth.	1.560	1.565	1.574	2V = 75° r < v	X = c; Z = a
$Al_2O_3 \cdot 3H_2O$	Mon.	1.566	1.566	1.587	2V = Sm.	Z∧c = −25° ±
$LiNH_4(d\text{-}C_4H_4O_6) \cdot H_2O$	Orth.	......	1.567	......	2V = 87°6′	......
$NaC_6H_4(NH_2)SO_3 \cdot 2H_2O$ (Sulfanilate)	Orth.	1.536	1.567	1.649	2V = 65°24′	Ax. pl. 010; Z = c
$HOC_6H_4SO_3K \cdot 2H_2O$ (o-Phenolsulfonate)	Orth.	1.527	1.568	1.647	......	......
$4CaO \cdot P_2O_5 \cdot 5H_2O$	Mon.	1.565	1.568	1.580	2V = Med.	X = b, Z∧c = Sm.
$K_3Fe(CN)_6$	Mon.	1.5660	1.5689	1.5831	2V = 49°10′	Ax. pl. 010, Z∧c = 3°53′
$NiCl_2 \cdot 6H_2O$	Mon.	1.535	1.57 ±	1.61	2V = Lg.	Ax. pl. 010; X∧c = 8° ±
$(NH_4)_2UO_2(NO_3)_4 \cdot 2H_2O$	Mon.	1.508	1.57 ±	1.639	......	Ax. pl. and Z ⊥ 010
$Na_2Ca_3Si_6O_{16}$	Orth.	1.564	1.570	1.579	2V = 75°	......
$3MgO \cdot P_2O_5 \cdot MgF_2$	Mon.	1.569	1.570	1.582	2V = 26° ± r > v	Z∧c = 21°30′; Y = b
$3MgO \cdot As_2O_5 \cdot 8H_2O$	Mon.	1.563	1.571	1.596	2V = 60°	X = b; Z∧c = 31° ±
$Sr(HCO_2)_2$	Orth.	1.559	1.574	1.598	2V = 74°14′	Ax. pl. 100; Z = b
$MnCl_2 \cdot 4H_2O$**	Mon.	1.555	1.575	1.607 ±	2V = 78° ±	r < v moderate
$2Al_2O_3 \cdot P_2O_5 \cdot 3H_2O$	Mon.	1.574	1.576	1.588	2V = 51°	Y = b; Z∧c = −34°
$CaSO_4$[a]	Orth.	1.571	1.576	1.614	2V = 42°	Ax. pl. 010; Z = a
$Ba(ClO_3)_2 \cdot H_2O$	Mon.	1.562	1.577	1.635	2V = 55°30′ r < v weak	Ax. pl. 010; Z∧c = −23°45′
$CuSO_4 \cdot 3H_2O$	Mon.	1.554	1.577	1.618	2V = 75°	......
$K_2Ca_3Si_6O_{16}$[b]	Orth.	1.575	1.58 ±	1.59	2V = Lg.	......
$Ca_2Fe(CN)_6 \cdot 12H_2O$	Tric.	1.5700	1.5818	1.5961	2V = 85°12′ r > v	X nearly ⊥001; one optic axis nearly ⊥010
$Al_2O_3 \cdot 3H_2O$[c]	......	......	1.583	......	......	......
$BaO \cdot 4CaO \cdot Al_2O_3 \cdot 9SiO_2 \cdot H_2O$	Orth.	1.583	1.585	1.590	2V = 50°	Z = b; Y = a

* Becomes uniaxial at 114°C.

** α-Phase.

[a] Stable low temp. phase.

[b] High temp. or α-phase.

[c] Pptd. from soln. and dried at 110°C.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$Fe_2O_3 \cdot 3SO_3 \cdot 7H_2O$	Mon.	1.572	1.586	1.640	2V = Sm.	Ax. pl. and Z ⊥ 010; X ∧ *c* = 20°
$BaO \cdot Al_2O_3 \cdot 2SiO_2$	Mon.	1.584	1.589	1.594	2V = 87°	Y = *b*; Z ∧ *a* = 28°
$3CaO \cdot CaF_2 \cdot 2SiO_2 \cdot H_2O$	Mon.	1.586	1.59	1.598	2V = 60° r > v strong	X = *b*; Y ∧ *a* = 6°
$4BeO \cdot B_2O_3 \cdot H_2O$	Orth.	1.5595	1.5908	1.6311	2V = 87°7′	Ax. pl. 010; Z = *c*; X = *a*
$K_2Cr_2O_7 \cdot Hg(CN)_2 \cdot 2H_2O$	Orth.	......	1.591	......	2V = 58°	Ax. pl. 100; Z = *c*
$Fe_3(PO_4)_2 \cdot 8H_2O$	Mon.	......	1.592	......	2V = 73°10′	Ax. pl. ⊥ 010; Z ∧ *c* = 61°30′
$Ca_2B_6O_{11} \cdot 5H_2O$	Mon.	1.5863	1.5920	1.6139	2V = 54°52′	Ax. pl. ⊥ 010; Z ∧ c = 83°
$BaAl_2Si_2O_8$	Mon.	1.587	1.593	1.600	2V = 70° ±	Ax. pl. 010; X ∧ c = 3°
$Na_2Ru(NO_2)_5 \cdot 2H_2O$*	Mon.	1.5889	1.5943	1.7163	2V = 25°14′	Ax. pl. 010; Z ∧ c = −84°18′
$SrCl_2 \cdot 2H_2O$	Mon. (?)	1.5942 ±	1.5948 ±	1.6172 ±	2V = Sm.	....
$MnSO_4 \cdot H_2O$	Mon.	1.562	1.595	1.632	2V = 90°	Ax. pl. and Z ⊥ 010; Y ∧ c = Lg.
$CaSO_3 \cdot 2H_2O$	....	1.590	1.595	1.628	2V = 30° ±	....
$BaS_2O_6 \cdot 2H_2O$	Mon.	1.5860	1.5951	1.6072	2V = 85° r < v strong	Ax. pl. 010; Z ∧ c = −13°15′
$Ba(HCO_2)_2$	Orth.	1.573	1.597	1.636	2V = 77°54′	Ax. pl. 010; Z = *a*
$NH_2C_{10}H_6SO_3Na \cdot 4H_2O$ (1,4-Naphthylamine sulfonate)	Mon.	1.573	1.599	1.657	....	....
$Y_2Pt_3(CN)_{12} \cdot 21H_2O$	Orth.	1.59	1.6 ±	2.051	2V = 15° ±	Ax. pl. 010; Z = c
$2Li_2O \cdot 7Al_2O_3 \cdot 2B_2O_3 \cdot 6SiO_2 \cdot 12H_2O$	....	......	1.6 ±	......	2V = 17° ±	....
$NaAuCl_4 \cdot 2H_2O$	Orth.	1.545	1.6 ±	1.75	....	....
Li_4SiO_4	Orth. (?)	1.59 ±	1.60 ±	1.61 ±	2V = Sm.	....
$Na_2Pt(CN)_4 \cdot 3H_2O$	Tric.	1.53	1.60	1.61	2V = Sm.	r > v strong
$2CaO \cdot As_2O_5 \cdot 3H_2O$	Orth.	1.590	1.602	1.638	2V = 58° r > v	X = *b*; Z = *c*
$3FeO \cdot P_2O_5 \cdot 8H_2O$	Mon.	1.579	1.603	1.633	2V = 83° ± r < v small	X = *b*; Z ∧ *c* = 28°30′
$Na_2O \cdot Al_2O_3 \cdot P_2O_5 \cdot H_2O$	Mon. (?)	1.594	1.603	1.615	2V = Lg.	....
$(AlO)_3BO_3$	Orth.	1.586	1.603	1.623	2V = 87°	Ax. pl. 010; Z = *c*
$Na_2O \cdot 4CaO \cdot 6SiO_2 \cdot H_2O$	Mon.	1.595	1.604**	1.633	2V = 60° r > v Sm.	Z = *b*; X ∧ *c* = 19°

* X = yellow; Z = orange.

** Int. Crit. Tab. gives 1.606.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$Mg_2P_2O_7$	Mon.	1.602	1.604	1.615	2V = 20°30′	Ax. pl. 010; $X \wedge c = 15°$
$CaCl_2$	Orth. (?)	1.600	1.605	1.613	2V = Mod.	....
$K_2S_4O_6$	Mon.	1.5896	1.6057 ±	1.6435 ±	2V = 67°	Ax. pl. 010; $Z \wedge c = 33°$
$5CaO \cdot 2P_2O_5 \cdot 1.5H_2O$	Mon. (?)	......	1.606	......	2V = Mod.	$Y = b$
$NaKPt(CN)_4 \cdot 3H_2O$	Mon.	1.6088	1.61 ±	1.90 ±	2V = Sm.	....
$CaSiO_3$	Mon.	1.610	1.610	1.654	2V = Sm.	....
$CaH_4Si_3SnO_{11}$*	Orth.	1.609	1.6125	1.619	2V = 69°30′	Ax. pl. 010; $Z = c$
					r < v	
$2CaO \cdot FeO \cdot P_2O_5 \cdot 4H_2O$	Tric.	1.602	1.613	1.649	2V = 53° ±	r > v
$4CuO \cdot Al_2O_3 \cdot SO_3 \cdot 8H_2O$	Orth.	1.588	1.617	1.655	2V = 82°	r < v; $Z = c$
$2ZnO \cdot SiO_2 \cdot H_2O$	Orth.	1.614	1.617	1.636	2V = 46°	$X = b$; $Z = c$
					r > v strong	
$4MgO \cdot 2SiO_2 \cdot Mg(F,OH)_2$	Mon.	1.604	1.617**	1.636	2V = 72° +	$X \wedge a = 27°$; $Z = b$
					r > v weak	
$ZnCl_2 \cdot 2NH_3$	Orth.	......	1.618 ±	......	2V = Lg.	Ax. pl. 010; $Z = c$
$KFeSi_2O_6$	......	......	1.619	......	......	....
$K_2Pt(CN)_4 \cdot 3H_2O$	Orth.	1.615	1.62 ±	1.62 ±	2V = 40° ±	Ax. pl. 100; $Z = c$
$Rb_2Pt(CN)_4 \cdot 3H_2O$ (?)	Mon.	1.61	1.62 ±	1.696	2V = Mod.	Ax. pl. ⊥010; Z nearly = c
$CuO \cdot 3Al_2O_3 \cdot 2P_2O_5 \cdot 9H_2O$	Tric.	1.61	1.62	1.65	2V = 40°	r < v strong
$CuO \cdot SiO_2 \cdot H_2O$	Orth.	1.61	1.62	1.71	2V = Sm	Z = elong.
$2(Al,F)O \cdot SiO_2$	Orth.	1.619	1.620	1.627	2V = 49° to 66°	$X = a$; $Z = c$
					r > v	
$3CaO \cdot 5Ce_2O_3 \cdot 6P_2O_5 \cdot 24H_2O$	Orth.	1.620	1.620	1.654	2V = 0° ±	....
$LiRbPt(CN)_4 \cdot 3H_2O$	Orth.	1.6204	1.6233	1.9310	2V = 12°40′	Ax. pl. 100; $Z = c$
					r > v	
$SrSO_4$	Orth.	1.6220	1.6237	1.6309	2V = 51°45′	Ax. pl. 010; $Z = a$
$ZnC_{10}H_6O_6S_2 \cdot 6H_2O$ (1,5-Naphthalene disulfonate)	Mon.	1.531	1.625	1.659	2V = 58°16′	Ax. pl. 010
$3ZnO \cdot P_2O_5 \cdot 4H_2O$	Tric.	1.614	1.625	1.637	2V = 90°	$Y \wedge c = 30°$; X *ca.* a
$2Fe_2O_3 \cdot P_2O_5 \cdot 2SO_3 \cdot 13H_2O$	Tric. (?)	1.615	1.625	1.665	2V = Sm.	r > v

* $CaO \cdot SnO_2 \cdot 3SiO_2 \cdot 2H_2O$.

** Int. Crit Tab. gives 1.619.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$2BaO \cdot 3SiO_2$	Orth.	1.620	1.625	1.645	2V = 54°	Ax. pl. 100; X = *c*
$5CaO \cdot 2MgO \cdot 6SiO_2$	Orth.	1.621	1.627	1.635	2V = 80° ±	....
$Na_6H_8(MoO_4)_7 \cdot 18H_2O$	Mon.	......	1.627	......	2V = 84°6′ r > v weak	Ax. pl. and X ⊥010; Z ∧ c = −84°30′
$LiKPt(CN)_4 \cdot 3H_2O$	Orth.	1.6237	1.6278	2.2916	2V = 19° r > v	Ax. pl. 100; Z = *c*
$2CaO \cdot Al_2O_3 \cdot 3SiO_2 \cdot H_2O$	Orth.	1.626	1.629	1.652	2V = Mod. r > v	X = *a*; Z = *c*
$BaHPO_4$	Orth.	1.617	1.63 ±	1.635	....	Ax. pl. 100
$6MgO \cdot 3SiO_2 \cdot Mg(F,OH)_2$	Orth.	1.622	1.632*	1.652	2V = 68° ± r > v weak	X = *a*; Z = *b*
$8MgO \cdot 4SiO_2 \cdot Mg(F,OH)_2$	Mon.	1.623	1.636**	1.651	2V *ca.* 90° r < v	Z = *b*; X ∧ *a* = 9° ±
$BaSO_4$	Orth.	1.634	1.636	1.647	2V = 37°28′	Ax. pl. 010; Z = *a*; X = *c*
$(NH_4)_2Mg(CrO_4)_2 \cdot 6H_2O$	Mon.	1.6363	1.6371	1.6531	2V = 27°	Ax. pl. 010; Z ∧ *c* = 3°27′
$BaS_5O_6 \cdot 3.5H_2O$ (?)	Orth.	1.620	1.64	1.670	2V = Lg.	....
$Ca_3P_2O_8 \cdot CaO$	Mon.	......	1.64	......	2V = 25°	Ax. pl. 010; Z = *c* nearly
$3Al_2O_3 \cdot 2SiO_2$	Orth.	1.638	1.642	1.653	2V = 20° ± r > v	X = *b*; Z = *c*
$Cs_2Mg(CrO_4)_2 \cdot 6H_2O$	Mon.	1.6369	1.6425	1.6547	2V = 67°3′ r > v	Ax. pl. ⊥010; Z ∧ *c* = −9°22′
$2CaO \cdot MnO \cdot P_2O_5 \cdot 2H_2O$	Tric.	1.636	1.644	1.654	2V = Lg.	r > v
$CaPt(CN)_4 \cdot 5H_2O$	Orth.	1.622	1.644	1.767	2V = 48°10′	Ax. pl. 010; X = *c*
$Al_6Si_2O_{13}$	Orth.	1.642	1.644	1.654	2V = 47° ±	Ax. pl. 010; Z = *c*
$Ca_3Si_2O_7$	Orth. (?)	1.641	1.645 ±	1.650	2V = Lg.	....
$Ca_2SiO_4{}^a$	Mon. (?)	1.642	1.645	1.654	2V = 60°	Z ∧ *c* = 3°
$BaCl_2 \cdot 2H_2O$	Mon.	1.635	1.646	1.660	2V = 83°46′	Ax. pl. 010; Z ∧ *c* = 8°
$Cs_2MnCl_4 \cdot 2H_2O$	Tric. (?)	1.64 ±	1.65 ±	1.65 ±	....	....
$Al_2O_3 \cdot H_2O^b$	....	......	1.65	......	....	....
$GeO_2{}^c$	Orth. (?)	......	1.650	......	....	....
$2MgO \cdot SiO_2$	Orth.	1.6359	1.6507	1.6688	2V = 85°16′	Ax. pl. 001; Z = *a*

*Int. Crit. Tab. gives 1.624.
**Int. Crit. Tab. gives 1.670.

[a] γ-Form; stable below 675°C.
[b] Prepd. by hydration with steam at 125 atm.
[c] Prepd. by hydrolysis of $GeCl_4$.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$CdCl_2\cdot 2.5H_2O$	Mon.	......	1.6513	......	$2V = 56°27'$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = 1°40'$
$MgSiO_3$*	Orth.	1.650	1.653	1.658	$2V = 31°$	Ax. pl. 010; $Z = c$; $Y = b$
$Mg_3(BO_3)_2$	Orth.	1.6527	1.6537	1.6748	$2V = 25°$ $r > v$ weak	Ax. pl. 010; $Z = c$
$MgSiO_3$**	Mon.	1.651	1.654	1.660	$2V = 53°30'$	Ax. pl. $\perp$010; $Z \wedge c = 22°$
$2BeO\cdot Al_2O_3\cdot 2SiO_2\cdot H_2O$	Mon.	1.653	1.656	1.673	$2V = 47°$ $r > v$	$Y = b$; $Z \wedge c = 42°18'$
$Na_2O\cdot 4CuO\ 3SO_3\cdot 3H_2O$	Mon.	1.649	1.656	1.714	$2V = 37°$ $r < v$ strong	$Y = b$; $Z \wedge c = -12°$
$3MnO\cdot P_2O_5\cdot 3H_2O$	Orth.	1.651	1.656	1.683	$2V = 41°$	$r > v$ strong
$Ag_2CO_3\cdot 4NH_3\cdot H_2O$	Orth.	1.66	1.66 ±	1.68	$2V = 10°$ $r < v$ strong	Ax. pl. 010; $Z = c$
$Ce_2Pt_3(CN)_{12}\cdot 18H_2O$	Mon.	1.65	1.66	1.68	....	....
$Fe_2O_3\cdot 9MnO\cdot 4P_2O_5\cdot 14H_2O$	Orth.	1.655	1.66	1.670	$2V =$ Lg.	$r < v$ strong
$2Na_2O\cdot BaO\cdot 2TiO_2\cdot 10SiO_2$	Mon.	1.645	1.661	1.688	$2V = 77°$ $r > v$ strong	$Z = b$; $Y \wedge c = 3°$
$3CoO\cdot As_2O_5\cdot 8H_2O$	Mon.	1.645	1.661	1.688	$2V = 90°$ ± $r < v$ weak	$X = b$; $Z \wedge c = 31°$
$3NiO\cdot 6CuO\cdot SO_3\cdot 2As_2O_5\cdot 7H_2O$	Mon. (?)	1.629	1.662	1.727	$2V = 73°$ $r < v$ strong	$X \wedge$elong. 26°; $Y = b$
Ca_2ClPO_4	Orth.	1.649	1.665	1.670	$2V =$ Lg.	Ax. pl. 010; $Z = c$
$Li_2O\cdot Al_2O_3\cdot 4SiO_2$[a]	Mon.	1.660	1.665	1.676	$2V = 58°$ ± $r < v$	$Y = b$; $Z \wedge c = 24°$
$5MgO\cdot 7B_2O_3\cdot MgCl_2$	Orth.	1.662	1.667	1.673	$2V =$ Lg.	....
$K_2PtBr_2(NO_2)_2\cdot H_2O$	Tric.	1.626	1.6684	1.757	$2V = 72°21'$	Ax. pl. nearly $\perp$001
$8MgO\cdot 4SiO_2\cdot Mg(F,OH)_2$	Mon.	......	1.670[b]	......	$2V =$ *ca.* 90° $r < v$	$Z = b$; $X \wedge a = 9°$ ±
$2PbO\cdot 3Al_2O_3\cdot 2SO_3\cdot P_2O_5\cdot 6H_2O$	....	1.670	1.671	1.689	$2V = 0° - 30°$	$Z = c$
$CaO\cdot MgO\cdot 2SiO_2$	Mon.	1.6646	1.6713	1.6945	$2V = 59°$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = 38°30'$; $Y = b$

*β-Phase; changes to α-phase at 1500°C.
**Most stable or α-phase.

[a] Metastable or β-phase.
[b] Also given as 1.636.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$BaSiO_3$	Orth.	1.673	1.674	1.678	$2V = 29°$ $r > v$ strong	Ax. pl. 100; $X = c$
$CaO \cdot Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	Orth.	1.665	1.674	1.684	$2V = 84°$ $r > v$ strong	$X = a$; $Z = c$
$Na_2O \cdot CaO \cdot MgO \cdot Al_2O_3 \cdot SiO_2$	Mon.	1.666	1.674	1.688	$2V = 70° - 80°$	$Y = b$; $Z \wedge c = 43 - 7°$
$Na_2O \cdot 2MnO \cdot P_2O_5$	Orth.	1.663	1.674	1.699	$2V =$ Lg. $r < v$	$Z = b$; $X = a$
$7FeO \cdot 2P_2O_5 \cdot 9H_2O$	Mon.	1.653	1.675	1.697	$2V = 82°$ $r > v$ weak	$X = b$; $Z \wedge c = -67°$
$3Fe_2O_3 \cdot 2As_2O_5 \cdot 13H_2O$	Mon. (?)	......	1.676	......	$2V =$ Lg.	$r < v$ strong
$BaPt(CN)_4 \cdot 4H_2O$	Mon.	1.6706	1.677	1.8982	$2V = 18°$ $r > v$	Ax. pl. 010; $Z \wedge c = -1°20'$
$Fe_2O_3 \cdot 2SO_3 \cdot 5H_2O$	Mon.	1.588	1.678	1.749	$2V =$ Lg.	Ax. pl. and $Z \perp 010$; $X \wedge c = 19°$
$Li_2O \cdot 2(Mn,Fe)O \cdot P_2O_5$	Orth.	1.676	1.679	1.687	$2V = 63°$ $r < v$	$X = a$; $Z = b$
$Ca_3Al_2SiO_8$	Orth. (?)	1.675	1.68 ±	1.685	$2V =$ Lg.	....
$Zn_3(AsO_4)_2 \cdot 8H_2O$	Mon.	1.662	1.683	1.717	$2V = 77°$ $r < v$	$Z \wedge c = 37°$; $X = b$
$CuCl_2 \cdot 2H_2O$	Orth.	1.644	1.684	1.742	$2V = 80°40'$ $r < v$	Ax. pl. 001
$Na_2O \cdot Fe_2O_3 \cdot FeO \cdot 5SiO_2 \cdot H_2O$	Mon.	......	1.687	......	$2V =$ Lg.	$Y = b$; $X \wedge c = 1°$ to $8°$
$MnCl_2 \cdot 3MnO_2 \cdot 3H_2O$	Orth.	1.684	1.695	1.698	$2V =$ Sm.	$X = c$; $Y = b$
$2BeO \cdot BaO \cdot 2SiO_2$	Orth.	1.691	1.696	1.703	$2V = 81°$ $r > v$ weak	$Y = a$; $X = b$
$4CuO \cdot As_2O_5 \cdot 7H_2O$	Orth.	1.695	1.698	1.733	$2V = 29°$ $r > v$	$X = b$; $Z = c$
$Na_2Cr_2O_7 \cdot 2H_2O$	Mon.	1.6610	1.6994	1.7510	$2V = 83°42'$ $r < v$	Ax. pl. $\perp 010$; $Z \wedge c = 13°$
$Na_2O \cdot 2FeO \cdot Fe_2O_3 \cdot 6SiO_2$	Mon. (?)	1.697	1.700	1.703	$2V =$ Lg.	$Z = b$; $Y \wedge c = 0° ±$

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$4CaO \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot H_2O$	Orth.	1.700	1.702	1.706	2V = 0°–60° r < v or r > v	X = *c*; Y = *b*; or, X = *b*; Y = *c*
$Mn_2P_2O_7$	Mon.	1.695	1.704	1.710	2V = 90° ±	Ax. pl. 010; X ∧ *c* = −4°
$MgO \cdot 3CaO \cdot 2SiO_2$	Mon.	1.708	1.711	1.718	2V = 67° r > v weak	Z = *b*; X ∧ *c* = 36°
$2CaO \cdot MnO \cdot As_2O_3 \cdot 2H_2O$	Mon.	1.709	1.711	1.724	2V = 23° r < v	X = *b*; Y ∧ *c* = 8°
$4CuO \cdot N_2O_5 \cdot 3H_2O$	Orth.	1.703	1.713	1.722	2V = Lg. r > v	X = *a*; Z = *c*
Ca_2SiO_4**	....	......	1.715	......	2V = Sm.	....
$4CaO \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot H_2O$	Mon.	1.715*	1.717*	1.719*	2V = 66° r < v	Y = *b*; Z ∧ *a* = 32°
$SrCr_2O_7 \cdot 3H_2O$	Mon.	1.7146	1.7174	1.812	2V = 20°28′ r < v	Ax. pl. 010; Z ∧ *c* = 78°8′
Ca-Al-silicate[a]	....	1.718	1.720	1.733	2V = 20° ±	r < v extreme
Ca_2SiO_4[b]	Mon. (?)	1.715	1.720	1.737	2V = Lg.	Ax. pl. and Z ⊥ 010; X ∧ *c* = 14°
$2MgO \cdot 2CaO \cdot As_2O_5 \cdot H_2O$	Mon.	1.712	1.721	1.731	2V = Lg. r < v	Y = *b*; Z ∧ *c* = 39°
$Al_2O_3 \cdot H_2O$	Orth.	1.702	1.722	1.750	2V = 84° r < v weak	Z = *a*; X = *c*
Ca_2SiO_4[c]	Orth.	1.717	1.726 ±	1.735	2V = Lg.	Ax. pl. 100; X = *c*
$BaBr_2 \cdot 2H_2O$	Mon.	1.7129	1.7266	1.7441	2V = 83°49′	Ax. pl. 010; Z ∧ *c* = 89°35′
$Fe_2O_3 \cdot P_2O_5 \cdot 4H_2O$	Orth.	1.730	1.732	1.762	2V = 29° r < v	X = *a* (?); Z = *b* (?)
Sr_2SiO_4	Mon. (?)	1.7275	1.732	1.756	2V = 32°30′	Ax. pl. ⊥ 010; X ∧ *c* = 17°
$Fe_2O_3 \cdot MoO_3 \cdot 7.5H_2O$	....	1.720	1.733	1.935	2V = 28° r < v	Y = *a*; Z = *c*
$MnSiO_3$	Tric.	1.733 ±	1.735 ±	1.739 ±	....	....
$BaCl_2$	....	1.7302	1.7361	1.7420	2V = 90° ±	....

*Unstable or β′-phase.

**Int. Crit. Tab. gives α1.724; β1.729; γ1.734.

[a] In Portland cement clinker.

[b] α-Phase; stable above 1420°C.

[c] β-Phase; stable 675° to 1420°C.

INDEX OF REFRACTION—BIAXIAL POSITIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$CuSO_4 \cdot 2CuO \cdot 2H_2O$	Orth.	1.726	1.738	1.789	$2V = 53°$ $r < v$	Ax. pl. 001; $X = b$
$K_2Cr_2O_7$	Tric.	1.7202	1.7380	1.8197	$2V = 51°53'$ $r > v$	Ax. pl. nearly $\perp 001$
$FeO \cdot CaO \cdot 2SiO_2$	Mon.	1.732	1.740	1.757	$2V = 70°$ $r > v$	$Y = b$; $Z \wedge c = 45° \pm$
$MgW_4O_{13} \cdot 8H_2O$	Mon.	......	1.74	......	$2V = 77°50'$ $r < v$ weak	Ax. pl. and $Z \perp 010$; $X \wedge c = -66°$
$2FeO \cdot 5Al_2O_3 \cdot 4SiO_2 \cdot H_2O$	Orth.	1.736	1.741	1.746	$2V = 88° \pm$ $r > v$ weak	$X = b$; $Z = c$
$AgNO_3$	Orth.	1.729	1.744	1.788	$2V = 62°16'$ $r < v$	Ax. pl. 100; $Z = c$
$BeO \cdot Al_2O_3$	Orth.	1.747	1.748	1.757	$2V = 45°$ $r > v$	$X = a$; $Y = b$
$Sr_2W_{12}SiO_{40} \cdot 16H_2O$	Mon.	......	1.749	......	$2V = 86°50'$ $r < v$	Ax. pl. and $X \perp 010$; $Z \wedge c = -17°$
$Fe_2O_3 \cdot 3MoO_3 \cdot 7.5H_2O$	Orth.	1.74	1.75 ±	1.95	$2V =$ Sm. $r < v$	$Y = a$; $Z = c$
CaC_2	Orth. (?)	......	1.75	......	$2V = 30° \pm$	$r < v$
$3CuO \cdot 2CO \cdot H_2O$	Mon.	1.730	1.758	1.838	$2v = 68°$ $r > v$	$X = b$; $Z \wedge c = -13°$
$CaFeSi_2O_6$	Mon.	......	1.76 ±	......	$2V = 60°$	Ax. pl. 010; $Z \wedge c = 46°$
$5CuO \cdot P_2O_5 \cdot 2H_2O$	Mon. or Tric.	1.719	1.762	1.805	$2V$ *ca.* $90°$ $r < v$	$X \wedge c = 22°$; Z *ca.* b
$CaV_2O_6 \cdot 4H_2O$	Tric.	1.710	1.770	1.840	$2V =$ Lg.	$Z = c \pm$
$4BaO \cdot FeO \cdot 2Fe_2O_3 \cdot 10SiO_2$	Orth.	1.770	1.774	1.83	$2V = 40°$ $r > v$	$X = a$; $Z = c$
$4CaO \cdot 2Mn_2O_3 \cdot 5SiO_2 \cdot 4H_2O$	Orth.	1.758	1.776	1.795	$2V = 67°$ $r < v$	$X = a$; $Y = c$
$FeAsO_4$	Mon.	......	1.78 ±	......	....	....

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Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$2BeO \cdot FeO \cdot 2Y_2O_3 \cdot 2SiO_2$	Mon.	1.78	1.78 ±	1.785	2V = Med. r < v	Y = *b*; Z ∧ *c* = 4° – 13°
$2CuO \cdot 2SiO_2 \cdot H_2O$	Mon.	1.752	1.782	1.815	2V = Lg.	X = *b*; Z ∧ *c* = small
$3Fe_2O_3 \cdot 2P_2O_5 \cdot 8H_2O$	Mon.	1.775	1.786	1.815	2V = Med.	Z = *b*; Y ∧ *c* = 1°30′
$4CuO \cdot As_2O_5 \cdot H_2O$	Orth.	1.747	1.788 ±	1.829	2V *ca.* 90° r < v	X = *b*; Z = *a*
$4PbO \cdot 9Fe_2O_3 \cdot 6As_2O_5 \cdot 4SO_3 \cdot 33H_2O$	Orth.	1.783	1.788	1.818	2V = 51° r > v	Y = *a*; Z = *c*
$Fe_2O_3 \cdot 3MoO_3 \cdot 7.5H_2O$	Orth.	1.78	1.79 ±	2.04 ±	2V = Sm. r < v	Y = *a*; Z = *c*
$CsHgCl_3$	Orth.	......	1.791	......	....	....
$Tl_2(dl\text{-}C_4H_4O_6)$	Mon.	......	1.80	......	2V = 88°22′	Ax. pl. 010; Z ∧ *c* = 84°44′
$Mn_2O_3 \cdot 4MnO \cdot As_2O_5 \cdot 4H_2O$	Orth.	1.783	1.801	1.834	2V = Lg.	Z = *a*; X = *b*
$Fe_2O_3 \cdot 2SO_3 \cdot H_2O$	Orth.	1.783	1.804	1.918	2V = Sm.	....
$4CuO \cdot As_2O_5 \cdot 3H_2O$	Orth.	1.79	1.807	1.84	2V = Lg.	r < v; Y = *c*
Ba_2SiO_4	....	1.81	1.82 ±	1.83	....	....
$4MgO \cdot B_2O_3 \cdot Fe_2O_3$	Orth.	1.99	1.85	1.85	....	....
$3MgO \cdot B_2O_3 \cdot FeO \cdot Fe_2O_3$	Orth.	1.85	1.85	2.02	2V = Sm.	r > v; Z = *c*
Tl_2SO_4	Orth.	1.8600	1.8671	1.8853	2V = 68°4′ r > v weak	Ax. pl. 010; Z = *a*; X = *c*
$2UO_3 \cdot 3V_2O_5 \cdot 15H_2O$	Orth.	1.817	1.879	2.057	2V = 52°	....
$6MnO \cdot As_2O_5 \cdot 5H_2O$	Orth.	1.87	1.88	1.93	2V = 35° r > v	X = *b*; Z = *c*
$PbSO_4$	Orth.	1.8771	1.8823	1.8937	2V = 75°24′ r < v	Ax. pl. 010; Z = *a*; X = *c*
$CaO \cdot TiO_2 \cdot SiO_2$	Mon.	1.900	1.907 ±	2.034	2V = 27° ± r > v	Y = *b*; Z ∧ *c* = 51°
$PbHAsO_4$	Mon.	1.8903	1.9097	1.9765	2V = 58°	Ax. pl. and X ⊥ 010; Y ∧ *c* = –24°
$6PbO \cdot 4CaO \cdot 6SiO_2 \cdot H_2O$	Hex.*	1.910	1.91	1.945	2V = Sm.	....
As_2O_3	Mon.	1.87	1.92	2.01	2V = 58° r < v	Ax. pl. 010; Z ∧ *c* = 6°

*Int. Crit. Tab. gives tet.

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Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$4PbO \cdot 2CuO \cdot P_2O_5 \cdot nH_2O$	Orth.	1.885	1.920	1.956	$2V = 89°$	$r < v$
$6Na_2O \cdot 4Fe_2O_3 \cdot 5SiO_2$	....	......	1.96	......	....	....
$Bi_2O_3 \cdot 2UO_3 \cdot 3H_2O$	Orth. (?)	1.955	1.985	1.205	$2V =$ Lg. $r < v$	$X = a$; $Z = c$
$2Bi_2O_3 \cdot 3SiO_2$	Mon.	......	1.99	......	$2V =$ Lg.	....
$3Bi_2O_3 \cdot As_2O_5 \cdot 2H_2O$	Mon.	2.14	2.15	2.18	$2V = 44°$	$r < v$
$3PbO \cdot 2Fe_2O_3 \cdot 3SiO_2$	Orth.	2.12	2.17	2.31	$2V = 67°$	$r < v$
$Fe_2O_3 \cdot H_2O$	Orth.	1.94	2.20	2.51	$2V = 90°$	$X = a$; $Y = c$
$3PbO \cdot 2Mn_2O_3 \cdot 3SiO_2$	Orth.	2.10	2.20	2.31	$2V = 88°$ $r < v$	$X = a$; $Y = b$
$2FeO \cdot Sb_2O_5$	....	2.19	2.20	2.33	$2V =$ Sm.	$r < v$
$Pb_2As_2O_7$	....	......	2.03	......	....	....
S	Orth.	1.9579	2.0377	2.2452	$2V = 68°58'$ $r < v$	Ax. pl. 010; $Z = c$; $X = a$
$PbCl_2$	Orth.	2.1992	2.2172	2.2596	$2V = 66°12'$	Ax. pl. 010; $Z = c$
$MnO \cdot WO_3$	Mon.	2.17	2.22	2.32	$2V = 73°$	$X = b$; $Z \wedge c = 19°$
$Ca_2Fe_2O_5$	Mon. (?)	......	2.25	......	$2V =$ Mod.	....
$MnO \cdot Ta_2O_5$	Orth.	2.22	2.25	2.29	$2V =$ Lg. $r < v$	$Y = a$; $Z = c$
$4(Pb,Zn)O \cdot V_2O_5 \cdot H_2O$	Orth.	2.17	2.27	2.32	$2V = 90° \pm$ $r > v$	$X = c$; $Z = a$
$2PbO \cdot PbCl_2$	Orth.	2.24	2.27	2.31	$2V = 90° \pm$ $r < v$	$Z = c$; $X = a$
$PbO \cdot WO_3$	Orth.	2.24	2.27	2.31	$2V = 0° \pm$ $r < v$	$Z = c$; $X = a$
$CaO \cdot TiO_2$	Orth.	......	2.38	......	$2V = 90° \pm$	$Z = a$; $Y = b$
$PbCrO_4$	Mon.	......	2.42	......	$2V = 54°$ $r > v$ weak	Ax. pl. 010; $Z \wedge c = 5°30'$*
HgO	Orth.	2.37	2.5	2.65	$2V =$ Lg.	$Z =$ elong.
TiO_2	Orth.	2.583	2.586	2.741	$2V = 30°$	$Z = a$
PbO	Orth.	2.51_{Li}	2.61_{Li}	2.71_{Li}	$2V = 90° \pm$	$Y = a$(?)

*Also given as $Y = b$; $Z \wedge c = -5°30'$.

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Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
Na_2SiF_6	Orth.	1.3089	1.3125	1.3125	2V = Sm.	X = *c*
KBF_4	Orth.	1.3239	1.3245	1.3247	2V = Mod.	Ax. pl. 010 (100?); X = *c*
NH_4HF_2	Orth.	1.385	1.390	1.394	2V = Sm.	Ax. pl. 100; X = *c*
$Na_2SO_4 \cdot 10H_2O$	Mon.	1.394	1.396	1.398	2V = 76°	Ax. pl. ⊥010; Z ∧ *c* = 30°
$Co(NO_3)_2 \cdot 6H_2O$	Mon.	1.38 (?)	1.4 ±	1.52 (?)	2V = 40° ±	....
$NaF \cdot CaF_2 \cdot AlF_3 \cdot H_2O$	Mon.	1.407	1.414	1.415	2V = 50° r < v weak	X ∧ *c* = −52°; Z = *b*
$Na_2CO_3 \cdot 10H_2O$	Mon.	1.405	1.425	1.440	2V = 71°	Ax. pl. ⊥010; Z ∧ *c* = 41°
$Na_2HPO_4 \cdot 12H_2O$	Mon.	1.4321	1.4361	1.4373	2V = 56°43′ r < v	Ax. pl. 010; X ∧ *c* = −31°
$CuF_2 \cdot 5HF \cdot 6H_2O$	Mon.	1.395	1.440	1.444	2V = 32°	....
$Na_2HAsO_4 \cdot 12H_2O$	Mon.	1.4453	1.4496	1.4513	2V = 65°13′	Ax. pl. ⊥010; X ∧ *c* = −1°
$KAl(SO_4)_2 \cdot 12H_2O$	Mon. (?)	1.430	1.452	1.458	2V = 52°	Y ∧ *c* = 13°; Z = *b*
$(Na, NH_4, K)_2O \cdot SO_3 \cdot 2H_2O$	Orth.	1.440	1.452	1.453	2V = 40°	r < v strong
$CaF_2 \cdot Al(F,OH)_3 \cdot H_2O$	Mon.	1.448	1.454	1.456	2V = Mod.	X = *b*; Y ∧ *c* = large
$Na_2O \cdot CaO \cdot 2SO_3 \cdot 4H_2O$	Mon.	1.435	1.455	1.459	2V = 48°	....
$MgSO_4 \cdot 7H_2O$	Orth.	1.4326	1.4554	1.4608	2V = 51°21′	Ax. pl. 001; X = *b*
$B_2O_3 \cdot 3H_2O$	Tric.	1.340	1.456	1.459	2V = 7°	Ax. pl. *ca.* *b*; X *ca.* ⊥001
$NaHSO_4 \cdot H_2O$	Mon.	1.43 ±	1.46 ±	1.47 ±	2V = Sm.	....
$NaAl(SO_4)_2 \cdot 12H_2O$	Mon.	1.449	1.461	1.463	2V = 56°	Ax. pl. ⊥010; Y ∧ *c* = 30°
$NaH_2PO_4 \cdot 2H_2O$	Orth.	1.4401	1.4629	1.4815	2V = 82°50′	Ax. pl. 010; X = *c*
$MgSO_4 \cdot 6H_2O$	Mon.	1.438	1.463	1.465	2V = 29° ± r > v	Ax. pl. 010; X ∧ *c* = −25°
$Na_2SiO_3 \cdot 8H_2O$	Mon.	1.457 +	1.463	1.465 +	2V = 63°	Ax. pl. 010; X ∧ *c* = 12°
$NaC_2H_3O_2$	Mon.	......	1.464	......	2V = 62°50′	Ax. pl. ⊥010; X ∧ *c* = −44°
$Na_2H_2P_2O_7 \cdot 6H_2O$	Mon.	1.4599	1.4645	1.4649	2V = 31°10′	Ax. pl. ⊥010; X ∧ *c* = −42°30′
Li_2SO_4	Mon.	......	1.465	......	2V = 72°58′ r > v weak	Ax. pl. ⊥010; X ∧ *c* = −31°
$Na_2B_4O_7 \cdot 10H_2O$	Mon.	1.4467	1.4694	1.4724	2V = 39°10′ r > v strong	Ax. pl. ⊥010; Z ∧ *c* = −56°; X = *b*
$2Al_2O_3 \cdot SO_3 \cdot 15H_2O$	....	1.462	1.470	1.471	2V = Sm.	X = elong.

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Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$Na_2B_4O_7 \cdot 4H_2O$	Mon.	1.455	1.472	1.487	2V = 80° r > v	Ax. pl. ⊥010; $X \wedge c = 70°30'$; $Z = b$
$Na_3HP_2O_6 \cdot 9H_2O$	Mon.	1.4653	1.4738	1.4804	2V = 82° r > v weak.	Ax. pl. ⊥010; $X \wedge c = -11°$
$Li_2SO_4 \cdot H_2O$	Mon.	1.459	1.477	1.488	2V = 78°24′ r < v weak	Ax. pl. ⊥010; $X \wedge c = -36°32'$
$CaO \cdot 2CaF_2 \cdot 2Al(F,OH)_3SO_3 \cdot 2H_2O$	Mon.	1.461	1.478	1.485	2V = 63° r > v	$Y = b$; $Z \wedge c = 41°$
$CsClO_4$	Orth.	1.4752	1.4788	1.4804	2V = 62°30′	Ax. pl. 100; $Z = b$
$NaPO_3$	Mon.	1.473	1.480 ±	1.486	2V = Lg.	....
$MgO \cdot Al_2O_3 \cdot 4SO_3 \cdot 22 \pm H_2O$	Mon.	1.476	1.480	1.483	2V = Med.	$Y = b$; $Z \wedge c = 37°$
$ZnSO_4 \cdot 7H_2O$	Orth.	1.4568	1.4801	1.4836	2V = 46°14′ r > v weak	Ax. pl. 001; $X = b$; $Z = a$
$3Na_2O \cdot N_2O_5 \cdot 2SO_3 \cdot 2H_2O$	Mon. (?)	1.391	1.481	1.486	2V = 26° r > v strong	$X = b$; $Z \wedge c = 12°$
$KHCO_3$	Mon.	1.380	1.482	1.573	2V = 81°30′	Ax. pl. 010; $X \wedge c = 30°$; $Y = b$
$MnO \cdot Al_2O_3 \cdot 4SO_3 \cdot 24H_2O$	Mon.	1.478	1.482	1.482	2V = Sm.	$Y = b$; $Z \wedge c = 29°$
$CoSO_4 \cdot 7H_2O$	Mon.	1.477	1.483	1.489	2V = 88° r < v weak	Ax. pl. 010; $X \wedge c = 29°18'$; $Z = b$
$K_2H_2P_2O_6 \cdot 3H_2O$	Orth.	1.4768	1.4843	1.4870	2V = 62° r < v weak	Ax. pl. 100; $X = c$
$NaH_2PO_4 \cdot H_2O$	Orth.	1.4557	1.4852	1.4873	2V = 29°22′ r < v weak	Ax. pl. 010; $X = a$
$K_2O \cdot MgO \cdot 2SO_3 \cdot 4H_2O$	Mon.	1.483	1.487	1.490	2V = 86° r < v	$Y = b$; $Z \wedge c =$ small
$Na_2SO_4 \cdot MgSO_4 \cdot 4H_2O$	Mon.	1.486	1.488	1.489	2V = 71° r < v	Ax. pl. 010; $X \wedge c = -44° \pm$; $Y = b$
$Rb_2(meso\text{-}C_4H_4O_6) \cdot 2H_2O$	Mon.	......	1.488	......	....	....
$FeO \cdot Al_2O_3 \cdot 4SO_3 \cdot 24H_2O$	Mon.	1.480	1.488	1.490	2V = Sm.	$Z \wedge c = 38°$; $Y = b$
$3Na_2SO_4 \cdot MgSO_4$	Mon. (?)	1.485	1.488	1.489	2V = 84° ±	r < v

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Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$MgSeO_4 \cdot 6H_2O$	Mon.	1.4856	1.4892	1.4911	$2V = 28°12'$ $r > v$ strong	Ax. pl. 010; $X \wedge c = -27°$
$NiSO_4 \cdot 7H_2O$	Orth.	1.4693	1.4893	1.4923	$2V = 41°54'$ $r > v$	Ax. pl. 001; $X = b$; $Z = a$
$K_3H(SO_4)_2$	Mon.	1.4793	1.4899	1.5259	$2V = 60°$	Ax. pl. $\perp 010$; $X \wedge c = -35°$
$(NH_4)_2MnF_5$	Orth.	1.46	1.49 ±	1.50	....	Ax. pl. 010; $X = c$
$NaLi(dl\text{-}C_4H_4O_6) \cdot 2H_2O$	Mon.	......	1.490	......	$2V = 69°_{\text{Li}}$	Ax. pl. 010; $X \wedge c = 34°30'$
$Mg(C_2H_3O_2)_2 \cdot 4H_2O$	Mon.	......	1.491	......	$2V = 56°34'$	Ax. pl. 010; $Z \wedge c = -48°15'$
$CaO \cdot Al_2O_3 \cdot 7SiO_2 \cdot 7H_2O$	Orth.	1.484	1.492	1.495	$2V = 44°$ $r < v$ weak	$X = c$; $Z = a$
$MgSO_4 \cdot 5H_2O$	Tric.	1.482	1.492	1.493	$2V = 45°8'$ $r < v$	Ax. pl. *ca.* $\perp 010$
$Na_2CO_3 \cdot 2.5H_2O$	Orth.	1.435	1.492	1.547	$2V = $ Lg.	$X = c$
$MgSO_4 \cdot 2H_2O$	....	......	1.493	......	....	....
$Zn(C_2H_3O_2)_2 \cdot 2H_2O$	Mon.	......	1.494	......	....	....
$NaNH_4(d\text{-}C_4H_4O_6) \cdot 4H_2O$	Orth.	1.495	1.498	1.499	$2V = 59°52'$	Ax. pl. 100; $X = c$
$Ca(NO_3)_2 \cdot 4H_2O$ (α)	Mon.	1.465	1.498	1.504	$2V = 50°$	....
$6NaNO_3 \cdot 2Na_2SO_4 \cdot 3H_2O$	Orth.	1.418	1.500	1.543	....	....
$NaHCO_3$	Mon.	1.380	1.500	1.586	$2V = 75°$ $r > v$	Ax. pl. 010; $X \wedge c = 27°30'$; $Y = b$
$BeSeO_4 \cdot 4H_2O$	Orth.	1.4664	1.5007	1.5027	$2V = 26°43'$	Ax. pl. 100; $X = c$
$(NH_4)_2SO_4 \cdot CuSO_4 \cdot 6H_2O$	Mon.	1.4910	1.5007	1.5054	$2V = 68°31'$ $r > v$	Ax. pl. 010; $Z \wedge c = -71°13'$
$MgCO_3 \cdot 3H_2O$	Orth.	1.412	1.501	1.526	$2V = 53°5'$	Ax. pl. 001; $X = a$; $Z = b$
$2CaO \cdot 3Al_2O_3 \cdot 9SiO_2$	Mon.	1.493	1.501	1.508	$2V = 81°$ $r > v$	$Y = b$; $X \wedge c = 40°$
$Ba(OH)_2 \cdot 8H_2O$	Mon.	1.4710	1.5017	1.502	$2V = 8°33'$	Ax. pl. $\perp 010$; X *ca.* $\perp 001$
$3MgO \cdot 2SiO_2 \cdot 2H_2O$	Orth.	1.490	1.502 ±	1.511	$2V = $ Lg.	$Z = b$; $X = c$
$(NH_4)_3H(SO_4)_2$	Mon.	1.4959	1.5021	1.5276	$2V = 52°$	Ax. pl. $\perp 010$; $X \wedge c = 17°30'$
KNO_3*	Orth.	1.3320	1.5038	1.5042	$2V = 7°12'$ $r < v$	Ax. pl. 100; $X = c$; $Z = b$

* Also given as $\alpha 1.3346$; $\beta 1.5056$; $\gamma 1.5064$.

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Substance	System	αD	βD	γD	Axial Angle and Dispersion	Optical Orientation
$MgO \cdot SO_3 \cdot KCl \cdot 3H_2O$	Mon.	1.494	1.505	1.516	2V = 85° r > v	Y = *b*; X ∧ *c* = −8°
$2CaO \cdot 3B_2O_3 \cdot 13H_2O$	Mon.	1.495	1.505 ±	1.520	2V = 70°	Y = b; r < v
$Sr(C_2H_5SO_4)_2 \cdot H_2O$*	Mon.	1.497	1.505	1.509	....	....
$Na_2Si_2O_5$	Orth.	1.497	1.505	1.508	2V = 52° +	Ax. pl. 010; X = *a*
$Na_2CO_3 \cdot H_2O$**	Orth.	1.420	1.506	1.524	2V = 48° r < v weak	Ax. pl. 001; X = *a*
$2MgO \cdot 3SiO_2 \cdot 4H_2O$	Orth.	1.498	1.506	1.508	2V = 50°	Z = along.
$MgO \cdot N_2O_5 \cdot nH_2O$	....	1.344	1.506	1.506	2V = 5°	r < v
$Ce_2(S_2O_6)_3 \cdot 15H_2O$	Tric.	......	1.507	......	2V = 88°52′ r > v weak	Both axial figures visible through 001[a]
$NaHCO_3 \cdot Na_2CO_3 \cdot 2H_2O$	Mon.	......	1.5073	......	2V = 72° r < v	Ax. pl. ⊥ 010; X ⊥ 010; Y ∧ *c* = 6°
$MnSO_4 \cdot 5H_2O$	Tric.	1.495	1.508	1.514	2V = Lg.	r > v
$K_2Si_2O_5$	Orth.	1.503	1.509 ±	1.513	2V = Lg.	Ax. pl. 010; X = *c*
$Rb_2(meso\text{-}C_4H_4O_6) \cdot H_2O$	Tric.	......	1.510	......	2V = 75°18′	Ax. pl. 19° with *c*
$Ca(UO_2)_2P_2O_8 \cdot 12H_2O$	Orth.	1.488	1.510	1.521	2V = 69°	Ax. pl. 010; X = *c*
$CaO \cdot Al_2O_3 \cdot 6SiO_2 \cdot 5H_2O$	Mon.	1.502	1.510	1.512	2V = 44° r < v strong	Y = *b*; Z ∧ *c* = 9°
$CaO \cdot 2SiO_2 \cdot 2H_2O$	Orth.	1.512	1.514	1.515	2V = Lg.	Z = *c*
$NaAlSiO_4$	Tric.	1.509	1.514	1.514	2V = 12°-15°	....
$Na_2Si_2O_5$	Orth.	1.504	1.514	1.518	2V = 50°-55°	Ax. pl. 010; X = *a*
$KClO_3$[b]	Mon.	1.4084	1.5167	1.5234	2V = 27° r > v	Ax. pl. ⊥ 010; X ∧ *c* = 48°
$Na_2O \cdot CaO \cdot 2CO_2 \cdot 5H_2O$	Mon.	1.444	1.516	1.523	2V = 34° r < v strong	X = *b*; Z ∧ *c* = −14°
$Ba(C_2H_3O_2)_2 \cdot H_2O$	Tric.	1.500	1.517	1.525	....	....
$K_2O \cdot CaO \cdot 2SO_3 \cdot H_2O$	Mon.	1.500	1.5170	1.5183	2V = 27° r < v strong	Z = *b*; Y ∧ *c* = 2°18′
$MnSO_4 \cdot 4H_2O$	Mon.	1.508	1.518	1.522	2V = 63° r > v weak	Ax. pl. 010, Z ∧ *c* = 5°

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* Ethyl sulfate.

** Also given as α1.420; β1.509; γ1.525; X = *b*.

[a] Acute bisectrix inclined to left; unsym. dispersion.

[b] Also given as α1.440, β1.515, γ1.525, 2V = 28°15′, r > v; X ∧ *c* = 57°30′.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$2K_2C_2O_4 \cdot H_2C_2O_4 \cdot 2H_2O$	Orth.	1.48	1.52	1.55	....	....
$KCl \cdot CaCl_2$	....	......	1.52	......	....	....
$Na_2O \cdot Al_2O_3 \cdot 2SiO_2$	Tric.	1.516	1.52	1.520	2V = 36°	....
Na_2SiO_3	Orth.	1.513	1.520	1.528	2V = Lg.	....
$Sr(HCO_2)_2 \cdot 2H_2O$	Orth.	1.484	1.521	1.538	2V = 66°59′	Ax. pl. 010; $X = c$
$CoSeO_4 \cdot 6H_2O$	Mon.	1.47 ±	1.5225	1.5227	2V = 7°13′ r > v	Ax. pl. 010; $X \wedge c = -34°42'$
$K_2Cu(SeO_4)_2 \cdot 6H_2O$*	Mon.	1.5101	1.5228	1.5349	2V = 88°27′ r > v weak	Ax. pl. 010; $Z \wedge c = -76°26'$
$LiK(d\text{-}C_4H_4O_6) \cdot H_2O$	Orth.	......	1.523	.....	2V = 73°58′	Ax. pl. 010; $X = a$
$KAlSi_3O_8$**	Mon.	1.519	1.523	1.525	2V = 62°	Ax. pl. ⊥010; $X \wedge a = 3°$
$NaHC_3H_2O_4 \cdot H_2O$[a]	Orth.	1.407	1.524	1.541	2V = 39°20′	Ax. pl. 100; $X = c$
$CaO \cdot Al_2O_3 \cdot 4SiO_2 \cdot 4H_2O$	Mon.	1.513	1.524	1.525	2V = 25° ± r < v strong	$Y = b$; $Z \wedge c = 20°\text{-}30°$
$Ca(meso\text{-}C_4H_4O_6) \cdot 3H_2O$[b]	....	1.470	1.525	1.555	....	Ax. pl. 010
$K_2(d\text{-}C_4H_4O_6) \cdot 0.5H_2O$	Mon.	......	1.526	......	2V = 62°	Ax. pl. ⊥010
$K_2O \cdot Al_2O_3 \cdot 6SiO_2$	Tric.	1.522	1.526	1.530	2V = 83°	r > v weak
$2NH_4NO_3 \cdot (NH_4)_2SO_4$[e]	Orth.	1.469	1.528	1.543	2V = 55°	Ax. pl. 100; $X = c$
$K_2Ca_2Si_9O_{21}$	Mon. (?)	1.515	1.53 ±	1.535	2V = Lg.	....
$KC_4H_5O_4 \cdot 2H_2O$[d]	Orth.	1.417	1.530	1.533	....	Ax. pl. 001; $Z = a$
$V_2O_4 \cdot 3SO_3 \cdot 16H_2O$	Mon.	1.518	1.530	1.542	2V = Lg.	$X = b$
K_2CO_3	....	1.426	1.531	1.541	2V = 35° ±	....
$2NH_4NO_3 \cdot (NH_4)_2SO_4$[e]	Orth.	1.521	1.531	1.536	2V = 64°	Ax. pl. 100; $X = c$
$K_2H_2P_2O_6 \cdot 2H_2O$	Mon.	1.4893	1.5314	1.5363	2V = 36°9′ r < v weak	Ax. pl. ⊥010; $X \wedge c = -36°30'$
$4CaO \cdot CaCl_2 \cdot 14H_2O$	Orth.	1.517	1.533	1.537	2V = 45°	Ax. pl. 100; X = a
$2MgO \cdot CO_2 \cdot 4H_2O$	Orth.	1.489	1.534	1.557	2V = Lg.	....
$(NH_4)_2Cu(SeO_4)_2 \cdot 6H_2O$[f]	Mon.	1.5201	1.5344*	1.5387	2V = 55°7′ r > v weak	Ax. pl. 010; $Z \wedge c = 102°42'$
$Na_2O \cdot CaO \cdot 2SO_3$	Mon.	1.515	1.535	1.536	2V = 7° r > v strong	$Z = b$; $Y \wedge c = 12°$

* Also given as α1.5096; β1.5235; γ1.5387; 2V = 88°12′.

** Stable below 600°C.

[a] Acid malonate.

[b] Stated to be +; indices indicate negative.

[e] See also values given under β1.531.

[d] Acid succinate.

[e] See also values given under β1.528.

[f] See also values given under β1.5395.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$2CaO \cdot 3B_2O_3 \cdot 7H_2O$	Tric.	1.500	1.535	1.560	2V = 79°	r > v
Na_2CO_3	....	1.415	1.535	1.546	2V = 34° ±	....
$FeSO_4 \cdot 4H_2O$	Mon.	1.533	1.535	......	2V = Lg.	Ax. pl. ⊥010; Z ⊥010
$CaCO_3 \cdot 6H_2O$	Mon.	1.460	1.535	1.545	2V = 38°	Ax. pl. 010; $Z \wedge c = 17°$
NH_4HCO_3	Orth.	1.4227	1.5358	1.5545	2V = 41°38′ r < v weak	Ax. pl. 010; $X = a$; $Y = b$
Na_4SiO_4*	....	......	1.536 ±	......	....	....
$FeSO_4 \cdot 5H_2O$	Tric.	1.526	1.536	1.542	2V = Mod.	r > v weak
$CuSO_4 \cdot 5H_2O$	Tric.	1.5141	1.5368	1.5434	2V = 56°2′	r < v weak, crossed and strong inclined dispersion.
$CaO \cdot Al_2O_3 \cdot 4SiO_2 \cdot 4H_2O$	Mon.	......	1.539	......	2V = 83° r < v weak	$X = b$; $Y \wedge c$ = Sm.
$(NH_4)_2Cu(SeO_4)_2 \cdot 6H_2O$**	Mon.	1.5213	1.5395	1.5363	2V = 55°24′	Ax. pl. 010; $X \wedge c = 12°21′$; $X \wedge a = 93°12′$
$CaC_4H_4O_4 \cdot 3H_2O^a$	....	1.460	1.540	1.610	....	....
$6MgO \cdot 2B_2O_3 \cdot 2SO_3 \cdot 9H_2O$	Orth.	1.527	1.540	1.544	2V = 70° ±	$X = c$; $Z = a$
$3MgO \cdot B_2O_3 \cdot P_2O_5 \cdot 8H_2O$	Mon.	1.520	1.541	1.545	2V = Mod.	$Y = b$
$K_4CaSi_6O_{15}$	Mon. (?)	1.535	1.541	1.543	2V = 60° ±	....
$Cu(HCO_2)_2 \cdot 4H_2O$	Mon.	1.413	1.542	1.557	2V = 34°54′	Ax. pl. 010; $X \wedge c = 23°35′$
$Co(C_2H_3O_2)_2 \cdot 4H_2O$	Mon.	......	1.542	......	2V = 30°43′	Ax. pl. 010; $X \wedge c = -53°30′$
$Na_2O \cdot Al_2O_3 \cdot 2CO_2 \cdot 2H_2O$	Orth.	1.466	1.542	1.596	2V = 77° r < v weak	$Y = c$; $X = a$
KHC_2O_4	Mon.	1.415	1.545	1.565	2V = 40°	Ax. pl. 010; X ⊥100
$Cs_2Ni(SeO_4)_2 \cdot 6H_2O$	Mon.	1.5395	1.5450	1.5489	2V = 83°8′ r < v weak	Ax. pl. 010; $Z \wedge c = -73°9′$
$BaSiO_3 \cdot 6H_2O$	Orth.	1.542	1.547	1.548	2V = 39°40′ r > v strong	Ax. pl. 010; $X = a$
$CoSO_4 \cdot 5H_2O$	Tric.	1.530	1.548	1.550	2V = Mod.	....
$BaO \cdot Al_2O_3 \cdot 3SiO_2 3H_2O$	Orth.	1.538	1.549	1.554	2V = 53° r < v weak	$X = c$; $Z = a$
$2MgO \cdot B_2O_3 \cdot H_2O$	....	1.53	1.55	1.55	2V = Sm.	....

*Low temp. phase.

**See also values given under β1.5344.

[a] Succinate.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$MgCrO_4 \cdot 7H_2O$	Orth.	1.5211	1.5500	1.5680	2V = 75°28′ r < v	Ax. pl. 001; X = *b*
$RbLi(d\text{-}C_4H_4O_6) \cdot H_2O$	Orth.	......	1.552	......	2V = 57°10′ Li	Ax. pl. 001; X = *a*
$NaH_2AsO_4 \cdot H_2O$	Orth.	1.5382	1.5535	1.5607	2V = 67°57′ r < v	Ax. pl. 010; X = *c*
$Rb_2S_3O_6$	Orth.	1.4874	1.5580	1.5867	2V = 62°33′	Ax. pl. 010; X = *c*
$Na_2O \cdot 2BeO \cdot P_2O_5$	Orth.	1.552	1.558	1.561	2V = 68°	X = *c*; Z = *b*
$(NH_4)_2SeO_4$	Orth.	......	1.56 ±	......	2V = 56° ±	Ax. pl. 010; X = *c*
$CuSeO_4 \cdot 5H_2O$	Tric.	......	1.56 ±	1.565 (?)	....	....
$H_4Al_2Si_2O_9$	Mon.	1.556	1.56 ±	1.564	2V = Sm. r > v	Ax. pl. ⊥010; Z ⊥010
$2CaO \cdot MgO \cdot K_2O \cdot 4SO_3 \cdot 2H_2O$[*]	Tric.	1.547	1.560	1.567[*]	2V = 62°	....
$LiHC_4H_4O_5 \cdot 6H_2O$[**]	Mon.	1.530	1.560	1.590	....	Ax. pl. 010
$K_2S_3O_6$	Orth.	1.4934	1.5641	1.602	2V = 70° ±	Ax. pl. 010; X = *c*
Cs_2SO_4	Orth.	1.5598	1.5644	1.5662	2V = 65°20′ r < v weak	Ax. pl. 010; X = *c*
$Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	Mon.	1.561	1.565	1.566	2V = 10°-57°	X *ca.* ⊥001
$K_2Ca_3Si_6O_{16}$ (β)	Orth.	1.56	1.565	1.57	....	....
$CdSO_4 \cdot 2.6H_2O$	Mon.	......	1.565	......	2V = 88°9′ r > v weak	Ax. pl. ⊥010; X ⊥010
$Ca(C_4H_5O_2)_2$[a]	....	1.536	1.567	1.649	....	....
Li_2CO_3	Mon.	1.428	1.567	1.572	2V = 15° ±	Ax. pl. ⊥010; X ∧ *c* = 0° ±
$Al_2O_3 \cdot P_2O_5 \cdot 4H_2O$	....	1.554	1.571	1.576	2V = Mod.	*r* > *v*; Z = elong.
$3MgO \cdot (NH_4)_2O \cdot 2P_2O_5 \cdot 10H_2O$	Tric.	1.555	1.572	1.575	2V = 42°	....
$CaO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O$	Mon.	1.56	1.574	1.580	2V = 62°	X = *b*
$CaC_4H_2O_4$[b]	Orth.	1.495	1.575	1.640	2V = 77°36′	X = *c*; Y = *a*; Z = *b*
$Ca(UO_2)_2P_2O_8 \cdot 8H_2O$	Orth.	1.553	1.575	1.577	2V = 33° r > v	Ax. pl. 010; X = *c*; Z = *a*
$(Pt(NH_3)Cl_3)K \cdot H_2O$	Orth.	1.5438	1.5754	1.588 ±	2V = 64° ±	Ax. pl. 100; X = *c*
$5Al_2O_3 \cdot 2P_2O_5 \cdot 16H_2O$[c]	Orth.	1.562	1.576	1.588	2V = Lg.	Z = *c*

[*] Also given as α1.548; β1.562; γ1.567; orth.
[**] Acid malate.

[a] Crotonate.
[b] Maleate.

[c] Int. Crit. Tab. gives $9H_2O$.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$K_4Fe(CN)_6 \cdot 3H_2O$	Mon.	......	1.5772	......	2V = 78°10′ r > v weak	Ax. pl. ⊥010; $X \wedge c = 31°50'$
$CuO \cdot Na_2O \cdot 2SO_3 \cdot 2H_2O$	Mon.	1.544	1.578	1.601	2V = 79° r < v weak	$Y = b$; $X \wedge c = -48°$
$CsCeCl_4$	Mon.	......	1.58 ±	......	....	....
$CaO \cdot 2UO_3 \cdot As_2O_5 \cdot 8H_2O$	Orth.	1.560	1.582	1.587	2V = 46°	r > v strong; $X = c$
$3ZnO \cdot P_2O_5 \cdot 4H_2O$	Orth.	1.560	1.582	1.587	2V = 0° ±	$X = b$; $Y = a$ or c
$SrAl_2Si_2O_8$	Tric.	1.574	1.582	1.586	2V = Mod.	....
$CaAl_2Si_2O_8$	Tric.	1.5755	1.5832	1.5885	2V = 77°	....
$K_4Ru(CN)_6 \cdot 3H_2O$	Mon.	......	1.5837	......	2V = 54°	Ax. pl. ⊥010; $X \wedge c = 32°10'$
$MgPt(CN)_4 \cdot C_3H_8O_3 \cdot 5H_2O$	Mon.	......	1.584	......	2V = 17°38′	Ax. pl. 010; $X \wedge c = 30°$
$Al_2O_3 \cdot 4SiO_2 \cdot H_2O$	Orth.	1.552	1.588	1.600	2V = 57°	r > v weak; $X = c$
$Tl_2Mg(SO_4)_2 \cdot 6H_2O$	Mon.	1.5705	1.5884	1.5949	2V = 74°57′	Ax. pl. 010; $Z \wedge c = -9°4'$
$3MgO \cdot 4SiO_2 \cdot H_2O$	....	1.539	1.589	1.589	2V = 6°-30°	r > v; $X = c$
$2CaO \cdot As_2O_5 \cdot 5H_2O$	Mon.	1.583	1.589	1.594	2V = 77° r < v strong	$Z = b$; $X \wedge c = 70°$
$4CaO \cdot 5B_2O_3 \cdot 7H_2O$*	Tric.	1.572	1.591	1.594	2V = 32°	r < v strong
$CuO \cdot 2UO_3 \cdot P_2O_5 \cdot 12H_2O$**	Orth.	1.582	1.592	1.592	2V = Sm.	r > v; $X = c$
$Al_2O_3 \cdot P_2O_5 \cdot 2LiF$	Tric.	1.578	1.595	1.598	2V = 52°-90°	r > v weak
$BeO \cdot CaO \cdot 2SiO_2 \cdot NaF$	Orth.	1.571	1.595	1.598	2V = 39° r > v weak	$X = c$; $Z = b$
$Na_2Ca_2(SiO_3)_3$	....	1.596	1.597 ±	1.599	....	....
$4CaO \cdot 5B_2O_3 \cdot 2SiO_2 \cdot 5H_2O$	Mon.	1.586	1.598	1.605	2V = Lg.	$X = b$; $Z \wedge c = 44°$ ±
$Tl_2Mn(SO_4)_2 \cdot 6H_2O$	Mon.	1.5861	1.5996	1.6084	2V = 71°26′	Ax. pl. 010; $Z \wedge c = -14°15'$
Cs_2SeO_4	Orth.	1.5989	1.5999	1.6003	2V = 71°49′[a] r > v	Ax. pl. 001; $X = b$
$Ca_2P_2O_7$	....	1.585	1.60 ±	1.605	2V = Sm.	....
$Na_2O \cdot 3Al_2O_3 \cdot 6SiO_2 \cdot 2H_2O$	Mon.	......	1.60	......	2V = 40° ±	....
$K_2Li_2Fe(CN)_6 \cdot 3H_2O$	Mon.	1.5883	1.6007[b]	1.6316	2V = 65°56′ r > v weak	Ax. pl. 010; $X \wedge c = -44°10'$

*Int. Crit. Tab. gives $5CaO \cdot 6B_2O_3 \cdot 9H_2O$.

**Int. Crit. Tab. gives $CuO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O$; tetr.

[a] Increases with rise in temp.; + at 60°C., uniaxial at 95°C.; + at 150°C., ax. pl. 010; − at 280°C., $X = c$.

[b] Given as negative; indices indicate positive.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$4ZnO \cdot P_2O_5 \cdot 4H_2O$	Mon.	1.586	1.602	1.606	2V = 49° r > v	$Z = b$; $X \iota a. = a$
$CaC_4H_2O_4 \cdot 2H_2O$*	Orth.	1.413	1.602	1.611	2V = 22°24′	$X = a$; $Y = b$; $Z = c$
$7MnO \cdot Al_2O_3 \cdot 8SiO_2 \cdot 6H_2O$	Mon.	1.573**	1.603**	1.604**	2V = 26° r < v	$X \wedge c$ = small; $Y = b$
$Sr(ClO_3)_2$	Orth.	1.5670	1.6047	1.6257	2V = 72°21′ r > v	Ax. pl. 100; $X = c$
$KFeSi_3O_8$	Mon.	1.601	1.605 ±	1.609	....	Ax. pl. 010
$Fe_2O_3 \cdot 2SO_3 \cdot 7H_2O$	Tric.	1.51	1.605	1.611	2V = 28°	r < v strong
$4BeO \cdot 2SiO_2 \cdot H_2O$	Orth.	1.591	1.605	1.614	2V = 75° r < v weak	$X = a$; $Z = c$
$KC_6H_4O_7S_2 \cdot H_2O^a$	Orth.	......	1.607	......	2V = 65°35′	Ax. pl. 010; $X = a$
$K_4Os(CN)_6 \cdot 3H_2O$	Mon.	......	1.6071	......	2V = 47°	Ax. pl. ⊥010; $X \wedge c = 30°10'$
$Tl_2Fe(SO_4)_2 \cdot 6H_2O$	Mon.	1.5929	1.6093	1.6162	2V = 69°	Ax. pl. 010; $Z \wedge c = -16°15'$
$Tl_2Zn(SO_4)_2 \cdot 6H_2O$	Mon.	1.5931	1.6093	1.6168	2V = 69°24′ r < v weak	Ax. pl. 010; $Z \wedge c = -13°29'$
$Tl_2Cu(SO_4)_2 \cdot 6H_2O$	Mon.	1.5996	1.6096	1.6190	2V = 85°16′	Ax. pl. 010; $Z \wedge c = -17°20'$
$2CaO \cdot SiO_2 \cdot H_2O$	Orth.	1.605	1.61 ±	1.612	2V = 70° (?)	$Z = c$; $Y = b$ (?)
$NH_4NO_3{}^b$	Orth.	1.413	1.611	1.637	2V = 35° r < v weak	Ax. pl. 100; $X = b$
$CaO \cdot 2BeO \cdot P_2O_5 \cdot Ca(F,OH)_2$	Mon.	1.592	1.612	1.621	2V = 74° r > v	$Y = b$; $Z \wedge c = 2°30'$
$BaO \cdot 2SiO_2$	Orth. (?)	1.597	1.612	1.621	2V = 75°	Ax. pl. 100; $X = c$
$MgC_{10}H_6O_6S_2 \cdot 6H_2O^c$	Mon.	1.520	1.613	1.639	2V = 52°20′	Ax. pl. 010
$2CaO \cdot 5MgO \cdot 8SiO_2 \cdot H_2O$	Mon.	1.600	1.616	1.627	2V = 80°	$Y = b$; $Z \wedge c = 15°$
$Tl_2Co(SO_4)_2 \cdot 6H_2O$	Mon.	1.6009	1.6176	1.6238	2V = 66°39′ r < v	Ax. pl. 010; $Z \wedge c = -15°40'$
$Tl_2Ni(SO_4)_2 \cdot 6H_2O$	Mon.	1.6024	1.6183	1.6224	2V = 61°37′ r < v strong	Ax. pl. 010; $Z \wedge c = -14°40'$
$CaHPO_4$	Tric.	1.61	1.62 ±	1.63	....	....
$SrHPO_4$	Orth.	1.608	.62 ±	1.625	....	Ax. pl. 100

*Fumarate.

**Also given as α1.705; β1.729; γ1.730

[a] Phenol-2,4-disulfonate.

[b] Stable between −16° and 32°C.

[c] Naphthalene-1,5-disulfonate.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$(NH_4)_4UO_2(CO_3)_3$	Mon.	1.60	1.62 ±	1.625	....	....
$BaO \cdot 2UO_3 \cdot P_2O_5 \cdot 8H_2O$	Orth.	1.610	1.623	1.623	2V = 10°	$X = c$; $Z = a$
$CuO \cdot 2CuSO_4 \cdot 5H_2O$	Tric.	1.601	1.623	1.641	2V = 87°	$r > v$ extreme
$Zn_2(OH)PO_4$	Orth. (?)	1.608	1.624	1.629	2V = Lg.	Ax. pl. 010; $X = a$
$CuC_{10}H_6O_6S_2 \cdot 6H_2O$*	Mon.	1.541	1.625	1.660	....	Ax. pl. 010
NaCNS	Orth. (?)	1.545 ±	1.625 ±	1.695 ±	2V = 82° ±	....
$Pb(UO_2)_2P_2O_8 \cdot 8H_2O$	Tetr. (?)	......	1.626 (?)	......	....	....
$CoC_{10}H_6O_6S_2 \cdot 6H_2O$*	Mon.	1.532	1.628	1.665	2V = 61°40′	Ax. pl. 010
$MnO \cdot Al_2O_3 \cdot 2SiO_2 \cdot 2H_2O$	Orth.	1.611	1.628	1.630	2V = 50° $r > v$ strong	$X = b$; $Z = c$
$CaSiO_3$[a]	Mon.	1.616	1.629	1.631	2V = 39°	....
$K_2S_5O_6 \cdot 1.5H_2O$	Orth.	1.570**	1.63 ±	1.658**	2V = 65° ± $r > v$	Ax. pl. 010; $X = a$
$SrPt(CN)_4 \cdot 5H_2O$	Mon.	1.5800	1.63 ±	1.6331	2V = 20° ±	Ax. pl. 010; $X \wedge c = 19°30'$
$10CaO \cdot 3P_2O_5 \cdot CO_2$	....	1.622	1.630	1.630	2V = Sm.	$Z = c$
$3UO_3 \cdot As_2O_5 \cdot 12H_2O$	Mon. (?)	1.585	1.630	1.630	2V = 0° ±	$X = c$
$8MnO \cdot 7SiO_2 \cdot 5H_2O$	Orth.	1.602	1.632	1.632	2V = 0° ±	$X = c$
$(NH_4)_2UO_2Cl_4 \cdot 2H_2O$	Tric.	1.57 ±	1.633 ±	1.637 ±	2V = Sm.	....
$CaO \cdot 2SiO_2 \cdot B_2O_3$	Orth.	1.630	1.633[b]	1.636	2V = 88° $r < v$ strong	$X = b$; $Z = a$
$Rb_2Mg(CrO_4)_2 \cdot 6H_2O$	Mon.	1.6217	1.6330	1.6435	2V = 86°32′ $r > v$ strong	Ax. pl. ⊥010; $Z \wedge c = -48°10'$
$Tl_2Mg(SeO_4)_2 \cdot 6H_2O$	Mon.	1.6250	1.6337	1.6404	2V = 77°33′	Ax. pl. 010; $Z \wedge c = -4°27'$
$(Mg,Fe)O \cdot Al_2O_3 \cdot P_2O_5 \cdot H_2O$	Mon.	1.612	1.634[c]	1.643	2V = Lg. $r < v$	$Y = b$; $X \wedge c = -9°$
$Fe_2O_3 \cdot 3SO_3 \cdot 6H_2O$[d]	Mon.	1.605	1.635	1.657	2V = Lg.	Ax. pl. 010; $X \wedge c = 24°$ ±
$NiC_{10}H_6O_6S_2 \cdot 6H_2O$*	Mon.	1.541	1.636	1.669	2V = 59°56′	Ax. pl. 010
$Na_2C_{10}H_6O_6S_2 \cdot 2H_2O$*	Mon.	1.577	1.636	1.639	....	....
$K(SbO)(d\text{-}C_4H_4O_6) \cdot 0.5H_2O$[e]	Orth.	1.620	1.636	1.638	2V = 42°34′	Ax. pl. 001; $X = b$
$Li_2C_{10}H_6O_6S_2 \cdot 2H_2O$*	Mon.	1.507	1.638	1.698	2V = 23°	Ax. pl. ⊥010

* Naphthalene-1,5-disulfonate.

[a] β-Phase; inverts at 1200°C. to α-phase.

** Also given as α1.565; γ1.655 ±.

[b] Also given as α1.623; β1.634; γ1.636.

[c] Int. Crit. Tab. gives α1.603; β1.632; γ1.639.

[d] Stable from 50° to 160°C.

[e] Tartar emetic.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$Al_2O_3 \cdot SiO_2$	Orth.	1.634	1.639	1.643	$2V = 85°$ $r > v$ weak	$X = c$; $Z = a$
$CoSO_4 \cdot H_2O$	Mon. (?)	1.603	1.639	1.683	$2V =$ Lg.	....
$K_2Pt(NO_2)_2 \cdot C_2O_4 \cdot H_2O$	Mon.	1.545	1.641	1.760	....	....
$3Na_2O \cdot 5MoO_3 \cdot P_2O_5 \cdot 14H_2O$	Orth.	1.5962	1.6411	1.6520	$2V = 51°18'$ $r < v$ weak	Ax. pl. 100; $X = b$
$Tl_2Mn(SeO_4)_2 \cdot 6H_2O$	Mon.	1.6276	1.6429	1.6531	$2V = 72°27'$	Ax. pl. 010; $Z \wedge c = -8°21'$
$CaO \cdot 2Al_2O_3 \cdot 2SiO_2 \cdot H_2O$	Mon.	1.632	1.643	1.645	$r < v$	$Z = b$; $X \wedge c = 6° \pm$
$3FeO \cdot Al_2O_3 \cdot 2SiO_2 \cdot 3H_2O$	Mon.	1.643	1.649	1.649	$2V =$ Sm.	$X = c$
$Tl_2Ni(SeO_4)_2 \cdot 6H_2O$	Mon.	1.6378	1.6498	1.6560	$2V = 58°59'$	Ax. pl. 010; $Z \wedge c = 10°19'$
$BaCdCl_4 \cdot 4H_2O$	Tric.	......	1.651	......	$2V = 61°1'$ $r < v$	X nearly $\perp 110$
$Tl_2Fe(SeO_4)_2 \cdot 6H_2O$	Mon.	1.6532	1.6514	1.6589	$2V = 69°36'$	Ax. pl. 010; $Z \wedge c = -9°9'$
$18CuO \cdot 4Al_2O_3 \cdot 5As_2O_3 \cdot 55H_2O$	Mon.	1.612	1.652	1.675	$2V = 67°$ $r < v$	$X = b$; $Z \wedge c = -25°$
$Tl_2Co(SeO_4)_2 \cdot 6H_2O$	Mon.	1.6442	1.6535	1.6590	$2V = 66°42'$	Ax. pl. 010; $Z \wedge c = -8°22'$
$Tl_2Zn(SeO_4)_2 \cdot 6H_2O$	Mon.	1.6414	1.6539	1.6615	$2V = 68°34'$	Ax. pl. 010; $Z \wedge c = -6°46'$
$2CaO \cdot 2SiO_2 \cdot B_2O_3 \cdot H_2O$	Mon.	1.626	1.654	1.670	$2V = 74°$	$r > v$ weak; $Y = b$
$5MnO \cdot 2P_2O_5 \cdot 5H_2O$	Mon.	1.647	1.654	1.660	$2V = 74°$ $r < v$ strong	$X = b$; $Z \wedge c = 75°$
$CaO \cdot Al_2O_3$	Mon.	1.643	1.655	1.663	$2V = 36°$	Ax. pl. 010; $X = c$
$2MnO \cdot Al_2O_3 \cdot P_2O_5 \cdot 4H_2O$	Orth.	1.633	1.655	1.662	$2V = 51° \pm$	$X = b$; $Z = c$
$5MnO \cdot 2P_2O_5 \cdot 4H_2O$	Mon.	1.652	1.656	1.660	$2V =$ Lg.	....
CaB_2O_4	Orth.	1.540	1.656	1.682	$2V = 51°$	Ax. pl. 001; $X = a$
$Zn_3P_2O_8 \cdot ZnO$	Orth. (?)	1.630	1.656	1.660	$2V = 30° \pm$	Ax. pl. $\perp 010$; $X = a$
$Tl_2Cu(SeO_4)_2 \cdot 6H_2O$	Mon.	1.6396	1.6565	1.6720	$2V = 85°9'$	Ax. pl. 010; $Z \wedge c = -14°25'$
$3NiO \cdot As_2O_5 \cdot 8H_2O$	Mon.	1.622	1.658	1.687	$2V = 84°$	$r > v$ strong; $X = b$
$3MnO \cdot P_2O_5 \cdot 4H_2O$ (?)	Tric.	1.63	1.66	1.69	$2V =$ Lg.	X *ca.* $\perp 100$
KCNS	Mon.	1.532 ±	1.660 ±	1.730 ±	$2V = 68° \pm$	$Z \wedge c = 16° \pm$
$2CaO \cdot MgO \cdot As_2O_5 \cdot MgF_2$	Mon.	1.640	1.660	1.675	$2V = 83°$	$Z = b$
$Ag_2S_2O_6 \cdot 2H_2O$	Orth.	1.632 ±	1.662 ±	1.665 ±	$2V = 33°$	Ax. pl. 001; $X = b$

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$CaO \cdot MgO \cdot SiO_2$	Orth.	1.651	1.662	1.668	2V = 76° r > v	X = *b*; Z = *a*
$SrO \cdot CO_2$	Orth.	1.516	1.664	1.666	2V = 7° r < v weak	X = *c*; Z = *a*
$CaO \cdot ZnO \cdot SiO_2 \cdot H_2O$	Mon.	1.662	1.667	1.669	2V = Med. r > v	Z = *b*; Y ∧ *c* = −28°
$CaO \cdot 2UO_3 \cdot 2SiO_2 \cdot 6H_2O$	Tric. (?)	1.642	1.667	1.669	2V = 32 r < v	X *ca. a*; Z ∧ *c* = 2°
$3FeO \cdot As_2O_5 \cdot 8H_2O$*	Mon.	1.635	1.668	1.702	2V = 87° r > v strong	X = *b*; Z ∧ *c* = 32°
$K_2C_{10}H_6O_6S_2 \cdot 2H_2O$**	Mon.	1.485	1.669	1.697	2V = 38°50′	Ax. pl. ⊥010
$ZnSO_4$	Orth.	1.658	1.669	1.670	2V = Sm. r < v strong	Ax. pl. 010 (?); Z = *c*
$CoCl_2 \cdot 2H_2O$	Tric. (?)	1.625	1.671	1.67	....	....
$Ca_3Al_{10}O_{18}$[a]	Orth. (?)	1.662	1.671	1.674	2V = 35°	r > v strong
$CuSO_4 \cdot H_2O$	....	1.626	1.671	1.699	2V = 75°	r < v
$Na_2O \cdot 2AlFO \cdot As_2O_5$	Mon.	1.634	1.673	1.685	2V = 45° r < v weak	Y = *b*; X ∧ *c* = 25°
$4CaO \cdot 2SiO_2 \cdot CaCO_3$[b]	Orth.	1.665	1.674 ±	1.680	2V = Lg.	Ax. pl. 100
$4CaSiO_3 \cdot 3MnSiO_2$	Tric.	1.662	1.674	1.676	2V = 52° ±	....
$BaCO_3$	Orth.	1.529	1.676	1.677	2V = 16° r > v weak	X = *c*; Z = *b*
$2FeO \cdot Al_2O_3 \cdot P_2O_5 \cdot 4H_2O$	Orth.	1.643	1.678	1.684	2V = 45° ± r > v strong	X = *b*; Z = *c*
$2KCl \cdot HgCl_2 \cdot H_2O$	Orth.	1.648	1.678	1.699	2V = 78°21′ r > v strong	Ax. pl. 001; X = *a*
$Na_3AsS_4 \cdot 8H_2O$	Mon.	......	1.6802	......	2V = 87°44′	Ax. pl. 010; X ∧ *c* = 81°11′
$CaCO_3$[c]	Orth.	1.5300	1.6809	1.6854	2V = 18°11′	Ax. pl. 100; X = *c*; Z = *b*
$BaO \cdot CaO \cdot 2CO_2$	Mon.	1.525	1.684	1.686	2V = 15° r > v	Z = *b*; X ∧ *c* = 64°24′
NH_4CNS	Mon.	1.546 ±	1.685 ±	1.692	2V = 23° ±	Ax. pl. 010; Z ∧ *c* = 22°

*Given as negative; indices indicate positive.

**Naphthalene-1,5-disulfonate.

[a] Unstable phase.

[b] High temp. or α-phase; stable above 1200°C., 90 atm.

[c] λ-Phase; metastable above 0°C.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$3CuO \cdot As_2O_5 \cdot 5H_2O$	Orth.	1.67	1.686	1.698	2V = Lg.	....
$8Al_2O_3 \cdot B_2O_3 \cdot 6SiO_2 \cdot H_2O$	Orth.	1.678	1.686	1.689	2V = 35° ± r < v	$X \wedge c = 0° \pm$; $Z = a$
$Ca_5Al_6O_{14}$*	Orth. (?)	1.687	1.69 ±	1.692	2V = Lg.	....
$Li_2O \cdot 2FeO \cdot P_2O_5$	Orth.	1.691	1.695	1.696	2V = Med. r < v strong	$X = c$; $Z = b$
$7FeO \cdot 8SiO_2 \cdot H_2O$**	Mon.	1.672	1.697	1.717	2V = 82°	r < v; $Y = b$
$Na_2ZrSi_2O_7$	Mon. (?)	1.688	1.7 ±	1.710	....	....
$2Ce_2O_3 \cdot 3SrO \cdot 7CO_2 \cdot 5H_2O$	Orth.	1.625	1.700	1.735	2V = 66°	$X = a$; $Y = b$
$Ca(Fe, Mn, Mg)_2Si_3O_9$	Tric.	1.69 ±	1.701	1.708 ±	2V = 65°30′	Extinction: ⊥ X at 5° and ⊥Z at nearly 0°.
$2BeO \cdot BaO \cdot 2SiO_2$[a]	Orth.	1.695	1.702	1.708	2V = 70°	....
$BaBr_2 \cdot CdBr_2 \cdot 4H_2O$	Tric.	......	1.702	......	2V = 70°13′	r < v
$4ZnO \cdot P_2O_5 \cdot H_2O$	Tric.	1.660	1.705	1.713	2V = 50°	....
$5MgO \cdot 6Al_2O_3 \cdot 2SiO_2$	Mon.	1.705	1.709	1.711	2V = 69° r < v	$Y = b$; $Z \wedge c = -8°30'$
Rb_2CrO_4	Orth.	......	1.71 ±	1.72 ±	2V = 74° ± r < v	Ax. pl. 010; $X = c$
$3(NH_4)_2O \cdot TeO_2 \cdot 6MoO_2 \cdot 7H_2O$	Tric.	1.639 ±	1.7102	1.755 ±	2V = 74° ±	....
$BaC_{10}H_6O_6S_2 \cdot H_2O$[b]	Orth.	1.614	1.714	1.729	....	....
$CaO \cdot MnO \cdot SiO_2$[c]	Orth.	1.679	1.716[c]	1.729	2V = Med. r > v	$X = b$; $Z = a$
$3UO_3 \cdot P_2O_5 \cdot 6H_2O$	Mon. (?)	1.691	1.720	1.720	2V = 0° ±	$X = b$
$Al_2O_3 \cdot SiO_2$	Tric.	1.712	1.720	1.728	2V = 82° r > v	X *ca.* ⊥100; $Z \wedge c = -30° \pm$
$5CuO \cdot As_2O_5 \cdot 9H_2O$	Orth.	1.694	1.726	1.730	2V = 36° r > v strong	$X = c$; $Z = a$
K_2CrO_4	Orth.	1.7087	1.7261	1.7304	2V = 57°47′ r > v weak	Ax. pl. 100; $X = b$
$7MnO \cdot Al_2O_3 \cdot 8SiO_2 \cdot 6H_2O$	Mon.	1.705	1.729[d]	1.730	....	....
$CuO \cdot SeO_2 \cdot 2H_2O$	Mon.	1.710	1.731	1.732	$2V = 34°_{Li}$	r > v; $Y = b$

*Unstable phase; fibrous.

**Int. Crit. Tab. gives $FeO \cdot SiO_2$.

[a] Also sometimes positive, β1.696.

[b] Naphthalene-1 5-disulfonate.

[c] Int. Crit. Tab. gives α1.686; β1.722; γ1.735.

[d] Also given as α1.573; β1.603; γ1.604.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$4ZnO \cdot As_2O_5 \cdot H_2O$	Orth.	1.708*	1.733*	1.758*	....	....
$CuSO_4$	Orth.	1.724	1.733	1.739	2V = Lg.	r > v extreme
$CaFeSiO_4$	Orth.	1.696	1.734	1.743	2V = 48°40′ r > v	Ax. pl. 001; X = *b*; Z = *c*
$7ZnO \cdot 3CO_2 \cdot 4H_2O$**	Mon. (?)	1.640	1.736	1.750	2V = 40°	r < v strong; X = *b*
$2Y_2O_3 \cdot 4SiO_2 \cdot H_2O$	Mon.	1.731	1.738	1.744	2V = 68° r < v weak	Z = *b* or X = *b*; Y ∧ *c* = Sm.
$Mn_3B_4O_9$	Tric.	1.617	1.738	1.776	2V = 55°47′	X ∧ ⊥001 = 27°43′; X ∧ ⊥100 = 29°11′
$Na_8Ti_5O_{14}$	Mon. (?)	......	1.74+	......	2V = Lg.	....
$K_2Ti_2O_5$	Orth.	......	1.74+	......	2V = Lg.	....
$SbBr_3$	Orth.	......	1.74+	......	....	....
$Cu_2(OH)PO_4$	Orth.	1.702	1.745	1.789	2V = 85° r > v strong	Ax. pl. 001; X = *b*; Y = *c*
$MgO \cdot Fe_2O_3 \cdot 3SiO_2 \cdot 4H_2O$	Orth.	1.723	1.745	1.765	2V = Lg. r < v strong	X = *a*; Y = *b*
$Na_2O \cdot SO_3 \cdot Pb(OH)Cl$	Orth.	1.743	1.754	1.764	2V *ca.* 90°	r > v strong
Na_2ZrO_3	Orth. (?)	1.720	1.76 ±	1.8 +	....	....
$4CuO \cdot SO_3 \cdot 3H_2O$[a]	Orth.	1.728	1.771[a]	1.800	2V = 77° r < v	Ax. pl. 100; X = *b*; Z = *c*
$CuO \cdot CuSO_4$	Mon.	......	1.777	......	2V = Lg. r > v	Ax. pl. 010; X nearly ⊥001
$7MnO \cdot As_2O_5 \cdot 4H_2O$	Mon.	1.760	1.779	1.779	2V = 4°	r > v strong
Na_2ZrSiO_5	Orth.	1.741	1.788 ±	1.790	2V = Sm.	....
$4CuO \cdot As_2O_5 \cdot H_2O$	Orth.	1.747	1.788	1.829	2V = 90° ± r < v strong	X = *b*; Z = *a*
$(Sc, Y)_2O_3 \cdot 2SiO_2$	Mon.	1.756	1.793	1.809	2V = 50°-65° r < v	X ∧ *c* = 5°; Y = *b*
$2CaO \cdot PbO \cdot 3SiO_2$	....	......	1.795	......	....	....
Mn_2SiO_4	Orth.	1.778	1.804	1.815	2V = 65° r > v	Ax. pl. 001; X = *b*; Z = *c*

* Also given as α1.708; β1.744; γ1.773.

** Int. Crit. Tab. gives $5ZnO \cdot 2CO_2 \cdot 3H_2O$.

[a] Int. Crit. Tab. gives α1.730; β1.778; γ1.803.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$4MnO \cdot As_2O_5 \cdot H_2O$	Mon.	1.793*	1.807*	1.809*	2V = 83°	Y = *b*; X ∧ *c* = −54°
$KFeSi_2O_6$	Mon.	......	1.81	......	2V = Lg.	Ax. pl. 010; X ∧ *c* = 1° ±
$Fe_2(SO_4)_3$**	Orth.	1.802	1.814	1.818	2V = 60°	Ax. pl. 100; X = *c*
$3V_2O_5 \cdot 2CaO \cdot 11H_2O$	Mon.	1.775	1.815	1.825	2V = 50°	r > v strong; X = *b*
$Ba_2W_{12}SiO_{40} \cdot 16H_2O$	Mon.	......	1.816	......	2V = 78°44′ r > v strong	Ax. pl. and X ⊥ 010; Z ∧ *c* = −14°
$NaFeSi_2O_6$	Mon.	1.776	1.816[a]	1.836	2V = 60° ± r > v strong	Ax. pl. 010; X ∧ *c* = 9° ±; Y = *b*
$Pb(H_2AsO_4)_2$	Tric.	1.74	1.82	......	....	....
$TlNO_3$	Orth.	1.817	1.82 ±	......	2V = Lg.	Ax. pl. 010; X = *c*
$2CuO \cdot 2CaO \cdot As_2O_5 \cdot H_2O$	Orth.	1.800	1.831	1.846	2V *ca.* 90° r > v strong	X = *a*; Y = *b*
$Na_2O \cdot 3Fe_2O_3 \cdot 4SO_3 \cdot 6H_2O$	Orth.	1.750	1.832	1.832	2V = Sm.	X = *c*
$PbO \cdot CuO \cdot SO_3 \cdot H_2O$[b]	Mon.	1.809	1.838	1.859	2V = 80° r < v	Z = *b*; X ∧ *a* = −24°
$4CuO \cdot P_2O_5 \cdot 3H_2O$	Mon.	1.69	1.84	1.85	2V = Sm.	....
$CuO \cdot 3Fe_2O_3 \cdot 2P_2O_5 \cdot 8H_2O$	Tric.	1.773	1.840	1.845	2V = 24°	r > v strong; X *ca.* *b*
$2CaO \cdot I_2O_5 \cdot CrO_3$[c]	Mon.	1.825	1.842	1.857	2V = 86°	r < v strong; Y = *b*
$KHg(CNS)_3$	Orth.	1.730	1.843	1.880 ±	2V = 67° ± r < v strong	Ax. pl. 100; X = *c*
$Pb(HCO_2)_2$	Orth.	1.789	1.852	1.877	2V = 70°34′	Ax. pl. 010; X = *c*
$HgCl_2$	Orth.	1.725	1.859	1.965	2V = 85°	Ax. pl. 100; X = *c*
$5CuO \cdot As_2O_5 \cdot 2H_2O$	....	1.820	1.86	1.88	2V = Sm. r < v	Z ⊥ elong.; Y = elong.
$6CuO \cdot As_2O_5 \cdot 3H_2O$	Mon.	1.73	1.870	1.91	2V = 53° r < v strong	Y = *b*; Z *ca.* *a*
$2CuO \cdot CO_2 \cdot H_2O$	Mon.	1.655	1.875	1.909	2V = 43° r < v	Y = *b*; X ∧ *c* = 23°
Fe_2SiO_4	Orth.	1.835	1.877	1.886	2V = 47° r > v strong	Ax. pl. 001; X = *b*; Z = *a*
$KC_6H_2O_7N_3$[d]	Orth.	1.527	1.903	1.952	2V = 33°34′	Ax. pl. 100; X = *c*

*Int. Crit. Tab. gives α1.780; β1.793; γ1.802.

**Also uniaxial.

[a] Int. Crit. Tab. gives α1.763; β1.799; γ1.813.

[b] Int. Crit. Tab. gives $5PbO \cdot 2CuO \cdot 3SO_3 \cdot 3H_2O$.

[c] Int. Crit. Tab. gives $15CaO \cdot 7I_2O_5 \cdot 8CrO_3$.

[d] Picrate.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
$2CaO \cdot 4FeO \cdot Fe_2O_3 \cdot 4SiO_2 \cdot H_2O$	Orth.	....	1.91	1.91	2V = Sm. r < v strong	Z = *c*; X = *b*
$K_2O \cdot 2UO_3 \cdot V_2O_5 \cdot 8 \pm H_2O$	Orth.	1.7 0	1.925	1.95	2V = 39°-44°	r < v weak; X = *c*
$10MnO \cdot Sb_2O_5$	Mon.	1.92	1.95	1.96	2V = Sm.	r > v
$Fe_2O_3 \cdot 3TeO_2 \cdot 4H_2O$	Orth.	1.702	1.955	1.965	2V = 22° r > v strong	X ⊥ cleav.
Tl_2SeO_4	Orth.	1.9493	1.9592	1.9640	2V = 72°58′ r > v weak	Ax. pl. 001; X = *b*; Z = *a*
S*	Mon.	....	1.96 ±	....	2V = 58° ±	Ax. pl. 010; X ∧ *c* = 44°
$PbSiO_3$	Mon.	1.947	1.961	1.968	2V = 65°	r < v strong
$2PbO \cdot SO_3$	Mon.	1.93	1.99	2.02	2V = 47°	r > v; Y = *b*
$4PbO \cdot SO_3 \cdot 2CO_2 \cdot H_2O$	Mon.	1.87	2.00	2.01	2V = 10° r < v strong	X ∧ *c* = 5°30′; Z = *b*
$5Bi_2O_3 \cdot 3UO_3 \cdot 2As_2O_5 \cdot 12H_2O$	Tric.	1.90	2.00 ±	2.05 ±	2V = Lg.	X ca. ⊥ 010
$Pb_2As_2O_7$	....	....	2.03		....	....
$4CaO \cdot Al_2O_3 \cdot Fe_2O_3$	....	1.97	2.04	2.07	2V = Mod.	....
$3MgO \cdot B_2O_3 \cdot MnO \cdot Mn_2O_3$	Orth.	1.908	2.05	2.065	2V = 32°	X = *b*; Z = *a*
$9PbO \cdot 3P_2O_5 \cdot PbCl_2$	....	2.042	2.050	2.050	2V = Sm.	....
$PbO \cdot CO_2$	Orth.	1.8037	2.0763	2.0780	2V = 8°14′ r > v	Ax. pl. 010; X = *c*; Z = *a*
$Bi_2TeO_6 \cdot 2H_2O$	....	....	2.09 ±	....	2V = Sm.	r < v extreme
$CaO \cdot 3V_2O_5 \cdot 9H_2O$	Orth. (?)	1.70	2.10	2.23 ±	2V = 52°	Z = elong.
$6PbO \cdot 2MnO \cdot 3As_2O_5 \cdot H_2O$	Mon.	2.07	2. 0	2.12	2V = Lg.	r < v; Y = *b*
$PbO \cdot 2PbCl_2 \cdot H_2O$	Mon.	1.816	2.102	2.126	....	Z = *b*
$PbCl_2 \cdot PbO \cdot H_2O$	Mon.	2.077	2.116	2.158	2V = 82°	X = *a*; Z = *c*
$PbO \cdot PbCl_2$	....	2.04	2.15	2.15	2V = 0° ±	X = *c*
$CaO \cdot 3V_2O_5 \cdot 9H_2O$	Orth.	1.77	2.18	2.35	2V = Med.	Z = elong.
ZrO_2	Mon.	2.13	2.19	2.20	2V = 30° r > v strong	X ∧ *c* = 12°; Y = *b*
$WO_3 \cdot H_2O$	Orth.	2.09	2.24	2.26	2V = Sm.	r < v strong
$2PbO \cdot 2CuO \cdot V_2O_5 \cdot H_2O$	Orth.	2.17	2.26	2.32	2V = 73° ±	r > v strong

*Stable above 98°C.

INDEX OF REFRACTION—BIAXIAL NEGATIVE

Substance	System	α_D	β_D	γ_D	Axial Angle and Dispersion	Optical Orientation
Sb_2O_3	Orth.	2.18	2.35	2.35	2V = Sm. $r < v$	$X = a$; $Z_{Li} = b$
$Fe_2O_3 \cdot H_2O$	Orth.	2.260	2.394	2.400	2V = Sm. $r > v$	Ax. pl.* 001; $X = b$; $Z = c$
$PbO \cdot 2PbCrO_4$	Orth. (?)	2.42	2.7	2.75 ±	2V = Sm.	....
CuO	Mon.	......	2.84	......	$r < v$	....
$HgS \cdot 2Sb_2S_3$	Orth. (?)	......	3	......	....	....
$3Ag_2S \cdot As_2S_5$	Mon.	......	3	......	2V = 34°	Y *ca.* a; $Z = b$
$9(Ag, Cu)_2S \cdot Sb_2S_3$**	Mon.	......	3	......	2V = 22°	$X = c$; $Y = a$
Sb_2S_3	Orth.	3.194	4.046	4.303	2V = 26°	$X = c$; $Z = b$

*Ax. pl. 100 for Li; uniaxial for λ612mμ.

**Int. Crit. Tab. gives $8Ag_2S \cdot Sb_2S_3$.

INDEX OF REFRACTION (LIQUIDS)

Arrangement. The substances are arranged in alphabetical order. No substance is listed more than once. To ascertain if a compound is listed in the table it is to be looked for under the alphabetical listing according to its common name or by reference to an accompanying *formula index*. In using the table for the identification of an unknown liquid, reference should be made to the table *Refractive Index Finding Numbers* and in this case consideration must be given to the effect of temperature. When possible, values for the refractive index were selected at or near 20°C. The index of refraction of a liquid decreases with rise in temperature and this thermal variation differs with various substances but is approximately 0.0004 per 1°C.

Specific Gravity. As an aid in applying formulas for calculation of refractive index (*q. v.*) the specific gravity is given at the same temperature as used in the refractive index determination.

Beil. Ref. In the column so headed will be found the reference to the volume and page numbers of the 4th edition of Beilstein: *Handbuch der Organischen Chemie.* Where the Roman numeral, which indicates the volume number, is preceded by an asterisk, reference is to the first supplementary volumes; two asterisks, to the second supplementary volumes.

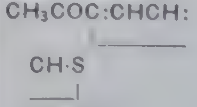
It is to be noted that the symbols α, β, γ which are often employed in reporting refractive index of liquids, refer to the wave length of light used and signify the wave length corresponding to the Hα, Hβ and Hγ spectrum lines. In the case of refractive index of biaxial crystals the symbols α, β and γ have a different significance (*q. v.*).

References. The information in the table has been collected mainly from the following sources:

Beilstein: *Handbuch der Organischen Chemie*, 4th edition. Published by Springer, Berlin.

International Critical Tables, Vol. VII. Published by McGraw-Hill Book Co., New York.

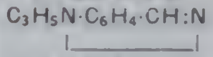
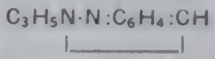
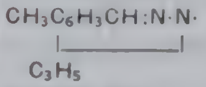
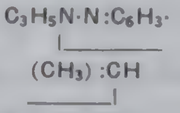
U. S. Bureau of Standards: *American Petroleum Institute Research Project 44.*

No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1	**Acenaphthene** (m.p. 95°)	$C_{12}H_{10}$	98.8	1.024	1.6048	V-586
2	**Acetal**	$CH_3CH(OC_2H_5)_2$	20	0.831	1.3819	I-603
3	**Acetaldehyde**	CH_3CHO	18	0.783	1.3392	I-594
4	oxime	$CH_3CH{:}NOH$	20.4	0.965	1.4257	I-608
5	**Acetic** acid	CH_3CO_2H	22.9	1.046	1.3715	II-96
6	anhydride	$(CH_3CO)_2O$	20	1.082	1.3901	II-166
7	**Acetimidoethyl ether**	$HN{:}C(CH_3)OC_2H_5$	18.8	0.873	1.4035	II-182
8	**Acetoin**	$CH_3CHOHCOCH_3$	15	1.002	1.4194	I-827
9	**Acetol**	CH_3COCH_2OH	20	1.082	1.4295	I-821
10	**Acetone**	$(CH_3)_2CO$	20	0.791	1.3591	I-635
11	cyanohydrin	$(CH_3)_2C(OH)CN$	19	0.932	1.4000	III-316
12	oxime (m.p. 60°)	$(CH_3)_2C{:}NOH$	75	.....	1.42	I-649
13	**Aceto**-nitrile	CH_3CN	16.5	0.78	1.3460	II-183
14	phenone	$CH_3COC_6H_5$	18.8	1.03	1.5338	VII-271
15	thienone (α)	 $CH_3COC{:}CHCH{:}CH{\cdot}S$	21.8	1.168	1.5663	XVII-287
16	**Acetonyl acetone**	$(CH_3COCH_2)_2$	20	0.974	1.4232	I-788
17	**Acetoxy**-acetone	$CH_3CO_2CH_2COCH_3$	20	1.075	1.4150	II-155
	propiophenone (α)	$C_6H_5COCH(CH_3)O{\cdot}OCCH_3$	19.7	1.113	1.5153	*VIII-547
18	γ-valero-lactone (γ)	$CH_3CO_2C(CH_3)CH_2{\cdot}CH_2COO$ (m.p. 78°)	78.6	1.123	1.4236	XVIII-2

INDEX OF REFRACTION—LIQUIDS

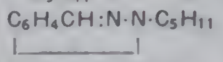
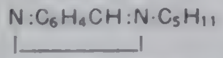
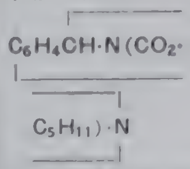
No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
19	**Acetoxymethylene-** cyclohexan-2-one (1)	$CH_3CO_2CH{:}C_6H_8O$	15.6	1.115	1.4994	*VIII-509
20	diethyl ketone	$C_2H_5COC(CH_3){:}CHO_2CCH_3$	18.3	1.034	1.4649	*II-73
21	menthone	$CH_3CO_2C_{11}H_{17}O$	16	1.032	1.4875	*VIII-512
22	pinacoline (m.p. 44°)	$(CH_3)_3CCOCH{:}CHO_2CCH_3$	55.3	0.965	1.4443	*II-73
23	**Acetyl-**acetone	$(CH_3CO)_2CH_2$	18.5	0.977	1.4518	I-777
24	acetone-*O*-ethyl ether	$CH_3C(OC_2H_5){:}CH{\cdot}COCH_3$	16.3	0.948	1.4665	I-844
25	acetone-*O*-methyl ether	$CH_3COCH{:}C(OCH_3){\cdot}CH_3$	20	0.971	1.4688	*I-426
26	bromide	CH_3COBr	15.8	1.663	1.4537	II-174
27	camphor (3)	$C_{12}H_{18}O_2$	19	1.031	1.4939	VII-596
28	chloride	CH_3COCl	20	1.105	1.3898	II-173
29	ethylamino-naphthalene (*β*)	$C_{10}H_7N(C_2H_5)CO{\cdot}CH_3$	23.1	1.089	1.6031	XII-1285
30	indazole (2) (*stable*)	$CH_3CON{\cdot}N{:}C_6H_4{:}CH$	20	1.186	1.588	*XXIII-33
31	methylheptenone	$C_{10}H_{16}O_2$	15	0.945	1.4849	I-804
32	6-methyl-indazole (2) (*stable*)	$CH_3CON{\cdot}N{:}C_6H_3{\cdot}(CH_3){:}CH$	5	1.162	1.587	....
33	5-methyltetra-hydroindazole (2)	$CH_3CON{\cdot}CH{:}C_6H_7{\cdot}(CH_3){:}N$	20	1.079	1.521	....
34	salicylaldehyde (*o*) (m.p. 37°)	$CH_3CO_2C_6H_4CHO$	44.5	1.158	1.5225	VIII-44
35	tetrahydroindazole (2)	$CH_3CON{\cdot}CH{:}C_6H_8{:}N$	20	1.119	1.531	....
36	tropein	$C_{10}H_{17}O_2N$	15.4	1.063	1.4769	XXI-18
37	**Acetylene** dibromide (*cis*)	$BrCH{:}CHBr$	17.5	2.271	1.5431	I-190
38	" (*trans*)	$BrCH{:}CHBr$	17.5	2.267	1.5505	I-190
39	dichloride (*cis*)	$ClCH{:}CHCl$	15	1.299	1.4519	I-187
40	" (*trans*)	$ClCH{:}CHCl$	15	1.265	1.4490	I-187
41	dicyanide	$NCC{:}CCN$	25	0.970	1.4647	*II-317
42	diiodide (*cis*)	$ICH{:}CHI$	11.2	3.1	1.706	I-194
43	**Acrylic** acid	$CH_2{:}CHCO_2H$	20	1.051	1.4224	II-397
44	aldehyde	$CH_2{:}CHCHO$	20	0.841	1.3998	I-725
45	**Adiponitrile**	$(CH_2CH_2CN)_2$	20(?)	0.950	1.4597	II-653
46	**Allyl** acetate	$CH_3CO_2CH_2CH{:}CH_2$	20	0.928	1.4045	II-136
47	acetic acid	$CH_2{:}CHCH_2CH_2{\cdot}CO_2H$	17.7	0.984	1.43	II-425
48	acetone	$C_3H_5CH_2COCH_3$	15.4	0.848	1.4213	I-734
49	acetylindazole (2) (*stable*)	$C_{12}H_{12}ON_2$	22.6	1.117	1.571	....
50	alcohol	$CH_2{:}CHCH_2OH$	20	0.854	1.4135	I-436
51	allylphenyl ether (*o*)	$CH_2{:}CHCH_2C_6H_4{\cdot}OCH_2CH{:}CH_2$	20	0.963	1.524	*VI-282
52	amine	$CH_2{:}CHCH_2NH_2$	21.8	0.761	1.4194	IV-205
53	anisole (*o*)	$CH_3OC_6H_4CH_2CH{:}CH_2$	20	0.972	1.524	*VI-282

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
54	**Allyl** benzene	$C_6H_5CH_2CH:CH_2$	20(?)	0.909	1.5143	V-484
55	bromide	$CH_2:CHCH_2Br$	20	1.398	1.4655	I-201
56	chloride	$CH_2:CHCH_2Cl$	20	0.938	1.4154	I-198
57	*o*-cresol (*o*)	$CH_2:CHCH_2C_6H_3:(CH_3)OH$ (1,2,3)	20	1.000	1.538	*VI-287
58	*o*-cresyl ether	$CH_3C_6H_4OCH_2CH:CH_2$	20	0.965	1.517	*VI-171
59	cyanide	$CH_2:CHCH_2CN$	16	0.837	1.4079	II-408
60	di-*o*, *o*-allylphenyl ether	$(C_3H_5)_2C_6H_3OC_3H_5$	20	0.950	1.523	*VI-301
61	guaiacol (*o*)	$CH_2:CHCH_2\cdot C_6H_3(OCH_3)OH$	20	1.066	1.539	*VI-461
62	guaiacyl ether	$CH_3OC_6H_4OCH_2\cdot CH:CH_2$ (1,2)	20	1.054	1.533	VI-772
63	2-hydroxydiphenyl (3)	$C_6H_5C_6H_3(OH)\cdot(CH_2CH:CH_2)$	20	1.072	1.601	**VI-664
64	1-indazole	 $C_3H_5N\cdot C_6H_4\cdot CH:N$	20	1.067	1.582	....
65	2-indazole	 $C_3H_5N\cdot N:C_6H_4:CH$	20	1.074	1.598	....
66	5-methylindazole (1)	 $CH_3C_6H_3CH:N\cdot N\cdot C_3H_5$	20	1.047	1.576	....
67	5-methylindazole (2)	 $C_3H_5N\cdot N:C_6H_3\cdot(CH_3):CH$	20	1.050	1.590	....
68	phenol (*o*)	$CH_2:CHCH_2C_6H_4OH$	20	1.021	1.545	*VI-282
69	phenol (*p*)	$CH_2:CHCH_2C_6H_4OH$	18	1.02	1.5441	*VI-571
70	tetrahydrofurfuryl ether	$C_3H_5OCH_2OC_4H_7$	20	0.957	1.4498	....
71	thymol (*o*) (1,2,3,4)	$(CH_3)(C_3H_5)(OH)\cdot(C_3H_7)C_6H_2$	20	0.966	1.526	....
72	thymyl ether	$(CH_3)(CH_2:CH\cdot CH_2O)C_6H_3(C_3H_7)$	20	0.935	1.508	**VI-498
73	*iso*-thiocyanate	$CH_2:CHCH_2NCS$	20	1.013	1.5266	IV-214
74	thiourea (m.p. 78°)	$CH_2:CHCH_2NH\cdot CSNH_2$	78.1	1.2	1.60	IV-211
75	**Allyloxy-*m*-xylene** (*sym*)	$(CH_3)_2C_6H_3OCH_2\cdot CH:CH_2$	20	0.948	1.514	*VI-244
76	**Aluminum** triethyl	$(C_2H_5)_3Al$	6.5	.....	1.480	IV-643
77	trimethyl	$(CH_3)_3Al$	12	.....	1.432	IV-643
78	**Amino**-ethylbenzene (*o*)	$NH_2C_6H_4C_2H_5$	22	0.983	1.5584	XII-1089
79	" (*p*)	$NH_2C_6H_4C_2H_5$	22	0.975	1.5529	XII-1090
80	hexahydrobenzene	$C_6H_{11}NH_2$	20	0.865	1.4318	XII-5
81	**Ammonia**	NH_3	16.5	.....	1.325	....
82	**Amyl** acetate (*n*)	$CH_3CO_2C_5H_{11}$	20	0.879	1.4012	II-131
83	" (*iso*) †	$CH_3CO_2C_5H_{11}$	18.1	0.87	1.4014	II-132
84	" ‡	$CH_3CO_2CH_2CH\cdot(CH_3)C_2H_5$	20	0.88	1.4012	II-131
85	acetic acid (*iso*)	$(CH_3)_2C_4H_7CO_2H$	19(?)	0.912	1.4209	II-342
86	α-aceto-cyanoacetate (*iso*)	$HC\vdots(COCH_3)(CN)\cdot(CO_2C_5H_{11})$	20	1.033	1.4676	III-798
87	acetylcamphorcarboxylate	$C_{18}H_{28}O_4$	20.5	1.022	1.4772	X-38

† Commonly called amyl acetate.
‡ From *l*-amyl alcohol.

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
88	**Amyl** alcohol (*n*)	$CH_3(CH_2)_3CH_2OH$	20	0.817	1.4101	I-383
89	" (*sec*) (*n*)	$C_2H_5CH_2CHOHCH_3$	20	0.809	1.4053	I-384
90	" (*prim*) (*iso*)	$C_4H_9CH_2OH$	15	0.813	1.4085	I-392
91	" (*sec*) (*iso*)	$(CH_3)_2CHCHOHCH_3$	20	0.818	1.3973	I-391
92	" (*tert*)	$(CH_3)_2COHC_2H_5$	20	0.809	1.406	I-388
93	amine (*iso*)	$C_4H_9CH_2NH_2$	17.9	0.751	1.4096	IV-180
94	*iso*-amylidene-amine (*iso*) §	$(CH_3)_2CH(CH_2)_2N{:}CHCH_2CH(CH_3)_2$	18.9	0.772	1.4258	....
95	anisate (*iso*)	$CH_3OC_6H_4CO_2C_5H_{11}$ (*p*)	20	1.040	1.5085	....
96	anthracene (*iso*) (9) (*meso*) (m.p. 58°)	$C_{19}H_{20}$	71.1	1.002	1.6364	I-685
97	benzene (*n*)	$CH_3(CH_2)_4C_6H_5$	20	0.86	1.4943	V-382
98	" (*iso*)	$C_5H_{11}C_6H_5$	15.6	0.863	1.4867	V-434
99	" (*tert*)	$C_5H_{11}C_6H_5$	23	0.8	1.4915	V-436
100	benzoate	$C_6H_5CO_2C_5H_{11}$	20	0.989	1.494	....
101	bromide (*n*)	$CH_3(CH_2)_3CH_2Br$	20	1.218	1.4444	I-131
102	" (*iso*)	$(CH_3)_2CHCH_2CH_2Br$	20	1.215	1.4412	I-136
103	" (*tert*)	$C_2H_5CBr(CH_3)_2$	20(?)	1.216	1.4421	I-136
104	*n*-butyrate	$C_2H_5CH_2CO_2C_5H_{11}$	20	0.87	1.4110	II-271
105	*iso*-butyrate	$(CH_3)_2CHCO_2C_5H_{11}$	20	0.859	1.4076	....
106	camphorcarboxylate (*iso*)	$C_{16}H_{26}O_3$	17.2	1.014	1.4760	X-645
107	carbamate (*iso*) (m.p. 64°)	$NH_2CO_2C_5H_{11}$	70.6	0.944	1.4175	III-30
108	chloride (*n*)	$CH_3(CH_2)_3CH_2Cl$	20	0.878	1.4119	I-130
109	" (*iso*)	$(CH_3)_2CHCH_2CH_2Cl$	18	0.800	1.4112	I-135
110	" (*tert*)	$(CH_3)_2CClC_2H_5$	18	0.869	1.407	I-134
111	chloroacetate	$ClCH_2CO_2C_5H_{11}$	20	1.055	1.434	II-198
112	3-chloro-campho-3-carboxylate	$C_{16}H_{25}O_3Cl$	19	1.091	1.4866	X-647
113	*α*-crotonate	$C_9H_{16}O_2$	20	0.896	1.4371	II-411
114	cyanide (*n*)	$CH_3(CH_2)_4CN$	14.3	0.80	1.4085	II-324
115	" (*iso*)	$(CH_3)_2CH(CH_2)_2CN$	22.2	0.80	1.4048	II-329
116	dichloroamine (*iso*)	$(CH_3)_2CHCH_2{\cdot}CH_2NCl_2$	25.7	1.027	1.4438	....
117	ether (*iso*)	$(C_5H_{11})_2O$	20	0.78	1.408	I-401
118	fluoride (*n*)	$CH_3(CH_2)_4F$	20	0.788	1.3574	**I-94
119	formate (*iso*)	$HCO_2C_5H_{11}$	20	0.871	1.3977	II-22
120	furylacrylate (*n*)	$C_4H_3OCH{:}CHCO_2{\cdot}C_5H_{11}$	20	1.032	1.5083	....
121	1-indazole (*iso*)	 $C_6H_4CH{:}N{\cdot}N{\cdot}C_5H_{11}$	20	1.001	1.546	....
122	2-indazole (*iso*)	 $N{:}C_6H_4CH{:}N{\cdot}C_5H_{11}$	20	1.007	1.558	....
123	2-indazole-carboxylate (*iso*)	 $C_6H_4CH{\cdot}N(CO_2{\cdot}C_5H_{11}){\cdot}N$	15.1	1.110	1.543	....
124	iodide (*n*)	$CH_3(CH_2)_3CH_2I$	20	1.510	1.4955	I-133
125	mercaptan (*n*)	$CH_3(CH_2)_3CH_2SH$	20(?)	0.857	1.4437	I-384
126	" (*iso*)	$C_5H_{11}SH$	20	0.835	1.4412	I-405

§ Probably not a pure material.

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
127	**Amyl** β-methoxyacrylic acid (β) (m.p. 55°)	$C_5H_{11}C(OCH_3){:}CH\cdot CO_2H$	60.8	0.969	1.4588	III-382
128	nitrate (*iso*)	$C_5H_{11}ONO_2$	21.7	0.996	1.4122	I-403
129	nitrite (*n*)	$CH_3(CH_2)_3CH_2ONO$	20(?)	0.853	1.3851	I-384
130	" (*iso*)	$C_5H_{11}ONO$	20.7	0.871	1.3871	I-402
131	phenyl ether (*iso*)	$C_5H_{11}OC_6H_5$	22.1	0.920	1.49	VI-143
132	phenyl ketone (*iso*)	$C_5H_{11}COC_6H_5$	15(?)	0.962	1.5125	VII-334
133	propiolic acid (*n*)	$C_5H_{11}C{\vdots}CCO_2H$	12.6	0.962	1.4634	II-487
134	propiolic diethyl acetal	$C_5H_{11}C{\vdots}CCH{:}(OC_2H_5)_2$	9.5	0.886	1.4421	I-751
135	propiolic nitrile	$C_5H_{11}C{\vdots}CCN$	13	0.851	1.4553	II-488
136	propionate (*iso*)	$C_2H_5CO_2C_5H_{11}$	20	0.870	1.4065	II-241
137	*iso*-propylmalonate (*iso*)	$CH_2(CO_2C_5H_{11})\cdot(CO_2C_3H_7)$	20	0.96	1.4293	....
138	salicylate (*iso*)	$HOC_6H_4CO_2C_5H_{11}$	20	1.05	1.506	X-76
139	thiophene (*iso*) (α)	$C_5H_{11}C{:}CHCH{:}CH\cdot S$	20	0.941	1.498	....
140	valerate (*n*)	$C_4H_9CO_2C_5H_{11}$	20	0.87	1.4145	II-301
141	*iso*-valerate (*iso*)	$C_4H_9CO_2C_5H_{11}$	18.7	0.86	1.4130	II-312
142	**Amylene glycol** (1,4)	$C_5H_{10}(OH)_2$	16.8	0.996	1.4439	I-480
143	" " (1,5)	$CH_2(CH_2CH_2OH)_2$	20	0.994	1.4499	I-481
144	**Anethole** (*p*)	$CH_3CH{:}CHC_6H_4\cdot OCH_3$	21	0.990	1.5614	VI-566
145	**Angelic acid** (*cis*) (m.p. 45°)	$CH_3CH{:}C(CH_3)\cdot CO_2H$	76	0.954	1.43	II-428
146	**Angelolactone** (α)	$CH_3C{:}CHCH_2CO\cdot O$	20	1.084	1.448	XVII-252
147	" (β)	$CH_3CHCH{:}CHCO\cdot O$	20	1.074	1.460	XVII-253
148	**Anhydro-δ-acetobutyl alcohol**	$CH_3C{:}CHCH_2CH_2\cdot$ CH_2O	20	0.906	1.446	XVII-21
149	**Aniline**	$C_6H_5NH_2$	20	1.022	1.5863	XII-59
150	**Anisaldehyde** (*o*)	$CH_3OC_6H_4CHO$	20.2	1.133	1.5597	VIII-43
151	" (*p*)	$CH_3OC_6H_4CHO$	12.7	1.13	1.5764	VIII-67
152	oxime methyl ether (*o*)	$CH_3OC_6H_4CH{:}NOCH_3$	20	1.092	1.554	VIII-77
153	**Anisidine** (*o*)	$CH_3OC_6H_4NH_2$	20	1.093	1.5754	XIII-358
154	" (*p*) (m.p. 58°)	$CH_3OC_6H_4NH_2$	67	1.061	1.5559	XIII-435
155	**Anisole**	$C_6H_5OCH_3$	20.6	0.994	1.5173	VI-138
156	**Anthracene octahydride** (m.p. 71°)	$C_{14}H_{18}$	88.8	0.965	1.5363	V-526
157	**Anthranil**	$O\cdot N{:}C_6H_4{:}CH$	20	1.18	1.586	XXVII-39
158	**Antimony** pentachloride	$SbCl_5$	14	.....	1.601	....
159	trimethyl	$(CH_3)_3Sb$	15	1.52	1.48	IV-617
160	**Apiol** (m.p. 30°)	$C_6H(O_2CH_2)(O\cdot CH_3)_2C_3H_5$	14	1.176	1.5380	*XIX-642
161	" (*iso*) (m.p. 56°)	$C_{12}H_{14}O_4$	12	1.197	1.5703	XIX-85
162	**Apocyclene** (m.p. 43°)	C_9H_{14}	40	0.871	1.4514	*V-66

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
163	**Arsenic triethyl**	$(C_2H_5)_3As$	20	1.150	1.467	IV-602
164	**Asaron** (1,2,4,5)	$CH_3CH:CHC_6H_2(O\cdot CH_3)_3$	11	1.091	1.5719	VI-1129
165	**Ascaridol**	$C_{10}H_{16}O_2$	20	0.999	1.4769	XIX-17
166	**Atractylene**	$C_{15}H_{24}$	20	0.927	1.5057	V-470
167	**Azelaic acid** (m.p. 107°)	$(CH_2)_7(CO_2H)_2$	107.3	1.0	1.43	II-707
168	**Azoxybenzene** (m.p. 36°)	$C_6H_5\cdot N(:O):N\cdot C_6H_5$	26	1.24	1.6644	XVI-622
169	**Benzal-acetone** (m.p. 41°)	$C_6H_5CH:CHCOCH_3$	45.9	.....	1.5836	VII-364
170	acetophenone (m.p. 62°)	$C_6H_5CH:CHCOC_6H_5$	62.3	1.071	1.6458	VII-478
171	bromide	$C_6H_5CHBr_2$	15(?)	1.51	1.541	V-308
172	chloride	$C_6H_5CHCl_2$	19.4	1.3	1.5515	V-297
173	dipropyl ketone (α)	$C_6H_5CH:C(C_2H_5)\cdot COC_3H_7$	23.9	0.972	1.5476	VII-379
174	pinacoline (m.p. 40°)	$C_{13}H_{16}O$	40	1.2	1.5473	VI-183
175	**Benzaldehyde**	C_6H_5CHO	19.5	1.049	1.5456	VII-174
176	oxime (*anti*) (m.p. 35°)	$C_6H_5CH:NOH$	20	1.111	1.5908	VII-218
177	oxime *O*-ethyl ether (α)	$C_6H_5CH:NOC_2H_5$	21.7	0.992	1.5350	VII-223
178	oxime *O*-methyl ether (α)	$C_6H_5CH:NOCH_3$	20	1.020	1.548	VII-223
179	**Benzene**	C_6H_6	20	0.879	1.5011	V-179
180	**Benzhydrylamine**	$(C_6H_5)_2CHNH_2$	21.5	1.064	1.5963	XII-1323
181	**Benzoic acid** (m.p. 122°)	$C_6H_5CO_2H$	131.9	1.2	1.504	IX-92
182	anhydride (m.p. 42°)	$(C_6H_5CO)_2O$	15	1.199	1.5767	IX-164
183	nitrile	C_6H_5CN	20	1.005	1.5289	IX-275
184	**Benzo**-phenone (*labile*) (m.p. 26.5°)	$(C_6H_5)_2CO$	23.4	1.108	1.6060†	VII-410
185	phenone (*labile*) (m.p. 48°)	$(C_6H_5)_2CO$	19	1.091	1.6077†	VII-410
186	phenone (m.p. 48.5°)	$(C_6H_5)_2CO$	45.2	1.089	1.5975	VII-410
187	trichloride	$C_6H_5CCl_3$	19.2	1.37	1.5584	V-300
188	**Benzoyl**-acetone (m.p. 61°)	$C_6H_5COCH_2COCH_3$	77.8	1.08	1.5678	VII-680
189	acetone *O*-methyl ether	$C_6H_5C(OCH_3):CH\cdot COCH_3$	16	1.068	1.5598	VIII-559
190	chloride	C_6H_5COCl	20	1.212	1.5537	IX-182
191	**Benzyl** acetate	$CH_3CO_2CH_2C_6H_5$	21	1.06	1.5242	VI-435
192	alcohol	$C_6H_5CH_2OH$	20	1.043	1.5396	VI-428
193	amine	$C_6H_5CH_2NH_2$	19.5	0.980	1.5441	XII-1013
194	aniline (m.p. 37°)	$C_6H_5CH_2NHC_6H_5$	24.8	1.065	1.6118	XII-1023
195	azide	$C_6H_5CH_2N_3$	24.9	1.066	1.5341	V-350
196	benzoate	$C_6H_5CO_2CH_2C_6H_5$	21.5	1.12	1.5685	IX-121
197	*iso*-butyrate	$(CH_3)_2CHCO_2C_7H_7$	18(?)	1.016	1.4910	VI-436
198	chloride	$C_6H_5CH_2Cl$	17.4	1.103	1.5391	V-292
199	chloroacetate	$ClCH_2CO_2CH_2C_6H_5$	20	1.2	1.523	VI-435

† Supercooled.

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
200	**Benzyl**-crotonolactone (γ)	$C_6H_5CH_2CHCH:$ └──── $CHCO{\cdot}O$ ────┘	20	1.149	1.563	XVII-340
201	cyanide	$C_6H_5CH_2CN$	20	1.018	1.5242	IX-441
202	cyclohex-1-ene (1)	$C_6H_5CH_2C:CH{\cdot}$ └──── $(CH_2)_3CH_2$ ────┘	14.1	0.969	1.5443	V-524
203	cyclohex-1-ene-6-one (1)	$C_6H_5CH_2C:CH{\cdot}$ └──── $(CH_2)_3CO$ ────┘	21.7	1.061	1.5628	*VII-208
204	*p*-cymene (2)	$(CH_3)(C_7H_7)C_6H_3{\cdot}$ $CH(CH_3)_2$	20	0.963	1.5564	V-620
205	dichloroacetate	$Cl_2CHCO_2CH_2C_6H_5$	20	1.3	1.526	VI-435
206	3,5-dimethylpyrazole (1)	$CH_3C:CHC(CH_3):$ └──────── $N{\cdot}N(CH_2C_6H_5)$ ──┘	20	1.034	1.549	....
207	lactate	$CH_3CHOHCO_2C_7H_7$	25	.....	1.5252	**VI-420
208	laurate	$C_{11}H_{23}CO_2CH_2C_6H_5$	20	0.95	1.483	**VI-417
209	3-methyl-4-chloropyrazole (1)	$CH:C(Cl){\cdot}C(CH_3):$ └────────── $N{\cdot}N{\cdot}CH_2C_6H_5$ ──┘	20	1.156	1.556	....
210	5-methyl-4-chloropyrazole (1)	$N:CHC(Cl):C{\cdot}$ └──────── $(CH_3){\cdot}N(C_7H_7)$ ────┘	20	1.178	1.560	....
211	methylnitroamine	$C_6H_5CH_2N(NO_2){\cdot}$ CH_3	25.7	1.171	1.5515	....
212	3-methylpyrazole (1)	$CH:CHC(CH_3):N{\cdot}N{\cdot}$ └──────────┘ $CH_2C_6H_5$	20	1.049	1.554	....
213	myristate (m.p. 20°)	$C_{13}H_{27}CO_2CH_2C_6H_5$	20	0.93	1.482	**VI-417
214	oleate	$C_{17}H_{33}CO_2CH_2C_6H_5$	25	0.933	1.4875	*VI-221
215	palmitate (m.p. 36°)	$C_{15}H_{31}CO_2CH_2C_6H_5$	50	0.9	1.4689	**VI-417
216	stearate (m.p. 46°)	$C_{17}H_{35}CO_2CH_2C_6H_5$	50	0.908	1.4663	*VI-221
217	tetrahydroindazole (1)	$C_6H_8{\cdot}CH:N{\cdot}NC_7H_7$ └───────┘	20	1.089	1.573	....
218	tetrahydroindazole (2)	$C_7H_7N{\cdot}N:C_6H_8:CH$ └───────┘	20	1.086	1.579	....
219	toluene (*p*)	$C_6H_5CH_2C_6H_4CH_3$	19.3	0.99	1.5710	V-607
220	trichloroacetate	$Cl_3CCO_2CH_2C_6H_5$	18.8	1.38	1.5288	VI-436
221	*d*-valerate	$C_4H_9CO_2CH_2C_6H_5$	20.4	0.98	1.4922	VI-436
222	**Bis-diethylacetal**	$[(C_2H_5O)_2CHC:]_2$	26	0.953	1.4328	I-805
223	**Bismuth trimethyl**	$(CH_3)_3Bi$	15	2.3	1.56	IV-622
224	**Bornyl** acetate (*d*)	$CH_3CO_2C_{10}H_{17}$	22.6	0.99	1.4623	VI-78
225	acetate (*dl*)	$CH_3CO_2C_{10}H_{17}$	20	0.985	1.4630	VI-85
226	acetate (*iso*)	$CH_3CO_2C_{10}H_{17}$	20(?)	0.984	1.4649	VI-89
227	*n*-butyrate (*d*)	$C_2H_5CH_2CO_2C_{10}H_{17}$	15	0.966	1.4638	VI-79
228	formate (*d*)	$HCO_2C_{10}H_{17}$	15	1.017	1.4708	VI-78
229	propionate (*d*)	$C_2H_5CO_2C_{10}H_{17}$	15	0.979	1.4644	VI-79
230	*n*-valerate (*d*)	$C_4H_9CO_2C_{10}H_{17}$	15	0.956	1.4628	VI-79
231	*iso*-valerate	$C_4H_9CO_2C_{10}H_{17}$	22.2	0.95	1.4600	VI-79

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
232	**Brassidic** acid (m.p. 60°)	$C_{21}H_{41}CO_2H$	57	0.859	1.45	II-474
233	anhydride (m.p. 64°)	$C_{44}H_{82}O_3$	100	0.8	1.4366	....
234	**Bromo-**aniline (*m*)	$BrC_6H_4NH_2$	20.4	1.579	1.6260	XII-633
235	anisole (*o*)	$BrC_6H_4OCH_3$	20	1.502	1.5725	VI-197
236	" (*p*)	$BrC_6H_4OCH_3$	20	1.457	1.5605	VI-199
237	benzene	C_6H_5Br	20	1.495	1.5604	V-206
238	2-butene (2)	$CH_3CBr:CHCH_3$	25.4	1.322	1.4583	I-205
239	*p-iso*-butyro-*o*-cresol (α)	$(CH_3)(OH)C_6H_3\cdot COCBr(CH_3)_2$	22.3	1.367	1.5714	*VIII-556
240	*p-iso*-butyro-*o*-cresyl acetate (α)	$CH_3CO_2C_6H_3(CH_3)\cdot COCBr(CH_3)_2$	25.7	1.317	1.5288	*VIII-556
241	*n*-butyrophenone (α)	$C_2H_5CHBrCOC_6H_5$	20	1.364	1.562	VII-314
242	*iso*-butyrophenone (α)	$(CH_3)_2CBrCOC_6H_5$	20	1.355	1.5567	VII-316
243	crotonaldehyde (α)	$CH_3CH:CBrCHO$	23	1.566	1.5165	*I-380
244	2,3-dimethylbutane (2)	$(CH_3)_2CHBr(CH_3)_2$	20(?)	1.177	1.4517	I-152
245	3,5-dimethyl-cyclohexane (1)	$(CH_3)_2C_6H_9Br$	18.2	1.207	1.4832	V-38
246	2,2-dimethylpropane (1)	$(CH_3)_3CCH_2Br$	20	1.260	1.4369	I-141
247	ethyl acetate (β)	$CH_3CO_2C_2H_4Br$	20	1.462	1.4433	II-128
248	" " (α)	$CH_3CO_2C_2H_4Br$	20	1.514	1.4550	II-153
249	methyl methyl ether	$BrCH_2OCH_3$	20	1.598	1.4562	I-582
250	naphthalene (α)	$C_{10}H_7Br$	20	1.482	1.6582	V-547
251	*m*-nitrobenzene	$BrC_6H_4NO_2$	20.1	1.704	1.5979	V-248
252	nonane (2)	$CH_3(CH_2)_6CHBrCH_3$	20(?)	1.081	1.4536	I-166
253	propionic acid (α) (*dl*)	$CH_3CHBrCO_2H$	20	1.700	1.4753	II-254
254	propiophenone (α)	$C_6H_5COCHBrCH_3$	19.6	1.430	1.5718	VII-302
255	propylene (α)	$CH_3CH:CHBr$†	20	1.428	1.4554	I-200
256	" (α)	$CH_3CH:CHBr$‡	15.8	1.417	1.4549	I-200
257	propylene (2)	$CH_3CBr:CH_2$	15.8	1.397	1.4467	I-200
258	styrene (α)	$C_6H_5CBr:CH_2$	20	1.406	1.588	V-477
259	" (ω)§	$C_6H_5CH:CHBr$	16.6	1.42	1.6091	V-477
260	" (ω)¶	$C_6H_5CH:CHBr$	22.5	1.425	1.5990	V-477
261	thiophene (α)	$\underline{BrC:CH\cdot CH:CH\cdot S}$	20	1.684	1.59	XVII-33
262	toluene (*o*)	$BrC_6H_4CH_3$	20(?)	1.422	1.5608	V-304
263	" (*m*)	$BrC_6H_4CH_3$	20	1.410	1.551	V-305
264	" (*p*) (m.p. 28°)	$BrC_6H_4CH_3$	20	1.390	1.5490	V-305
265	1,1,4-trimethylcyclohexane (4)	$(CH_3)_3C_6H_8Br$	17.4	1.170	1.4800	*V-17
266	1,3,5-trimethylcyclohexane (1)	$(CH_3)_3C_6H_8Br$	11.1	1.175	1.4828	*V-18
267	*o*-xylene (4)	$BrC_6H_3(CH_3)_2$ (4,1,2)	18.4	1.37	1.5571	V-365
268	*p*-xylene (2)	$BrC_6H_3(CH_3)_2$ (2,1,4)	18.5	1.36	1.5514	V-385
269	**Bromoform**	$HCBr_3$	19	2.892	1.5980	I-68
270	**Butenyl-anisole** (α) (*p*)	$CH_3OC_6H_4CH:CH\cdot C_2H_5$	19	0.980	1.5559	VI-575
271	**Butyl-**acetate (*n*)	$CH_3CO_2CH_2C_2H_5$	20	0.881	1.3951	II-130
272	acetate (*iso*)	$CH_3CO_2C_4H_9$	18.8	0.870	1.3907	II-131

† α-form. ‡ β-form. § Isomer No. 1. ¶ Isomer No. 2.

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
273	**Butyl** acetate (*sec*)	$CH_3CO_2C_4H_9$	20	0.870	1.3877	II-131
274	acetate (*tert*)	$CH_3CO_2C(CH_3)_3$	20(?)	0.896	1.3947	II-131
275	alcohol (*n*)	$C_2H_5CH_2CH_2OH$	20	0.810	1.3991	I-367
276	" (*iso*)	$(CH_3)_2CHCH_2OH$	17.5	0.805	1.3968	I-373
277	" (*sec*)	$CH_3CHOHC_2H_5$	22	0.806	1.3924	I-371
278	" (*tert*)	$(CH_3)_3COH$	20	0.786	1.3878	I-379
279	amine (*n*)	$C_2H_5CH_2CH_2NH_2$	20	0.740	1.401	IV-156
280	" (*iso*)	$(CH_3)_2CHCH_2NH_2$	17	0.74	1.3988	IV-163
281	" (*sec*)	$C_4H_9NH_2$	20	0.724	1.394	IV-160
282	" (*tert*)	$(CH_3)_3CNH_2$	18	0.698	1.3794	IV-173
283	*d*-amyl ether (*iso*) †	$(CH_3)_2CHCH_2O\cdot C_5H_{11}$	20.2	0.77	1.4008	I-387
284	anisate (*p*)	$CH_3OC_6H_4CO_2C_4H_9$	20	1.054	1.508	....
285	" (*p*) (*iso*)	$CH_3OC_6H_4CO_2C_4H_9$	20	1.052	1.507	....
286	benzene (*n*)	$C_6H_5C_4H_9$	20	0.860	1.4898	V-413
287	" (*iso*)	$C_6H_5CH_2CH(CH_3)_2$	20	0.853	1.4865	V-414
288	" (*sec*)	$C_6H_5CH(CH_3)C_2H_5$	20	0.862	1.4902	V-414
289	" (*tert*)	$C_6H_5C(CH_3)_3$	20	0.867	1.4926	V-416
290	benzoate (*sec*) (*d*)	$C_6H_5CO_2C_4H_9$	20	1.000	1.4930	*IX-63
291	bromide (*n*)	$C_2H_5CH_2CH_2Br$	20	1.279	1.4398	I-119
292	" (*iso*)	$(CH_3)_2CHCH_2Br$	20	1.264	1.436	I-126
293	" (*sec*)	$C_2H_5CHBrCH_3$	25.3	1.251	1.4344	I-119
294	" (*tert*)	$(CH_3)_3CBr$	20.5	1.211	1.428	I-127
295	*n*-butyrate (*n*)	$C_2H_5CH_2CO_2C_4H_9$	20	0.872	1.4049	II-271
296	" (*iso*)	$C_2H_5CH_2CO_2C_4H_9$	18.4	0.862	1.4030	II-271
297	*iso*-butyrate (*iso*)	$(CH_3)_2CHCO_2CH_2\cdot CH(CH_3)_2$	20	0.87	1.3999	II-291
298	"carbitol"	$C_4H_9O(CH_2)_2O\cdot (CH_2)_2OH$	27	0.95	1.4290	**I-521
299	"collosolve"	$C_4H_9OCH_2CH_2OH$	20	0.900	1.4191	**I-519
300	chloride (*n*)	$C_2H_5CH_2CH_2Cl$	20	0.884	1.4015	I-118
301	" (*iso*)	$(CH_3)_2CHCH_2Cl$	17.8	0.879	1.3970	I-124
302	" (*sec*)	$C_2H_5CHClCH_3$	25.2	0.87	1.3953	I-119
303	" (*tert*)	$(CH_3)_3CCl$	17.8	0.843	1.3869	I-125
304	chloroformate (*n*)	$ClCO_2CH_2CH_2C_2H_5$	20	1.078	1.41	**III-11
305	decyl ether	$C_4H_9OC_{10}H_{21}$	20	0.801	1.4278	....
306	dichloroamine (*iso*)	$(CH_3)_2CHCH_2NCl_2$	24	1.090	1.4484	IV-171
307	ether (*n*)	$(C_2H_5CH_2CH_2)_2O$	20	0.769	1.3992	I-369
308	2-ethylhexyl phthalate	$C_6H_4(CO_2C_4H_9)\cdot CO_2C_8H_{17}$	20	1.01	1.4888	....
309	formate (*n*)	$HCO_2CH_2CH_2C_2H_5$	20	0.89	1.3891	II-21
310	" (*iso*)	$HCO_2CH_2CH(CH_3)_2$	20	0.885	1.3857	II-21
311	furylacrylate (*n*)	$C_4H_3OCH:CHCO_2\cdot C_4H_9$	20	1.048	1.5129	....
312	indazole (1) (*n*)	$C_6H_4CH:N\cdot N\cdot C_4H_9$ |__________|	20	1.019	1.553	....
313	" (2) (*n*)	$C_4H_9N:CH\cdot C_6H_4:N$ |__________|	20	1.025	1.562	....
314	iodide (*n*)	$C_2H_5CH_2CH_2I$	20	1.617	1.4998	I-123
315	" (*iso*)	$(CH_3)_2CHCH_2I$	20	1.606	1.4960	I-128
316	mercaptan (*iso*)	$(CH_3)_2CHCH_2SH$	20	0.836	1.4386	I-378
317	nitrate (*iso*)	$(CH_3)_2CHCH_2ONO_2$	20	1.015	1.4028	I-377
318	nitrite (*iso*)	$(CH_3)_2CHCH_2ONO$	22.1	0.87	1.3715	I-377
319	nitroamine (*n*)	$C_2H_5CH_2CH_2NHNO_2$	23	1.058	1.4604	IV-571
320	" (*sec*)	$C_4H_9NHNO_2$	21.9	1.057	1.4581	IV-571
321	oleate (*n*)	$C_{17}H_{33}CO_2C_4H_9$	20	0.864	1.4522	**II-439

† Mixture of isomers?

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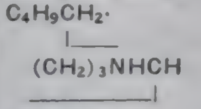
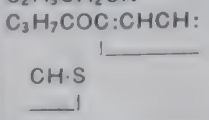
No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
322	**Butyl**-phenyl ketone (*iso*)	$(CH_3)_2CHCH_2CO\cdot C_6H_5$	15.3	0.99	1.5139	VII-329
323	" " (*tert*)	$(CH_3)_3CCOC_6H_5$	19.2	0.968	1.5086	VII-330
324	piperidine (*α*) (*iso*)	 $C_4H_9CH_2\cdot(CH_2)_3NHCH$	21.7	0.851	1.4553	XX-128
325	propionate (*iso*)	$C_2H_5CO_2C_4H_9$	20	0.869	1.3975	II-241
326	" (*sec*)	$C_2H_5CO_2C_4H_9$	20	0.866	1.3952	II-241
327	*iso*-propylmalonate (*n*)	$CH_2(CO_2C_4H_9)(CO_2\cdot C_3H_7)$	20	0.97	1.4311	....
328	ricinoleate (*n*)	$HOC_{17}H_{32}CO_2C_4H_9$	22	0.906	1.4566	III-388
329	" (*iso*)	$HOC_{17}H_{32}CO_2CH_2\cdot CH(CH_3)_2$	22	0.903	1.4538	III-388
330	styryl ketone (*n*) (m.p. 40°)	$C_4H_9COCH{:}CHC_6H_5$	44.7	0.960	1.5518	VII-377
331	*iso*-thiocyanate (*iso*)	$(CH_3)_2CHCH_2NCS$	14	0.964	1.5005	IV-171
332	toluene (*p*) (*tert*)	$CH_3C_6H_4C(CH_3)_3$	13.3	0.867	1.4947	V-439
333	*iso*-valerate (*iso*)	$(CH_3)_2CHCH_2CO_2\cdot CH_2CH(CH_3)_2$	20	0.854	1.4057	II-312
334	valerate (*sec*)	$C_4H_9CO_2CH(CH_3)\cdot(C_2H_5)$	20	0.860	1.4070	II-131
335	**Butylene** (*α*) (b.p. −5°)	$C_2H_5CH{:}CH_2$	20	.....	1.3962	I-203
336	chlorohydrin (*β, γ*)	$CH_3CHClCHOHCH_3$	20(?)	1.105	1.4438	I-373
337	phenylacetylene (*iso*)	$(CH_3)_2C{:}CHC\vdots CC_6H_5$	13	0.930	1.5828	V-568
338	**Butyne** (1)	$C_2H_5C\vdots CH$	?	0.7	1.3962	I-248
339	" (2)	$CH_3C\vdots CCH_3$	20	0.693	1.392	I-249
340	**Butyraldehyde** (*n*)	$C_2H_5CH_2CHO$	20	0.817	1.3843	I-662
341	" (*iso*)	$(CH_3)_2CHCHO$	20	0.794	1.3730	I-671
342	oxime (*iso*)	$(CH_3)_2CHCH{:}NOH$	20.5	0.902	1.4302	*I-350
343	**Butyrchloral**	$CH_3CHClCCl_2CHO$	20	1.396	1.4755	I-664
344	**Butyric acid** (*n*)	$C_2H_5CH_2CO_2H$	20	0.964	1.3979	II-264
345	" " (*iso*)	$(CH_3)_2CHCO_2H$	20	0.949	1.3930	II-288
346	**Butyro**-anisole (*p*) (*iso*)	$(CH_3)_2CHCO\cdot C_6H_4OCH_3$	16.6	1.050	1.5393	*VIII-553
347	*p*-chlorophenol (*o*) (*iso*)	$(HO)(Cl)C_6H_3CO\cdot CH(CH_3)_2$	20	1.192	1.552	....
348	*o*-cresol (*o*) (*iso*)	$(CH_3)_2CHCOC_6H_3{:}(CH_3)OH$	20	1.047	1.537	....
349	*m*-cresol (*o*) (*iso*)	$(CH_3)_2CHCOC_6H_3{:}(CH_3)(OH)$	20	1.042	1.540	....
350	*p*-cresol (*o*) (*iso*)	$(CH_3)_2CHCOC_6H_3{:}(CH_3)OH$	21.3	1.043	1.5355	*VIII-556
351	*o*-cresyl acetate (*o, iso*) (1,2,3)	$(CH_3)(CH_3CO_2){:}C_6H_3(COC_3H_7)$	20	1.074	1.514	....
352	*p*-methoxytoluene (*m*) (*iso*)	$CH_3C_6H_3(OCH_3)CO\cdot CH(CH_3)_2$	13.7	1.024	1.5218	*VIII-556
353	nitrile (*n*)	$C_2H_5CH_2CN$	20	0.88	1.3808	I-335
354	thienone (*α*)	 $C_3H_7COC{:}CHCH{:}CH\cdot S$	20	1.098	1.542	....

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
355	**Butyro-*uns-m*-**xylenol (*o*) (*iso*)	$(CH_3)_2C_6H_2(OH)\cdot COCH(CH_3)_2$	20	1.028	1.573	....
356	**Butyroin**	$C_2H_5CH_2CHOHCO\cdot CH_2C_2H_5$	16.7	0.911	1.4346	I-840
357	**Butyryl-**acetophenone (ω)	$C_6H_5(COCH_2)_2C_2H_5$	20	1.049	1.5712	VII-689
358	camphor (3)	$C_{14}H_{22}O_2$	17.4	1.016	1.4923	VII-598
359	chloride (*n*)	$C_2H_5CH_2COCl$	20	1.028	1.4121	II-274
360	chloride (*iso*)	$(CH_3)_2CHCOCl$	20	1.017	1.4079	II-293
361	indazole (2) (*n*) (*stable*)	$C_2H_5CH_2CON{:}CH\cdot$ $C_6H_4{:}N$	20	1.120	1.565	....
362	indazole (2) (*iso*) (*stable*)	$(CH_3)_2CHCON{:}CH\cdot$ $C_6H_4{:}N$	20	1.112	1.562	....
363	**Cadaverine**	$H_2N(CH_2)_5NH_2$	16	0.88	1.46	IV-266
364	**Cadinene** (*l*)	$C_{15}H_{24}$	20	0.918	1.5073	V-459
365	**Cadmium** diethyl	$(C_2H_5)_2Cd$	18.1	1.65	1.5680	IV-677
366	dimethyl	$(CH_3)_2Cd$	17.9	1.984	1.5849	IV-677
367	**Camphenamine**	$C_{10}H_{17}N$	20	0.940	1.4935	XII-50
368	**Camphene**	$C_{10}H_{16}$	78(?)	0.822	1.44	V-156
369	" —*d*(*l*) (m.p. 43°)	$C_{10}H_{16}$	50	.....	1.4564	V-156
370	**Campholene**	C_9H_{16}	20	0.803	1.4441	I-81
371	**Camphoroxime-*d*** ethyl ether	$C_8H_{14}CH_2C{:}NOC_2H_5$	17	0.947	1.4785	VII-114
372	methyl ether	$C_8H_{14}CH_2C{:}NOCH_3$	22.5	0.958	1.4795	VII-114
373	**Camphoryl** chloride (*trans*) (*l*)	$C_8H_{14}(COCl)_2$	20.7	1.227	1.4988	IX-754
374	dichloride (*d*) (*cis*)	$C_{10}H_{14}O_2Cl_2$	19.9	1.245	1.5013	IX-754
375	**Camphylamine** (α)	$C_{10}H_{19}N$	17.8	0.874	1.4728	XII-40
376	**Capric** acid (m.p. 31°)	$CH_3(CH_2)_8CO_2H$	30	0.895	1.4308	II-355
377	aldehyde (*n*)	$CH_3(CH_2)_8CHO$	22	0.82	1.4273	I-711
378	**Caproic** acid (*n*)	$CH_3(CH_2)_4CO_2H$	19.6	0.921	1.4145	II-321
379	acid (*iso*)	$(CH_3)_2CHC_2H_4CO_2H$	20	0.925	1.4150	II-327
380	aldehyde (*n*)	$CH_3(CH_2)_4CHO$	20	0.834	1.4279	I-688
381	**Caproimido ethyl ether** (*iso*)	$C_5H_{11}C({:}NH)O\cdot C_2H_5$	17.9	0.858	1.4200	II-329
382	**Caproyl chloride** (*n*)	$CH_3(CH_2)_4COCl$	20	.....	1.4867	II-324
383	**Caprylic** acid (*n*)	$CH_3(CH_2)_6CO_2H$	21	0.91	1.4268	II-347
384	aldehyde (*n*)	$CH_3(CH_2)_6CHO$	20	0.821	1.4217	I-704
385	**Carane**	$C_{10}H_{18}$	20	0.838	1.4567	*V-47
386	**Carbethoxy-7-methyltetrahydroindazole** (2)	$C_2H_5O_2CCH_2N\cdot CH{:}$ $C_6H_7(CH_3){:}N$	20	1.093	1.506	....
387	**"Carbitol"**	$C_2H_5O(CH_2)_2O\cdot(CH_2)_2OH$	26	0.98	1.4244	**I-520
388	**Carbon** disulfide	CS_2	20	1.263	1.6276	III-197
389	suboxide	$OC{:}C{:}CO$	0	1.114	1.4538	I-805
390	tetrachloride	CCl_4	15	1.604	1.4630	I-65
391	**Carone** (*d*)	$C_{10}H_{16}O$	18.8	0.958	1.4788	VII-91

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392	**Carvacrol**	$(CH_3)(C_3H_7)C_6H_3OH$ (1,4,2)	18.6	0.98	1.5245	VI-527
393	**Carvacrylamine** (1,2,4)	$C_6H_3(CH_3)(NH_2)\cdot(C_3H_7)$	19	0.995	1.543	XII-1171
394	**Carvenone** (*dl*)	$C_{10}H_{16}O$	20	0.926	1.4825	VII-78
395	**Carvo**-menthene (*d*)	$C_{10}H_{18}$	18	0.83	1.4563	V-84
396	menthol	$C_{10}H_{19}OH$	20	0.908	1.4619	VI-26
397	menthone	$C_{10}H_{18}O$	20	0.9	1.4553	VII-34
398	tanacetone (*dl*)	$(CH_3)_2CHCHCH_2\cdot$ $COC(CH_3):CHCH_2$	20	0.935	1.4806	VII-77
399	**Carvone** (*d*)	$C_{10}H_{14}O$	18.7	0.96	1.4994	VII-153
400	**Caryophyllene** (α)	$C_{15}H_{24}$	20	0.903	1.4998	I-464
401	**Cedrene**	$C_{15}H_{24}$	20	0.929	1.5034	V-461
402	**"Cellosolve acetate"**	$CH_3CO_2CH_2CH_2\cdot OC_2H_5$	20	0.973	1.4030	II-141
403	**Cerotic acid** (m.p. 78°)	$C_{25}H_{51}CO_2H$	79	0.836	1.44	II-394
404	**Cetyl** acetate	$CH_3CO_2C_{16}H_{33}$	33.9	0.85	1.4358	II-136
405	alcohol (m.p. 50°)	$CH_3(CH_2)_{14}CH_2OH$	79	0.798	1.43	I-429
406	iodide (m.p. 22°)	$CH_3(CH_2)_{14}CH_2I$	20	1.123	1.4806	I-172
407	**Chavibetol** (1,3,4)	$CH_2:CHCH_2\cdot C_6H_3(OH)(OCH_3)$	16	1.065	1.5397	VI-963
408	**Chloral**	Cl_3CCHO	20	1.512	1.4557	I-616
409	**Chloro**-acetic acid (m.p. 63°)	$ClCH_2CO_2H$	65	1.370	1.4297	II-194
410	acetylacetone (3)	$CH_3COCHClCOCH_3$	16.7	1.169	1.4798	I-785
411	aniline (*o*)	$ClC_6H_4NH_2$	20	1.213	1.5895	XII-597
412	" (*m*)	$ClC_6H_4NH_2$	20	1.216	1.5931	XII-602
413	anthracene (1) (m.p. 81°)	$C_{14}H_9Cl$	99.5	1.171	1.6959	*V-324
414	benzaldehyde (*o*)	ClC_6H_4CHO	20	1.252	1.567	VII-233
415	" (*m*)	ClC_6H_4CHO	20	1.241	1.5650	VII-234
416	" (*p*) (m.p. 47°)	ClC_6H_4CHO	61	1.196	1.5553	VII-235
417	benzene	C_6H_5Cl	20	1.107	1.5251	V-199
418	bromobenzene (*o*)	ClC_6H_4Br	20	1.644	1.5814	V-209
419	" (*m*)	ClC_6H_4Br	20	1.630	1.577	V-209
420	1-bromoethylene (2) (*cis*)	$BrCH:CHCl$	15	1.797	1.4982	I-189
421	1-bromoethylene (2) (*trans*)	$BrCH:CHCl$	20	1.77	1.4998	I-189
422	butyric acid (β)	$CH_3CHClCH_2CO_2H$	19.9	1.186	1.4421	II-277
423	butyryl chloride (β)	$CH_3CHClCH_2COCl$	20	1.217	1.4511	II-278
424	*d*-camphoryldichloride (3) (m.p. 26°)	$C_{10}H_{13}O_2Cl_3$	31.3	1.322	1.5080	IX-751
425	diethyl ether (β)	$C_2H_5OCH_2CH_2Cl$	20	0.989	1.4113	I-337
426	1,3-dimethyl-4-(β,β dichloroethyl) benzene (5)	$(CH_3)_2(Cl)C_6H_2\cdot CH_2CHCl_2$	16.1	1.262	1.5528	....

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
427	**Chloro-**1,3-dimethyl-1-dichloromethyl-4-methene-cyclohexa-2,5-diene (5)	$(CH_3)_2(Cl)\cdot C_6H_2(:CH_2)\cdot CHCl_2$	17.3	1.269	1.5681	*V-206
428	ethyl acetate (2)	$CH_3CO_2CH_2CH_2Cl$	20	1.17	1.4247	II-128
429	ethyl ether (2)	$(ClCH_2CH_2)_2O$	20	1.220	1.457	**I-335
430	fumaryl chloride	$(ClCCOCl):CHCOCl$	17.6	1.566	1.5217	*II-303
431	hexane (1)	$CH_3(CH_2)_4CH_2Cl$	20	0.876	1.4194	I-143
432	" (2)	$CH_3CHCl(CH_2)_3CH_3$	21	0.869	1.4142	I-144
433	maleyl chloride (*uns*)	$ClC:CHCCl_2\cdot O\cdot CO$	18.1	1.605	1.5136	....
434	1-methyl-4-(β,β-dichloroethyl)-benzene (3)	$(CH_3)(Cl)C_6H_3CH_2\cdot CHCl_2$	20.3	1.287	1.5501	*V-194
435	methyl methyl ether	$ClCH_2OCH_3$	20	1.070	1.3974	I-580
436	naphthalene (α)	$C_{10}H_7Cl$	20	1.194	1.6332	V-541
437	" (β) (m.p. 56°)	$C_{10}H_7Cl$	70.7	1.138	1.6079	V-541
438	pentane (2)	$CH_3(CH_2)_2CHClCH_3$	19.5	0.870	1.4062	I-131
439	phenol (*o*)	HOC_6H_4Cl	40	1.2	1.5473	VI-183
440	" (*m*) (m.p. 28°)	HOC_6H_4Cl	40	1.2	1.5565	VI-185
441	phenol (*p*) (m.p. 41°)	HOC_6H_4Cl	40	1.2	1.5579	VI-186
442	propan-2-ol (1)	$CH_3CHOHCH_2Cl$	20	1.114	1.4392	I-363
443	propan-1-ol (2)	$CH_3CHClCH_2OH$	20	1.103	1.4362	I-356
444	quinoline (2) (m.p. 37°)	$C_6H_4\cdot CH:CH\cdot$ $C(Cl):N$	24.6	1.246†	1.6342†	XX-359
445	styrene (α)	$C_6H_5CCl:CH_2$	16.6	1.10	1.5623	V-476
446	" (ω)	$C_6H_5CH:CHCl$	17.8	1.11	1.5774	V-476
447	sulfonic acid	$HOSO_2Cl$	14	.....	1.437	....
448	thiophene (α)	$ClC:CHCH:CH\cdot S$	20	1.278	1.55	XVII-32
449	toluene (*o*)	$ClC_6H_4CH_3$	20.2	1.081	1.5247	V-290
450	" (*m*)	$ClC_6H_4CH_3$	18.7	1.07	1.5225	V-291
451	" (*p*)	$ClC_6H_4CH_3$	24.4	1.06	1.5193	V-292
452	1,2,2-tribromoethane (1)	$ClBrCHCHBr_2$	20	2.65	1.603	....
453	**Chloroform**	$CHCl_3$	19	1.490	1.4457	I-61
454	**Chloroprene**	$CH_2:CClCH:CH_2$	20	0.958	1.4583	....
455	**Chromane**	$C_6H_4CH_2CH_2CH_2\cdot O$	20	1.059	1.544	XVII-52
456	**Cineol**	$C_{10}H_{18}O$	20	0.927	1.4584	XVII-24
457	**Cinnamic aldehyde**	$C_6H_5CH:CHCHO$	20	1.110	1.6195	VII-348
458	**Cinnamyl alcohol** (m.p. 33°)	$C_6H_5CH:CHCH_2OH$	36.1	1.04	1.5754	VI-570
459	**Cinnamoyl chloride** (m.p. 36°)	$C_6H_5CH:CHCOCl$	42.5	.....	1.6136	IX-587
460	**Citraconic anhydride**	$C_5H_4O_3$	20	1.245	1.4717	....
461	**Citral** (α)	$C_9H_{15}CHO$	17	0.890	1.4895	I-753
462	" (β)	$C_{10}H_{16}O$	19	0.888	1.4900	I-755

† Supercooled.

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
463	**Citronellal** (*d*)	$C_9H_{17}CHO$	14	0.86	1.455	I-745
464	**Citronellol** (*d*)	$C_{10}H_{20}O$	20	0.85	1.459	I-451
465	**Citronellyl** acetate	$C_{12}H_{22}O_2$	17.5	0.893	1.4456	II-139
466	formate	$HCO_2C_{10}H_{19}$	20	0.884	1.4556	II-23
467	**Clovene**	$C_{15}H_{24}$	18	0.930	1.5007	V-468
468	**Cocaine** (*pseudo*) (*d*) (m.p. 41°)	$C_{17}H_{21}O_4N$	99.6	1.102	1.5022	XXII-206
469	**Cocaine** (*dl*) (m.p. 81°)	$C_{17}H_{21}O_4N$	99.5	1.103	1.5021	XXII-211
470	**Coniceine** (*γ*)	$C_8H_{15}N$	18.4	0.875	1.4607	XX-145
471	**Coniine** (*d*)	$C_8H_{17}N$	21.9	0.84	1.4512	XX-111
472	**Coumalin**	$CH{:}CHCH{:}CH\cdot$ $O\cdot CO$	20	1.198	1.5298	XVII-271
473	**Coumaran**	$C_6H_4CH_2CH_2\cdot O$	19	1.057	1.5420	XVII-50
474	**Coumaranone** (*iso*)	$O\cdot C_6H_4CH_2CO$	20	1.217	1.5523	XVII-309
475	**Coumarone**	$C_6H_4CH{:}CH\cdot O$	22.7	1.09	1.5645	XVII-54
476	**Creosol** (3,1,4)	$CH_3OC_6H_3(CH_3)OH$	25	1.09	1.5353	VI-878
477	**Cresol** (*o*) (m.p. 30°)	$CH_3C_6H_4OH$	40	1.04	1.5372	VI-349
478	" (*m*)	$CH_3C_6H_4OH$	18	1.04	1.5425	VI-373
479	" (*p*) (m.p. 35°)	$CH_3C_6H_4OH$	35	1.03	1.5	VI-389
480	**Cresyl acetate** (*p*)	$CH_3CO_2C_6H_4CH_3$	23	1.050	1.4991	VI-397
481	**Crotonic** acid (*α*) (m.p. 72°)	$CH_3CH{:}CHCO_2H$	72	0.96	1.43	II-408
482	acid (*β*)	$CH_3CH{:}CHCO_2H$	19.6	1.026	1.446	II-412
483	aldehyde (*α*)	$CH_3CH{:}CHCHO$	20.5	0.852	1.4362	I-728
484	anhydride	$(CH_3CH{:}CHCO)_2O$	20	1.040	1.4745	II-411
485	nitrile	$CH_3CH{:}CHCN$	20	0.822	1.4156	II-412
486	**Crotonoyl**-anisole	$CH_3CH{:}CHCO\cdot C_6H_4OCH_3$	11.7	1.091	1.587	....
487	chloride	C_3H_5COCl	17.9	1.09	1.4600	II-411
488	**Crotonyl** alcohol	$CH_3CH{:}CHCH_2OH$	20	0.854	1.4240	I-442
489	**Cuminic aldehyde** (*p*)	$(CH_3)_2CHC_6H_4CHO$	20(?)	0.978	1.5301	VII-318
490	**Cyanamide** (m.p. 44°)	H_2NCN	48	1.073	1.4418	III-75
491	**Cyano**-acetic ester	$CH_3COCH(CN)CO_2\cdot C_2H_5$	20	1.111	1.4710	III-796
492	cyclohexan-2-one (1)	$CH_2(CH_2)_3COCHCN$	20	1.070	1.477	....
493	2-ethoxycyclohex-1-ene (1)	$C_2H_5OC{:}C(CN)CH_2\cdot$ $(CH_2)_2CH_2$	20	1.019	1.494	....
494	Δ¹-*iso*-heptenic acid (*α*) (m.p. 53°)	$(CH_3)_2CHCH_2CH{:}C(CN)CO_2H$	99.6	0.972	1.4469	II-792
495	heptoic acid (*α*)	$C_2H_5(CH_2)_3\cdot CH(CN)CO_2H$	20	1.022	1.448	....
496	1-methyl-3-*iso*-propylcyclopentane (2)	$C_{10}H_{17}N$	16.2	0.881	1.45	*IX-17
497	tetrabromide (*iso*) (m.p. 38.5°)	$Br_2C{:}N\cdot N{:}CBr_2$	55	2.680	1.6465	III-120

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
498	**Cyclo-**acetobutyl methyl ether	$C_7H_{14}O_2$	20	0.946	1.427	....
499	butane (b.p. 12°)	$\underline{CH_2CH_2CH_2CH_2}$	0	0.703	1.3752	V-17
500	butane carboxylic acid	$\underline{CH_2(CH_2)_2CH}CO_2H$	19	1.053	1.4434	IX-5
501	butanol	$\underline{CH_2CH_2CH_2CH}OH$	20	0.92	1.4335	VI-4
502	citral (β)	$C_{10}H_{16}O$	13.3	0.96	1.4971	VII-87
503	fenchene	$C_{10}H_{16}$	20.4	0.859	1.4521	V-165
504	heptane	$\underline{CH_2(CH_2)_5CH_2}$	20	0.810	1.4440	V-29
505	heptanone	$\underline{CH_2(CH_2)_5CO}$	21.9	0.95	1.4603	VII-13
506	heptene	$\underline{CH_2(CH_2)_4CH:CH}$	20	0.823	1.4530	V-65
507	hexane	$\underline{CH_2(CH_2)_4CH_2}$	20	0.779	1.4262	V-20
508	hexanol (m.p. 24°)	$\underline{CH_2(CH_2)_4CH}OH$	37	0.9	1.461	VI-5
509	hexanone	$\underline{CH_2(CH_2)_4CO}$	19	0.947	1.4503	VII-8
510	hex-1-ene propionic acid (α)	$C_6H_9CH(CH_3)CO_2H$	20.3	1.010	1.4753	IX-51
511	hexylacetic acid (m.p. 32°)	$\underline{CH_2(CH_2)_3CH_2CH}\cdot$ CH_2CO_2H	33.5	1.001	1.46	IX-14
512	hexyl bromide	$\underline{CH_2(CH_2)_4CH}Br$	14.6	1.3	1.4956	V-24
513	hexyl chloride	$\underline{CH_2(CH_2)_4CH}Cl$	18	0.977	1.4555	V-21
514	γ-hydroxy valeric aldehyde	$CH_3\underline{CHCH_2CH_2\cdot}$ $\underline{CHOH\cdot O}$	20	1.019	1.435	*I-421
515	octane	$\underline{CH_2(CH_2)_6CH_2}$	20	0.839	1.4586	V-35
516	pentadiene	$\underline{CH_2CH:CHCH:CH}$	20	0.803	1.45	V-112
517	pentane	$\underline{CH_2CH_2CH_2CH_2CH_2}$	20	0.745	1.4065	V-19
518	pentane carboxylic acid	$\underline{CH_2(CH_2)_3CH}CO_2H$	20	1.053	1.4532	IX-6
519	pentanol	$\underline{CH_2(CH_2)_3CH}OH$	20	0.947	1.4529	VI-5
520	pentanone	$\underline{CH_2(CH_2)_3CO}$	20	0.948	1.4366	VII-5
521	pentene	$\underline{CH:CHCH_2CH_2CH_2}$	14	0.775	1.4208	V-61
522	pentylacetic acid	$\underline{CH_2(CH_2)_3CH}CH_2\cdot$ CO_2H	18	1.022	1.45	IX-10
523	propane carboxylic acid	$\underline{CH_2CH_2CH}CO_2H$	20.9	1.087	1.4370	IX-4
524	propyl carbinol	$(\underline{CH_2)_2CH}CH_2OH$	15.1	0.90	1.4313	VI-4

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
525	**Cymene** (*o*)	$CH_3C_6H_4CH(CH_3)_2$	20	0.877	1.5006	V-419
526	" (*m*)	$CH_3C_6H_4CH(CH_3)_2$	20	0.861	1.4930	V-419
527	" (*p*)	$CH_3C_6H_4CH(CH_3)_2$	20	0.857	1.4909	V-420
528	**Decahydronaphthalene** (*trans*)	$C_{10}H_{18}$	20	0.877	1.4701	V-92
529	**Decane** (*n*)	$CH_3(CH_2)_8CH_3$	14.9	0.73	1.4108	I-168
530	**Decene-**1	$CH_2{:}CH(CH_2)_7CH_3$	16	0.75	1.4313	I-223
531	**Decyl** acetate (*n*)	$CH_3CO_2(CH_2)_9CH_3$	20	.....	1.4273	II-135
532	alcohol (*n*)	$CH_3(CH_2)_8CH_2OH$	20	0.830	1.4372	I-425
533	bromide (*n*)	$C_{10}H_{21}Br$	20	1.068	1.4550	**I-130
534	*n*-butyrate (*n*)	$C_2H_5CH_2CO_2CH_2\cdot(CH_2)_8CH_3$	20	0.862	1.4308	....
535	caprate (*n*)	$C_9H_{19}CO_2C_{10}H_{21}$	20	0.859	1.4423	II-356
536	chloride (*n*)	$CH_3(CH_2)_8CH_2Cl$	20	0.887	1.4380	I-168
537	formate (*n*)	$HCO_2CH_2(CH_2)_8CH_3$	20	0.873	1.4271	....
538	iodide (*n*)	$CH_3(CH_2)_8CH_2I$	20	1.256	1.4859	I-168
539	phenyl ether	$CH_3(CH_2)_9OC_6H_5$	20	0.898	1.4862	....
540	propionate (*n*)	$C_2H_5CO_2C_{10}H_{21}$	20	0.864	1.4291	....
541	**Diacetyl**	$(CH_3CO)_2$	18.5	0.981	1.3933	I-769
542	acetone (m.p. 49°)	$(CH_3CO)_2(CH_2CO\cdot CH_2)$	60	1.06	1.4787	I-808
543	**Diallyl-**acetic acid	$(CH_2{:}CHCH_2)_2CH\cdot CO_2H$	21.6	0.947	1.4508	II-489
544	acetone (*sym*)	$(CH_2{:}CHCH_2CH_2)_2{:}CO$	14	0.868	1.4504	I-751
545	" (*uns*)	$(CH_2{:}CHCH_2)_2CH\cdot COCH_3$	20.9	0.859	1.4462	I-751
546	phenol (*o,o*)	$(CH_2{:}CHCH_2)_2{:}C_6H_3OH$	20	0.988	1.540	*VI-301
547	sulfide	$(CH_2{:}CHCH_2)_2S$	26.8	0.888	1.4877	I-440
548	**Diamyl-**amine (*iso*)	$(C_5H_{11})_2NH$	21.1	0.767	1.4229	IV-182
549	aniline (*iso*)	$C_6H_5N(C_5H_{11})_2$	24.9	0.889	1.5083	XII-169
550	cyanamide (*iso*)	$[(CH_3)_2CHCH_2\cdot CH_2]_2NCN$	23.7	0.846	1.4392	IV-186
551	oxalate (*iso*)	$(CO_2C_5H_{11})_2$	11	0.968	1.42	II-540
552	sulfide (*iso*)	$(C_5H_{11})_2S$	20	0.843	1.4524	I-405
553	**Diazidoethane**	$(CH_2N_3)_2$	24.9	1.170	1.4798	I-103
554	**Dibenzyl-**amine	$(C_6H_5CH_2)_2NH$	21.6	1.026	1.5743	XII-1035
555	methane	$(C_6H_5CH_2)_2CH_2$	20	1.007	1.5760	V-613
556	**Dibromo-**benzene	$C_6H_4Br_2$ (*o*)	17.4	1.964	1.6117	V-210
557	" (*m*)	$C_6H_4Br_2$	17.4	1.962	1.6083	V-211
558	" (*p*) (m.p. 88°)	$C_6H_4Br_2$	99.3	1.9	1.5743	V-211
559	butane (1,3)	$CH_3CHBrCH_2CH_2Br$	20	1.806	1.507	I-120
560	ethane (1,1)	CH_3CHBr_2	20	2.055	1.5128	I-90
561	hexane (1,2)	$CH_3(CH_2)_3CHBr\cdot CH_2Br$	13.5	1.596	1.5060	I-144
562	" (1,6)	$(CH_2CH_2CH_2Br)_2$	15	1.595	1.5111	I-145
563	2-methylpropane (1,2)	$(CH_3)_2CBrCH_2Br$	20	1.759	1.509	I-127
564	pentane (1,5)	$BrCH_2(CH_2)_3CH_2Br$	15	1.70	1.5146	I-131
565	" (2,3)	$C_2H_5(CHBr)_2CH_3$	20	1.678	1.5078	I-132
566	propane (1,2)	$CH_3CHBrCH_2Br$	20	1.933	1.5203	I-109
567	" (1,3)	$BrCH_2CH_2CH_2Br$	15	1.987	1.5249	I-110
568	propan-1-ol (2,3)	$BrCH_2CHBrCH_2OH$	25	2.126	1.5577	I-357

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
569	**Dibromo**-propan-2-ol (1,3)	$BrCH_2CHOHCH_2Br$	25	2.120	1.5495	I-365
570	propylene (1,2)	$C_3H_4Br_2$ (*cis*)	17.4	2.024	1.5337	**I-171
571	propylene (1,2) (*trans*)	$C_3H_4Br_2$	17.4	2.003	1.5369	**I-171
572	thiophene (α,α′)	$BrC:CH·CH:CBr·S$	20	2.141	1.63	XVII-33
573	1,1,4-trimethyl-cyclohexane (3,4)	$(CH_3)_3C_6H_7Br_2$	18.7	1.532	1.5281	*V-17
574	valeronitrile (α,β)	$C_2H_5(CHBr)_2CN$	20	1.756	1.520	**II-269
575	**Dibutyl**-amine (*n*)	$(C_4H_9)_2NH$	20	0.76	1.4097	IV-157
576	" (*iso*)	$(C_4H_9)_2NH$	19.6	0.747	1.4093	IV-166
577	ketone (*iso*)	$(C_4H_9)_2CO$	21	0.805	1.412	I-710
578	oxalate (*n*)	$(CO_2C_4H_9)_2$	20	1.0	1.4229	II-540
579	phthalate (*n*)	$C_6H_4(CO_2C_4H_9)_2$	25	1.045	1.4925	....
580	succinate (*sec*)	$(CH_2CO_2C_4H_9)_2$	25.3	0.97	1.4238	II-611
581	tartrate (*n*)	$(CHOHCO_2C_4H_9)_2$	20	1.090	1.4463	III-518
582	**Dichloro**-acetic acid	Cl_2CHCO_2H	20	1.563	1.4659	II-202
583	acetone (β) (*sym*) (m.p. 45°)	$(ClCH_2)_2CO$	46	1.383	1.4714	I-655
584	acetyl-acetone (3,3)	$CH_3COCCl_2COCH_3$	16.8	1.307	1.4589	I-785
585	benzene (*o*)	$C_6H_4Cl_2$	17	1.30	1.5524	V-201
586	" (*m*)	$C_6H_4Cl_2$	17.3	1.28	1.5472	V-202
587	" (*p*) (m.p. 53°)	$C_6H_4Cl_2$	69.9	1.4	1.5266	V-203
588	1-bromoethylene (1,2)	$ClBrC:CHCl$	16	1.91	1.5190	I-130
589	crotonic acid (γ,γ) (m.p. 43°)	$Cl_2CHCH:CHCO_2H$	99.4	1.333	1.4597	**II-397
590	crotononitrile (γ,γ)	$Cl_2CHCH:CHCN$	20	1.305	1.4974	**II-397
591	crotonoyl chloride (γ,γ)	$Cl_2CHCH:CHCOCl$	20	1.442	1.4991	**II-397
592	cyclopropane (1,1)	$CH_2CH_2CCl_2$	17.7	1.211	1.4402	V-17
593	1,2-dibromo-ethylene (1,2)	$BrClC:CClBr$	16	2.303	1.579	**I-164
594	ethane (1,1)	CH_3CHCl_2	20	1.175	1.4166	I-83
595	ethyl sulfide	$(CH_3CHCl)_2S$	20	1.27	1.5313	**I-685
596	2-methylbutane (2,3)	$(CH_3)_2CClCHClCH_3$	18	1.06	1.445	I-135
597	1-methyl-4-(β,β-dichloroethyl)-benzene (3,5)	$(CH_3)Cl_2C_6H_2CH_2·CHCl_2$	19.2	1.397	1.5678	*V-194
598	1-methyl-1-dichloromethyl-4-methene-cyclohexa-2,5-diene (3,5)	$(CH_3)Cl_2(CHCl_2)·C_6H_2:CH_2$	16.7	1.408	1.5801	*V-194
599	methyl ether (*sym*)	$(ClCH_2)_2O$	20	1.315	1.4346	I-582
600	naphthalene (1,2) (m.p. 37°)	$C_{10}H_6Cl_2$	48.5	1.315	1.6338	V-542
601	naphthalene (1,4) (m.p. 68°)	$C_{10}H_6Cl_2$	75.9	1.300	1.6228	V-542
602	naphthalene (1,7) (m.p. 64°)	$C_{10}H_6Cl_2$	99.5	1.261	1.6092	V-543
603	naphthalene (1,8)	$C_{10}H_6Cl_2$	99.8	1.292	1.6236	V-544

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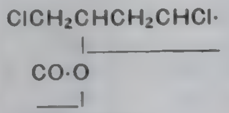
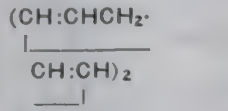
No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
604	**Dichloro**-propane (1,2)	$CH_3CHClCH_2Cl$	20	1.157	1.4387	I-105
605	" (2,2)	$(CH_3)_2CCl_2$	20	1.093	1.4093	I-105
606	(2-*p*-tolyl)-butane (1,1)	$C_2H_5CH(C_6H_4CH_3)\cdot CHCl_2$	19.8	1.112	1.5283	*V-209
607	1,1,2-tribromo-ethane (1,2)	$Br_2CCl\cdot CHBrCl$	15.5	2.63	1.5989	I-94
608	γ-valerolactone (α,δ)	 $ClCH_2CHCH_2CHCl\cdot CO\cdot O$	24.6	1.436	1.4962	*XVII-131
609	**Dicyclopentadiene** (m.p. 33°)	 $(CH{:}CHCH_2\cdot CH{:}CH)_2$	35	0.976	1.5050	V-495
610	**Didecyl ether** (*n*)	$(C_{10}H_{21})_2O$	20	0.819	1.4418	....
611	**Diethanolamine**	$HN(CH_2CH_2OH)_2$	20	1.097	1.4776	IV-283
612	**Diethoxydiphenyl**	$(C_2H_5OC_6H_4)_2$	47.4	1.043	1.5602	VI-989
613	**Diethyl**-acetic acid	$(C_2H_5)_2CHCO_2H$	10.2	0.933	1.4179	II-333
614	acetoacetic ester	$CH_3COC(C_2H_5)_2CO_2\cdot C_2H_5$	17	0.971	1.4326	III-710
615	acetone di-carboxylate	$CO(CH_2CO_2C_2H_5)_2$	23.6	1.107	1.4378	III-791
616	acetylmalonate	$CH_3COCH(CO_2\cdot C_2H_5)_2$	26	1.083	1.4374	III-796
617	acetylmalonate-*O*-acetate	$CH_3CO_2C(CH_3){:}C{:}(CO_2C_2H_5)_2$	17.7	1.117	1.451	*III-163
618	acetylmalonate-*O*-propionate	$C_2H_5CO_2C(CH_3){:}C{:}(CO_2C_2H_5)_2$	18.6	1.098	1.4519	*III-163
619	acetylsuccinate	$CH_3COC_2H_3(CO_2\cdot C_2H_5)_2$	16	1.09	1.438	III-801
620	adipate	$(CH_2CH_2CO_2C_2H_5)_2$	20	1.009	1.4281	II-652
621	amine	$(C_2H_5)_2NH$	19	0.712	1.3871	IV-95
622	aminonaphthalene	$C_{10}H_7N(C_2H_5)_2$ (α)	18.1	1.007	1.5933	XII-1223
622.1	aminonaphthalene (β)	$C_{10}H_7N(C_2H_5)_2$	21.6	1.025	1.6321	XII-1275
623	aniline	$C_6H_5N(C_2H_5)_2$	22.3	0.93	1.5411	XII-164
624	benzalmalonate (m.p. 32°)	$C_6H_5CH{:}C(CO_2\cdot C_2H_5)_2$	20.4	1.105	1.5389	IX-892
625	benzene (*o*)	$(C_2H_5)_2C_6H_4$	20	0.881	1.5031	V-426
626	" (*m*)	$(C_2H_5)_2C_6H_4$	20	0.864	1.4953	V-426
627	" (*p*)	$(C_2H_5)_2C_6H_4$	20	0.862	1.4949	V-426
628	α-bromoacetyl malonate	$BrCH_2COCH(CO_2\cdot C_2H_5)_2$	18.1	1.391	1.4602	*III-279
629	*n*-butyrylmalonate	$C_2H_5CH_2COCH{:}(CO_2C_2H_5)_2$	20	1.055	1.4451	III-807
630	*iso*-butyryl-malonate	$(CH_3)_2CHCOCH{:}(CO_2C_2H_5)_2$	20	1.050	1.4403	III-811
631	*d*-camphorate	$C_{14}H_{24}O_4$	19.1	1.032	1.456	IX-752
632	*trans*-camphorate (*l*)	$C_{14}H_{24}O_4$	21.6	1.029	1.4545	*IX-333
633	camphoric carbon-ate	$C_8H_{14}C{:}C(OCO_2\cdot C_2H_5)(CO_2C_2H_5)$	20	1.076	1.4739	X-38
634	*O*-carbethoxy-β-hydroxyethylidene malonate	$CH_3C(OCO_2C_2H_5){:}C(CO_2C_2H_5)_2$	20	1.127	1.4484	*III-163

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
635	**Diethyl** carbonate	$CO(OC_2H_5)_2$	20	0.975	1.3846	III-5
636	α-chloroacetyl malonate	$ClCH_2COCH(CO_2C_2H_5)_2$	12.3	1.195	1.4446	*III-279
637	chlorofumarate	$CH{:}CCl(CO_2C_2H_5)_2$	18.3	1.19	1.4578	II-745
638	chloromalonate	$ClCH(CO_2C_2H_5)_2$	19.3	1.205	1.4353	II-593
639	citraconate	$CH_3C_2H(CO_2C_2H_5)_2$	20.3	1.062	1.4468	II-771
640	crotonylidene malonate	$CH_3CH{:}CHCH{:}C{:}(CO_2C_2H_5)_2$	20	1.045	1.481	**II-676
641	cyanamide	$(C_2H_5)_2NCN$	48	0.8	1.4126	IV-121
642	cyanomalonate	$NCCH(CO_2C_2H_5)_2$	20	1.093	1.4263	II-811
643	*dl*-dehydrocamphorate	$(CH_3)_3C_6H_3(CO_2C_2H_5)_2$	20	1.039	1.4644	*IX-345
644	diacetylmalonate	$(CH_3CO)_2C(CO_2C_2H_5)_2$	20	1.115	1.4502	III-838
645	diallylmalonate	$(CH_2{:}CHCH_2)_2{:}C(CO_2C_2H_5)_2$	17.2	0.996	1.4475	II-807
646	diethylmalonate	$(C_2H_5)_2C(CO_2C_2H_5)_2$	16.6	0.99	1.4252	II-686
647	*cis*-α,β-dimethylglutaconate	$CH_3C(CO_2C_2H_5){:}C(CH_3)CH_2CO_2C_2H_5$	20	1.024	1.454	*II-314
648	*cis*-α,β-dimethylglutaconate (*trans*)	$C_{11}H_{18}O_4$	20	1.031	1.454	*II-314
649	α,α′-dimethylglutarate (*mal*)	$CH_2[CH(CH_3)CO_2C_2H_5]_2$	20	0.980	1.423	....
650	α,α′-dimethylglutarate	$C_{11}H_{20}O_4$	20	0.977	1.422	*II-591
651	dimethylmalonate	$(CH_3)_2C(CO_2C_2H_5)_2$	24.1	0.995	1.4105	II-648
652	dimethylsuccinate (*sym*) (*mal*)	$(CH_3CHCO_2C_2H_5)_2$	20	0.996	1.423	II-668
653	dimethylsuccinate (*sym*) (*fum*)	$(CH_3CHCO_2C_2H_5)_2$	20	0.995	1.421	II-667
654	dimethylsuccinate (*uns*)	$(CH_3)_2CCH_2(CO_2C_2H_5)_2$	20	0.993	1.421	II-663
655	disulfide	$(C_2H_5S)_2$	20	0.993	1.5063	I-347
656	dithiocarbonate	$CO(SC_2H_5)_2$	18.2	1.084	1.5370	III-210
657	ethylacetylmalonate	$CH_3COC(C_2H_5){:}(CO_2C_2H_5)_2$	19.3	1.054	1.4338	III-812
658	ethylcyanomalonate	$NCC(C_2H_5)(CO_2C_2H_5)_2$	20	1.052	1.4267	II-818
659	ethylmalonate	$C_2H_5CH(CO_2C_2H_5)_2$	14.8	1.01	1.4180	II-644
660	ethylidenemalonate	$CH_3CH{:}C(CO_2C_2H_5)_2$	16.1	1.043	1.4408	II-773
661	ethoxymethylenemalonate	$C_2H_5OCH{:}C(CO_2C_2H_5)_2$	15.3	1.081	1.4631	III-469
662	fumarate	$(CHCO_2C_2H_5)_2$	20.4	1.052	1.4410	II-742
663	glutaconate	$C_3H_4(CO_2C_2H_5)_2$	19	1.05	1.4466	II-759
664	glutarate	$CH_2(CH_2CO_2C_2H_5)_2$	20	1.025	1.4241	II-633
665	hexahydrohomophthalate (*cis*)	$C_{13}H_{22}O_4$	20	1.040	1.454	....
666	hexahydrohomophthalate (*trans*)	$C_{13}H_{22}O_4$	20	1.038	1.453	....
667	hexahydrophthalate (*m*) (*cis*)	$C_6H_{10}(CO_2C_2H_5)_2$	20	1.054	1.453	....
668	hexahydrophthalate (*trans*)	$C_{12}H_{20}O_4$	20	1.040	1.450	....

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
669	**Diethyl** hexahydro-*iso*-phthalate	$C_6H_{10}(CO_2C_2H_5)_2$ (*m*) (*cis*)	20	1.045	1.452	....
670	hexahydro-*tere*-phthalate (*cis*)	$C_6H_{10}(CO_2C_2H_5)_2$ (*p*)	20.6	1.052	1.452	....
671	hydrazo-*iso*-butyrate	$[HNC(CH_3)_2CO_2 \cdot C_2H_5]_2$	20.5	0.999	1.434	IV-560
672	hydroxymethylene-malonate	$HOCH:C(CO_2C_2H_5)_2$	14.3	1.128	1.4561	III-787
673	imidocarbonate	$(C_2H_5O)_2C:NH$	18.2	0.964	1.4170	III-37
674	indane-1,3-dione (2,2)	$C_6H_4COC(C_2H_5)_2CO$	20	1.064	1.5393	*VII-381
675	indazole (2,3)	$C_2H_5N \cdot N:C_6H_4:C \cdot C_2H_5$	20	1.039	1.579	....
676	isoprenedi-carboxylate	$C_2H_5O_2CCH:C(CH_3) \cdot CH:CHCO_2C_2H_5$	20	1.056	1.500	*II-318
677	itaconate	$C_3H_4(CO_2C_2H_5)_2$	20.2	1.045	1.4388	II-762
678	ketene	$(C_2H_5)_2C:CO$	14.9	0.834	1.4136	I-740
679	ketone	$(C_2H_5)_2CO$	16.6	0.82	1.3939	I-679
680	ketoxime	$(C_2H_5)_2C:NOH$	20	0.914	1.4454	I-680
681	malate	$(CHOHCH_2)(CO_2 \cdot C_2H_5)_2$	20	1.128	1.4362	III-437
682	maleate	$(CHCO_2C_2H_5)_2$	20.1	1.067	1.4416	II-751
683	malonate	$CH_2(CO_2C_2H_5)_2$	20	1.055	1.4143	II-573
684	mesaconate	$CH_3C_2H(CO_2C_2H_5)_2$	20	1.047	1.4494	II-766
685	mesoxalate	$CO(CO_2C_2H_5)_2$	15.6	1.136	1.4187	III-769
686	methylcyano-malonate	$NCC(CH_3)(CO_2 \cdot C_2H_5)_2$	20	1.070	1.4232	II-814
687	5-methylcouma-ranone (2,2)	$CH_3C_6H_3CO \cdot C(C_2H_5)_2 \cdot O$	22.6	1.032	1.531	....
688	β-methyl-α-ethyl-glutaconate (*cis*)	$C_2H_5C(CO_2C_2H_5): C(CH_3)CH_2CO_2 \cdot C_2H_5$	20	1.019	1.455	*II-315
689	β-methyl-α-ethyl-glutaconate (*trans*)	$C_{12}H_{20}O_4$	20	1.014	1.453	*II-315
690	methylethyl-malonate	$C_2H_5C(CH_3): (CO_2C_2H_5)_2$	18.2	0.99	1.4190	II-664
691	β-methylgluta-conate (*cis*)	$C_2H_5O_2CCH: C(CH_3)CH_2CO_2 \cdot C_2H_5$	20	1.034	1.452	*II-311
692	β-methylgluta-conate (*trans*)	$C_{10}H_{16}O_4$	20	1.034	1.452	*II-311
693	*N*-methylpyrrol-idene-2,5-di-acetate	$CH_3NC_4H_6(CH_2CO_2 \cdot C_2H_5)_2$	15.5	1.047	1.4597	....
694	muconate (m.p. 64°)	$(CH:CHCO_2C_2H_5)_2$	99.1	0.983	1.468	II-804
695	naphthalate (1,8) (m.p. 58°)	$C_{10}H_6(CO_2C_2H_5)_2$	70	1.140	1.5586	IX-919
696	naphthalene (1,4)	$C_{10}H_6(C_2H_5)_2$	13.1	0.998	1.5970	**V-471
697	nitrosoamine	$(C_2H_5)_2NNO$	19.9	0.943	1.4386	IV-129
698	oxalacetate	$(CH_2CO)(CO_2C_2H_5)_2$	16.6	1.172	1.4561	III-782
699	oxalate	$(CO_2C_2H_5)_2$	20	1.079	1.4101	II-535

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
700	**Diethyl** α-oxalyl-γ- phenylbutyrate	$C_6H_5(CH_2)_2CH\cdot$ $(CO_2C_2H_5)CO\cdot$ $CO_2C_2H_5$	20	1.112	1.493	....
701	pentane (3,3)	$(C_2H_5)_4C$	20	0.752	1.4200	**I-129
702	phosphite	$(C_2H_5O)_2POH$	20	1.074	1.4082	*I-166
703	phthalate (*o*)	$C_6H_4(CO_2C_2H_5)_2$	17.7	1.12	1.5029	IX-798
704	*iso*-phthalate (*m*)	$C_6H_4(CO_2C_2H_5)_2$	17.5	1.13	1.5082	IX-834
705	phthalide (3,3) (m.p. 55°)	$C_6H_4CO\cdot OC(C_2H_5)_2$ $\lvert\underline{\qquad\qquad}\rvert$	61.5	1.040	1.50[illegible]7	XVII-325
706	phthalylmalonate (m.p. 75°)	$C_6H_4CO\cdot OC{:}C(CO_2\cdot$ $\lvert\underline{\qquad\qquad\quad}\rvert$ $C_2H_5)_2$	84.4	1.189	1.5411	XVIII-498
707	pimelate	$(CH_2)_5(CO_2C_2H_5)_2$	20	0.99	1.4305	II-671
708	propionylmalonate	$C_2H_5COCH(CO_2\cdot$ $C_2H_5)_2$	16.4	1.079	1.4436	III-800
709	propionylmalonate- *O*-acetate	$C_2H_5CO_2C(CH_3):$ $C(CO_2C_2H_5)_2$	18.6	1.098	1.452	*III-163
710	propionylmalonate- *O*-propionate	$C_2H_5CO_2C(C_2H_5):$ $C(CO_2C_2H_5)_2$	19.1	1.079	1.4511	*III-163
711	propylcyano- malonate	$NCC(C_3H_7)(CO_2\cdot$ $C_2H_5)_2$	20	1.033	1.4291	II-820
712	*iso*-propyli- denemalonate	$(CH_3)_2C{:}C(CO_2\cdot$ $C_2H_5)_2$	17	1.028	1.4486	II-781
713	pyrotartrate	$CH_3CH(CO_2C_2H_5)\cdot$ $CH_2CO_2C_2H_5$	19.1	1.012	1.4198	II-639
714	styrene (β,β)	$C_6H_5CH{:}C(C_2H_5)_2$	18.7	0.892	1.5168	V-502
715	suberate	$[(CH_2)_3CO_2C_2H_5]_2$	20	0.982	1.4328	II-693
716	succinate	$(CH_2CO_2C_2H_5)_2$	20	1.040	1.4201	II-609
717	*iso*-succinate	$CH_3CH(CO_2C_2H_5)_2$	20	1.018	1.4131	II-629
718	succinylmalonate (m.p. 68°)	$COCH_2CH_2COC:$ $\lvert\underline{\qquad\qquad\qquad}\rvert$ $(CO_2C_2H_5)_2$	73	1.167	1.4725	XVIII-489
719	sulfate	$(C_2H_5O)_2SO_2$	20	1.178	1.3902	I-327
720	sulfide	$(C_2H_5)_2S$	20.5	0.837	1.4425	I-344
721	sulfite	$(C_2H_5O)_2SO$	11	1.08	1.4198	I-325
722	tartrate	$(CHOHCO_2C_2H_5)_2$	25	1.20	1.4454	III-512
723	tetramethyl- succinate	$[(CH_3)_2CCO_2C_2H_5]_2$	20	0.995	1.436	II-707
724	thiocarbonate	$CS(OC_2H_5)_2$	17.5	1.027	1.4601	III-133
725	trimethylsuccinate	$(CH_3)_2CCHCH_3\cdot$ $(CO_2C_2H_5)_2$	20	0.993	1.427	*II-595
726	*iso*-valerylmalonate	$(CH_3)_2CHCH_2CO\cdot$ $CH(CO_2C_2H_5)_2$	20	1.034	1.4447	....
727	**Diethylenediamine** (m.p. 106°)	$NHC_2H_4NHC_2H_4$ $\lvert\underline{\qquad\qquad\qquad}\rvert$	113	.....	1.446	XXIII-4
728	**Difluoro**-acetic acid	F_2CHCO_2H	20	1.526	1.3419	II-193
729	benzene (*m*)	$C_6H_4F_2$	20	1.172	1.4417	*V-108
730	" (*p*)	$C_6H_4F_2$	20	1.164	1.4375	V-199
731	1-bromoethane (2,2)	CHF_2CH_2Br	20	1.8	1.39	I-89
732	1,2-dibromoethane (1,1)	CF_2BrCH_2Br	17.5	2.24	1.4482	I-92
733	1,1-dibromoethane (2,2)	Br_2CHCHF_2	20	2.312	1.4622	I-92
734	1-iodoethane (2,2)	CHF_2CH_2I	12.2	2.243	1.4681	I-98

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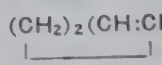
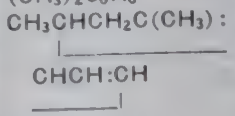
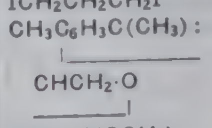
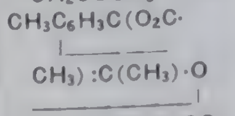
No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
735	**Difluoro-**1,1,2-tribromoethane (1,2)	$CBr_2FCHBrF$	17.5	2.6	1.5079	I-94
736	**Difurfuryl ether**	$(C_4H_3OCH_2)_2O$	20	1.140	1.5088	. . . .
737	**Dehydrocamphoryl chloride** (*d*) (m.p. 50°)	$(CH_3)_3C_5H_3(COCl)_2$	48	1.219	1.5043	*IX-345
738	**Dihydro-**amylanthracene (*iso*) (9) (*meso*)	$C_{19}H_{22}$	44.4	0.994	1.5626	V-653
739	benzene (1,2)	 $(CH_2)_2(CH:CH)_2$	20	0.842	1.4744	V-113
740	" (1,4)	C_6H_8	25	0.84	1.4681	V-113
741	carveol	$C_{10}H_{18}O$	20(?)	0.927	1.4817	VI-63
742	carvone (*l*)	$C_{10}H_{16}O$	20	0.925	1.4711	VII-83
743	eucarvone (*α*)	$C_{10}H_{16}O$	18.9	0.923	1.4674	VII-73
744	methylindole (2?)	$C_9H_{11}N$	23.4	1.020	1.5687	. . . .
745	naphthalene (Δ^1)	$C_{10}H_{10}$	18.3	0.998	1.5832	V-519
746	" (Δ^2)	$C_{10}H_{10}$	32.7	0.993	1.5549	V-519
747	toluene (1,3)	$CH_3C_6H_7$	20	0.835	1.4763	V-115
748	" (2,4)	$CH_3C_6H_7$	20	0.827	1.4680	V-115
749	*o*-xylene ($\Delta^{1,3}$)	$(CH_3)_2C_6H_6$	19.5	0.830	1.4789	V-120
750	" ($\Delta^{1,5}$)	$(CH_3)_2C_6H_6$	20	0.823	1.4675	V-119
751	*m*-xylene	 $CH_3CHCH_2C(CH_3):$ $CHCH:CH$	19.7	0.823	1.4721	V-119
752	*p*-xylene ($\Delta^{1,3}$)	$(CH_3)_2C_6H_6$	19	0.83	1.4797	V-119
753	**Dihydroxynaphthalene** (1,5) di-*iso*-amyl ether (m.p. 96°)	$C_{10}H_6(OC_5H_{11})_2$	99.9	0.941	1.5160	**VI-950
754	di-*iso*-amyl ether (2,3)	$C_{10}H_6(OC_5H_{11})_2$	20	0.991	1.545	**VI-955
755	di-*iso*-amyl ether (2,7)	$C_{10}H_6(OC_5H_{11})_2$	99.6	0.934	1.5155	**VI-956
756	**Diiodo-**hexane (1,6)	$ICH_2(CH_2)_4CH_2I$	15	2.1	1.5890	I-147
757	pentane (1,5)	$ICH_2(CH_2)_3CH_2I$	15	2.20	1.6046	I-133
758	propane (1,3)	$ICH_2CH_2CH_2I$	15	2.576	1.6363	I-115
759	**Dimethoxy-*α*-chromene** (4,6)	 $CH_3C_6H_3C(CH_3):$ $CHCH_2{\cdot}O$	20	1.042	1.5623	*XVII-29
760	**Dimethyl-**acetal	$CH_3CH(OCH_3)_2$	20	0.850	1.37	I-603
761	acetamide (*N,N*)	$CH_3CON(CH_3)_2$	22.5	0.94	1.4371	IV-59
762	acetoacetic ester	$CH_3COC(CH_3)_2CO_2{\cdot}C_2H_5$	18.8	0.98	1.4183	III-695
763	acetophenone (2,4)	$(CH_3)_2C_6H_3COCH_3$	18.6	0.996	1.5301	VII-324
764	" (3,4)	$(CH_3)_2C_6H_3COCH_3$	15.5	1.007	1.5408	VII-323
765	acetonylacetone (*ω,ω*)	$(CH_3)_2CHCOCH_2{\cdot}CH_2COCH_3$	23	0.934	1.4317	I-796
766	3-acetoxycoumarone (2,5) (m.p. 29°)	 $CH_3C_6H_3C(O_2C{\cdot}$ $CH_3):C(CH_3){\cdot}O$	20	1.132	1.5389	*XVII-66
767	acetylacetone	$CH_3COC(CH_3)_2CO{\cdot}CH_3$	27.8	0.950	1.4262	I-794

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768	**Dimethyl-**δ-acetyl-valeric acid (β,β)	$CH_3CO(CH_2)_2C{:}$ $(CH_3)_2CH_2CO_2H$	20	1.032	1.4564	**III-249
769	acetylene dibromide	$CH_3CBr{:}CBrCH_3$	25.5	1.318	1.4562	I-206
770	acryl chloride (β,β)	$(CH_3)_2C{:}CHCOCl$	12.4	1.065	1.479	*II-193
771	adipate	$(CH_2CH_2CO_2CH_3)_2$	20	1.063	1.4286	II-652
772	allylanisole	$(CH_3)_2(C_3H_5)C_6H_2\cdot$ OCH_3 (1,3,4,5)	20	0.960	1.524	*VI-293
773	aminoethanol	$(CH_3)_2NCH_2CH_2OH$	20	0.887	1.43	IV-276
774	aminonaphthalene (β) (m.p. 46°)	$C_{10}H_7N(CH_3)_2$	53.2	1.028	1.6443	XII-1273
775	amino-*o*-xylene (4)	$(CH_3)_2C_6H_3N(CH_3)_2$ (1,2,4)	20	0.916	1.5201	XII-1103
776	" (*m*) (2)	$(CH_3)_2C_6H_3N(CH_3)_2$ (1,3,2)	20	0.915	1.5131	XII-1108
777	" (*m*) (*uns*)	$(CH_3)_2C_6H_3N(CH_3)_2$ (1,3,4)	20	0.939	1.5481	XII-1115
778	angelolactone	$(CH_3)C{:}CHC(CH_3)_2\cdot$ $CO\cdot O$	20	0.976	1.433	....
779	aniline	$C_6H_5N(CH_3)_2$	20	0.956	1.5587	XII-141
780	benzene (*o*)	$(CH_3)_2C_6H_4$	20	0.880	1.5054	V-362
781	" (*m*)	$(CH_3)_2C_6H_4$	20	0.864	1.4972	V-370
782	" (*p*)	$(CH_3)_2C_6H_4$	20	0.861	1.4958	V-382
783	4-bromopyrazole (1,3)	$CH_3N\cdot CH{:}CBr\cdot C\cdot$ $(CH_3){:}N$	20	1.490	1.519	....
784	buta-1,3-diene (2,3)	$[CH_2{:}C(CH_3)]_2$	20	0.726	1.4391	I-256
785	butane (2,2)	$(CH_3)_3CC_2H_5$	20	0.649	1.3688	I-150
786	" (2,3)	$[(CH_3)_2CH]_2$	20	0.661	1.3750	I-151
787	butan-3-ol (2,2)	$(CH_3)_3CCHOHCH_3$	20	0.82	1.4146	I-412
788	butan-2-ol (2,3)	$(CH_3)_2CHC{:}$ $(CH_3)_2OH$	20(?)	0.821	1.4140	I-413
789	but-3-ene (2,2)	$CH_2{:}CHC(CH_3)_3$	20	0.653	1.3760	I-217
790	but-1-ene (2,3)	$CH_2{:}C(CH_3)\cdot$ $CH(CH_3)_2$	20	0.678	1.3904	I-218
791	but-2-ene (2,3)	$(CH_3)_2C{:}C(CH_3)_2$	20	0.708	1.4122	I-218
792	butenyl carbinol	$(CH_3)_2C(OH)C_4H_7$	18	0.854	1.443	*I-489
793	camphorate	$C_{12}H_{20}O_4$	16.9	1.077	1.4633	IX-750
794	5-chlorocoumaranone (2,2) (m.p. 67°)	$ClC_6H_3COC(CH_3)_2O$	99.6	1.148	1.522	....
795	2-chlorocoumaranone (2,5)	$CH_3C_6H_3COC\cdot$ $(ClCH_3)\cdot O$	20	1.217	1.555	....
796	5-chlorocyclohexa-3,5-diene (1,3)	$(CH_3)_2C_6H_5Cl$	15.4	1.007	1.5046	V-119
797	3-chlorocyclohex-3-ene-5-one (1,1)	$(CH_3)_2C_6H_5OCl$	19.7	1.084	1.4955	*VII-49
798	chloroformamide	$ClCON(CH_3)_2$	22.1	1.166	1.4520	IV-73
799	4-chloropyrazole (1,3)	$CH_3N\cdot CH{:}CCl\cdot$ $C(CH_3){:}N$	20	1.153	1.492	....

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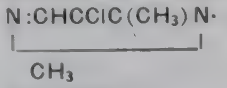
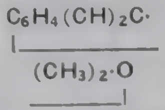
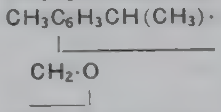
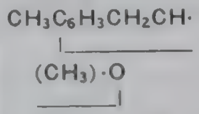
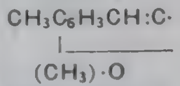
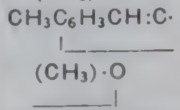
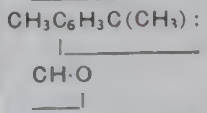
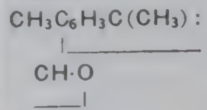
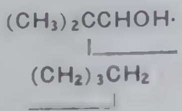
No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
800	**Dimethyl-**4-chloropyrazole (1,5)	 $N{:}CHCClC(CH_3)N\cdot$ CH_3	20	1.166	1.497	....
801	chromene (α) (2,2)	 $C_6H_4(CH)_2C\cdot$ $(CH_3)_2\cdot O$	20	1.013	1.5512	XVII-64
802	citraconate	$CH_3C_2H(CO_2CH_3)_2$	20.1	1.12	1.4475	II-770
803	coumarane (2,5)	 $CH_3C_6H_3CH(CH_3)\cdot$ $CH_2\cdot O$	13.7	1.015	1.5279	*XVII-24
804	" (2,7)	 $CH_3C_6H_3CH_2CH\cdot$ $(CH_3)\cdot O$	13.8	1.015	1.5297	*XVII-24
805	coumarone (2,5)	 $CH_3C_6H_3CH{:}C\cdot$ $(CH_3)\cdot O$	20	1.031	1.5534	XVII-62
806	" (2,7)	 $CH_3C_6H_3CH{:}C\cdot$ $(CH_3)\cdot O$	20	1.036	1.5546	XVII-62
807	" (3,5)	 $CH_3C_6H_3C(CH_3){:}$ $CH\cdot O$	22.2	1.035	1.5485	XVII-62
808	" (3,6)	 $CH_3C_6H_3C(CH_3){:}$ $CH\cdot O$	20	1.046	1.5505	XVII-62
809	" (5,7)	$C_{10}H_{12}O$	18.9	1.026	1.5358	*XVII-24
810	cyclohexa-1,3-diene-2-carboxylic acid (m.p. 41°)	$(CH_3)_2C_6H_5CO_2H$	18.5†	1.045	1.4938	IX-82
811	cyclohexane (1,1)	$(CH_3)_2(C\cdot C_5H_{10})$	20	0.781	1.4290	V-35
812	cyclohexane (1,2) (*cis*)	$(CH_3)_2C_6H_{10}$	20	0.796	1.4360	V-36
813	cyclohexane (1,2) (*trans*)	$(CH_3)_2C_6H_{10}$	20	0.776	1.4270	V-36
814	cyclohexane (1,3) (*cis*) ‡	$(CH_3)_2C_6H_{10}$	20	0.766	1.4229	V-36
815	cyclohexane (1,3) (*trans*) §	$(CH_3)_2C_6H_{10}$	20	0.785	1.4309	V-36
816	cyclohexane (1,4) (*cis*)	$(CH_3)_2C_6H_{10}$	20	0.783	1.4297	V-38
817	cyclohexane (1,4) (*trans*)	$(CH_3)_2C_6H_{10}$	20	0.763	1.4209	V-38
818	cyclohexan-2-ol (1,1)	 $(CH_3)_2CCHOH\cdot$ $(CH_2)_3CH_2$	20	0.923	1.4648	VI-12
819	cyclohexan-3-ol (1,1)	$(CH_3)_2C_6H_9OH$	19.7	0.909	1.4589	VI-17

† Supercooled.
‡ Boiling point 120.09°.
§ Boiling point 124.45°.

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
820	**Dimethyl-**cyclohexan-4-ol (1,1)	$(CH_3)_2C_6H_9OH$	24.7	0.922	1.4613	*VI-13
821	cyclohexan-1-ol (1,2)	$CH_3COHCH(CH_3)\cdot(CH_2)_3CH_2$	13.7	0.925	1.4625	VI-17
822	cyclohexan-4-ol (1,2)	$(CH_3)_2C_6H_9OH$	16	0.907	1.458	VI-17
823	cyclohexan-1-ol (1,3)	$(CH_3)_2C_6H_9OH$	22.9	0.903	1.4541	VI-17
824	cyclohexan-4-ol (1,3)	$(CH_3)_2C_6H_9OH$	16	0.912	1.458	VI-18
825	cyclohexan-1-ol (1,4)	$(CH_3)_2C_6H_9OH$	23.9	0.906	1.4553	*VI-13
826	cyclohexan-2-ol (1,4)	$(CH_3)_2C_6H_9OH$	16	0.907	1.455	VI-19
827	cyclohexan-1-ol (3,5) (*cis*)	$(CH_3)_2C_6H_9OH$	20	0.911	1.4540	VI-18
828	cyclohexan-1-ol (3,5) (*trans*)	$(CH_3)_2C_6H_9OH$	16	0.902	1.457	VI-18
829	cyclohexan-1-ol (3,5)	$(CH_3)_2C_6H_9OH$¶	18.6	0.900	1.4560	VI-18
830	cyclohexan-2-one (1,1)	$(CH_3)_2C_5H_8CO$	20	0.913	1.4486	*VII-17
831	cyclohexan-3-one (1,1)	$(CH_3)_2C_5H_8CO$	18.6	0.907	1.4476	VII-22
832	cyclohexan-4-one (1,1)	$(CH_3)_2C_5H_8CO$	24.2	0.928	1.4533	*VII-17
833	cyclohexan-4-one (1,2)	$(CH_3)_2C_5H_8CO$	12.6	0.912	1.4509	VII-23
834	cyclohexan-2-one (1,3)	$(CH_3)_2C_5H_8CO$	11.9	0.92	1.4519	VII-23
835	cyclohexan-5-one (1,3)	$(CH_3)_2C_5H_8CO$	18.2	0.896	1.4433	VII-24
836	cyclohexanyl-5 acetate (1,3)	$(CH_3)_2C_6H_9\cdot O_2CCH_3$	20.2	0.928	1.4376	VI-18
837	cyclohex-3-ene (1,1)	$(CH_3)_2C_6H_8$	16.2	0.806	1.4452	V-72
838	cyclohex-4-ene-5-acetic acid (1,3)	$(CH_3)_2C_6H_7CH_2\cdot CO_2H$	20.3	0.995	1.4773	*IX-34
839	cyclohex-1-ene-3-ol (1,3)	$(CH_3)_2C_6H_7OH$	17.5	0.933	1.4771	VI-50
840	cyclohex-3-ene-5-one (1,3)	$(CH_3)_2C_5H_6CO$	22	0.94	1.4819	VII-60
841	cyclohexyl-1-chloride (1,2)	$CH_3C(Cl)CH(CH_3)\cdot(CH_2)_3CH_2$	13.3	0.971	1.4672	*V-15
842	cyclohexyl-1-chloride (1,4)	$(CH_3)_2C_6H_9Cl$	18.5	0.944	1.4537	*V-16
843	cyclopentane (1,1)	$(CH_3)_2(C\cdot C_4H_8)$	20	0.754	1.4136	V-33
844	cyclopentane (1,2) (*cis*)	$(CH_3)_2C_5H_8$	20	0.773	1.4222	V-34
845	cyclopentane (1,2) (*trans*)	$(CH_3)_2C_5H_8$	20	0.751	1.4120	V-34
846	cyclopentane (1,3) (*cis*)	$(CH_3)_2C_5H_8$	20	0.749	1.4111	V-34
847	cyclopentane (1,3) (*trans*)	$(CH_3)_2C_5H_8$	20	0.745	1.4089	V-34

¶ Mixture of stereoisomers.

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
848	**Dimethyl-*d*-**dehydrocamphorate	$(CH_3)_3C_5H_3(CO_2\cdot CH_3)_2$	18.1	1.088	1.4736	*IX-344
849	*iso*-dehydrocamphorate	$(CH_3)_3C_5H_3(CO_2\cdot CH_3)_2$	17.5	1.085	1.4678	*IX-345
850	1-dichloromethylcyclohexa-2,5-diene-4-one (1,3) (m.p. 56°)	$(CH_3)_2C_5H_3COCHCl_2$	20	1.241	1.5440	VII-150
851	1-dichloromethylcyclohexa-3,5-diene-2-one	$(CH_3)_2(CHCl_2)\cdot C_5H_3CO$	20	1.225	1.5336	....
852	1-dichloromethylcyclohex-3-ene (1,4)	$(CH_3)_2C_6H_7\cdot CHCl_2$	20	1.125	1.5005	*V-40
853	4-dichloromethylcyclohex-1-ene-3-one (1,4) (m.p. 40°)	$(CH_3)_2C_5H_5CO\cdot CHCl_2$	45.8	1.207	1.5151	VII-67
854	4,4-diethylcyclohexan-2-ol (1,1)	$(CH_3)_2(C_2H_5)_2\cdot C_6H_7OH$	13.6	0.922	1.4759	*VI-33
855	4,4-diethylcyclohexan-2-one (1,1)	$(CH_3)_2(C_2H_5)_2\cdot C_5H_6CO$	15.2	0.911	1.4631	*VII-48
856	2,2-diethylindane-1,3-dione (4,7) (m.p. 51°)	$(CH_3)_2C_6H_2COC\cdot$ $(C_2H_5)_2CO$	62.4	1.017	1.5260	*VII-382
857	diethylmalonate	$(C_2H_5)_2C(CO_2CH_3)_2$	24.5	1.031	1.4253	II-686
858	diethylmethanetetracarboxylate	$C(CO_2CH_3)_2(CO_2\cdot C_2H_5)_2$	17.2	1.183	1.4333	*II-331
859	2,6-diethylphenol methyl ether (3,5)	$(CH_3)_2(C_2H_5)_2\cdot C_6HOCH_3$	20	0.946	1.513	*VI-272
860	dimethylmalonate	$(CH_3)_2C(CO_2CH_3)_2$	24.2	1.059	1.4131	II-648
861	disulfide	$(CH_3S)_2$	16	1.057	1.5219	I-291
862	2-ethoxycoumaranone (2,5)	$CH_3C_6H_3COC\cdot$ $(CH_3)(OC_2H_5)\cdot O$	14.1	1.103	1.5322	*XVII-304
863	3-ethylbenzene (1,2)	$(CH_3)_2C_6H_3C_2H_5$	20	0.892	1.5117	....
864	4-ethylbenzene	$C_{10}H_{14}$ (1,2)	20	0.875	1.5031	V-427
865	2-ethylbenzene	$C_{10}H_{14}$ (1,3)	20	0.890	1.5107	....
866	4-ethylbenzene	$C_{10}H_{14}$ (1,3)	20	0.876	1.5038	V-428
867	5-ethylbenzene	$C_{10}H_{14}$ (1,3)	20	0.865	1.4981	V-429
868	2-ethylbenzene	$C_{10}H_{14}$ (1,4)	20	0.877	1.5043	V-428
869	3-ethylchromanone (2,6)	$CH_3C_6H_3COCH\cdot$ $(C_2H_5)CH(CH_3)\cdot O$	21	1.063	1.539	....
870	2-ethylcoumaranone (2,5)	$CH_3C_6H_3COC(CH_3)\cdot$ $(C_2H_5)\cdot O$	19.6	1.056	1.5360	*XVII-168

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
871	**Dimethyl-**2-ethylcoumaranone (4,6)	$(CH_3)_2C_6H_2COCH\cdot$ $(C_2H_5)\cdot O$	20	1.067	1.5426	. . . .
872	3-ethylcoumarone (2,5)	$CH_3C_6H_3C(C_2H_5):$ $C(CH_3)\cdot O$	20	1.003	1.5433	. . . .
873	2-ethyl-7-hydroxyhydrindone (3,4)	$(CH_3)(OH)C_6H_2CH\cdot$ $(CH_3)CH\cdot$ $(C_2H_5)CO$	20	1.073	1.548	. . . .
874	2-ethyl-3-methoxybenzene (1,5)	$(CH_3)_2C_2H_5C_6H_2\cdot$ (CH_3O)	20	0.956	1.515	*VI-268
875	3-ethylpentane (2,2)	$(CH_3)_3CCH(C_2H_5)_2$	20	0.735	1.4123	. . . .
876	" (2,3)	$(CH_3)_2CHC(CH_3):$ $(C_2H_5)_2$	20	0.754	1.419	. . . .
877	" (2,4)	$[(CH_3)_2CH]_2CHC_2H_5$	20	0.738	1.4137	. . . .
878	3-ethylpyrazine (2,5)	$C_8H_{12}N_2$	24	0.966	1.5014	XXIII-99
879	α-ethylstyrene (β,β)	$C_6H_5C(C_2H_5):C:$ $(CH_3)_2$	17.5	0.889	1.5142	V-502
880	4-ethylidenecyclohexa-2,5-diene (1,1)	$(CH_3)_2C_6H_4:CHCH_3$	20	0.857	1.5135	V-427
881	formamide	$HCON(CH_3)_2$	22.4	0.948	1.4294	IV-58
882	furan (2,5)	$CH_3C:CHCH:C\cdot$ $(CH_3)\cdot O$	21.6	0.887	1.4351	XVII-41
883	furazan	$CH_3C:NON:CCH_3$	18.9	1.050	1.4271	XXVII-565
884	hepta-1,3-diene (2,6)	C_9H_{16}	10	0.765	1.4620	I-260
885	heptane (2,2)	$(CH_3)_3C(CH_2)_4\cdot$ CH_3	20	0.711	1.402	. . . .
886	" (2,3)	$(CH_3)_2CHCH(CH_3)$ $(CH_2)_3CH_3$	20	0.726	1.4085	. . . .
887	" (2,4)	$(CH_3)_2CHCH_2CH:$ $(CH_3)(CH_2C_2H_5)$	20	0.716	1.403	*I-64
888	" (2,5)	$(CH_3)_2CH(CH_2)_2\cdot$ $CH(CH_3)(C_2H_5)$	20	0.715	1.4038	I-167
889	" (2,6)	$[(CH_3)_2CHCH_2]_2CH_2$	20	0.709	1.4007	I-167
890	" (3,3)	$C_2H_5C(CH_3)_2CH_2\cdot$ $CH_2C_2H_5$	20	0.725	1.4085	**I-129
891	" (3,4)	$C_2H_5CH(CH_3)CH:$ $(CH_3)(CH_2C_2H_5)$	20	0.731	1.4108	. . . .
892	" (3,5)	$[C_2H_5(CH_3)CH]_2CH_2$	20	0.723	1.407.	. . . .
893	" (4,4)	$(C_2H_5CH_2)_2C:$ $(CH_3)_2$	20	0.725	1.408	. . . .
894	heptan-4-ol (2,4)	$(CH_3)_2CHCH_2COH:$ $(CH_3)CH_2C_2H_5$	18	0.827	1.4318	I-425
895	heptan-5-ol (2,5)	$(CH_3)_2CH(CH_2)_2\cdot$ $COH(CH_3)C_2H_5$	20	0.829	1.4310	I-425

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
896	**Dimethyl-**heptan-4-ol (2,6)	$[(CH_3)_2CHCH_2]_2:CHOH$	21	0.81	1.423	I-425
897	heptan-4-ol (3,5)	$[C_2H_5(CH_3)CH]_2:CHOH$	20	0.836	1.4322	**I-458
898	hept-2-ene-6-ol (2,6)	$(CH_3)_2C:CH(CH_2)_2\cdot COH(CH_3)_2$	20	0.855	1.4506	I-450
899	hexadecylethylene	$(CH_3)_2C:CHC_{16}H_{33}$	79.1	.....	1.428	....
900	hexa-1,5-diene (2,5)	$[CH_2:C(CH_3)CH_2\cdot]_2$	20	0.75	1.4309	I-259
901	hexane (2,2)	$(CH_3)_3C(CH_2)_3\cdot CH_3$	20	0.695	1.3935	**I-126
902	" (2,3)	$(CH_3)_2CHCH(CH_3)\cdot CH_2C_2H_5$	20	0.712	1.4013	*I-62
903	" (2,4)	$(CH_3)_2CHCH_2\cdot CH(CH_3)C_2H_5$	20	0.700	1.3953	I-162
904	" (2,5)	$[(CH_3)_2CHCH_2]_2$	20	0.694	1.3925	I-162
905	" (3,3)	$C_2H_5C(CH_3)_2CH_2\cdot C_2H_5$	20	0.710	1.4001	*I-62
906	" (3,4)	$[C_2H_5CH(CH_3)]_2$	20	0.719	1.4042	I-163
907	hexan-4-ol (2,4)	$(CH_3)_2CHCH_2COH\cdot(CH_3)(C_2H_5)$	18	0.83	1.4286	I-422
908	hexan-2-ol (2,5)	$(CH_3)_2CH(CH_2)_2\cdot C(CH_3)_2OH$	20	0.823	1.4209	I-422
909	hex-3-ene (2,2) (*cis?*)	$(CH_3)_3CCH:CHC_2H_5$	20	0.719	1.4099	....
910	hex-3-ene (2,2) (*trans*)	$(CH_3)_3CCH:CHC_2H_5$	....	.....	......	....
911	hex-4-ene (2,2) (*cis?*)	$CH_3CH:CHCH_2\cdot C(CH_3)_3$	20	0.716	1.410	....
912	hex-4-ene (2,2) (*trans*)	$CH_3CH:CHCH_2\cdot C(CH_3)_3$	....	.....	......	....
913	hex-5-ene (2,2)	$CH_2:CHCH_2CH_2\cdot C(CH_3)_3$	20	0.709	1.405	....
914	hex-2-ene (2,3)	$(CH_3)_2C:C(CH_3)\cdot CH_2C_2H_5$	20	0.740	1.4260	....
915	hex-3-ene (2,3) (*cis?*)	$(CH_3)_2CHC(CH_3):CHC_2H_5$	20	0.728	1.416	....
916	hex-3-ene (2,3) (*trans*)	$(CH_3)_2CHC(CH_3):CHC_2H_5$	......	.....	......	....
917	hex-4-ene (2,3) (*cis?*)	$CH_3CH:CHCH(CH_3)\cdot CH(CH_3)_2$	20	0.725	1.413	....
918	hex-4-ene (2,3) (*trans*)	$CH_3CH:CHCH(CH_3)\cdot CH(CH_3)_2$	....	.....	......	....
919	hex-5-ene (2,3)	$CH_2:CHCH_2\cdot CH(CH_3)\cdot CH:(CH_3)_2$	20	0.728	1.414	....
920	hex-2-ene (2,4)	$(CH_3)_2C:CHCH:(CH_3)(C_2H_5)$	20	0.725	1.411	....
921	hex-3-ene (2,4) (*cis?*)	$(CH_3)_2CHCH:C:(CH_3)(C_2H_5)$	20	0.714	1.409	....
922	hex-3-ene (2,4) (*trans*)	$(CH_3)_2CHCH:C:(CH_3)(C_2H_5)$	....	.....	......	....
923	hex-4-ene (2,4) (*cis?*)	$CH_3CH:C(CH_3)CH_2\cdot CH(CH_3)_2$	20	0.725	1.416	....
924	hex-4-ene (2,4) (*trans*)	$CH_3CH:C(CH_3)CH_2\cdot CH(CH_3)_2$	....	.....	......	....

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
925	**Dimethyl**-hex-5-ene (2,4)	$CH_2:CHCH(CH_3)\cdot CH_2\cdot CH(CH_3)_2$	20	0.708	1.404	....
926	hex-2-ene (2,5)	$(CH_3)_2C:CHCH_2\cdot CH(CH_3)_2$	20	0.720	1.4140	....
927	hex-3-ene (2,5) (*cis?*)	$[(CH_3)_2CH\cdot CH:]_2$	20	0.710	1.403	....
928	hex-3-ene (2,5) (*trans*)	$[(CH_3)_2CH\cdot CH:]_2$	....	.....	......	....
929	hex-1-ene (3,3)	$CH_2:CHC(CH_3)_2\cdot CH_2C_2H_5$	20	0.714	1.4070	....
930	hex-4-ene (3,3) (*cis*)	$CH_3CH:CHC(C_2H_5)\cdot(CH_3)_2$	20	0.722	1.413	....
931	hex-5-ene (3,3)	$CH_2:CHCH_2C(CH_3)_2\cdot C_2H_5$	20	0.720	1.4102	....
932	hex-1-ene (3,4)	$CH_2:CHCH(CH_3)CH:(CH_3)(C_2H_5)$	20	0.724	1.413	....
933	hex-2-ene (3,4) (*cis?*)	$CH_3CH:C(CH_3)CH:(CH_3)(C_2H_5)$	20	0.737	1.418	....
934	hex-2-ene (3,4) (*trans*)	$CH_3CH:C(CH_3)CH:(CH_3)(C_2H_5)$	....	.....	......	....
935	hex-3-ene (3,4) (*cis?*)	$[(C_2H_5)(CH_3)C:]_2$	20	0.747	1.430	*I-94
936	hex-3-ene (3,4) (*trans*)	$[(C_2H_5)(CH_3)C:]_2$	....	.....	......	*I-94
937	Δ²-hexenic acid (β,δ)	$(CH_3)_2CHCH_2C\cdot(CH_3):CHCO_2H$	15.8	0.936	1.4480	....
938	hydrazine (*sym*)	$CH_3NHNHCH_3$	20	0.827	1.4209	IV-547
939	" (*uns*)	$(CH_3)_2NNH_2$	22.3	0.791	1.4075	IV-547
940	hydrind-1-one (2,2) (m.p. 44°)	$C_6H_4CH_2C(CH_3)_2CO$	13.9	1.031	1.5408	*VII-198
941	hydrind-1-one (3,3)	$C_6H_4C(CH_3)_2\cdot$ CH_2CO	20	1.027	1.5427	....
942	7-hydroxyhydrindone (2,5)	$(CH_3)(HO)C_6H_2\cdot$ $CH_2CH(CH_3)CO$	20	1.123	1.567	....
943	2-hydroxystyrene (1′,5)	$(CH_3)(HO)C_6H_3\cdot C(CH_3):CH_2$	20	1.012	1.5514	VI-577
944	isoprene dicarboxylate (m.p. 39°)	$CH_3O_2CCH:C(CH_3)\cdot CH:CHCO_2CH_3$	42.7	1.096	1.505	*II-319
945	isoxazole (α,γ)	$CH_3C:CHC\cdot$ $(CH_3):N\cdot O$	20	0.983	1.442	XXVII-17
946	itaconate	$C_3H_4(CO_2CH_3)_2$	20	1.122	1.4441	II-762
947	1-keto-1,2,3,4-tetrahydronaphthalene (m.p. 49°)	$(CH_3)_2C_6H_2CH_2\cdot$ CH_2CH_2CO	15.5	1.065	1.5650	....
948	malate	$C_2H_4O(CO_2CH_3)_2$	20	1.233	1.4425	III-429
949	maleate	$(CHCO_2CH_3)_2$	19.9	1.151	1.4416	II-751
950	malonate	$H_2C(CO_2CH_3)_2$	20	1.154	1.4140	II-572
951	mesaconate	$CH_3C_2H(CO_2CH_3)_2$	19.9	1.121	1.4557	II-765

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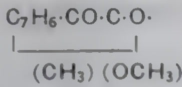
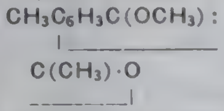
No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
952	**Dimethyl**-2-methoxycoumaranone (2,5)	 $C_7H_6\cdot CO\cdot C\cdot O\cdot$ $(CH_3)\,(OCH_3)$	22.6	1.130	1.5383	*XVIII-304
953	3-methoxycoumarone (2,5)	 $CH_3C_6H_3C(OCH_3):$ $C(CH_3)\cdot O$	19	1.081	1.5440	*XVII-65
954	3-methylalhept-3-ene (2,6)	$(CH_3)_2CHCH_2CH:C(CHO)CH(CH_3)_2$	17.4	0.854	1.45	I-748
955	4-methylene-cyclohexa-2,5-diene (1,1)	$(CH_3)_2C_6H_4:CH_2$	15.8	0.836	1.5030	V-399
956	1-methylenecyclohexane (3,5)	$(CH_3)_2(CH_2:)C_6H_8$	14.6	0.792	1.4463	*V-40
957	3-methylenepentane (2,2)	$CH_2:C(C_2H_5)C\vdots(CH_3)_3$	20	0.728	1.416	....
958	3-methylenepentane (2,4)	$CH_2:C[CH(CH_3)_2]_2$	20	0.722	1.409	....
959	naphthalene (1,2)	$(CH_3)_2C_{10}H_6$	20	1.019	1.616	*V-267
960	" (1,4)	$(CH_3)_2C_{10}H_6$	16.4	1.02	1.6157	V-570
961	" (1,6)	$(CH_3)_2C_{10}H_6$	20	1.002	1.607	*V-268
962	naphthylamine (α)	$C_{10}H_7N(CH_3)_2$	20(?)	1.042	1.624	XII-1221
963	nitroamine (m.p. 57°)	$(CH_3)_2NNO_2$	72.3	1.109	1.4462	IV-85
964	nitrosoamine	$(CH_3)_2NNO$	18.4	1.01	1.4374	IV-84
965	nona-2,8-diene-6-ol (2,6)	$(CH_3)_2C_9H_{13}OH$	16.6	0.866	1.4647	I-462
966	octa-2,6-diene (2,6)	$C_{10}H_{18}$	19	0.78	1.4497	I-260
967	octa-2,7-diene (2,6)	$C_{10}H_{18}$	20(?)	0.788	1.455	I-261
968	octa-2,6-diene-8-ol (2,6)	$C_9H_{15}CH_2OH$	15	0.883	1.4773	I-457
969	octa-2,7-diene-6-ol (2,6)	$C_{10}H_{18}O$	20	0.862	1.4624	I-460
970	octane (2,6)	$(CH_3)_2CH(CH_2)_3\cdot CH(CH_3)C_2H_5$	15	0.74	1.4135	I-168
971	" (2,7)	$[(CH_3)_2CHCH_2CH_2]_2$	18.1	0.72	1.4092	I-169
972	octan-6-ol (2,6)	$C_{10}H_{22}O$	15	0.836	1.4388	I-426
973	octan-8-ol (2,6)	$C_{10}H_{22}O$	18	0.830	1.438	I-426
974	octa-3,5,7-triene (2,6)	$(CH_3)_2CHCH:CH\cdot CH:C(CH_3)CH:CH_2$	20	0.809	1.5436	....
975	oct-2-ene (2,6)	$(CH_3)_2C:CH(CH_2)_2\cdot CH(CH_3)C_2H_5$	20	0.75	1.4303	I-224
976	" (2,7)	$(CH_3)_2CH(CH_2)_3\cdot CH:C(CH_3)_2$	20	0.75	1.4304	I-224
977	oct-2-ene-6-ol (2,6)	$(CH_3)_2C:CH(CH_2)_2\cdot COH(CH_3)C_2H_5$	15.9	0.858	1.4555	I-452
978	oxalate (m.p. 54°)	$(CO_2CH_3)_2$	56.6	1.14	1.3915	II-534
979	penta-1,3-diene (2,4)	$(CH_3)_2C:CHC\vdots(CH_3)CH_2$	23	0.734	1.4390	I-257
980	penta-2,4-diene (2,4)	$(CH_3)_2C:CHC(CH_3):CH_2$	12	0.749	1.4468	I-257
981	pentane (2,2)	$(CH_3)_3CCH_2C_2H_5$	20	0.674	1.3822	I-157

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
982	**Dimethyl**-pentane (2,3)	$(CH_3)_2CHCH(CH_3)\cdot C_2H_5$	20	0.695	1.3920	I-157
983	" (2,4)	$[(CH_3)_2CH]_2CH_2$	20	0.673	1.3815	I-158
984	" (3,3)	$(CH_3)_2C(C_2H_5)_2$	20	0.693	1.3909	I-158
985	pentan-2-ol (2,4)	$(CH_3)_2COHCH_2\cdot CH(CH_3)_2$	20	0.82	1.4172	I-417
986	pentan-3-ol (2,4)	$[(CH_3)_2CH]_2CHOH$	20	0.829	1.4226	I-417
987	pent-3-ene (2,2) (*cis?*)	$(CH_3)_3CCH{:}CH\cdot CH_3$	20	0.688	1.399	*I-92
988	pent-3-ene (2,2) (*trans*)	$(CH_3)_3CCH{:}CH\cdot CH_3$	....	.....	.....	....
989	pent-4-ene (2,2)	$(CH_3)_3CCH_2CH{:}CH_2$	20	0.683	1.3918	....
990	pent-1-ene (2,3)	$CH_2{:}C(CH_3)CH{:}(CH_3)(C_2H_5)$	20	0.710	1.403	....
991	pent-2-ene (2,3)	$(CH_3)_2C{:}C(CH_3)\cdot C_2H_5$	20	0.728	1.421	*I-92
992	pent-3-ene (2,3) (*cis?*)	$CH_3CH{:}C(CH_3)\cdot CH(CH_3)_2$	20	0.713	1.407	....
993	pent-3-ene (2,3) (*trans*)	$CH_3CH{:}C(CH_3)\cdot CH(CH_3)_2$	....	.....	......	....
994	pent-4-ene (2,3)	$CH_2{:}CHCH(CH_3)\cdot CH(CH_3)_2$	20	0.701	1.399	....
995	pent-1-ene (2,4)	$CH_2{:}C(CH_3)CH_2\cdot CH(CH_3)_2$	20	0.694	1.397	....
996	pent-2-ene (2,4)	$(CH_3)_2C{:}CHCH{:}(CH_3)_2$	20	0.696	1.403	I-220
997	pent-1-ene (3,3)	$CH_2{:}CHC(CH_3)_2C_2H_5$	20	0.696	1.399	....
998	phenyl carbinol	$C_6H_5COH(CH_3)_2$	18.5	0.972	1.5314	VI-506
999	5-phenylcyclo-hexa-3,5-diene (1,3)	$(CH_3)_2C_6H_5C_6H_5$	17	0.972	1.5749	V-572
1000	5-phenylcyclo-hex-3-ene (1,3)	$(CH_3)_2(C_6H_5)C_6H_7$	20	0.942	1.5341	*V-254
1001	phthalate (*o*)	$C_6H_4(CO_2CH_3)_2$	20.8	1.192	1.5155	IX-797
1002	piperidylamine (γ)	$C_7H_{15}N$	19.2	0.759	1.4220	IV-222
1003	7-*iso*-propyl-coumarone (2,4)	$(CH_3)(C_3H_7){:}C_6H_2CH{:}C(CH_3)\cdot O$	20	0.994	1.5401	....
1004	4-propylidene-cyclohexa-2,5-diene (1,1)	$(CH_3)_2C_6H_4{:}CHC_2H_5$	20	0.858	1.5042	**V-334
1005	pyrazine (2,5)	$CH_3C{:}CHN{:}C(CH_3)\cdot$ $CH{:}N$	23.6	0.986	1.4992	XXIII-96
1006	pyrazole (1,3)	$CH{:}CH\cdot C(CH_3){:}N\cdot N\cdot$ CH_3	20	0.966	1.473	....
1007	pyrazole (3,4) (m.p. 58°)	$(CH_3)_2C_3H_2N_2$	99.3	0.933	1.4657	XXIII-72
1008	pyrotartrate	$CH_3CH(CO_2CH_3)\cdot CH_2CO_2CH_3$	19.6	1.069	1.4204	II-639
1009	pyrrole (2,4)	$C_4H_2(CH_3)_2NH$	13.7	0.927	1.4993	XX-172
1010	" (2,5)	$CH_3C{:}CHCH{:}C{:}$ $(CH_3)NH$	20	0.935	1.5036	XX-172

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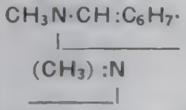
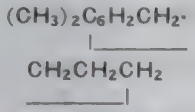
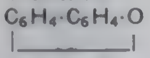
No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1011	**Dimethyl**-styrene (α,β)	$C_6H_5C(CH_3):CHCH_3$	19.7	0.910	1.5339	V-488
1012	styrene (β,β)	$C_6H_5CH:C(CH_3)_2$	19.6	0.899	1.5273	V-489
1013	succinate	$(CH_2CO_2CH_3)_2$	20	1.121	1.4198	II-609
1014	sulfate	$(CH_3O)_2SO_2$	20	1.33	1.3874	I-283
1015	tetrahydroindazole (2,7)	 $CH_3N\cdot CH:C_6H_7\cdot(CH_3):N$	20	1.012	1.512	....
1016	5,6,7,8-tetrahydronaphthalene (1,3)	 $(CH_3)_2C_6H_2CH_2\cdot CH_2CH_2CH_2$	21	0.959	1.5409	**V-398
1017	thiophene (β,β)	$(CH_3)_2C_4H_2S$	15	0.99	1.522	XVII-40
1018	" (2,5)	$(CH_3)_2C_4H_2S$	19	0.994	1.5142	XVII-41
1019	*o*-toluidine (*N*)	$CH_3C_6H_4N(CH_3)_2$	23.3	0.93	1.5244	XII-785
1020	*m*-toluidine (*N*)	$CH_3C_6H_4N(CH_3)_2$	20	0.941	1.5492	XII-857
1021	*p*-toluidine (*N*)	$CH_3C_6H_4N(CH_3)_2$	20	0.937	1.5471	XII-902
1022	*p*-tolyl carbinol	$CH_3C_6H_4COH:(CH_3)_2$	20	0.977	1.5162	VI-544
1023	*m*-tolyl ketone	$CH_3COC_6H_4CH_3$	15.3	1.011	1.5327	VII-307
1024	undecyl carbinol	$(CH_3)_2COC_{11}H_{23}$	81.8	.....	1.417	I-429
1025	**Dinitroethane** (1,1)	$CH_3CH(NO_2)_2$	20	1.35	1.4488	I-102
1026	**Diosphenol** acetate	$CH_3CO_2C_{10}H_{15}O$	20	1.036	1.481	VIII-9
1027	ethyl ether	$C_2H_5OC_{10}H_{15}O$	20	0.977	1.485	VIII-9
1028	methyl ether	$CH_3OC_{10}H_{15}O$	20	0.988	1.485	VIII-9
1029	**Dioxan** (1,4)	$O:(CH_2)_4:O$	20	1.033	1.4221	XIX-3
1030	**Dipentene** (*dl*)	$C_{10}H_{16}$	20.9	0.840	1.4744	V-137
1031	**Diphenyl** (m.p. 69°)	$C_6H_5\cdot C_6H_5$	77.1	0.99	1.5882	V-576
1032	acetaldehyde	$(C_6H_5)_2CHCHO$	20	1.100	1.5921	VII-438
1033	ethane (*uns*)	$(C_6H_5)_2CHCH_3$	20	1.004	1.5761	V-605
1034	ketene	$(C_6H_5)_2C:CO$	14.1	1.11	1.615	VII-471
1035	methane (m.p. 27°)	$(C_6H_5)_2CH_2$	16.8	1.01	1.5788	V-588
1036	sulfide	$(C_6H_5)_2S$	18.5	1.117	1.635	VI-299
1037	**Diphenylene oxide** (m.p. 87°)	 $C_6H_4\cdot C_6H_4\cdot O$	99.3	1.089	1.6079	XVII-70
1038	**Dipropargyl**	$(CH\vdots CCH_2\cdot)_2$	20	0.805	1.4414	I-266
1039	**Dipropyl**-amine (*n*)	$(C_2H_5CH_2)_2NH$	19.5	0.739	1.4046	IV-138
1040	carbimide	$C_3H_7N:C:NC_3H_7$	23	0.838	1.4454	IV-145
1041	cyanamide	$(C_2H_5CH_2)_2NCN$	24.4	0.857	1.4298	IV-144
1042	fumarate (*n*)	$(CHCO_2C_3H_7)_2$	20	1.022	1.4435	II-742
1043	ketone (*n*)	$(C_2H_5CH_2)_2CO$	22	0.82	1.4073	I-699
1044	" (*iso*)	$[(CH_3)_2CH]_2CO$	20(?)	0.806	1.417	I-703
1045	ketoxime	$(C_3H_7)_2C:NOH$	24.1	0.888	1.4472	I-700
1046	malate (*l*)	$(CHOHCH_2):(CO_2\cdot C_3H_7)_2$	20	1.075	1.4380	III-432
1047	maleate (*n*)	$(CHCO_2C_3H_7)_2$	20	1.029	1.4437	II-752
1048	nitrosoamine	$(C_3H_7)_2NNO$	20	0.916	1.4446	IV-146
1049	**Dodecane** (*n*)	$CH_3(CH_2)_{10}CH_3$	20(?)	0.751	1.4209	I-171
1050	**Dotriacontane** (*n*)	$CH_3(CH_2)_{30}CH_3$	79.4	0.775	1.43	I-177
1051	**Eicosane** (*n*) (m.p. 38°)	$CH_3(CH_2)_{18}CH_3$	42.9	0.77	1.434	I-174
1052	**Elaidic acid** (m.p. 51°)	$C_{17}H_{33}CO_2H$	79.4	0.851	1.44	II-469
1053	**Elemicin** (1,3,4,5)	$CH_2:CHCH_2\cdot C_6H_2(OH)_3$	20(?)	1.063	1.5285	VI-1131

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1054	**Elemol** (α) (m.p. 46°)	$C_{15}H_{26}O$	20(?)	0.941	1.5030	*VI-66
1055	**Epichlorohydrin** (α)	OCH_2CHCH_2Cl	16.1	1.18	1.4397	XVII-6
1056	**Epidibromohydrin** (β)	$BrCH_2CH{:}CHBr$	25	1.995	1.5378	I-201
1057	**Erucic acid** (m.p. 33°)	$CH_3(CH_2)_7CH{:}CH\cdot(CH_2)_{11}CO_2H$	55	0.860	1.45	II-472
1058	anhydride (m.p. 48°)	$(C_{21}H_{41}CO)_2O$	100	.....	1.4347	II-474
1059	**Estragole** (1,4)	$CH_2{:}CHCH_2C_6H_4\cdot OCH_3$	17.5	0.971	1.5230	VI-571
1060	**Ethanolamine**	$H_2NCH_2CH_2OH$	20	1.022	1.4539	IV-274
1061	**Ether**	$(C_2H_5)_2O$	24.8	0.708	1.3497	I-314
1062	**Ethoxy** acetic acid	$C_2H_5OCH_2CO_2H$	20	1.102	1.4194	III-233
1063	allylphenol (*p*)	$C_2H_5OC_6H_4CH_2CH{:}CH_2$	12.2	0.961	1.5179	VI-572
1064	5-bromotoluene (2)	$CH_3C_6H_3(OC_2H_5)Br$	11.4	1.359	1.5486	*VI-176
1065	coumarone (3)	$C_6H_4C(OC_2H_5){:}CH\cdot O$	17.9	1.106	1.5477	*XVII-59
1066	1,3-dimethylbenzene (2)	$(CH_3)_2C_6H_3OC_2H_5$	13.9	0.942	1.4969	VI-485
1067	methylene-cyclohexan-2-one (1)	$C_9H_{14}O_2$	10.8	1.029	1.5002	*VIII-509
1068	methylene-diethyl ketone	$C_2H_5COC(CH_3){:}CHOC_2H_5$	18.2	0.945	1.4717	*I-427
1069	methylene-menthone	$C_2H_5OC_{11}H_{17}O$	15.2	0.970	1.4895	*VIII-512
1070	methylene-pinacoline	$(CH_3)_3CCOCH{:}CHOC_2H_5$	14.2	0.916	1.4605	*I-427
1071	styrene (α)	$C_6H_5C(OC_2H_5){:}CH_2$	17.5	0.977	1.5304	VI-563
1072	thionaphthene (3)	$C_6H_4C(OC_2H_5){:}CH\cdot S$	17.9	1.159	1.6050	*XVII-61
1073	toluene (*o*)	$CH_3C_6H_4OC_2H_5$	13.3	0.959	1.5079	VI-352
1074	" (*m*)	$CH_3C_6H_4OC_2H_5$	20	0.949	1.513	VI-376
1075	" (*p*)	$CH_3C_6H_4OC_2H_5$	17.6	0.8	1.5058	VI-393
1076	γ-valerolactone (δ)	$C_2H_5OCH_2CHCH_2\cdot CH_2CO\cdot O$	24.9	1.072	1.4408	*XVIII-297
1077	*o*-xylene (1,2,3)	$(CH_3)_2C_6H_3OC_2H_5$	20	0.952	1.510	VI-480
1078	" (1,2,4)	$(CH_3)_2C_6H_3OC_2H_5$	20	0.950	1.510	VI-481
1079	*m*-xylene (1,3,5)	$(CH_3)_2C_6H_3OC_2H_5$	20	0.939	1.505	VI-493
1080	" (1,3,4)	$(CH_3)_2C_6H_3OC_2H_5$	14	0.949	1.5069	*VI-241
1081	*p*-xylene	$(CH_3)_2C_6H_3OC_2H_5$	20	0.938	1.504	VI-495
1082	**Ethyl** acetate	$CH_3CO_2C_2H_5$	19.2	0.901	1.3728	II-125
1083	acetoacetate	$CH_3COCH_2CO_2C_2H_5$	20	1.025	1.4198	III-632
1084	acetoacetic ester	$CH_3COCH(C_2H_5)\cdot CO_2C_2H_5$	18.7	0.99	1.4226	III-691
1085	α′-acetothienone (α)	$CH_3COC{:}CHCH{:}C\cdot(C_2H_5)\cdot S$	20	1.079	1.551	XVII-297
1086	acetonoxalate	$CH_3COCH_2COCO_2\cdot C_2H_5$	17.6	1.128	1.4750	III-747

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1087	**Ethyl**-acetonoxalate *O*-ethyl ether	$CH_3COCH:C(O\cdot C_2H_5)CO_2C_2H_5$	20	1.060	1.4689	III-877
1088	acetoxymethylene acetate	$CH_3CO_2CH:CHCO_2\cdot C_2H_5$	18.1	1.090	1.4474	III-370
1089	acetoxymethylene propionate	$CH_3CO_2C(CH_3):CH\cdot CO_2C_2H_5$	20	1.060	1.4447	III-373
1090	acetylacetone	$CH_3COCH(C_2H_5)CO\cdot CH_3$	16.9	0.956	1.4397	I-794
1091	*β*-acetylacrylate	$CH_3COCH:CHCO_2\cdot C_2H_5$	20	1.037	1.453	III-731
1092	4-acetylnaphthalene (1)	$C_2H_5C_{10}H_6COCH_3$	15.7	1.092	1.6198	....
1093	acid-*d*-camphorate (*α*)	$C_8H_{14}(CO_2H)(CO_2\cdot C_2H_5)$	16.8	1.102	1.4737	IX-751
1094	alcohol ‡	C_2H_5OH	20.5	0.788	1.3610	I-292
1095	allocinnamate	$C_6H_5CH:CHCO_2C_2H_5$	20	1.048	1.5451	IX-594
1096	allocinnamylidene acetate	$C_6H_5\cdot(CH:CH)_2\cdot CO_2C_2H_5$	20	1.043	1.619	....
1097	allomethylcamphorate (*o*)	$C_{13}H_{22}O_4$	17.7	1.057	1.4604	....
1098	allylaceto-acetate	$CH_3COCH(CH_2CH:CH_2)CO_2C_2H_5$	17.6	0.992	1.4388	III-738
1099	allyl ether	$C_2H_5OCH_2CH:CH_2$	20	0.765	1.3881	I-438
1100	1-allyl-3-methylpyrazole-5-carboxylate	$C_3H_5N\cdot C(CO_2C_2H_5):$ $CHC(CH_3):N$	20	1.046	1.489	....
1101	1-allyl-5-methylpyrazole-5-carboxylate	$C_3H_5NC(CH_3):CH\cdot$ $C(CO_2C_2H_5):N$	20	1.077	1.502	....
1102	*β*-aminocrotonate	$CH_3C(NH_2):CH\cdot CO_2C_2H_5$	18.8	1.022	1.5007	III-654
1103	aminoethanol (*β*)	$C_2H_5NHCH_2CH_2OH$	20	0.914	1.444	IV-282
1104	aminonaphthalene (*α*)	$C_{10}H_7NHC_2H_5$	15.1	1.06	1.6477	XII-1222
1105	aminonaphthalene (*β*)	$C_{10}H_7NHC_2H_5$	21.3	1.06	1.6544	XII-1274
1106	*cis-p*-amino-*o,o,o′*-trimethylhexahydrobenzoate	$(CH_3)_3C_6H_7(NH_2)\cdot CO_2C_2H_5$	20	0.990	1.475	XIV-307
1107	*trans-p*-amino-*o,o,o′*-trimethylhexahydrobenzoate	$C_{12}H_{23}O_2N$	20	0.980	1.473	XIV-308
1108	*n*-amyl ketone	$C_2H_5COC_5H_{11}$	20	0.8	1.4156	I-706
1109	*iso*-amyl malonate	$CH_2(CO_2C_2H_5)(CO_2\cdot C_5H_{11})$	20	0.95	1.4275	....
1110	amylpropiolate	$C_5H_{11}C\vdots CCO_2C_2H_5$	25	0.910	1.4453	II-487
1111	angelate	$C_4H_7CO_2C_2H_5$	19.5	0.918	1.431	II-429
1112	aniline	$C_6H_5NHC_2H_5$	20	0.963	1.5559	XII-159
1113	anisate (*p*)	$CH_3OC_6H_4CO_2C_2H_5$	20	1.106	1.5249	X-159
1114	anthracene (9)	$C_{16}H_{14}$ (m.p. 59°)	99.2	1.041	1.6762	V-678
1115	anthranilate (*o*)	$NH_2C_6H_4CO_2C_2H_5$	20	1.117	1.5646	XIV-319

‡ See special tables.

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
1116	**Ethyl** atropate	$C_6H_5C(:CH_2)CO_2\cdot C_2H_5$	16.1	1.051	1.5261	*IX-252
1117	benzene	$C_6H_5C_2H_5$	20	0.867	1.4959	V-351
1118	benzoate	$C_6H_5CO_2C_2H_5$	18.7	1.046	1.5057	IX-110
1119	benzoic acid (*o*) (m.p. 68°)	$C_2H_5C_6H_4CO_2H$	99.6	1.042	1.5101	IX-526
1120	benzoic acid (*m*) (m.p. 47°)	$C_2H_5C_6H_4CO_2H$	100	1.042	1.5345	IX-528
1121	benzoylacetate	$C_6H_5COCH_2CO_2\cdot C_2H_5$	16	1.12	1.5312	X-674
1122	benzoylformate	$C_6H_5COCO_2C_2H_5$	25.1	1.122	1.5190	X-657
1123	benzoylformylacetate	$C_6H_5COCH(CHO)\cdot CO_2C_2H_5$	24.9	1.140	1.5313	....
1124	β-benzylaminoacetoacetate	$CH_3C(:NC_7H_7)CH_2\cdot CO_2C_2H_5$	20.6	1.060	1.5579	....
1125	α-benzylcinnamate (m.p. 38°)	$C_6H_5CH:C(CH_2\cdot C_6H_5)CO_2C_2H_5$	16.1	1.08	1.5885	*IX-299
1126	benzyl ether	$C_2H_5OCH_2C_6H_5$	20	0.949	1.4955	VI-431
1127	*d*-bornyl ether	$C_2H_5OC_{10}H_{17}$	24.7	0.9	1.4555	VI-78
1128	bornylenecarboxylate	$C_{13}H_{20}O_2$	19.8	0.983	1.4760	*IX-51
1129	brassidate (m.p. 30°)	$C_{24}H_{46}O_2$	35	.....	1.4587	II-475
1130	bromide	C_2H_5Br	20	1.460	1.4239	I-88
1131	bromoacetate	$BrCH_2CO_2C_2H_5$	13	1.514	1.4542	II-214
1132	α-bromoacetoacetate	$CH_3COCHBrCO_2\cdot C_2H_5$	14.1	1.429	1.4634	III-664
1133	γ-bromoacetoacetate	$BrCH_2COCH_2CO_2\cdot C_2H_5$	18.1	1.528	1.4831	III-664
1134	bromobenzoate (*o*)	$BrC_6H_4CO_2C_2H_5$	20	1.439	1.543	IX-348
1135	" (*m*)	$BrC_6H_4CO_2C_2H_5$	20	1.430	1.543	IX-350
1136	" (*p*)	$BrC_6H_4CO_2C_2H_5$	20	1.430	1.547	IX-352
1137	α-bromopropionate	$CH_3CHBrCO_2C_2H_5$	20(?)	1.394	1.4469	II-255
1138	buta-1,3-diene (2)	$CH_2:C(C_2H_5)CH:CH_2$	20	0.730	1.445	....
1139	butan-1-ol (2)	$(C_2H_5)_2CHCH_2OH$	20	0.831	1.4208	I-412
1140	butyl acetate (2)	$CH_3CO_2CH_2\cdot CH(C_2H_5)_2$	20	0.879	1.4103	....
1141	*n*-butylcarbamate	$C_4H_9NHCO_2C_2H_5$	25.6	0.943	1.4278	IV-158
1142	*iso*- "	$C_4H_9NHCO_2C_2H_5$	20	0.943	1.4288	IV-168
1143	*sec*- "	$C_4H_9CH(CH_3)NH\cdot CO_2C_2H_5$	26	0.940	1.4267	IV-162
1144	*tert*-butyl ether	$C_2H_5OC(CH_3)_3$	20	0.752	1.3794	I-381
1145	*n*-butyl malonate	$CH_2(CO_2C_2H_5)(CO_2\cdot C_4H_9)$	20	0.98	1.4242	*II-528
1146	*iso*- "	$CH_2(CO_2C_2H_5)(CO_2\cdot C_4H_9)$	20	0.97	1.4248	....
1147	*sec*- "	$CH_2(CO_2C_2H_5)(CO_2\cdot C_4H_9)$	20	0.99	1.4284	....
1148	*n*-butylnitrocarbamate	$C_4H_9N(NO_2)CO_2\cdot C_2H_5$	20.7	1.099	1.4455	IV-159
1149	*iso*-butylnitrocarbamate	$C_4H_9N(NO_2)CO_2\cdot C_2H_5$	20.5	1.094	1.4433	IV-172
1150	*sec*-butylnitrocarbamate	$C_4H_9N(NO_2)CO_2\cdot C_2H_5$	21.4	1.086	1.4397	IV-163
1151	*n*-butyrate	$C_2H_5CH_2CO_2C_2H_5$	18	0.88	1.3930	II-270

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
1152	**Ethyl-*iso*-butyrate**	$(CH_3)_2CHCO_2C_2H_5$	20	0.871	1.3903	II-291
1153	α-*n*-butyro-α-cyanoacetate	$C_2H_5CH_2COCH\cdot(CN)CO_2C_2H_5$	20	1.056	1.4614	III-807
1154	α-*iso*-butyro-α-cyanoacetate	$(CH_3)_2CHCO\cdot CH(CN)CO_2C_2H_5$	20	1.054	1.4606	III-811
1155	camphor (α)	$C_{12}H_{20}O$	20	0.937	1.4719	VII-142
1156	camphorcarboxylate	$C_{10}H_{15}OCO_2C_2H_5$	24.3	1.053	1.4736	X-644
1157	chavibetol (1,3,4)	$CH_2{:}CHCH_2C_6H_3(O\cdot C_2H_5)(OCH_3)$	11.5	1.013	1.5276	. . . .
1158	*iso*-chavibetol	$CH_3CH{:}CHC_6H_3(O\cdot C_2H_5)(OCH_3)$	11	1.039	1.5602	VI-958
1159	chloroacetate	$ClCH_2CO_2C_2H_5$	20	1.159	1.4216	II-197
1160	*o*-chlorobenzoate	$ClC_6H_4CO_2C_2H_5$	20	1.189	1.523	IX-336
1161	*m*- "	$ClC_6H_4CO_2C_2H_5$	20	1.181	1.520	IX-338
1162	*p*- "	$ClC_6H_4CO_2C_2H_5$	20	1.181	1.524	IX-340
1163	β-chlorobutyrate	$CH_3CHClCH_2CO_2\cdot C_2H_5$	20	1.052	1.4246	II-277
1164	*o*-chlorocinnamate	$ClC_6H_4CH{:}CHCO_2\cdot C_2H_5$	20	1.171	1.568	. . . .
1165	α-chlorocrotonate	$CH_3CH{:}CClCO_2C_2H_5$	20.1	1.108	1.453	II-415
1166	α-chloro-*iso*-crotonate	$CH_3CH{:}CClCO_2C_2H_5$	20	1.100	1.453	**II-396
1167	β-chlorocrotonate†	$CH_3CCl{:}CHCO_2C_2H_5$	19.6	1.106	1.459	II-416
1168	β-chloro-*iso*-crotonate	$CH_3CCl{:}CHCO_2C_2H_5$	18.7	1.092	1.4542	II-417
1169	chloroformate	$ClCO_2C_2H_5$	20	1.138	1.3955	III-10
1170	α-chloropropionate	$CH_3CHClCO_2C_2H_5$	20	1.087	1.4185	II-249
1171	β-chloropropionate	$ClCH_2CH_2CO_2C_2H_5$	20	1.109	1.4254	II-250
1172	β-chloro-α (*p*-tolyl)-acrylate	$CH_3C_6H_4C({:}CHCl)\cdot CO_2C_2H_5$	19.7	1.136	1.5358	*IX-257
1173	cinnamate (*trans*)	$C_6H_5CH{:}CHCO_2C_2H_5$	20	1.049	1.5598	IX-581
1174	cinnamylidene-acetate (m.p. 25°)	$C_6H_5CH{:}CH\cdot CH{:}CHCO_2C_2H_5$	42.2	1.029	1.613	IX-639
1175	coumalate (m.p. 36°)	$C_2H_5O_2CC{:}CH\cdot O\cdot$ $COCH{:}CH$	39.2	1.209	1.5066	XVIII-406
1176	coumarilate (m.p. 31°)	$C_6H_4CH{:}C(CO_2\cdot$ $C_2H_5)\cdot O$	32.2	1.162	1.5619	XVIII-308
1177	crotonate (α)	$C_3H_5CO_2C_2H_5$	20	0.919	1.4246	II-411
1178	*iso*-crotonate	$CH_3CH{:}CHCO_2C_2H_5$	20	0.925	1.4246	II-411
1179	crotonic acid (α) §	$CH_3CH{:}C(C_2H_5)\cdot CO_2H$	20	0.976	1.4511	II-440
1180	" (m.p. 45°) ∦	$CH_3CH{:}C(C_2H_5)\cdot CO_2H$	56.1	0.948	1.4426	II-439
1181	*iso*-cyanide	C_2H_5NC	25	0.744	1.36	IV-107
1182	cyanoacetate	$NCCH_2CO_2C_2H_5$	20.5	1.062	1.4179	II-585
1183	α-cyanocrotonate	$CH_3CH{:}C(CN)CO_2\cdot C_2H_5$	20	1.024	1.4525	**II-655
1184	1-cyano-cyclo-hexan-2-one (1)	$C_2H_5(CN){:}$ $C\cdot CO(CH_2)_3CH_2$	20	1.008	1.466	. . . .
1185	cyanoformate	$NCCO_2C_2H_5$	20	1.003	1.3821	II-547

† Ester of acid m.p. 94°.
§ For liquid variety.
∦ For solid variety.

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1186	**Ethyl** α-cyano-Δ¹-*iso*-heptenate	$(CH_3)_2CHCH_2CH:C(CN)CO_2C_2H_5$	20	0.966	1.4549	**II-665
1187	α-cyano-Δ¹-pentenate	$C_2H_5CH:C(CN)\cdot CO_2C_2H_5$	20	1.000	1.4529	**II-657
1188	cyclohexane	$C_2H_5(CHC_5H_{10})$	20	0.788	1.4330	V-35
1189	cyclohex-1-ene (1)	$C_2H_5C:CH\cdot(CH_2)_3CH_2$	19.1	0.824	1.4567	V-71
1190	cyclohex-1-ene acetate	$C_6H_9CH_2CO_2C_2H_5$	16.2	0.989	1.4691	*IX-23
1191	α-cyclohexene-propionate	$CH_2(CH_2)_3CH:C\cdot CH(CH_3)CO_2\cdot C_2H_5$	17.5	0.968	1.4646	IX-51
1192	cyclohexylidene-acetate	$CH_2(CH_2)_4C:CHCO_2\cdot C_2H_5$	16.9	0.983	1.4808	*IX-24
1193	cyclopentane	$C_2H_5(CHC_4H_8)$	20	0.766	1.4198	**V-19
1194	cyclopentan-1-ol-1-carboxylate	$CH_2(CH_2)_3COHCO_2\cdot C_2H_5$	16	1.060	1.4516	*X-3
1195	cymene (2)	$C_6H_3(CH_3)(C_2H_5)\cdot(C_3H_7)$ (1,2,4)	15.6	0.871	1.4988	V-448
1196	*n*-decyl ether	$C_2H_5OC_{10}H_{21}$	20	0.794	1.4223	....
1197	diacetoacetate	$(C_2H_3O)_2CHCO_2\cdot C_2H_5$	18.3	1.08	1.4695	III-751
1198	diallylacetate	$(CH_2:CHCH_2)_2CH\cdot CO_2C_2H_5$	19.1	0.897	1.4364	II-489
1199	diallylacetoacetate	$CH_3COC(CO_2C_2H_5):(CH_2CH:CH_2)_2$	17.4	0.982	1.4572	III-741
1200	diazoacetate	$N_2CHCO_2C_2H_5$	17.6	1.085	1.4588	*III-211
1201	dibromoacetate	$Br_2CHCO_2C_2H_5$	12.5	1.91	1.5017	II-219
1202	2,7-dibromofluorene-9-acetate (m.p. 87°)	$C_{17}H_{14}O_2Br_2$	99.8	1.512	1.6130	....
1203	α,β-dibromo-valerate	$C_2H_5CHBrCHBr\cdot CO_2C_2H_5$	20	1.613	1.496	**II-269
1204	dichloroacetate	$Cl_2CHCO_2C_2H_5$	20	1.282	1.4386	II-203
1205	γ,γ-dichloro-crotonate	$Cl_2CHCH:CHCO_2\cdot C_2H_5$	20	1.229	1.4619	**II-397
1206	γ,γ-dichloro-α,β-dibromo-butyrate	$Cl_2CH(CHBr)_2CO_2\cdot C_2H_5$	20	1.830	1.5235	**II-257
1207	α,β-dichloro-propionate	$CH_2ClCHClCO_2C_2H_5$	20	1.246	1.4482	II-252
1208	β,β-dichloro-α (*p*-tolyl)-propionate	$Cl_2CHCH(C_6H_4\cdot CH_3)CO_2C_2H_5$	18.7	1.202	1.5214	*IX-214
1209	α,α-diethoxy-propionate	$CH_3C(OC_2H_5)_2CO_2\cdot C_2H_5$	17.1	0.979	1.4151	III-617
1210	α,α-diethyl-(*o*-methoxy-benzoyl) acetate	$(C_2H_5)_2C(CO_2C_2H_5)\cdot COC_6H_4OCH_3$	20	1.086	1.5140	....

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1211	**Ethyl** Δ^1-dihydro-α-naphthoate (*stable*)	$C_6H_4CH_2CH_2CH{:}C\cdot$ $CO_2C_2H_5$	20	1.102	1.559	X-642
1212	Δ^2-dihydro-α-naphthoate (*labile*)	$C_{10}H_9CO_2C_2H_5$	20	1.089	1.535	....
1213	Δ^1-dihydro-β-naphthoate	$C_6H_4CH_2CH_2C(CO_2\cdot$ $C_2H_5{:}CH$	20	1.093	1.578	....
1214	Δ^3-dihydro-β-naphthoate	$C_{10}H_9CO_2C_2H_5$	20	1.085	1.551	....
1215	4,6-dimethyl-3-acetoxycoumarone (2)	$(CH_3)_2C_6H_2C(O_2C\cdot$ $CH_3){:}C(C_2H_5)\cdot O$	20	1.078	1.5303	....
1216	β,β-dimethyl-acrylate	$(CH_3)_2C{:}CHCO_2\cdot$ C_2H_5	20	0.913	1.435	II-433
1217	α,β-dimethyl-cinnamate	$C_6H_5C(CH_3){:}C{:}$ $(CH_3)CO_2C_2H_5$	15.2	1.020	1.5212	*IX-260
1218	2,5-dimethyl-coumaran-3-one-2-carboxylate	$CH_3C_6H_3COC(CH_3)\cdot$ $(CO_2C_2H_5)\cdot O$	20	1.161	1.536	*XVIII-492
1219	3,5-dimethyl-coumarilate (m.p. 55°)	$CH_3C_6H_3C(CH_3){:}C\cdot$ $(CO_2C_2H_5)\cdot O$	59	1.093	1.5464	XVIII-310
1220	α-(1,3-dimethyl-cyclohexa-3,5-diene)-5-*iso*-butyrate	$(CH_3)_2C_6H_5C{:}$ $(CH_3)_2(CO_2C_2H_5)$	13.4	0.969	1.4895	*IX-52
1221	1,3-dimethyl-cyclohexan-5-ol-5-acetate	$(CH_3)_2C_6H_8(OH)\cdot$ $CH_2CO_2C_2H_5$	14.9	0.990	1.4566	*X-12
1222	1,3-dimethyl-cyclohex-4-ene-5-acetate	$(CH_3)_2C_6H_7CH_2CO_2\cdot$ C_2H_5	20.3	0.938	1.458	*IX-35
1223	1,3-dimethyl-cyclohex-3-ene-5-hydroxy-5-acetate	$(CH_3)_2C_6H_6(OH)\cdot$ $CH_2CO_2C_2H_5$	17.6	1.012	1.4713	*X-14
1224	3,5-dimethyl-cyclohexylidene-5-acetate	$(CH_3)_2C_6H_8{:}CHCO_2\cdot$ C_2H_5	20.3	0.937	1.4575	*IX-35
1225	α-(1,3-dimethyl-cyclohexylidene)-5-propionate	$(CH_3)_2C_6H_8{:}C{:}$ $(CH_3)CO_2C_2H_5$	20	0.969	1.5069	....
1226	dimethyloxamate	$(CH_3)_2NCOCO_2C_2H_5$	22.5	1.074	1.4414	IV-61
1227	β,δ-dimethyl-sorbate	$(CH_3)_2C{:}CHC(CH_3)$ ${:}CHCO_2C_2H_5$	18.5	0.934	1.488	II-490
1228	1,4-diphenyl-but-3-ene (1)	$C_2H_5CH(C_6H_5)CH_2\cdot$ $CH{:}CHC_6H_5$	20	0.992	1.5880	*V-317
1229	erucate	$C_{21}H_{41}CO_2C_2H_5$	20	0.865	1.4543	II-473

No.	Substance	Formula	t.°C.	d_4^t	n_D^t	Beil. Ref.
1230	**Ethyl**-ethenyl-*o*-phenylene-amidine	$C_6H_4 \cdot N:C(CH_3) \cdot N \cdot$ C_2H_5	19.8	1.073	1.5802	XXIII-145
1231	α-ethoxyacrylate	$CH_2:C(OC_2H_5)CO_2 \cdot C_2H_5$	17.2	0.996	1.4324	III-370
1232	β-ethoxyacrylate	$C_2H_5OCH:CHCO_2 \cdot C_2H_5$	18.1	0.995	1.448	III-370
1233	β-ethoxy-β,*n*-amylacrylate	$C_5H_{11}C(OC_2H_5):CH \cdot CO_2C_2H_5$	23.2	0.931	1.4518	III-382
1234	β-ethoxy-cinnamate	$C_6H_5C(OC_2H_5):CH \cdot CO_2C_2H_5$	16	1.074	1.5336	X-301
1235	3-ethoxycoumarilate	$C_6H_4C(OC_2H_5):C \cdot$ $(CO_2C_2H_5) \cdot O$	14.3	1.168	1.5592	*XVIII-457
1236	β-ethoxycrotonate (m.p. 31°)	$CH_3C(OC_2H_5):CH \cdot CO_2C_2H_5$	37.6	0.966	1.4468	III-373
1237	β-ethoxy-α-methylacrylate	$C_2H_5OCH:C(CH_3) \cdot CO_2C_2H_5$	21.6	0.979	1.4501	III-377
1238	α-ethoxymethyleneacetoacetate	$C_2H_5OCH:C(CO \cdot CH_3)CO_2C_2H_5$	16.9	1.071	1.4762	III-878
1239	ethylbenzoylacetate	$C_6H_5COCH(C_2H_5) \cdot CO_2C_2H_5$	20	1.066	1.5082	X-710
1240	α-ethylcinnamate	$C_6H_5CH:C(C_2H_5) \cdot CO_2C_2H_5$	13.8	1.025	1.5425	*IX-259
1241	2-ethylcoumaran-3-one-2-carboxylate	$C_6H_4COC(C_2H_5) \cdot$ $(CO_2C_2H_5) \cdot O$	18.6	1.155	1.5366	*XVIII-491
1242	-ethylcrotonate†	$CH_3CH:C(C_2H_5) \cdot CO_2C_2H_5$	20	0.899	1.428	II-440
1243	" ‡	$CH_3CH:C(C_2H_5) \cdot CO_2C_2H_5$	20	0.908	1.435	II-440
1244	α-ethyl-β-hydroxycarbethoxy-α,β-crotonate	$C_2H_5O_2C \cdot O \cdot C(CH_3):C(C_2H_5)CO_2C_2H_5$	20	1.056	1.4431	III-380
1245	1-ethylindazole-3-carboxylate	$C_2H_5N \cdot C_6H_4 \cdot C(CO_2 \cdot$ $C_2H_5):N$	17.3	1.143	1.566	....
1246	2-ethylindazole-3-carboxylate	$N \cdot C_6H_4 \cdot C(CO_2 \cdot$ $(C_2H_5) \cdot NC_2H_5$	22.8	1.129	1.571	....
1247	ethyloximinocyanoacetate	$NCC(:NOC_2H_5) \cdot CO_2C_2H_5$	20	1.082	1.4530	III-775
1248	ethyl-*iso*-phorone carboxylate	$(CH_3)_3C_6H_3(OC_2H_5) \cdot CO_2C_2H_5$	19	1.011	1.4829	X-37
1249	α-ethylsorbate	$CH_3CH:CHCH:C:(C_2H_5)CO_2C_2H_5$	20	0.931	1.494	**II-455
1250	ethylsulfonate	$C_2H_5SO_2OC_2H_5$	22	1.145	1.4196	IV-6
1251	ethylideneacetoacetate	$CH_3COC(CO_2C_2H_5):CHCH_3$	18	1.023	1.4528	III-736
1252	eugenyl ether	$C_2H_5OC_{10}H_{11}O$	18.3	1.014	1.53	VI-964

† For ester of liquid variety.
‡ For ester of the solid acid variety.

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1253	**Ethyl** fluoroacetate	$FCH_2CO_2C_2H_5$	20	1.093	1.3767	II-193
1254	formate	$HCO_2C_2H_5$	20	0.906	1.3598	II-19
1255	formylcamphor	$C_{13}H_{20}O_2$	17.9	1.004	1.5047	....
1256	furoate (m.p. 34°)	$C_4H_3OCO_2C_2H_5$	40	1.097	1.4699	XVIII-275
1257	furylacrylate	$C_4H_3OCH:CHCO_2\cdot C_2H_5$	20	1.09	1.5286	XVIII-300
1258	glycinate	$H_2NCH_2CO_2C_2H_5$	20	1.028	1.4242	IV-340
1259	glycol ether	$HOCH_2CH_2OC_2H_5$	20	0.930	1.4080	I-467
1260	heptane (3)	$(C_2H_5)_2CH(CH_2)_3\cdot CH_3$	20	0.727	1.4092	....
1261	" (4)	$C_2H_5CH(CH_2C_2H_5)_2$	20	0.730	1.4109	I-167
1262	*α,β-iso*-heptenate	$(CH_3)_2CHCH_2CH:CHCO_2C_2H_5$	20	0.889	1.436	**II-411
1263	heptylate	$C_6H_{13}CO_2C_2H_5$	15	0.88	1.4144	II-340
1264	hexahydrobenzoate	$C_6H_{11}CO_2C_2H_5$	16	0.962	1.452	IX-8
1265	hexan-1-al (2)	$C_4H_9CH(C_2H_5)CHO$	20	0.823	1.4160	I-707
1266	hexane (3)	$(C_2H_5)_2CHCH_2C_2H_5$	20	0.714	1.4016	*I-62
1267	hexan-1-ol (2)	$C_4H_9CH(C_2H_5)\cdot CH_2OH$	20	0.833	1.4300	....
1268	hexan-3-ol (3)	$(C_2H_5)_2COHCH_2\cdot C_2H_5$	13	0.84	1.4322	I-421
1269	hexan-1-ol acetate (2)	$C_4H_9CH(C_2H_5)\cdot CH_2O_2CCH_3$	20	0.871	1.4204	....
1270	hexan-1-ol butyrate (2)	$C_3H_7CO_2C_8H_{17}$	20	0.87	1.4266	....
1271	hexan-1-ol formate (2)	$HCO_2CH_2CH(C_2H_5)\cdot C_4H_9$	20	0.88	1.4232	....
1272	hexan-1-ol phthalate (2)	$C_6H_4(CO_2C_8H_{17})_2$	20	0.98	1.4867	....
1273	hexan-1-ol propionate (2)	$C_2H_5CO_2C_8H_{17}$	20	0.87	1.4238	....
1274	*α,β*-hexenate	$CH_3(CH_2)_2CH:CH\cdot CO_2C_2H_5$	20	0.901	1.434	II-434
1275	*α,β-iso*-hexenate	$(CH_3)_2CHCH:CH\cdot CO_2C_2H_5$	20	0.896	1.432	II-439
1276	hex-1-ene (3)	$CH_2:CHCH(C_2H_5)\cdot CH_2C_2H_5$	20	0.715	1.407	....
1277	hex-2-ene (3) (*cis?*)	$CH_3CH:C(C_2H_5)\cdot CH_2C_2H_5$	20	0.737	1.424	I-222
1278	" (*trans*)	$CH_3CH:C(C_2H_5)\cdot CH_2C_2H_5$	20	.....	.....	....
1279	hex-3-ene (3)	$(C_2H_5)_2C:CHC_2H_5$	20	0.729	1.418	....
1280	hex-4-ene (3) (*cis*)	$CH_3CH:CHCH:(C_2H_5)_2$	20	0.725	1.412	....
1281	hex-5-ene (3)	$CH_2:CHCH_2CH:(C_2H_5)_2$	20	0.726	1.412	....
1282	hex-2-ene-1-al (2)	$C_2H_5CH_2CH:C(C_2H_5)CHO$	20	0.848	1.4535	I-744
1283	hex-5-ene-3-ol (3)	$CH_2:CHCH_2COH:(C_2H_5)_2$	21.7	0.847	1.4410	I-449
1284	Δ^2-hexenic acid (*α*)	$CH_3CH_2CH:CHCH:(C_2H_5)CO_2H$	20	0.928	1.4421	**II-414
1285	*n*-hexylcarbamate	$C_6H_{13}NHCO_2C_2H_5$	26.8	0.923	1.4341	IV-188
1286	hexylpropiolate	$C_6H_{13}C\vdots CCO_2C_2H_5$	25	0.903	1.4464	II-490
1287	hydracrylate	$HOCH_2CH_2CO_2C_2H_5$	23	1.07	1.4271	III-297

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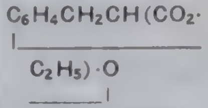
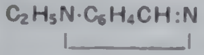
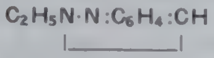
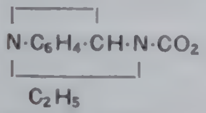
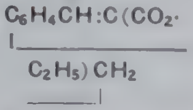
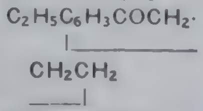
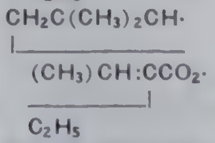
No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1288	**Ethyl** hydrocinnamate	$C_6H_5(CH_2)_2CO_2\cdot C_2H_5$	20	1.015	1.4954	IX-511
1289	hydrocoumarilate	 $C_6H_4CH_2CH(CO_2\cdot C_2H_5)\cdot O$	13.9	1.154	1.5250	XVIII-305
1290	hydrogen fumarate (m.p. 70°)	$HO_2CCH{:}CHCO_2\cdot C_2H_5$	83	1.115	1.4409	II-741
1291	hydrogen malonate	$CH_2(CO_2H)(CO_2\cdot C_2H_5)$	20	1.176	1.4271	II-573
1292	hydrogen phthalate	$C_6H_4(CO_2C_2H_5)\cdot(CO_2H)$ (o)	22	.....	1.5088	IX-797
1293	hydrogen pyrotartrate	$CH_3CH(CO_2C_2H_5)\cdot CH_2CO_2H$§	20.2	1.098	1.4312	II-639
1294	β-hydroxy-carbethoxy-α, β-crotonate	$C_2H_5O_2C\cdot O\cdot C(CH_3){:}CHCO_2C_2H_5$	20	1.093	1.4435	III-374
1295	hydroxymethylene-acetoacetate	$CH_3COC({:}CHOH)\cdot CO_2C_2H_5$	16.9	1.134	1.4738	III-749
1296	α-hydroxy-methylene-propionate	$HOCH{:}C(CH_3)CO_2\cdot C_2H_5$	20	1.024	1.4270	III-669
1297	hydroxylamine (m.p. 59°)	C_2H_5NHOH	63.9	0.9	1.4152	IV-535
1298	indazole (1)	 $C_2H_5N\cdot C_6H_4CH{:}N$	15.7	1.07	1.5747	....
1299	" (2)	 $C_2H_5N\cdot N{:}C_6H_4{:}CH$	20	1.073	1.591	XXIII-124
1300	indazole-2-carboxylate	 $N\cdot C_6H_4\cdot CH\cdot N\cdot CO_2C_2H_5$	13.2	1.206	1.569	....
1301	indene-β-carboxylate (m.p. 50°)	 $C_6H_4CH{:}C(CO_2C_2H_5)CH_2$	73.9	1.054	1.5481	*IX-268
1302	iodide	CH_3CH_2I	18.5	1.93	1.5133	I-96
1303	iodoacetate	$ICH_2CO_2C_2H_5$	12.7	1.817	1.5079	II-222
1304	1-keto-1,2,3,4-tetrahydronaphthalene (7)	 $C_2H_5C_6H_3COCH_2\cdot CH_2CH_2$	17.2	1.056	1.5599	....
1305	lactate	$CH_3CHOHCO_2C_2H_5$	20	1.031	1.4125	III-280
1306	laurate	$CH_3(CH_2)_{10}CO_2\cdot C_2H_5$	12.9	0.868	1.44	II-361
1307	*iso*-lauronolate	 $CH_2C(CH_3)_2CH\cdot(CH_3)CH{:}CCO_2\cdot C_2H_5$	20	0.953	1.4650	IX-58
1308	levulinate	$CH_3CO(CH_2)_2CO_2\cdot C_2H_5$	16.2	1.017	1.4242	III-675
1309	2-menthatriene (p)	$C_{12}H_{18}$¶	18	0.886	1.5041	V-448
1310	menthyl ether	$C_2H_5OC_{10}H_{19}$	17.1	0.86	1.4435	VI-31
1311	mercaptan	C_2H_5SH	20	0.839	1.4306	I-340

§ Or $CH_3CH(CO_2H)CH_2CO_2C_2H_5$
¶ Probably a mixture of isomers.

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1312	**Ethyl-**mesitylene	$(CH_3)_3C_6H_2C_2H_5$ (1,3,5,2)	16.4	0.889	1.5127	V-442
1313	methoxybenzoate (*o*)	$CH_3OC_6H_4CO_2C_2H_5$	14.6	1.116	1.5238	X-74
1314	methoxybenzoate (*m*)	$CH_3OC_6H_4CO_2C_2H_5$	16.4	1.103	1.5170	X-139
1315	*p*-methoxycinnamate (m.p. 49°)	$CH_3OC_6H_4CH:CH\cdot CO_2C_2H_5$	59.2	1.066	1.5619	X-299
1316	3-methoxycoumarilate (m.p. 59°)	$C_6H_4C(OCH_3):C\cdot(CO_2C_2H_5)\cdot O$	70	1.160	1.5499	*XVIII-456
1317	1-methoxy-2-naphthoate	$CH_3OC_{10}H_6CO_2C_2H_5$	20	1.146	1.588	....
1318	3-methoxy-2-naphthoate	$CH_3OC_{10}H_6CO_2C_2H_5$ (3,2)	20	1.159	1.560	....
1319	3-methoxy-3-phthalide	$C_6H_4C(C_2H_5)(O\cdot CH_3)OCO$	20.4	1.132	1.5199	*XVIII-305
1320	methylacetoacetate	$CH_3COCH(CH_3)CO_2\cdot C_2H_5$	17.8	1.02	1.4207	III-679
1321	5-methyl-3-acetoxycoumarone (2)	$CH_3C_6H_3C(O_2C\cdot CH_3):C(C_2H_5)\cdot O$	20	1.107	1.5343	*XVII-68
1322	methylcinnamate (*o*)	$CH_3C_6H_4CH:CH\cdot CO_2C_2H_5$	16.3	1.043	1.5555	*IX-256
1323	methylcinnamate (*p*)	$CH_3C_6H_4CH:CH\cdot CO_2C_2H_5$	15.9	1.034	1.5630	IX-617
1324	methylcinnamate (α)	$C_6H_5CH:C(CH_3)\cdot CO_2C_2H_5$	20.6	1.032	1.5475	IX-616
1325	methylcinnamate (β)	$C_6H_5C(CH_3):CHCO_2\cdot C_2H_5$	16.6	1.039	1.5456	IX-614
1326	methylcinnamylideneacetate (α)	$C_6H_5CH:CH\cdot CH:C(CH_3)CO_2C_2H_5$	20	1.041	1.615	....
1327	methylcinnamylideneacetate (β)	$C_6H_5CH:CH\cdot C(CH_3):CHCO_2C_2H_5$	20	1.043	1.602	....
1328	methylcinnamylideneacetate (γ)	$C_6H_5CH:C(CH_3)\cdot CH:CHCO_2C_2H_5$	20	1.037	1.601	....
1329	2-methyl-coumarane-5-carboxylate	$C_2H_5O_2CC_6H_3CH_2\cdot CH(CH_3)\cdot O$	14.3	1.118	1.5363	*XVIII-442
1330	2-methyl-coumaran-3-one-2-carboxylate	$C_6H_4COC(CH_3)\cdot(CO_2C_2H_5)\cdot O$	16.7	1.192	1.5390	*XVIII-491
1331	3-methylcoumarilate (m.p. 51°)	$C_6H_4C(CH_3):C(CO_2\cdot C_2H_5)\cdot O$	56.6	1.116	1.5482	XVIII-309
1332	6-methylcoumarilate (m.p. 42°)	$CH_3C_6H_3CH:C(CO_2\cdot C_2H_5)\cdot O$	43.9	1.119	1.5558	*XVIII-443

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
1333	**Ethyl** 1-methylcyclohex-1-ene-3-methenecarboxylate	$CH_3C_6H_7{:}CHCO_2{\cdot}C_2H_5$	20	0.998	1.5319	IX-82
1334	1-methylcyclohex-(1 or 2)-ene-2-acetate	$(CH_3)C_6H_8CH_2CO_2{\cdot}C_2H_5$	18.4	0.948	1.4539	*IX-29
1335	1-methylcyclohex-(2 or 3)-ene-3-acetate	$(CH_3)C_6H_8CH_2CO_2{\cdot}C_2H_5$	15.2	0.951	1.4559	*IX-30
1336	2-methylcyclohexylidene-1-acetate	$(CH_3)C_6H_9{:}CHCO_2{\cdot}C_2H_5$	14.8	0.959	1.4791	*IX-29
1337	3-methylcyclohexylidene-1-acetate	$CH_3C_6H_9{:}CHCO_2{\cdot}C_2H_5$	15	0.957	1.4773	*IX-30
1338	4-methylcyclohexylidene-1-acetate	$CH_3C_5H_9C{:}CHCO_2{\cdot}C_2H_5$	17	0.994	1.4738	*IX-31
1339	1-methyl-1-dichloromethylcyclohexa-2,5-diene-4-methenecarboxylate	$(CH_3)(CHCl_2)C_6H_4{:}CHCO_2C_2H_5$	22.1	1.215	1.5691	*IX-214
1340	4-methyl-4-dichloromethylcyclohex-1-ene-3-one (1)	$(C_2H_5)(CH_3)C_5H_5{\cdot}COCHCl_2$	17	1.196	1.5233	VII-87
1341	3-methyl-4-ethoxybenzoate	$(CH_3)(C_2H_5O)C_6H_3{\cdot}CO_2C_2H_5$	20	1.057	1.5169	*X-98
1342	5-methyl-3-ethoxycoumarilate (m.p. 47°)	$CH_3C_6H_3C(OC_2H_5){:}C(CO_2C_2H_5){\cdot}O$	52.6	1.104	1.5404	*XVIII-460
1343	methylethylacetoacetate	$CH_3COC(CH_3){\cdot}(C_2H_5)CO_2C_2H_5$	17.7	0.973	1.426	III-703
1344	methylfurazan	$C_2H_5C{:}N{\cdot}O{\cdot}N{:}CCH_3$	18.8	1.018	1.4326	XXVII-565
1345	α-methyl-β-hydroxy-carbethoxy-α,β-crotonate	$C_2H_5O_2COC(CH_3){:}C(CH_3)CO_2C_2H_5$	20	1.078	1.4398	III-378
1346	1-methylindene-2-carboxylate (m.p. 38°)	$CH_3C_9H_6CO_2C_2H_5$	39.1	1.074	1.5609	IX-644
1347	α-methyl-*p*-methoxycinnamate	$CH_3OC_6H_4CH{:}C{:}(CH_3)(CO_2C_2H_5)$	15.6	1.089	1.5701	*X-138
1348	5-methyl-3-methoxycoumarilate (m.p. 29°)	$CH_3C_6H_3C(OCH_3){:}C(CO_2C_2H_5){\cdot}O$	23.8	1.170	1.5628	*XVIII-460
1349	α-methyl-β-naphthoate	$CH_3C_{10}H_6CO_2C_2H_5$	20	1.113	1.5950	....

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1350	**Ethyl** Δ¹-α-methyl-β-naphthoate	$C_6H_4CH_2CH_2C(CO_2\cdot$ $C_2H_5):CCH_3$	20	1.087	1.572	....
1351	methylnitrocarbamate	$CH_3N(NO_2)CO_2\cdot C_2H_5$	23	1.229	1.4483	IV-86
1352	methylnitrosocarbamate	$CH_3N(NO)CO_2\cdot C_2H_5$	20	1.122	1.4363	IV-85
1353	methyl-β-phenylglycidate	$C_6H_5C(CH_3)CH\cdot O\cdot$ $CO_2C_2H_5$	20	1.091	1.5045	XVIII-306
1354	methyl-*iso*-phoronecarboxylate	$(CH_3)_3C_6H_3(OCH_3)\cdot CO_2C_2H_5$	19	1.025	1.4818	*X-18
1355	5-methyl-2-*iso*-propylcyclohexa-1,5-diene-1-carboxylate	$(CH_3)(C_3H_7)C_6H_5\cdot CO_2C_2H_5$	16.9	0.977	1.5001	*IX-49
1356	1-methyl-3-*iso*-propylcyclopentane-2-carboxylate	$C_9H_{17}CO_2C_2H_5$	11.8	0.918	1.44	*IX-17
1357	α-methylsorbate	$CH_3CH:CHCH:C(CH_3)CO_2C_2H_5$	20	0.947	1.498	....
1358	γ-methylsorbate	$CH_3CH:C(CH_3)CH:CHCO_2C_2H_5$	20	0.946	1.499	**II-454
1359	5-methyltetrahydroindazole (1)	$CH_3C_6H_7:[CH:N\cdot N\cdot C_2H_5]$	20	0.985	1.502	....
1360	5-methyltetrahydroindazole (2)	$CH_3C_6H_7[:CH\cdot N\cdot(C_2H_5)\cdot N:]$	20	0.987	1.500	....
1361	7-methyltetrahydroindazole (2)	$C_2H_5N\cdot CH:C_6H_7\cdot$ $(CH_3):N$	20	0.990	1.507	....
1362	naphthoate (α)	$C_{10}H_7CO_2C_2H_5$	20	1.122	1.594	IX-648
1363	" (β) (m.p. 26°)	$C_{10}H_7CO_2C_2H_5$	22.7	1.114	1.5951	IX-657
1364	naphthyl ether (α)	$C_2H_5OC_{10}H_7$	20(?)	1.061	1.5992	VI-606
1365	" " (β) (m.p. 37°)	$C_2H_5OC_{10}H_7$	35.6	1.05	1.5975	VI-641
1366	nitrate	$C_2H_5ONO_2$	21.5	1.104	1.3848	I-329
1367	nona-1,8-diene-5-ol (5)	$[CH_2:CHCH_2CH_2]_2:COHC_2H_5$	20.7	0.866	1.4623	*I-239
1368	α,β-nonenate	$C_6H_{13}CH:CHCO_2\cdot C_2H_5$	20	0.889	1.442	II-453
1369	orthocarbonate	$C(OC_2H_5)_4$	18.5	0.919	1.3935	III-5
1370	orthoformate	$HC(OC_2H_5)_3$	18.8	0.897	1.3922	II-20
1371	palmitate	$CH_3(CH_2)_{14}CO_2C_2H_5$	34.3	.....	1.4347	II-372
1372	pentane (3)	$(C_2H_5)_3CH$	20	0.698	1.3934	I-157
1373	pentan-3-ol (3)	$(C_2H_5)_3COH$	20	0.839	1.4314	I-417
1374	α,β-pentenate	$CH_3CH_2CH:CHCO_2\cdot C_2H_5$	20	0.909	1.431	*II-191
1375	pent-1-ene (3)	$CH_2:CHCH(C_2H_5)_2$	20	0.699	1.398	**I-198
1376	pent-2-ene (3)	$(C_2H_5)_2C:CHCH_3$	20	0.722	1.4143	I-200
1377	phenylacetate	$C_6H_5CH_2CO_2C_2H_5$	18.5	1.034	1.4992	IX-434
1378	γ-phenylbutyrate	$C_6H_5(CH_2)_3CO_2\cdot C_2H_5$	20	1.001	1.494	*IX-211

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1379	**Ethyl** phenylcarbamate (m.p. 52°)	$C_6H_5NHCO_2C_2H_5$	30.4	1.106	1.5376	XII-320
1380	phenyl carbinol	$C_2H_5CHOHC_6H_5$	20	0.996	1.5200	VI-502
1381	*α*-phenylcinnamate (m.p. 28°)	$C_6H_5CH:C(C_6H_5)\cdot CO_2C_2H_5$	18.6	1.097	1.5972	*IX-294
1382	*α*-(*β*-phenylethyl)-acetoacetate	$C_6H_5(CH_2)_2CH(CO\cdot CH_3)CO_2C_2H_5$	20	1.048	1.498	*X-339
1383	phenylhydrazine (*α,α*)	$C_6H_5N(C_2H_5)NH_2$	20.8	1.018	1.571	XV-119
1384	phenylhydrazine (*α,β*)	$C_6H_5NHNHC_2H_5$	15	1.004	1.55	XV-120
1385	phenyl ketone	$C_2H_5COC_6H_5$	20	1.011	1.5270	VII-300
1386	phenylpropiolate	$C_6H_5C\vdots CCO_2C_2H_5$	13	1.063	1.5566	IX-634
1387	*iso*-phoronecarboxylate	$O:C_6H_4(CH_3)_3CO_2\cdot C_2H_5$	20.4	1.029	1.4788	*X-303
1388	piperidine (*N*)	$C_5H_{10}NC_2H_5$	18.9	0.826	1.4445	XX-17
1389	" (*β*)	$C_7H_{15}N$	23.2	0.857	1.4531	XX-106
1390	propargyl ether	$CH\vdots CCH_2OC_2H_5$	20	0.833	1.4039	I-454
1391	*α*-propiocyanoacetate	$C_2H_5COCH(CN)\cdot CO_2C_2H_5$	20	1.076	1.4603	III-800
1392	propiolate	$CH\vdots CCO_2C_2H_5$	15	0.968	1.42	II-477
1393	propionate	$C_2H_5CO_2C_2H_5$	20	0.891	1.3839	I-240
1394	*β*-*n*-propylacrolein (*α*)	$C_2H_5CH_2CH:C:(C_2H_5)CHO$	20	0.848	1.4535	I-744
1395	*n*-propyl ether	$C_2H_5OCH_2C_2H_5$	20	0.739	1.3695	I-354
1396	*n*-propyl ketone	$C_2H_5COCH_2C_2H_5$	22	0.813	1.3990	I-690
1397	*α*-*iso*-propylideneacetoacetate	$CH_3COC(CO_2C_2H_5):C(CH_3)_2$	19.9	1.001	1.4523	III-738
1398	pseudocumene (*sym*)	$(CH_3)_3C_6H_2C_2H_5$ (1,2,4,5)	15.8	0.887	1.5105	V-442
1399	pseudocumyl ether	$(CH_3)_3C_6H_2OC_2H_5$ (1,2,4,5)	20	0.942	1.509	VI-510
1400	pyridine (2)	$C_2H_5\cdot C_5H_4N$	22.5	0.94	1.5021	XX-241
1401	pyruvate	$CH_3COCO_2C_2H_5$	15.6	1.060	1.4083	III-616
1402	ricinoleate	$HOC_{17}H_{32}CO_2C_2H_5$	22	0.915	1.4618	II-387
1403	salicylate (*o*)	$HOC_6H_4CO_2C_2H_5$	14.4	1.14	1.5251	X-73
1404	sorbate	$CH_3(CH:CH)_2CO_2\cdot C_2H_5$	20	0.956	1.5023	II-484
1405	styrene (*β*)	$C_6H_5CH:CHC_2H_5$	20	0.910	1.5387	V-487
1406	styryl ether	$C_6H_5CH:CHOC_2H_5$	21.2	0.971	1.5502	VI-564
1407	styryl ketone (m.p. 38°)	$C_2H_5COCH:CHC_6H_5$	50.3	0.987	1.5684	VII-373
1408	Δ¹-tetrahydrobenzoate	$C_6H_9CO_2C_2H_5$	20	0.998	1.469	IX-41
1409	5,6,7,8-tetrahydronaphthalene (2)	$C_2H_5C_{10}H_{11}$	17.6	0.950	1.5347	**V-397
1410	Δ¹-tetrahydro-*m*-toluate	$CH_3C_6H_8CO_2C_2H_5$	20	0.975	1.470	IX-47
1411	thiocyanate	C_2H_5SCN	22.9	0.994	1.4653	III-175
1412	*iso*-thiocyanate	C_2H_5NCS	18	0.998	1.5142	IV-123
1413	thionaphthene-2-carboxylate (m.p. 37°)	$C_{11}H_{10}O_2S$	55.4	1.172	1.592	....
1414	thiophene (*α*)	$C_2H_5\underline{C:CHCH:CH\cdot S}$	20	0.992	1.513	XVII-39

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1415	**Ethyl** α-thiophene-carboxylate	$\underline{SCH:CHCH:C}CO_2\cdot C_2H_5$	20	1.159	1.526	XVIII-289
1416	tiglate	$CH_3CH:C(CH_3)CO_2\cdot C_2H_5$	19.5	0.924	1.436	II-431
1417	*o*-toloxyacetate	$CH_3C_6H_4OCH_2CO_2\cdot C_2H_5$	12.9	1.085	1.5061	*VI-172
1418	α,*p*-toloxy-*iso*-butyrate	$(CH_3)_2C(OC_6H_4\cdot CH_3)CO_2C_2H_5$	20	1.027	1.4893	VI-399
1419	toluate (*o*)	$CH_3C_6H_4CO_2C_2H_5$	21.6	1.033	1.5070	IX-463
1420	" (*m*)	$CH_3C_6H_4CO_2C_2H_5$	21.6	1.03	1.5050	IX-476
1421	" (*p*)	$CH_3C_6H_4CO_2C_2H_5$	18.2	1.03	1.5089	IX-484
1422	*p*-tolyl ketone	$C_2H_5COC_6H_4CH_3$	20.7	0.990	1.5271	VII-317
1423	triazoacetate	$N_3CH_2CO_2C_2H_5$	24.9	1.13	1.4349	II-229
1424	tribromoacetate	$Br_3CCO_2C_2H_5$	12.5	2.2	1.5438	II-221
1425	trichloroacetate	$Cl_3CCO_2C_2H_5$	20	1.383	1.4507	II-209
1426	γ,γ,γ-trichloro-β-acetoxybutyrate	$CH_3CO_2CH(CCl_3)\cdot CH_2CO_2C_2H_5$	14.1	1.340	1.4646	*III-117
1427	γ,γ,γ-trichloro-crotonate	$Cl_3CCH:CHCO_2\cdot C_2H_5$	14.2	1.338	1.4869	*II-190
1428	trifluoroacetate	$F_3CCO_2C_2H_5$	20	1.19	1.306	....
1429	trimethylacrylate	$(CH_3)_2C:C(CH_3)\cdot CO_2C_2H_5$	19.3	0.907	1.4299	II-443
1430	*p*,α,β-trimethyl-cinnamate	$CH_3C_6H_4C(CH_3):C:(CH_3)CO_2C_2H_5$	18.4	1.003	1.5192	*IX-264
1431	tropane-2-carboxylate	$C_{11}H_{19}O_2N$	20.5	1.041	1.4756	XXII-18
1432	tropidine-2-carboxylate	$C_{11}H_{17}O_2N$	21.3	1.063	1.4948	....
1433	tropinone-2-carboxylate	$C_{11}H_{17}O_3N$	20.8	1.121	1.4954	....
1434	urethane	$C_2H_5NHCO_2C_2H_5$	20	0.981	1.4219	IV-114
1435	*n*-valerate	$CH_3(CH_2)_3CO_2C_2H_5$	20	0.877	1.39	II-301
1436	*iso*-valerate	$(CH_3)_2CHCH_2CO_2\cdot C_2H_5$	18.4	0.87	1.3974	II-312
1437	*iso*-valerylcam-phor-carboxylate	$C_{18}H_{28}O_4$	22.7	1.022	1.4764	X-38
1438	β-vinylacrylate	$CH_2:CHCH:CHCO_2\cdot C_2H_5$	20	0.938	1.476	**II-451
1439	**Ethylene** bromide	$BrCH_2CH_2Br$	20	2.182	1.5379	I-90
1440	bromohydrin	$BrCH_2CH_2OH$	20	1.772	1.4969	I-338
1441	chloride	$ClCH_2CH_2Cl$	20	1.253	1.4443	I-84
1442	chlorohydrin	$ClCH_2CH_2OH$	20	1.199	1.4419	I-337
1443	diamine	$(CH_2NH_2)_2$	26.1	0.892	1.4540	IV-230
1444	diamine hydrate	$C_2H_8N_2\cdot H_2O$	20.5	0.963	1.4500	IV-230
1445	dipiperidine (γ)	$C_{12}H_{24}N_2$	17.8	0.921	1.4887	XX-67
1446	ethylidene oxide	$CH_3CH:(OCH_2)_2$	20	0.981	1.40	XIX-8
1447	fluorohydrin	FCH_2CH_2OH	20	1.114	1.3639	*I-170
1448	oxide	$(CH_2)_2O$	8.4	0.886	1.3599	XVII-4
1449	**Ethylidene** acetone	$CH_3CH:CHCOCH_3$	19.6	0.862	1.4390	I-732
1450	cyclohexane	$CH_3CH:\underline{C(CH_2)_4CH_2}$	20	0.822	1.4626	V-71
1451	**Eucarvone**	$C_{10}H_{14}O$	21.2	0.948	1.5087	VII-151
1452	**Eugenol** (*iso*) (1,3,4)	$C_6H_3(C_3H_5)(O\cdot CH_3)OH$	19	1.08	1.5739	VI-955

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1453	**Eugenol** (1,3,4)	$C_6H_3(C_3H_5)(O\cdot CH_3)OH$	19.4	1.07	1.5416	VI-961
1454	acetate (m.p. 31°)	$C_{12}H_{14}O_3$	20	1.084	1.5207	VI-965
1455	*iso*-amyl ether	$C_5H_{11}OC_{10}H_{11}O$	14.8	0.973	1.5128	VI-964
1456	ethyl ether (*iso*)	$CH_3CH{:}CHC_6H_3(O\cdot CH_3)(OC_2H_5)$	11	1.044	1.5607	VI-957
1457	**Farnesol**	$C_{15}H_{26}O$	20	0.88	1.4899	I-464
1458	**Fenchene**	$C_{10}H_{16}$	20	0.867	1.4705	V-163
1459	**Fencholamide** (m.p. 94°)	$C_{10}H_{19}ON$	108.2	0.907	1.45	IX-32
1460	**Fencholenamide** (α) (m.p. 113°)	$CH_3C_5H_6C(CH_3)_2\cdot CONH_2$	117.9	0.933	1.47	IX-67
1461	**Fenchone** (*d*)	$C_{10}H_{16}O$	18	0.948	1.4636	VII-96
1462	**Fenchyl alcohol** (*l*) (*iso*)	$C_{10}H_{18}O$	15	0.961	1.4801	VI-72
1463	**Fenchylene**	$C_{10}H_{16}$	20	0.838	1.4502	*V-80
1464	**Fluoro**-aniline (*o*)	$FC_6H_4NH_2$	20	1.151	1.5407	*XII-296
1465	" (*m*)	$FC_6H_4NH_2$	20	1.16	1.5455	XII-597
1466	" (*p*)	$FC_6H_4NH_2$	20	1.152	1.536	XII-597
1467	benzene	C_6H_5F	20	1.024	1.4677	V-198
1468	1,2-dibromoethane (2)	$FBrCHCH_2Br$	19	2.26	1.5012	I-92
1469	nitrobenzene (*o*)	$FC_6H_4NO_2$	17.2	1.338	1.5323	V-241
1470	" (*m*)	$FC_6H_4NO_2$	17.2	1.33	1.5207	V-241
1471	" (*p*) (m.p. 26°)	$FC_6H_4NO_2$	56	1.30	1.5150	V-241
1472	phenol (*m*)	FC_6H_4OH	20	1.222	1.514	*VI-97
1473	" (*p*) (m.p. 48°)	FC_6H_4OH	56	1.189	1.5010	VI-183
1474	1,1,1,2-tetrabromoethane (2)	$Br_3CCHBrF$	16	1.939	1.5971	I-95
1475	toluene (*o*)	$CH_3C_6H_4F$	20	1.001	1.4704	V-290
1476	" (*m*)	$CH_3C_6H_4F$	20	0.999	1.4691	V-290
1477	" (*p*)	$CH_3C_6H_4F$	20	0.99	1.470	V-290
1478	1,1,2-tribromoethane (1)	$BrCH_2CFBr_2$	17.5	2.605	1.5022	I-93
1479	1,1,2-tribromoethane (2)	$FBrCHCHBr_2$	18	2.674	1.5638	I-93
1480	trichloromethane	CCl_3F	18.5	1.494	1.3865	I-64
1481	**Formamide**	$HCONH_2$	20	1.139	1.4472	II-26
1482	**Formanilide** (m.p. 47°)	$C_6H_5NHCH{:}O$	25	1.14	1.5876	XII-230
1483	**Formic acid**	HCO_2H	20	1.220	1.3714	II-8
1484	**Formyl-menthone** (2)	$C_{11}H_{18}O_2$	15.5	1.001	1.5000	VII-568
1485	**Fumaryl chloride**	$(CHCOCl)_2$	18.1	1.41	1.5004	II-743
1486	**Furan**	$(CH{:}CH)_2O$	20	0.937	1.4216	XVII-27
1487	**Furfural** (2)	C_4H_3OCHO	20	1.159	1.5261	XVII-272
1488	" (3)	$C_5H_4O_2$	20	1.111	1.4945	....
1489	**Furfuryl** alcohol	$C_4H_3OCH_2OH$	20	1.129	1.4852	XVII-112
1490	chloride	$C_4H_3OCH_2Cl$	20	1.178	1.4941	....
1491	**Furylimido ethyl ether**	$OC_4H_3\cdot C({:}NH)O\cdot C_2H_5$	17.8	1.078	1.4930	XVIII-278
1492	**Geranic acid**	$C_{10}H_{16}O_2$	20.2	0.951	1.4870	II-491
1493	**Geraniolene**	C_9H_{16}	21.5	0.768	1.4453	I-260
1494	**Geranyl** acetate	$CH_3CO_2C_{10}H_{17}$	15	0.917	1.4628	II-140

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1495	**Geranyl**-acetic acid	$C_{12}H_{20}O_2$	21 (?)	0.938	1.4739	*II-210
1496	amine	$C_{10}H_{19}N$	20 (?)	0.83	1.4727	*IV-398
1497	chloride	$C_{10}H_{17}Cl$	20 (?)	0.92	1.4741	*I-123
1498	formate	$HCO_2C_{10}H_{17}$	20	0.909	1.4659	II-23
1499	**Germanium tetraethyl**	$Ge(C_2H_5)_4$	20 (?)	.....	1.400	IV-631
1500	**Glycerol**	$CHOH(CH_2OH)_2$	20	1.26	1.4729	I-502
1501	dichlorohydrin (1,3) (α)	$CHOH(CH_2Cl)_2$	16.9	1.351	1.4802	I-364
1502	**Glyceryl** triacetate	$(CH_3CO_2)_3C_3H_5$	20	1.16	1.4306	II-147
1503	tributyrate	$(C_3H_7CO_2)_3C_3H_5$	20	1.032	1.4359	II-273
1504	tricaproate	$(C_5H_{11}CO_2)_3C_3H_5$	20	0.988	1.4427	II-324
1505	tricaprylate	$(C_7H_{15}CO_2)_3C_3H_5$	20	0.954	1.4482	II-348
1506	triformate	$(HCO_2)_3C_3H_5$	18	1.320	1.4412	*II-19
1507	trilaurate (m.p. 46°)	$(C_{11}H_{23}CO_2)_3C_3H_5$	60	0.894	1.4404	II-362
1508	trimyristate (m.p. 56°)	$(C_{13}H_{27}CO_2)_3C_3H_5$	60	0.885	1.4429	II-367
1509	trioleate	$(C_{17}H_{33}CO_2)_3C_3H_5$	60	0.9	1.4561	II-468
1510	tripalmitate (m.p. 65°)	$(C_{15}H_{31}CO_2)_3C_3H_5$	80	0.866	1.4381	II-373
1511	tristearate (m.p. 70°)	$(C_{17}H_{35}CO_2)_3C_3H_5$	60	0.9	1.4441	II-383
1512	**Glycol**	$(CH_2OH)_2$	20	1.114	1.4318	I-465
1513	diacetate	$(CH_3CO_2CH_2)_2$	15	1.108	1.4183	II-142
1514	ether	$(HOCH_2CH_2)_2O$	20	1.117	1.4475	I-468
1515	**Glycolic** aldehyde† (m.p. 97°)	CH_2OHCHO	11	1.4	1.4811	I-817
1516	nitrile	$HOCH_2CN$	19	1.104	1.4117	III-242
1517	**Glyoxal**	$(CHO)_2$	20	1.14	1.3828	I-759
1518	**Glutaric** acid (m.p. 97.5°)	$CH_2(CH_2CO_2H)_2$	106.4	1.192	1.4188	II-631
1519	nitrile	$CH_2(CH_2CN)_2$	23.2	0.99	1.4365	II-635
1520	**Glutaryl** chloride	$CH_2(CH_2COCl)_2$	20.2	1.324	1.4728	II-634
1521	**Guaiacol** (*o*) (m.p. 28°)	$CH_3OC_6H_4OH$	?	1.1	1.54	VI-768
1522	**Guajene**	$C_{15}H_{24}$	20	0.909	1.5005	V-468
1523	**Hemimellitenyl ethyl ether**	$(CH_3)_3C_6H_2OC_2H_5$ (1,2,3,5)	20	0.956	1.516	**VI-480
1524	**Heneicosane** (*n*) (m.p. 40°)	$CH_3(CH_2)_{19}CH_3$	45.3	0.775	1.4344	I-174
1525	**Hepta**-cosane (*n*) (m.p. 60°)	$CH_3(CH_2)_{25}CH_3$	65	0.77	1.4345	I-176
1526	decane (*n*)	$CH_3(CH_2)_{15}CH_3$	20 (?)	0.778	1.4405	I-173
1527	2,4-diene	$CH_3CH{:}CHCH{:}CH\cdot C_2H_5$	21.5	0.733	1.4486	I-257
1528	1,5-diene-4-ol	$CH_2{:}CHCH_2CHOH\cdot CH{:}CHCH_3$	20	0.861	1.454	*I-235
1529	**Heptaldehyde**	$CH_3(CH_2)_5CHO$	19.9	0.817	1.4125	I-695
1530	oxime (m.p. 58°)	$CH_3(CH_2)_5CH{:}NOH$	83.9	0.833	1.421	I-698
1531	oxime-*O*-methyl ether	$CH_3(CH_2)_5CH{:}NO\cdot CH_3$	19.4	0.838	1.4243	I-698
1532	**Heptane** (*n*)	$CH_3(CH_2)_5CH_3$	20	0.684	1.3876	I-154
1533	**Heptanoic** acid	$CH_3(CH_2)_5CO_2H$	19.8	0.918	1.4216	II-338
1534	anhydride	$(C_6H_{13}CO)_2O$	15	0.94	1.4335	II-340
1535	**Heptanol** (2)	$C_5H_{11}CHOHCH_3$	20	0.819	1.4209	I-415

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† Supercooled.

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
1536	**Heptanol** (3)	$C_4H_9CHOHC_2H_5$	20	0.823	1.4206	*I-205
1537	" (4)	$C_3H_7CHOHC_3H_7$	20	0.820	1.4166	I-415
1538	**Heptan-2-thiol**	$C_5H_{11}CH(SH)CH_3$	20(?)	0.835	1.4460	I-415
1539	**Heptatriene** (1,3,5)	$CH_2:CHCH:CHCH:CHCH_3$	20	0.764	1.516	*I-126
1540	**Heptene** (1)	$CH_2:CH(CH_2)_4CH_3$	20	0.697	1.3994	I-219
1541	" (2) (*cis*)	$CH_3CH:CHC_4H_9$	20	0.708	1.406	I-219
1542	" (2) (*trans*)	$CH_3CH:CHC_4H_9$	20	0.704	1.406	I-219
1543	" (3) (*cis?*)	$C_2H_5CH:CHC_3H_7$	20	0.701	1.404	I-220
1544	" (3) (*trans*)	$C_2H_5CH:CHC_3H_7$	20	.....	......	....
1545	**Hept-2-ene-4-ol**	$CH_3CH:CHCHOH\cdot CH_2C_2H_5$	20	0.845	1.4373	I-447
1546	**Heptenic acid** (*iso*) (*α,β*)	$(CH_3)_2CHCH_2CH:CHCO_2H$	20	0.941	1.4444	II-445
1547	**Heptenonitrile** (Δ^2) (*iso*)	$(CH_3)_2CHCH_2CH:CHCN$	20	0.826	1.430	**II-411
1548	**Heptenoyl** chloride (*α,β*) (*iso*)	$(CH_3)_2CHCH_2CH:CHCOCl$	20	0.991	1.461	**II-411
1549	**Heptyl** acetate (*n*)	$CH_3CO_2C_7H_{15}$	20	0.87	1.4153	II-134
1550	alcohol (*n*)	$CH_3(CH_2)_5CH_2OH$	22.4	0.817	1.4233	I-414
1551	amine (*n*)	$CH_3(CH_2)_5CH_2NH_2$	26.5	0.77	1.42	IV-193
1552	fluoride (*n*)	$CH_3(CH_2)_5CH_2F$	20	0.804	1.3861	I-56
1553	*n*-heptylate	$CH_3(CH_2)_5CO_2CH_2\cdot(CH_2)_5CH_3$	18.8	0.865	1.4318	II-340
1554	iodide (*n*)	$CH_3(CH_2)_5CH_2I$	20	1.4	1.4594	I-155
1555	**Heptyne** (1)	$CH\vdots C(CH_2)_4CH_3$	12.6	0.738	1.4136	I-256
1556	**Hexa**-cosane (*n*) (m.p. 60°)	$CH_3(CH_2)_{24}CH_3$	65	0.8	1.4333	I-175
1557	decene (1)	$CH_3(CH_2)_{13}CH:CH_2$	19	0.782	1.4420	I-226
1558	diene (1,2)	$CH_2:C:CHC_3H_7$	20	0.717	1.428	**I-229
1559	" (1,3) (*cis?*)	$CH_2:CHCH:CHC_2H_5$	20	0.705	1.438	I-253
1560	" (1,3) (*trans*)	$CH_2:CHCH:CHC_2H_5$	20	.....	......	....
1561	" (1,4) (*cis?*)	$CH_2:CHCH_2CH:CHCH_3$	20	0.695	1.410	I-253
1562	" (1,4) (*trans*)	$CH_2:CHCH_2CH:CHCH_3$	20	.....	......	....
1563	" (1,5)	$(CH_2:CHCH_2)_2$	20	0.691	1.4042	I-253
1564	" (2,3)	$CH_3CH:C:CHC_2H_5$	20	0.680	1.395	....
1565	" (2,4) (*cis, cis?*)	$(CH_3CH:CH)_2$	20	0.720	1.450	I-254
1566	diene (2,4) (*cis, trans*)	$(CH_3CH:CH)_2$	20	.....	......	....
1567	diene (2,4) (*trans, trans*)	$(CH_3CH:CH)_2$	20	.....	......	....
1568	ethylbenzene (m.p. 129°)	$(C_2H_5)_6C_6$	130	0.831	1.48	V-471
1569	**Hexahydro**-benzoic acid (m.p. 31°)	$\underbrace{CH_2(CH_2)_4CH}CO_2H$	33.8	1.03	1.46	IX-7
1570	benzyl alcohol	$\underbrace{CH_2(CH_2)_4CH}\cdot CH_2OH$	20	0.928	1.4649	VI-14
1571	cresol (*o*)	$CH_3C_6H_{10}OH$	20	0.933	1.461	VI-11
1572	" (*m*) (*l*)	$CH_3C_6H_{10}OH$	20	0.914	1.4581	VI-12
1573	" (*m*) (*dl*)	$CH_3C_6H_{10}OH$	20	0.923	1.4590	VI-13
1574	" (*p*)	$CH_3C_6H_{10}OH$	20	0.918	1.4573	VI-14

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
1575	**Hexahydro-**cymene (*p*)	$CH_3C_6H_{10}C_3H_7$	20	0.793	1.4380	V-47
1576	mesitylene	$(CH_3)_3C_6H_9$ (1,3,5)	13.1	0.778	1.4318	V-45
1577	naphthalene	$C_{10}H_{14}$	18.4	0.94	1.5331	V-433
1578	xylene (*o*)	$(CH_3)_2C_6H_{10}$	17.9	0.78	1.4302	V-36
1579	" (*m*)	$(CH_3)_2C_6H_{10}$	20.8	0.770	1.4250	V-36
1580	" (*p*)	$(CH_3)_2C_6H_{10}$	20	0.769	1.4244	V-38
1581	**Hexane** (*n*)	$CH_3(CH_2)_4CH_3$	20	0.659	1.3749	I-142
1582	**Hexanol** (2)	$CH_3CHOHC_4H_9$	20	0.814	1.4135	I-408
1583	" (3)	$C_2H_5CHOHCH_2C_2H_5$	20	0.818	1.4141	I-408
1584	**Hexan-6-ol-2-one**	$CH_3COCH_2(CH_2)_2 \cdot CH_2OH$	20	0.990	1.450	I-835
1585	**Hexatriene** (1,3,5)	$CH_2:CHCH:CHCH:CH_2$	16.2	0.741	1.49	I-263
1586	**Hexene** (1)	$CH_2:CH(CH_2)_3CH_3$	20	0.673	1.3876	I-215
1587	" (2) (*cis*)	$CH_3CH:CHCH_2C_2H_5$	20	0.685	1.3954	I-215
1588	" (2) (*trans*)	$CH_3CH:CHCH_2C_2H_5$	20	0.678	1.3935	I-215
1589	" (3) (*cis*)	$C_2H_5CH:CHC_2H_5$	20	0.680	1.3934	I-215
1590	" (3) (*trans*)	$C_2H_5CH:CHC_2H_5$	20	0.678	1.3938	I-215
1591	**Hex-2-ene-4-ol**	$CH_3CH:CHCHOH \cdot C_2H_5$	25	0.841	1.4312	I-445
1592	**Hexenic** acid (α,β) (m.p. 32°)	$C_3H_7CH:CHCO_2H$	40	0.95	1.4466	II-434
1592.1	acid (β,γ)	$C_2H_5CH:CHCH_2 \cdot CO_2H$	23	0.964	1.44	II-435
1593	acid (*iso*) (α,β)	$(CH_3)_2CHCH:CH \cdot CO_2H$	16	0.96	1.4506	II-438
1594	**Hexenonitrile** (β,γ)	$C_2H_5CH:CHCH_2CN$	20	0.841	1.432	**II-404
1595	" (*iso*) (α,β)	$(CH_3)_2CHCH:CHCN$	20	0.855	1.4374	II-439
1596	**Hexenoyl chloride** (β,γ)	$C_2H_5CH:CHCH_2 \cdot COCl$	20	1.014	1.447	....
1597	**Hexenoyl chloride** (*iso*) (α,β)	$(CH_3)_2CHCH:CH \cdot COCl$	20	1.018	1.461	....
1598	**Hexyl** alcohol (*n*)	$CH_3(CH_2)_4CH_2OH$	20	0.820	1.4133	I-407
1599	bromide (*n*)	$CH_3(CH_2)_4CH_2Br$	20	1.173	1.4478	I-144
1600	bromide (*iso*)	$(CH_3)_2CH(CH_2)_2 \cdot CH_2Br$	20(?)	1.168	1.4490	I-148
1601	cyanide (*n*)	$CH_3(CH_2)_5CN$	20(?)	0.81	1.4195	II-341
1602	iodide (*n*)	$CH_3(CH_2)_4CH_2I$	20	1.439	1.4929	I-146
1603	nitrite (*n*)	$CH_3(CH_2)_4CH_2ONO$	20	0.885	1.4018	I-407
1604	nitroamine (*N*)	$C_2H_5(CH_2)_3 \cdot CH_2NHNO_2$	25.2	1.004	1.4593	IV-572
1605	**Hexylpropiolic** acid	$C_6H_{13}C\vdots CCO_2H$	25	0.944	1.4596	II-490
1606	diethylacetal	$CH_3(CH_2)_5C\vdots CCH(OC_2H_5)_2$	12.1	0.881	1.4424	I-751
1607	nitrile	$C_6H_{13}C\vdots CCN$	14.4	0.849	1.4564	II-490
1608	**Homocatechol** (m.p. 65°)	$CH_3C_6H_3(OH)_2$ (1,3,4)	73.6	1.129	1.5425	VI-878
1609	**Hydrazine**	H_2NNH_2	22	.....	1.470	....
1610	**Hydrindene** (1,2)	$C_6H_4CH_2CH_2CH_2$	20.8	0.96	1.5351	V-486
1611	**Hydrindone** (α) (m.p. 41°)	$C_6H_4CH_2CH_2CO$	45	1.09	1.5608	VII-360
1612	**Hydrindone** (β) (m.p. 58°)	$C_6H_4CH_2COCH_2$	66.3	1.07	1.538	VII-363

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1613	**Hydro**-cinnamic acid (m.p. 48°)	$C_6H_5CH_2CH_2CO_2H$	80	1.06	1.50	IX-508
1614	cinnamyl alcohol	$C_6H_5CH_2CH_2CH_2OH$	20	1.008	1.5357	VI-503
1615	cyanic acid	HCN	19	0.698	1.254	II-29
1616	**Hydrogen** bromide	HBr	10	.....	1.325	....
1617	chloride	HCl	?	.....	1.256	....
1618	disulfide	H_2S_2	?	.....	1.885	....
1619	iodide	HI	12	.....	1.466	....
1620	peroxide	H_2O_2	?	.....	1.333	....
1621	“	$H_2O_2.2H_2O$	22	.....	1.414	....
1622	sulfide	H_2S	?	.....	1.374	....
1623	**Hydroxy-aceto-phenone** (*o*)	$HOC_6H_4COCH_3$	21.3	1.131	1.5550	VIII-85
1624	**Hydroxy-aceto-phenone** (*m*) (m.p. 95°)	$HOC_6H_4COCH_3$	109	1.099	1.54	VIII-86
1625	**Hydroxy-aceto-phenone** (*p*) (m.p. 109°)	$HOC_6H_4COCH_3$	109	1.109	1.56	VIII-87
1626	*o*-(α-**Hydroxy**-*iso*-**butyro**)-*p*-**cresol** (m.p. 55°)	$(CH_3)_2COHCO\cdot C_6H_3(OH)(CH_3)$ (2,1,4)	54	1.094	1.5347	*VIII-624
1627	**Hydroxy-Δ¹**-crotonolactone (γ) (m.p. 55°)	$CH_2CH{:}CHCO\cdot O$ |______________|	99.3	1.262	1.4563	III-727
1628	diethylaceto-*p*-cresol (α)	$(C_2H_5)_2COHCO\cdot C_6H_3(CH_3)OH$ (1,3,6)	21.1	1.080	1.540	....
1629	dihydrocinnamyl alcohol (*o*)	$HOC_6H_4CH_2CH_2\cdot CH_2OH$	15	1.126	1.5558	VI-928
1630	2,5-dimethoxy-propiophenone (α)	$(CH_3O)_2C_6H_3CO\cdot CHOHCH_3$	13.4	1.149	1.5353	*VIII-690
1631	glutaric nitrile (2)	$C_3H_5OH(CN)$	20	1.181	1.4805	*III-157
1632	methene-4,5-dimethylcyclo-hexan-2-one (1)	$(CH_3)_2C_6H_6O{:}CHOH$	20	1.022	1.4977	....
1633	3-methylaceto-phenone (6) (m.p. 50°)	$CH_3C_6H_3(OH)CO\cdot CH_3$	53	1.080	1.5410	VIII-111
1634	methylene-cyclo-hexan-2-one (1)	$CH_2(CH_2)_3COC{:}$ |______________| $CHOH$	20.5	1.085	1.5122	VII-558
1635	methylene diethyl ketone	$C_2H_5COCH(CH_3)\cdot CHO$	48.9	0.965	1.4579	*I-406
1636	methylene-3-methylcyclo-hexan-2-one (1)	$CH_3C_6H_7O{:}CHOH$	15.4	1.056	1.507	*VII-314
1637	methylene-pinacoline	$(CH_3)_3CCOCH{:}CHOH$	20	0.935	1.4527	I-794
1638	(α-**Hydroxypropi-onyl**)-*p*-**meth-oxytoluene** (*m*)	$(CH_3)(CH_3O)C_6H_3\cdot COCHOHCH_3$	19.2	1.099	1.5263	*VIII-624
1639	**Hydroxy**-propio-phenone (α)	$C_6H_5COCHOHCH_3$	22.8	1.104	1.5356	*VIII-547

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1640	**Hydroxy**-styrene (*o*) (m.p. 29°)	$HOC_6H_4CH{:}CH_2$	17.4	1.06	1.5572	VI-560
1641	valeric lactone (γ)	$CH_3CHCH_2\cdot$ $CH_2CO\cdot O$	22.4	1.050	1.4331	XVII-235
1642	**Hydroxylamine**	NH_2OH	23.5	.....	1.440	....
1643	**Indene**	$C_6H_4CH_2CH{:}CH$	16.1	1.01	1.5739	V-515
1644	**Indoxazene**	$C_6H_4CH{:}N\cdot O$	20	1.170	1.563	XXVII-39
1645	**Iodo**-benzene	C_6H_5I	17.8	1.835	1.6213	V-215
1646	2,3-dimethyl-butane (2)	$(CH_3)_2CICH(CH_3)_2$	20	1.446	1.5047	I-153
1647	2-methylbutane (1)	$C_2H_5CH(CH_3)CH_2I$	15	1.53	1.4981	I-138
1648	2-methylhexane (1)	$CH_3(CH_2)_3CH{:}(CH_3)CH_2I$	21	1.366	1.4891	I-157
1649	methyl methyl ether	ICH_2OCH_3	20	2.030	1.5472	I-538
1650	naphthalene (α)	$C_{10}H_7I$	14	1.747	1.7054	V-550
1651	" (β) (m.p. 54°)	$C_{10}H_7I$	99.4	1.632	1.6662	V-552
1652	propan-1-ol (3)	$ICH_2CH_2CH_2OH$	20	1.998	1.5585	I-358
1653	pseudocumene (m.p. 37°)	$(CH_3)_3C_6H_2I$ (1,2,4,5)	65.3	1.511	1.5813	V-404
1654	toluene (*o*)	$CH_3C_6H_4I$	20	1.023	1.6085	V-639
1655	*o*-xylene (*vic*)	$(CH_3)_2C_6H_3I$ (1,2,3)	20	1.639	1.6072	V-367
1656	" (*uns*)	$(CH_3)_2C_6H_3I$ (1,2,4)	20	1.631	1.604	V-367
1657	*m*-xylene (*sym*)	$(CH_3)_2C_6H_3I$	20	1.607	1.596	V-376
1658	" (*uns*)	$(CH_3)_2C_6H_3I$ (1,3,4)	20	1.623	1.599	V-376
1659	*p*-xylene	$(CH_3)_2C_6H_3I$	20	1.613	1.598	V-386
1660	**Ionone** (α)	$C_{10}H_{16}{:}CHCOCH_3$	22.3	0.93	1.4984	VII-168
1661	" (β)	$C_{10}H_{16}{:}CHCOCH_3$	18.9	0.95	1.5198	VII-167
1662	" (pseudo)	$C_{13}H_{20}O$	18.8	0.90	1.5312	I-757
1663	**Irone** (β)	$C_{10}H_{16}{:}CHCOCH_3$	20	0.939	1.5017	VII-169
1664	**Isoxazole**	$OCH{:}CHCH{:}N$	20	1.078	1.428	XXVII-14
1665	**Kairoline**	$C_9H_{10}N\cdot CH_3$	23.1	1.019	1.5802	XX-264
1666	**Ketazine**	$[(CH_3)_2C{:}N]_2$	24.5	0.84	1.4510	I-651
1667	**Keto**-octahydro-phenanthrene (m.p. 81°)	$C_{14}H_{16}O$	100	1.064	1.5628	....
1668	1,2,3,4-tetra-hydro-naphthalene (1)	$C_6H_4COCH_2CH_2CH_2$	15.5	1.099	1.5712	VII-370
1669	**Lactic** acid	$CH_3CHOHCO_2H$	20	1.24	1.44	III-268
1670	nitrile	$CH_3CHOHCN$	18.4	0.992	1.4058	III-284
1671	**Lauric** acid (m.p. 48°)	$CH_3(CH_2)_{10}CO_2H$	60	0.8	1.4267	II-359
1672	**Laurolene**	$(CH_3)_3C_5H_5$ (1,2,3)	20(?)	0.797	1.4438	V-75
1673	**Laurone** (m.p. 69°)	$(C_{11}H_{23})_2CO$	79.5	0.8	1.4283	I-719
1674	**Lead** butyl-tri-*iso*-amyl	$(C_5H_{11})_3Pb\cdot CH_2\cdot CH(CH_3)_2$	19.5	1.252	1.4962	*IV-596
1675	diethyl-di-*iso*-butyl	$(C_2H_5)_2Pb(C_4H_9)_2$	20	1.444	1.5086	*IV-594
1676	diethyl-di-*n*-propyl	$(C_2H_5)_2Pb(C_3H_7)_2$	20	1.533	1.5149	*IV-592
1676.1	diethyl-*n*-propyl-*iso*-amyl	$(C_2H_5)_2(C_3H_7)Pb\cdot C_5H_{11}$	22.1	1.439	1.5066	*IV-595
1677	diethyl-*n*-propyl-*iso*-butyl	$(C_2H_5)_2(C_3H_7)Pb\cdot(C_4H_9)$	20	1.489	1.5120	*IV-594

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1678	**Lead** dimethyl-di-*iso*-amyl	$(CH_3)_2Pb(C_5H_{11})_2$	20	1.430	1.5005	*IV-596
1679	dimethyl-di-*iso*-butyl	$(CH_3)_2Pb(C_4H_9)_2$	20	1.505	1.5024	*IV-594
1680	dimethyl-diethyl	$(CH_3)_2Pb(C_2H_5)_2$	20	1.785	1.5177	*IV-591
1681	dimethyl-di-*n*-propyl	$(CH_3)_2Pb(C_3H_7)_2$	20	1.627	1.5086	*IV-592
1682	dimethyl-ethyl-*iso*-amyl	$(CH_3)_2(C_2H_5)Pb\cdot(C_5H_{11})$	21.7	1.558	1.5052	*IV-595
1683	dimethyl-ethyl-*iso*-butyl	$(CH_3)_2(C_2H_5)Pb\cdot C_4H_9$	20.7	1.623	1.5078	*IV-593
1684	dimethyl-*n*-propyl-*iso*-amyl	$(CH_3)_2(C_3H_7)Pb\cdot(C_5H_{11})$	22	1.503	1.5020	....
1685	ethyl-tri-*iso*-amyl	$C_2H_5Pb(C_5H_{11})_3$	19.6	1.292	1.4983	*IV-596
1686	ethyl-tri-*iso*-butyl	$C_2H_5Pb(C_4H_9)_3$	22.1	1.376	1.5055	*IV-594
1687	ethyl-tri-*n*-propyl	$(C_2H_5)Pb(C_3H_7)_3$	21.3	1.485	1.5115	*IV-592
1688	methyl-diethyl-*iso*-amyl	$(CH_3)(C_2H_5)_2Pb\cdot C_5H_{11}$	20.8	1.523	1.5078	*IV-595
1689	methyl-diethyl-*n*-propyl	$(CH_3)(C_2H_5)_2Pb\cdot(C_3H_7)$	22.1	1.640	1.5141	*IV-592
1690	methyl-ethyl-*n*-propyl-*iso*-amyl	$(CH_3)(C_2H_5):Pb(C_3H_7)(C_5H_{11})$	21	1.479	1.5064	*IV-595
1691	methyl-tri-*iso*-amyl	$CH_3Pb(C_5H_{11})_3$	22	1.313	1.4962	*IV-596
1692	methyl-tri-*iso*-butyl	$(C_4H_9)_3PbCH_3$	20	1.397	1.5030	*IV-594
1693	methyl-triethyl	$CH_3Pb(C_2H_5)_3$	20	1.713	1.5183	*IV-591
1694	methyl-tri-*n*-propyl	$(C_3H_7)_3PbCH_3$	22.3	1.522	1.5091	....
1695	propyl-tri-*iso*-amyl	$C_2H_5CH_2Pb(C_5H_{11})_3$	22	1.274	1.4970	*IV-596
1696	propyl-tri-*iso*-butyl	$C_2H_5CH_2Pb(C_4H_9)_3$	19.6	1.351	1.5056	*IV-594
1697	tetra-*iso*-amyl	$(C_5H_{11})_4Pb$	20.5	1.233	1.4946	*IV-596
1698	tetra-*iso*-butyl	$[(CH_3)_2CHCH_2]_4Pb$	20.2	1.324	1.5042	*IV-594
1699	tetraethyl	$(C_2H_5)_4Pb$	20	1.653	1.5198	IV-639
1700	tetramethyl	$(CH_3)_4Pb$	20	1.995	1.5120	IV-639
1701	tri-*iso*-butyl-*iso*-amyl	$(C_4H_9)_3Pb(C_5H_{11})$	20.6	1.298	1.5010	*IV-596
1702	triethyl-*iso*-amyl	$(C_2H_5)_3PbC_5H_{11}$	20	1.484	1.5099	*IV-595
1703	triethyl-*iso*-butyl	$(C_2H_5)_3PbC_4H_9$	20	1.531	1.5127	*IV-594
1704	triethyl-*n*-propyl	$(C_2H_5)_3PbC_3H_7$	20	1.589	1.5168	*IV-592
1705	trimethyl-*iso*-amyl	$(CH_3)_3PbC_5H_{11}$	20.3	1.525	1.4926	*IV-595
1706	trimethyl-*n*-butyl	$(CH_3)_3PbC_4H_9$	20	1.678	1.5046	*IV-593
1707	trimethyl-*iso*-butyl	$(CH_3)_3PbC_4H_9$	20	1.672	1.5026	*IV-593
1708	trimethyl-ethyl	$(CH_3)_3PbC_2H_5$	20	1.882	1.5154	*IV-591
1709	trimethyl-*n*-propyl	$(CH_3)_3PbC_3H_7$	20	1.767	1.5095	*IV-592
1710	tri-*n*-propyl-*iso*-amyl	$(C_2H_5CH_2)_3PbC_5H_{11}$	21	1.381	1.5047	*IV-594
1711	tri-*n*-propyl-*iso*-butyl	$(C_3H_7)_3PbC_4H_9$	22.6	1.403	1.5067	*IV-594
1712	**Levulinic** acid (m.p. 33°)	$CH_3CO(CH_2)_2CO_2H$	17	1.143	1.4429	III-671
1713	aldehyde	$CH_3CO(CH_2)_2CHO$	21.5	1.02	1.4257	I-774
1714	**Limonene** *d* (*l*)	$C_{10}H_{16}$	19.6	0.843	1.4727	V-133
1715	**Linalool** (*d*)	$C_{10}H_{18}O$	20	0.868	1.4623	I-461
1716	**Linalyl** acetate	$CH_3CO_2C_{10}H_{17}$	21	0.89	1.4544	II-141
1717	**Malonic nitrile** (m.p. 30°)	$CH_2(CN)_2$	34.2	1.049	1.4146	II-589
1718	**Malonyl chloride**	$CH_2(COCl)_2$	22.1	1.449	1.4617	II-582
1719	**Menthane** (*o*)	$C_{10}H_{20}$	21	0.814	1.447	V-46

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1720	**Menthane** (*m*)	$C_{10}H_{20}$	20(?)	0.79	1.4420	V-46
1721	**Menthene** (*d*)	$C_{10}H_{18}$	20	0.81	1.4524	V-87
1722	**Menthol** (*l*) (*α*)	$C_{10}H_{19}OH$	25§	0.88	1.458	VI-28
1723	**Menthone**	$C_{10}H_{18}O$	20	0.896	1.4498	VII-38
1724	" (*dl*)	$C_{10}H_{18}O$	20(?)	0.898	1.4521	*VII-36
1725	**Menthyl** acetate	$C_{12}H_{22}O_2$	20	0.919	1.4467	VI-32
1726	amine (*l*)	$C_{10}H_{21}N$	20	0.860	1.4606	XII-26
1727	chloride (*sec*)	$C_{10}H_{19}Cl$	20	0.941	1.4642	V-49
1728	" (*tert*)	$C_{10}H_{19}Cl$	18.8	0.948	1.4655	V-49
1728.1	*iso*-valerate	$C_{15}H_{28}O_2$	20	0.906	1.4485	VI-33
1729	**Mercury** diethyl	$(C_2H_5)_2Hg$	23.2	2.423	1.5399	IV-679
1730	dimethyl	$(CH_3)_2Hg$	22.2	2.954	1.5327	IV-678
1731	**Mesityl**-amine (*ω*)	$(CH_3)_2C_6H_3CH_2NH_2$	20.5	0.950	1.5305	XII-1163
1732	ethyl ether	$(CH_3)_2C_6H_3CH_2O\cdot C_2H_5$ (1,3,5)	20	0.930	1.496	....
1733	methyl ether	$CH_3OC_6H_2(CH_3)_3$ (1,2,4,6)	14.4	0.953	1.5055	VI-519
1734	oxide	$(CH_3)_2C:CHCOCH_3$	20	0.858	1.4440	I-736
1735	oxide oxime (*α*)	$C_6H_{10}:NOH$	21	0.942	1.4908†	I-738
1736	oxide oxime (*α*) (m.p. 49°)	$C_6H_{10}:NOH$	40	0.969	1.4900‡	I-739
1737	oxide oxime acetate (*α*)	$(CH_3)_2C:CHC(:NO\cdot OCCH_3)(CH_3)$	20	0.990	1.478	II-186
1738	oxide oxime acetate (*β*)	$(CH_3)_2C:CHC(:NO\cdot OCCH_3)(CH_3)$	20	0.990	1.478	II-186
1739	oxide oxime benzyl ether (*α*)	$(CH_3)_2C:CHC(CH_3):NOCH_2C_6H_5$	20	0.987	1.533	VI-441
1740	**Methoxy**-acetic acid	$CH_3OCH_2CO_2H$	20	1.177	1.4168	III-232
1741	acetophenone (*o*)	$CH_3OC_6H_4COCH_3$	23.6	1.085	1.5379	VIII-85
1742	" (*m*)	$CH_3OC_6H_4COCH_3$	19	1.094	1.5367	VIII-86
1743	" (*p*) (m.p. 38°)	$CH_3OC_6H_4COCH_3$	41.3	1.082	1.5468	VIII-87
1744	benzaldehyde (*m*)	$CH_3OC_6H_4CHO$	20	1.119	1.5530	VIII-59
1745	coumarone (3)	$\underline{C_6H_4C(OCH_3):CH\cdot O}$	19.3	1.144	1.5589	*XVII-59
1746	1,3-dimethylbenzene (2)	$CH_3OC_6H_3(CH_3)_2$	20	0.956	1.502	VI-485
1747	3-methylacetophenone (6)	$(CH_3O)(CH_3)C_6H_3\cdot COCH_3$	13.8	1.069	1.5377	*VIII-549
1748	methylene-*d*-camphor (m.p. 39°)	$C_{12}H_{18}O_2$	47.3	1.002	1.4999	VIII-28
1749	naphth-1-aldehyde (4) (m.p. 34°)	$CH_3OC_{10}H_6CHO$	43.7	1.183	1.6530	VIII-147
1750	phthalide (*α*)	$\underline{C_6H_4CO\cdot O\cdot CH}(O\cdot CH_3)$	22.8	1.215	1.5352	XVIII-17
1751	styrene (*α*)	$C_6H_5C(OCH_3):CH_2$	20	1.00	1.5422	VI-563
1752	" (*β*)	$C_6H_5CH:CHOCH_3$	24.3	1.0	1.5620	VI-564
1753	" (*o*)	$CH_3OC_6H_4CH:CH_2$	17.4	1.003	1.5570	VI-560
1754	" (*p*)	$CH_3OC_6H_4CH:CH_2$	20(?)	1.0	1.5642	VI-561
1755	thionaphthene (3)	$\underline{C_6H_4C(OCH_3):CH\cdot S}$	13.6	1.209	1.6277	XVII-120
1756	toluene (*m*)	$CH_3C_6H_4OCH_3$	12.9	0.978	1.5164	VI-376
1757	*m*-toluic aldehyde (*o*)	$(CH_3)(CH_3O)C_6H_3\cdot CHO$	20	1.098	1.5534	....

§ Supercooled.
† Labile; alkali stable form.
‡ Melted.

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1758	**Methoxy**-valero-δ-lactone (γ)	$CH_3OCH_2CHCH_2\cdot$ $CH_2CO\cdot O$	23.2	1.120	1.4453	*XVIII-297
1759	*o*-xylene (*vic*) (m.p. 29°)	$(CH_3)_2C_6H_3OCH_3$ (1,2,3)	39.7	0.960	1.5120	VI-480
1760	*o*-xylene (*uns*)	$(CH_3)_2C_6H_3OCH_3$ (1,2,4)	20	0.969	1.517	VI-481
1761	*m*-xylene (*sym*)	$(CH_3)_2C_6H_3OCH_3$ (1,3,5)	20	0.958	1.513	VI-493
1762	" (*uns*)	$(CH_3)_2C_6H_3OCH_3$ (1,3,4)	12.9	0.970	1.5173	VI-486
1763	*p*-xylene	$(CH_3)_2C_6H_3OCH_3$	20	0.963	1.515	VI-494
1764	**Methyl acetate**	$CH_3CO_2CH_3$	20	0.934	1.3594	II-124
1765	acetoacetate	$CH_3COCH_2CO_2CH_3$	20	1.076	1.4196	III-632
1766	α′-acetothienone (α) (m.p. 25°)	$CH_3COC{:}CHCH{:}C\cdot$ $(CH_3)\cdot S$	24.7	1.119	1.560	XVII-296
1767	β-acetoxystyrene (α)	$C_6H_5C(CH_3){:}CH\cdot O\cdot COCH_3$	15.2	1.057	1.5428	*VI-285
1768	2-acetoxystyrene (1′)	$CH_3CO_2C_6H_4CH{:}CHCH_3$	13.5	1.048	1.5175	*VI-284
1769	3-acetoxystyrene (1′)	$CH_3CO_2C_6H_4\cdot C(CH_3){:}CH_2$	14.1	1.061	1.5325	*VI-285
1770	acetylacetone	$CH_3COCH(CH_3)CO\cdot CH_3$	13.5	0.978	1.4380	I-791
1771	acetylcamphor-carboxylate	$C_{14}H_{20}O_4$	19.8	1.082	1.4844	X-37
1772	2-acetylnaphthalene (1)	$CH_3C_{10}H_6COCH_3$	16.1	1.105	1.6270	....
1773	(5) 8-acetylnaphthalene (2)	$CH_3C_{10}H_6COCH_3$	13.3	1.099	1.6244	....
1774	acrylate¶	$CH_2{:}CHCO_2CH_3$	20	0.95	1.4600	II-399
1775	acrylic acid (α)	$CH_2{:}C(CH_3)CO_2H$	20	1.015	1.4314	II-421
1776	alcohol	CH_3OH	20	0.791	1.3288	I-274
1777	allocinnamate	$C_6H_5CH{:}CHCO_2CH_3$	20	1.078	1.5575	IX-594
1778	alloethyl camphorate (*o*)	$C_{13}H_{22}O_4$	17.1	1.049	1.4589	....
1779	allo-β-methyl-cinnamate (m.p. 27°)	$C_6H_5C(CH_3){:}CHCO_2\cdot CH_3$	38.1	1.037	1.5276	*IX-253
1780	allo-β-methyl-*o*-methoxycinnamate (m.p. 44°)	$CH_3OC_6H_4C(CH_3){:}CHCO_2CH_3$	17	1.098	1.5390	*X-138
1781	allylcamphor carboxylate (m.p. 75°)	$C_{15}H_{22}O_3$	20.2	1.067	1.4911	X-653
1782	allyl carbinol	$(CH_3)(CH_2{:}CH\cdot CH_2)CHOH$	20	0.834	1.425	I-443
1783	allyl ether	$CH_3OCH_2CH{:}CH_2$	?	0.7	1.38 ±	I-437
1784	2-allylphenol (4)	$CH_3C_6H_3(OH)CH_2\cdot CH{:}CH_2$	20	1.002	1.541	*VI-287
1785	aminobenzoate (*o*)	$NH_2C_6H_4CO_2CH_3$	20	1.16	1.5844	XIV-317
1786	aminoethanol (β)	$CH_3NHCH_2CH_2OH$	20	0.937	1.4385	IV-276
1787	*o*-aminophenylsulfide	$CH_3\cdot S\cdot C_6H_4NH_2$	17	1.133	1.6263	XIII-399

¶ Liquid polymer.

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1788	**Methyl** *n*-amyl ether	$CH_3OC_5H_{11}$	20	0.754	1.3849	**I-417
1789	*n*-amyl ketone	$CH_3CO(CH_2)_4CH_3$	20	0.817	1.4083	I-699
1790	*iso*-amyl ketoxime	$CH_3C(NOH)C_5H_{11}$	20(?)	0.888	1.4448	I-701
1791	β-amyl-β-methoxyacrylate	$C_5H_{11}C(OCH_3):CH\cdot CO_2CH_3$	23.1	0.961	1.4549	III-382
1792	amylpropiolate	$C_5H_{11}C{\vdots}CCO_2CH_3$	12.3	0.934	1.4509	II-487
1793	Δ¹-angelolactone (β)	$CH_3C:C(CH_3)CH_2\cdot$ $CO\cdot O$	20	1.056	1.4545	*XVII-139
1794	aniline	$C_6H_5NHCH_3$	21.5	0.986	1.5702	XII-135
1795	anthracene (α) (m.p. 86°)	$CH_3C_{14}H_9$	99.4	1.047	1.6803	V-674
1796	anthracene (9) (m.p. 80°)	$C_{15}H_{12}$	99.4	1.066	1.6959	**V-586
1797	anthranil	$C_6H_4N\cdot O\cdot CCH_3$	20	1.133	1.5780	XXVII-45
1798	benzalacetone (α,α)	$C_6H_5CH:C(CH_3)\cdot COCH_3$	45.3	1.002	1.5691	VII-373
1799	benzoate	$C_6H_5CO_2CH_3$	18.7	1.092	1.5144	IX-109
1800	benzoylacetate	$C_6H_5COCH_2CO_2CH_3$	24.7	1.15	1.5365	X-673
1801	α-benzoyl-acetone (α)	$C_6H_5COCH(CH_3)\cdot COCH_3$	20	1.079	1.5382	*VII-369
1802	*o*-benzoylbenzoate (m.p. 52°)	$C_6H_5COC_6H_4CO_2\cdot CH_3$	19.7	1.190	1.5913	X-748
1803	benzylcarbinol (*d*)	$C_6H_5CH_2CHOHCH_3$	20	0.991	1.5174	VI-503
1804	benzyl ketone	$CH_3COCH_2C_6H_5$	20	1.028	1.5168	VII-303
1805	benzylthiophene (α)	$S\cdot CH:CH\cdot CH:C\cdot$ $CH_2C_6H_4CH_3$	20	1.083	1.586	. . . .
1806	*d*-bornyl ether	$CH_3OC_{10}H_{17}$	23.4	0.914	1.4624	I-78
1807	5-bromocoumaran (2)	$BrC_6H_3CH_2CH\cdot$ $(CH_3)\cdot O$	14.4	1.458	1.5727	*XVII-23
1808	5-bromocoumarone (2) (m.p. 20°)	$BrC_6H_3\cdot CH:$ $C(CH_3)\cdot O$	34.8	1.477	1.5915	. . . .
1809	*o*-bromophenyl sulfide	$CH_3\cdot S\cdot C_6H_4Br$	20	1.522	1.6319	**VI-300
1810	α-bromopropionate	$CH_3CHBrCO_2CH_3$	20	1.492	1.4506	II-253
1811	β-bromopropionate	$BrCH_2CH_2CO_2CH_3$	20	1.519	1.4570	II-256
1812	4-bromopyrazole (3) (m.p. 76°)	$CH:CBrC(CH_3):$ $N\cdot NH$	99.6	1.564	1.52	XXIII-61
1813	buta-1,3-diene (2)	$CH_2:CHC(CH_3):CH_2$	20	0.681	1.4216	I-252
1814	buta-2,3-diene (2)	$CH_2:C:C(CH_3)_2$	20	0.680	1.410	I-252
1815	but-1-ene (2)	$CH_2:C(CH_3)C_2H_5$	20	0.650	1.3778	I-211
1816	but-2-ene (2)	$(CH_3)_2C:CHCH_3$	20	0.662	1.3874	I-211
1817	but-3-ene (2)	$CH_2:CHCH(CH_3)_2$	15	0.627	1.3643	I-213
1818	*n*-butylamine	$CH_3NHC_4H_9$	18.1	0.736	1.4018	IV-157
1819	*n*-butylbenzene (*o*)	$CH_3C_6H_4C_4H_9$	18.3	0.870	1.4966	V-437

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1820	**Methyl-*n*-butyl-benzene (*m*)**	$CH_3C_6H_4C_4H_9$	18.4	0.86	1.4932	V-437
1821	*n*-butylbenzene (*p*)	$CH_3C_6H_4C_4H_9$	14.2	0.861	1.4912	V-437
1822	butylcarbamate (*n*)	$C_4H_9NHCO_2CH_3$	23.3	0.969	1.4289	IV-158
1823	" (*iso*)	$C_4H_9NHCO_2CH_3$	21.6	0.965	1.4275	IV-168
1824	" (*sec*)	$C_4H_9CH(CH_3)NH\cdot CO_2CH_3$	24.9	0.965	1.4263	IV-162
1825	5-*tert*-butyl-coumarone (2)	$(CH_3)_3CC_6H_3CH{:}C(CH_3)\cdot O$	20	0.988	1.5355	. . . .
1826	*n*-butyl ether	$CH_3OCH_2CH_2C_2H_5$	20	0.744	1.38	I-369
1827	*n*-butyl hydrazine (*uns*)	$CH_3(C_4H_9)NNH_2$	21.3	0.804	1.4259	IV-552
1828	*iso*-butyl ketone	$CH_3COCH_2CH{:}(CH_3)_2$	20	0.800	1.3959	I-691
1829	*sec*-butyl ketone	$CH_3COCH(CH_3)\cdot(C_2H_5)$	18	0.815	1.4002	I-693
1830	*n*-butylnitroamine	$CH_3N(NO_2)C_4H_9$	23.6	1.023	1.4563	IV-158
1831	*iso*-butylnitroamine	$(CH_3)_2CH\cdot CH_2N(NO_2)CH_3$	22.5	1.021	1.4561	IV-172
1832	*n*-butylnitro-carbamate	$C_4H_9N(NO_2)CO_2\cdot CH_3$	22	1.139	1.4486	IV-159
1833	*iso*-butylnitro-carbamate	$(CH_3)_2CH\cdot CH_2N(NO_2)CO_2\cdot CH_3$	21.9	1.135	1.4461	IV-172
1834	*sec*-butylnitro-carbamate	$C_4H_9N(NO_2)CO_2\cdot CH_3$	23.3	1.125	1.4417	IV-163
1835	*α,β*-butylene-oxide-*δ*-carboxylate	$CH_3O_2CCH_2CH_2\cdot CHCH_2O$	24.7	1.073	1.4259	. . . .
1836	but-3-yne (2)	$CH\vdots CCH(CH_3)_2$	20	0.665	1.378	I-251
1837	*n*-butyrate	$C_2H_5CH_2CO_2CH_3$	20	0.898	1.39	II-270
1838	*iso*-butyrate	$(CH_3)_2CHCO_2CH_3$	20	0.891	1.3840	II-290
1839	butyric acid (*α*)	$(C_2H_5)(CH_3){:}CH\cdot CO_2H$	20	0.941	1.4051	II-304
1840	*α*-butyrocyano-acetate	$C_2H_5CH_2COCH\cdot(CN)CO_2CH_3$	20	1.093	1.4763	III-807
1841	camphidine (*N*)	$C_{11}H_{21}N$	19	0.901	1.4763	. . . .
1842	camphocarboxylate	$C_{12}H_{18}O_3$	18	1.085	1.4833	X-644
1843	carbamate (m.p. 54°)	$NH_2CO_2CH_3$	55.6	1.136	1.4125	III-21
1844	"carbitol"	$CH_3O(CH_2)_2O\cdot(CH_2)_2OH$	27	1.03	1.4264	. . . .
1845	carvacryl ether	$CH_3(OCH_3)C_6H_3\cdot CH(CH_3)_2$	20	0.944	1.506	VI-529
1846	"cellosolve"	$CH_3OCH_2CH_2OH$	20	0.964	1.4028	. . . .
1847	chloroacetate	$ClCH_2CO_2CH_3$	20	1.236	1.4221	II-197
1848	*α*-chlorocrotonate	$CH_3CH{:}CClCO_2CH_3$	22.6	1.159	1.4563	*II-189
1849	*β*-chloroethyl ether	$CH_3OCH_2CH_2Cl$	20	1.046	1.4111	I-337
1850	chloroformate	$ClCO_2CH_3$	20	1.223	1.3868	III-9
1851	chromane (6)	$CH_3C_6H_3(CH_2)_3\cdot O$	14.3	1.037	1.5421	*XVII-24

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
1852	**Methyl-**chromanone (6) (m.p. 35°)	$CH_3C_6H_3COCH_2\cdot$ CH_2O	57.1	1.125	1.5553	*XVII-163
1853	cinnamate (m.p. 35°)	$C_6H_5CH{:}CHCO_2CH_3$	21.4	1.05	1.5766	IX-581
1854	coumarane (2)	$C_6H_4CH_2CH(CH_3)\cdot O$	13.7	1.036	1.5338	*XVII-23
1855	" (5)	$CH_3C_6H_3CH_2CH_2\cdot O$	18.6	1.046	1.5404	XVII-53
1856	coumaranone (2)	$C_6H_4COCH(CH_3)\cdot O$	19.7	1.153	1.5632	XVII-122
1857	" (5) (m.p. 54°)	$CH_3C_6H_3COCH_2\cdot O$	53.8	1.151	1.5652	XVII-123
1858	*o*-coumarketone methyl ether (m.p. 48°)	$CH_3OC_6H_4CH{:}CH\cdot$ $COCH_3$	61.4	1.053	1.5859	*VIII-559
1859	coumarone (2)	$C_6H_4CH{:}C(CH_3)\cdot O$	20	1.054	1.5589	XVII-60
1860	" (3)	$C_6H_4C(CH_3){:}CH\cdot O$	23.4	1.054	1.5526	XVII-60
1861	" (5)	$CH_3C_6H_3CH{:}CH\cdot O$	19	1.060	1.5573	XVII-61
1862	" (7)	$CH_3C_6H_3CH{:}CH\cdot O$	17	1.05	1.5525	XVII-61
1863	*o*-cresyl diketone ethyl ether (m.p. 64°)	$(C_2H_5O)(CH_3)C_6H_3\cdot$ $COCOCH_3$	65	1.052	1.5127	*VIII-628
1864	*p*-cresyl diketone methyl ether (m.p. 60°)	$CH_3C_6H_3(OCH_3)\cdot$ $COCOCH_3$	16†	1.119	1.5378	*VIII-628
1865	cresyl ether (*o*)	$CH_3OC_6H_4CH_3$	15.3	0.985	1.5189	VI-352
1866	" " (*p*)	$CH_3OC_6H_4CH_3$	19.3	0.97	1.5124	VI-392
1867	cyclobutane	$CH_3CHCH_2CH_2CH_2$	18	0.69	1.3847	V-20
1868	cyclohexane	$CH_3(CHC_5H_{10})$	20	0.769	1.4231	V-29
1869	cyclohexan-1-ol (1)	$CH_3COH(CH_2)_4CH_2$	20	0.930	1.4620	VI-11
1870	cyclohexan-2-one (1)	$CH_3C_5H_9CO$	20	0.926	1.4493	VII-14
1873	cyclohexan-3-one (1)	$CH_3C_5H_9CO$	20	0.896	1.4478	VII-17
1874	cyclohexan-4-one (1)	$CH_3C_5H_9CO$	20	0.914	1.4458	VII-18
1875	cyclohexene-acetate	$CH_2(CH_2)_3CH{:}C\cdot$ $CH_2CO_2CH_3$	18.2	1.003	1.4687	*IX-23
1876	cyclohex-(1 or 6)-ene-2-acetic acid (2)	$CH_3C_6H_8CH_2CO_2H$	15.8	1.028	1.4817	*IX-29
1877	cyclohex-(2 or 3)-ene-3-acetic acid (1)	$(CH_3)C_6H_8CH_2\cdot$ CO_2H	15.4	1.027	1.4824	*IX-30

† Supercooled.

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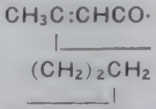
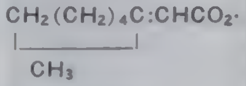
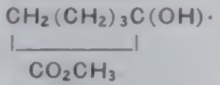
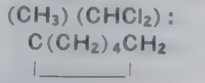
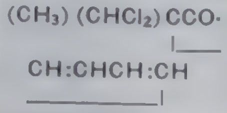
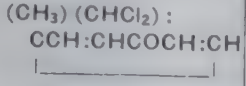
1878	**Methyl**-cyclohex-1-ene-3-one (1)	 $CH_3C:CHCO\cdot(CH_2)_2CH_2$	18.7	0.971	1.4955	VII-54
1879	α-cyclohexene-propionate	$C_8H_{13}CO_2CH_3$	18.3	0.986	1.4665	*IX-29
1880	cyclohexylideneacetate	 $CH_2(CH_2)_4C:CHCO_2\cdot CH_3$	19.7	0.999	1.4831	*IX-24
1881	cyclopentane	$CH_3(CHC_4H_8)$	20	0.749	1.4097	V-27
1882	cyclopentan-1-ol-1-carboxylate	 $CH_2(CH_2)_3C(OH)\cdot CO_2CH_3$	17	1.105	1.4567	*X-3
1883	1-cyanohexan-2-one (1)	$CH_3C_5H_8(CO)CN$	20	1.015	1.461	....
1884	1-cyanohexan-2-one (3)	$CH_3C_5H_8(CO)CN$	20	1.040	1.471	....
1885	cymene (2)	$(CH_3)_2CHC_6H_3:(CH_3)_2$ (1,2,4)	15.5	0.874	1.5000	V-440
1886	*n*-decyl ether	$CH_3OC_{10}H_{21}$	20	0.797	1.4218	....
1887	diacetone ether	$(CH_3)_2C(OCH_3)\cdot CH_2COCH_3$	20	0.909	1.487	**I-876
1888	γ,γ-dichloro-crotonate	$Cl_2CHCH:CHCO_2\cdot CH_3$	20	1.302	1.4694	**II-397
1889	1-dichloromethyl-cyclohexane (1)	 $(CH_3)(CHCl_2):C(CH_2)_4CH_2$	23.7	1.127	1.4895	*V-14
1890	1-dichloromethyl-cyclohexan-2-one (1)	$CH_3C_5H_8COCHCl_2$	17.5	1.235	1.5008	*VII-17
1891	1-dichloromethyl-cyclohexan-4-one (1) (m.p. 47°)	$(CH_3)(CHCl_2)C_5H_8:CO$	52.8	1.221	1.4978	*VII-18
1892	1-dichloromethyl-4-ethyl-cyclohex-2-ene-6-one (1)	$(CH_3)(C_2H_5)C_5H_5\cdot COCHCl_2$	17.4	1.167	1.5029	VII-86
1893	dichloromethyl-ketodihydrobenzene (*o*) (m.p. 33°)	 $(CH_3)(CHCl_2)CCO\cdot CH:CHCH:CH$	33.5	1.270	1.5328	VII-149
1894	dichloromethyl-ketodihydrobenzene (*p*) (m.p. 55°)	 $(CH_3)(CHCl_2):CCH:CHCOCH:CH$	56.2	1.26	1.5342	VII-149
1895	1-dichloromethyl-4-*iso*-propylcyclohex-3-ene-2-one (1)	$(C_3H_7)(CH_3)C_5H_5\cdot COCHCl_2$	15.8	1.165	1.5177	VII-138
1896	2,4-diethylnaphthalene (1)	$(CH_3)(C_2H_5)_2C_{10}H_5$	13.3	0.987	1.5923	**V-473
1897	α,α-dimethylaceto-acetate	$CH_3COC(CH_3)_2CO_2\cdot CH_3$	16.8	1.012	1.4217	III-695
1898	β,β-dimethyl-acrylate	$(CH_3)_2C:CHCO_2CH_3$	19.8	0.934	1.4321	II-433
1899	α,*p*-dimethylcinnamate	$CH_3C_6H_4CH:C(CH_3)CO_2CH_3$	18.3	1.051	1.5640	*IX-261

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1900	**Methyl-**β,*p*-dimethylcinnamate (m.p. 45°)	$CH_3C_6H_4C(CH_3):CHCO_2CH_3$	60.2	1.014	1.5408	IX-624
1901	1,4-dimethylcyclohexa-1,3-diene-2-carboxylate	$(CH_3)_2C_6H_5CO_2CH_3$	18.2	0.997	1.4755	IX-83
1902	1,4-dimethylcyclohex-3-ene-2-carboxylate	$(CH_3)_2C_6H_7CO_2CH_3$	20	0.970	1.4588	*IX-31
1903	3,5-dimethylcyclohexylideneacetate	$(CH_3)_2C_6H_8:CHCO_2\cdot CH_3$	15	0.957	1.4763	*IX-35
1904	*α,m*-dimethyl-*o*-methoxycinnamate	$(CH_3)(CH_3O)C_6H_3\cdot CH:C(CH_3)CO_2\cdot CH_3$	14.6	1.099	1.5642	*X-141
1905	*α,α*-dimethyloxypropionate	$CH_3C(OCH_3)_2CO_2\cdot CH_3$	17.6	1.068	1.4122	*III-219
1906	diphenylamine (*N*)	$(C_6H_5)_2NCH_3$	20	1.048	1.6193	XII-180
1907	*l*-ecgoninate	$C_{10}H_{17}O_3N$	20.5	1.147	1.4877	XXII-198
1908	erucate	$C_{21}H_{41}CO_2CH_3$	20	0.870	1.4558	**II-446
1909	3-ethoxycoumarone (5)	$CH_3C_6H_3C(OC_2H_5):$ $CH\cdot O$	16.6	1.083	1.5440	*XVII-64
1910	4-ethyl-2-acetylnaphthalene (1)	$C_{10}H_5(CH_3)(C_2H_5)\cdot(COCH_3)$	15.1	1.074	1.6118	....
1911	β-ethylacrolein (α)	$C_3H_6:C(CH_3)\cdot CHO$	20	0.856	1.4454	I-735
1912	2-ethylbenzene (1)	$CH_3C_6H_4C_2H_5$	20	0.881	1.5045	V-396
1913	3-ethylbenzene (1)	$CH_3C_6H_4C_2H_5$	20	0.865	1.4966	V-396
1914	4-ethylbenzene (1)	$CH_3C_6H_4C_2H_5$	20	0.861	1.4950	V-397
1915	α-ethyl-β-chlorostyrene (4)	$CH_3C_6H_4C(C_2H_5):CHCl$	19.9	1.036	1.5418	*V-239
1916	4-ethylcyclohexa-1,3-diene (1)	$CH_3C_6H_6C_2H_5$	19.4	0.837	1.4825	V-121
1917	2-ethylcyclohexa-1,5-diene-1-carboxylic acid (5)	$(CH_3)(C_2H_5)C_6H_5\cdot CO_2H$	14.8	1.028	1.4989	*IX-47
1918	1-ethylcyclopentane (1)	$CH_3\cdot C_5H_8\cdot C_2H_5$	20	0.781	1.4272	....
1919	2-ethylcyclopentane (1) (*cis*)	$CH_3\cdot C_5H_8\cdot C_2H_5$	20	0.785	1.4295	V-39
1920	2-ethylcyclopentane (1) (*trans*)	$CH_3\cdot C_5H_8\cdot C_2H_5$	20	0.769	1.4219	V-39
1921	3-ethylcyclopentane (1) (*cis*)	$CH_3\cdot C_5H_8\cdot C_2H_5$	20	0.772	1.420	V-39
1922	3-ethylcyclopentane (1) (*trans*)	$CH_3\cdot C_5H_8\cdot C_2H_5$	20	0.762	1.4186	V-39
1923	5-ethylhept-5-ene (2)	$(CH_3)_2CH(CH_2)_3\cdot C(C_2H_5):CHCH_3$	20(?)	0.75	1.4271	I-224
1924	3-ethylhexane (2)	$(CH_3)_2CHCH:(C_2H_5)(CH_2C_2H_5)$	20	0.731	1.411	....
1925	4-ethylhexane (2)	$(CH_3)_2CHCH_2CH:(C_2H_5)_2$	20	0.723	1.407	....
1926	3-ethylhexane (3)	$(C_2H_5)_2(CH_3)C\cdot CH_2C_2H_5$	20	0.741	1.415	....
1927	4-ethylhexane (3)	$(C_2H_5)(CH_3)CH\cdot CH(C_2H_5)_2$	20	0.742	1.416	....

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1928	**Methyl**-4-ethylhexan-4-ol (2)	$(C_2H_5)_2COHCH_2CH:(CH_3)_2$	13	0.8	1.4346	I-425
1929	1-ethylindazole (3)	$C_2H_5N\cdot C_6H_4C\cdot$ $(CH_3):N$	20	1.035	1.561	XXIII-142
1930	2-ethylindazole (3)	$C_2H_5N\cdot N:C_6H_4:C\cdot$ CH_3	20	1.058	1.587	XXIII-142
1931	1-ethylindazole (5)	$CH_3C_6H_3CH:N\cdot N\cdot$ C_2H_5	20	1.043	1.568	....
1932	2-ethylindazole (5)	$C_2H_5N\cdot N:C_6H_3\cdot$ $(CH_3):CH$	20	1.050	1.581	....
1933	ethylketazine	$[CH_3(C_2H_5)C:N]_2$	26.6	0.834	1.4516	I-669
1934	ethyl ketone	$CH_3COC_2H_5$	15.9	0.81	1.3807	I-666
1935	ethyl ketoxime	$CH_3C(NOH)C_2H_5$	20(?)	0.923	1.4428	I-668
1936	2-ethylnaphthalene (1)	$CH_3C_{10}H_6C_2H_5$	15.4	1.001	1.6014	**V-470
1937	4-ethylnaphthalene (1)	$CH_3C_{10}H_6C_2H_5$	13.1	1.009	1.6057	**V-470
1938	ethylnitroamine	$CH_3N(NO_2)C_2H_5$	19.2	1.097	1.4571	IV-130
1939	ethyloximino-cyanoacetate	$NCC(:NOC_2H_5)\cdot CO_2CH_3$	20	1.124	1.4578	III-775
1940	3-ethylpentane (2)	$(C_2H_5)_2CHCH:(CH_3)_2$	20	0.719	1.4040	I-164
1941	" (3)	$(C_2H_5)_3CCH_3$	20	0.727	1.4078	....
1942	3-ethylpent-1-ene (2)	$CH_2:C(CH_3)CH:(C_2H_5)_2$	20	0.730	1.415	....
1943	3-ethylpent-4-ene (2)	$(CH_3)_2CHCH(C_2H_5)\cdot CH:CH_2$	20	0.726	1.410	....
1944	3-ethylpent-1-ene (3)	$CH_2:CHC(CH_3):(C_2H_5)_2$	20	0.731	1.418	....
1945	3-methylpyrazole (1)	$CH:CHC(CH_3):N\cdot N$ C_2H_5	20	0.945	1.472	....
1946	ethyl pyrotartrate	$C_5H_6O_4(CH_3)(C_2H_5)$	21.9	1.029	1.4196	II-639
1947	eugenyl ether	$CH_2:CHCH_2C_6H_3(O\cdot CH_3)_2$ (1,3,4)	17	1.036	1.5383	VI-963
1948	*iso*-eugenyl ether (1,3,4)	$CH_2CH:CH\cdot C_6H_3(OCH_3)_2$	19.1	1.052	1.57	VI-956
1949	fluorene (9) (m.p. 46°)	$C_6H_4\cdot C_6H_4\cdot CHCH_3$	66.2	1.026	1.6101	V-642
1950	formate	HCO_2CH_3	20	0.974	1.344	II-18
1951	furan (2)	$CH_3C_4H_3O$	20	0.913	1.4344	XVII-36
1952	furfuryl ether	$CH_3OCH_2C_4H_3O$	20	1.02	1.4570	XVII-112
1953	furoate	$C_4H_3OCO_2CH_3$	20	1.18	1.4860	XVIII-274
1954	geranate	$C_{11}H_{18}O_2$	19.1	0.923	1.4714	*II-210
1955	hemimellitenyl ether	$(CH_3)_3C_6H_2OCH_3$ (1,2,3,5)	20	0.976	1.524	**VI-480
1956	hepta-1,6-diene-4-ol (4)	$(CH_2:CHCH_2)_2COH\cdot CH_3$	20.6	0.844	1.4417	I-456
1957	heptane (2)	$(CH_3)_2CHC_5H_{11}$	20	0.698	1.3950	I-161

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1958	**Methyl**-heptane (3)	$C_2H_5CH(CH_3)\cdot(CH_2)_3CH_3$	20	0.706	1.3985	I-162
1959	" (4)	$(C_2H_5CH_2)_2CHCH_3$	20	0.705	1.3979	I-162
1960	heptan-2-ol (2)	$CH_3(CH_2)_4COH:(CH_3)_2$	20(?)	0.879	1.4303	I-420
1961	heptan-3-ol (2)	$(CH_3)_2CHCHOH\cdot C_4H_9$	20	0.825	1.4204	I-421
1962	heptan-4-ol (2)	$(CH_3)_2CHCH_2\cdot CHOHC_3H_7$	20	0.821	1.4203	I-421
1963	heptan-5-ol (2)	$(CH_3)_2CH(CH_2)_2\cdot CHOHC_2H_5$	20	0.808	1.4201	I-421
1964	heptan-6-ol (2)	$(CH_3)_2CH(CH_2)_3\cdot CHOHCH_3$	20	0.813	1.4238	I-421
1965	heptan-3-ol (3)	$(CH_3)(C_2H_5)COH\cdot(C_4H_9)$	19	0.827	1.4274	I-421
1966	hept-1-ene (2)	$CH_2:C(CH_3)C_5H_{11}$	20	0.721	1.4123	....
1967	hept-2-ene (2)	$(CH_3)_2C:CHC_4H_9$	20	0.725	1.4170	I-222
1968	hept-3-ene (2) (*cis?*)	$(CH_3)_2CHCH:CH\cdot CH_2C_2H_5$	20	0.706	1.407	....
1969	hept-3-ene (2) (*trans*)	$(CH_3)_2CHCH:CH\cdot CH_2C_2H_5$	....	.....	......	....
1970	hept-4-ene (2) (*cis?*)	$C_2H_5CH:CHCH_2\cdot CH(CH_3)_2$	20	0.713	1.410	....
1971	hept-4-ene (2) (*trans*)	$C_2H_5CH:CHCH_2\cdot CH(CH_3)_2$	....	.....	......	....
1972	hept-5-ene (2) (*cis?*)	$CH_3CH:CHCH_2CH_2\cdot CH(CH_3)_2$	20	0.718	1.412	....
1973	hept-5-ene (2) (*trans*)	$CH_3CH:CHCH_2CH_2\cdot CH(CH_3)_2$	....	.....	......	....
1974	hept-6-ene (2)	$CH_2:CH(CH_2)_3CH:(CH_3)_2$	20	0.712	1.4070	*I-94
1975	hept-1-ene (3)	$CH_2:CHCH(CH_3)\cdot C_4H_9$	20	0.711	1.406	....
1976	hept-2-ene (3) (*cis?*)	$CH_3CH:C(CH_3)\cdot C_4H_9$	20	0.729	1.419	....
1977	hept-2-ene (3) (*trans*)	$CH_3CH:C(CH_3)\cdot C_4H_9$	....	.....	......	....
1978	hept-3-ene (3) (*cis?*)	$C_2H_5C(CH_3):CH\cdot CH_2C_2H_5$	20	0.728	1.418	....
1979	hept-3-ene (3) (*trans*)	$C_2H_5C(CH_3):CH\cdot CH_2C_2H_5$	....	.....	......	....
1980	hept-4-ene (3) (*cis?*)	$C_2H_5CH:CHCH:(CH_3)(C_2H_5)$	20	0.713	1.410	....
1981	hept-4-ene (3) (*trans*)	$C_2H_5CH:CHCH:(CH_3)(C_2H_5)$	....	.....	......	....
1982	hept-5-ene (3) (*cis?*)	$CH_3CH:CHCH_2CH:(CH_3)(C_2H_5)$	20	0.723	1.414	....
1983	hept-5-ene (3) (*trans*)	$CH_3CH:CHCH_2CH:(CH_3)(C_2H_5)$	....	.....	......	....
1984	hept-6-ene (3)	$CH_2:CHCH_2CH_2\cdot CH(CH_3)(C_2H_5)$	20	0.716	1.4094	....
1985	hept-1-ene (4)	$CH_2:CHCH_2CH:(CH_3)(C_3H_7)$	20	0.717	1.410	....
1986	hept-2-ene (4) (*cis?*)	$CH_3CH:CHCH:(CH_3)(C_3H_7)$	20	0.716	1.410	....

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1987	**Methyl**-hept-2-ene (4) (*trans*)	$CH_3CH:CHCH:(CH_3)(C_3H_7)$	....	.....	......	....
1988	hept-3-ene (4) (*cis?*)	$C_2H_5CH:C(CH_3)\cdot CH_2C_2H_5$	20	0.725	1.417	I-222
1989	hept-3-ene (4) (*trans*)	$C_2H_5CH:C(CH_3)\cdot CH_2C_2H_5$	....	.....	......	....
1990	hept-2-ene-6-ol (2)	$(CH_3)_2C:CH(CH_2)_2\cdot CHOHCH_3$	20	0.854	1.4505	I-448
1991	hept-1-ene-4-ol (4)	$CH_2:CHCH_2COH:(CH_3)CH_2C_2H_5$	21.3	0.834	1.4376	I-449
1992	hept-2-ene-6-one (2)	$(CH_3)_2C:CH(CH_2)_2\cdot COCH_3$	20	0.860	1.4403	I-741
1993	*n*-heptylate	$CH_3(CH_2)_5CO_2CH_3$	20	0.88	1.4114	II-339
1994	*n*-heptyl ketone	$CH_3(CH_2)_6COCH_3$	20(?)	0.832	1.4279	I-709
1995	hexane (2)	$(CH_3)_2CH(CH_2)_3CH_3$	20	0.679	1.3849	I-156
1996	" (3)	$C_2H_5CH(CH_3)\cdot CH_2C_2H_5$	20	0.687	1.3887	I-157
1997	hexan-1-ol (2)	$CH_3(CH_2)_3CH:(CH_3)CH_2OH$	20	0.82	1.4226	I-415
1998	hexan-2-ol (2)	$(CH_3)_2COH(CH_2)_3\cdot CH_3$	20(?)	0.816	1.4159	I-415
1999	hexan-3-ol (2)	$(CH_3)_2CHCHOH\cdot CH_2C_2H_5$	20	0.82	1.4215	I-416
2000	hexan-6-ol (2)	$(CH_3)_2CH(CH_2)_3\cdot CH_2OH$	20(?)	0.82	1.4254	I-416
2001	hexan-3-ol (3)	$C_2H_5CH_2C:(CH_3)(OH)C_2H_5$	20	0.82	1.423	I-416
2002	hex-1-ene (2)	$CH_2:C(CH_3)C_4H_9$	20	0.700	1.404	....
2003	hex-2-ene (2)	$(CH_3)_2C:CHC_3H_7$	20	0.709	1.410	**I-197
2004	hex-3-ene (2) (*cis?*)	$(CH_3)_2CHCH:CH\cdot C_2H_5$	20	0.694	1.399	....
2005	hex-3-ene (2) (*trans*)	$(CH_3)_2CHCH:CH\cdot C_2H_5$	....	.....	......	....
2006	hex-4-ene (2) (*cis*)	$CH_3CH:CHCH_2\cdot CH(CH_3)_2$	20	0.700	1.400	....
2007	hex-4-ene (2) (*trans*)	$CH_3CH:CHCH_2\cdot CH(CH_3)_2$	20	0.700	1.400	....
2008	hex-5-ene (2)	$CH_2:CHCH_2CH_2\cdot CH(CH_3)_2$	20	0.692	1.3970	*I-91
2009	hex-1-ene (3)	$CH_2:CHCH(CH_3)\cdot C_3H_7$	20	0.695	1.397	....
2010	hex-2-ene (3) (*cis?*)	$CH_3CH:C(CH_3)\cdot C_3H_7$	20	0.712	1.410	*I-91
2011	hex-2-ene (3) (*trans*)	$CH_3CH:C(CH_3)\cdot C_3H_7$	....	.....	......	....
2012	hex-3-ene (3) (*cis?*)	$C_2H_5C(CH_3):CH\cdot C_2H_5$	20	0.703	1.407	**I-198
2013	hex-3-ene (3) (*trans*)	$C_2H_5C(CH_3):CH\cdot C_2H_5$	....	.....	......	....
2014	hex-4-ene (3) (*cis*)	$CH_3CH:CHCH:(CH_3)(C_2H_5)$	20	0.701	1.399	....
2015	hex-4-ene (3) (*trans*)	$CH_3CH:CHCH:(CH_3)(C_2H_5)$	20	0.698	1.399	....
2016	hex-5-ene (3)	$CH_2:CHCH_2CH:(CH_3)(C_2H_5)$	20	0.697	1.399	....

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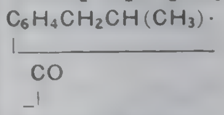
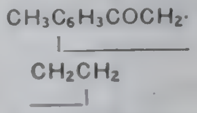
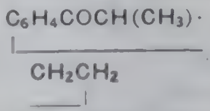
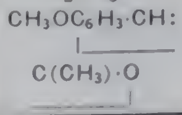
No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2017	**Methyl**-hex-5-ene-2-ol (2)	$CH_2{:}CH(CH_2)_2COH{:}(CH_3)_2$	16.2	0.838	1.4345	I-447
2018	Δ^2-hexenic acid (α)	$C_2H_5CH{:}CHCH{:}(CH_3)CO_2H$	20	0.942	1.4395	**II-410
2019	" (γ)	$CH_3CH_2C(CH_3){:}CH{\cdot}CH_2CO_2H$	20	0.966	1.4503	**II-411
2020	*n*-hexyl ketone	$CH_3(CH_2)_5COCH_3$	20	0.819	1.4161	I-704
2021	*n*-hexyl ketoxime	$CH_3C({:}NOH){\cdot}C_6H_{13}$	20	0.886	1.4511	I-705
2022	*n*-hexylpropiolate	$C_6H_{13}C{\vdots}CCO_2CH_3$	12.5	0.924	1.4518	II-490
2023	hydracrylate	$HOCH_2CH_2CO_2CH_3$	20	1.12	1.432	*III-112
2024	hydrindone (β)	 $C_6H_4CH_2CH(CH_3){\cdot}CO$	20	1.066	1.5538	VII-372
2025	hydrogen pyrotartrate	$CH_3CH(CO_2CH_3){\cdot}CH_2CO_2H$†	20.7	1.144	1.4323	II-639
2026	2-hydroxystyrene (1′)	$HOC_6H_4C(CH_3){:}CH_2$	18.5	1.030	1.5490	VI-572
2027	3-hydroxystyrene (α)	$HOC_6H_4C(CH_3){:}CH_2$	13.0	1.048	1.5734	*VI-284
2028	hydroxylamine (β)	CH_3NHOH	20	1.000	1.4164	IV-534
2029	indazole (1)	$C_8H_8N_2$	99.2	1.032	1.5522	....
2030	indene (1)	$C_6H_4C(CH_3){:}CHCH_2$	27	0.968	1.5591	V-520
2031	iodide	CH_3I	21	2.277	1.5293	I-70
2032	isoxazole (α)	$CH_3C{:}CHCH{:}NO$	20	1.023	1.44	XXVII-16
2033	" (γ)	$CH_3CCH{:}CH{\cdot}O{\cdot}N$	20	1.022	1.44	XXVII-16
2034	1-keto-1,2,3,4-tetrahydronaphthalene (7) (m.p. 33°)	 $CH_3C_6H_3COCH_2{\cdot}CH_2CH_2$	35	1.057	1.5567	....
2035	1-keto-1,2,3,4-tetrahydronaphthalene (2)	 $C_6H_4COCH(CH_3){\cdot}CH_2CH_2$	20.9	1.060	1.5515	*VII 97
2036	lactate	$CH_3CHOHCO_2CH_3$	16	1.08	1.4156	III-280
2037	*iso*-lauronolate	$(CH_3)_3C_5H_4CO_2CH_3$	20	0.970	1.469	IX-58
2038	*p*-menthatriene (2)	$C_{11}H_{16}$	19	0.874	1.5012	V-441
2039	methenyl-*o*-phenyleneamidine	$C_6H_4{\cdot}N(CH_3){\cdot}CH{:}N$	17.1	1.128	1.6013	XXIII-132
2040	α-methoxyacrylate	$CH_2{:}C(OCH_3)CO_2{\cdot}CH_3$	20	1.068	1.4316	*III-134
2041	*o*-methoxybenzoate	$CH_3OC_6H_4CO_2CH_3$	19.5	1.157	1.5342	X-71
2042	2-methoxybenzoylacetone	$(CH_3)(CH_3O)C_6H_3{\cdot}COCH_2COCH_3$	20	1.118	1.5847	....
2043	β-methoxycinnamate	$C_6H_5C(OCH_3){:}CH{\cdot}CO_2CH_3$	24.7	1.118	1.5497	*X-133
2044	*o*-methoxycinnamate	$CH_3OC_6H_4CH{:}CH{\cdot}CO_2CH_3$	16.7	1.137	1.5854	X-291
2045	7-methoxycoumarone (2)	 $CH_3OC_6H_3{\cdot}CH{:}C(CH_3){\cdot}O$	20	1.119	1.5636	....

† Or $CH_3CH(CO_2H)CH_2CO_2CH_3$

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2046	**Methyl**-3-methoxycoumarone (5)	$CH_3C_6H_3C(OCH_3):$ $CH\cdot O$	24.3	1.107	1.5504	*XVII-64
2047	6-methoxyhydrindone (2)	$CH_3OC_6H_3COCH\cdot$ $(CH_3)CH_2$	16.9	1.119	1.5588	*VIII-560
2048	*o*-methoxyhydrocinnamate	$CH_3OC_6H_4CH_2CH_2\cdot CO_2CH_3$	18.4	1.095	1.5126	X-242
2049	2-methoxystyrene (1′)	$CH_3OC_6H_4C(CH_3):CH_2$	19	0.99	1.5315	VI-572
2050	3-methoxystyrene (1′)	$CH_3OC_6H_4C(CH_3):CH_2$	20(?)	0.99	1.5417	VI-573
2051	α-methylacetoacetate	$CH_3COCH(CH_3)CO_2\cdot CH_3$	23.8	1.031	1.4163	III-679
2052	β-methylcinnamate (m.p. 29°)	$C_6H_5C(CH_3):CHCO_2\cdot CH_3$	37.8	1.054	1.5505	IX-614
2053	*p*-methylcinnamate (m.p. 57°)	$CH_3C_6H_4CH:CH\cdot CO_2CH_3$	56.6	1.027	1.5581	*IX-256
2054	1-methylcyclohex-(2 or 3)-ene-3-acetate	$CH_3C_6H_8CH_2CO_2\cdot CH_3$	15.7	0.969	1.4582	*IX-30
2055	1-methylcyclohex-1-ene-4-acetate	$CH_3C_6H_8CH_2CO_2\cdot CH_3$	16.9	0.961	1.4540	*IX-30
2056	2-methylcyclohexylidene-1-acetate	$CH_2(CH_2)_3CH\cdot$ $(CH_3)C:CHCO_2\cdot$ CH_3	14.2	0.977	1.4807	*IX-51
2057	3-methylcyclohexylidene-1-acetate	$(CH_3)C_6H_9:CHCO_2\cdot CH_3$	15.5	0.975	1.4793	*IX-30
2058	4-methylcyclohexylidene-1-acetate	$(CH_3)C_6H_9:CHCO_2\cdot CH_3$	16.9	0.970	1.4758	*IX-31
2059	α-methyl-*o*-methoxycinnamate	$CH_3OC_6H_4CH:C(CH_3)CO_2CH_3$	15.2	1.126	1.5721	X-311
2060	β-methyl-*o*-methoxycinnamate	$CH_3OC_6H_4C(CH_3):CHCO_2CH_3$	16.7	1.104	1.5488	*X-137
2061	β-methyl-2-methoxy-5-methylcinnamate (m.p. 36°)	$(CH_3)(CH_3O)C_6H_3\cdot C(CH_3):CHCO_2\cdot CH_3$	12.7	1.087	1.5472	*X-141
2062	6-methyl-1-naphthoate	$CH_3C_{10}H_6CO_2CH_3$	20	1.135	1.606	*IX-279
2063	methyloximinocyanoacetate	$NCC(:NOCH_3)CO_2\cdot CH_3$	20	1.177	1.4591	III-775
2064	β-methylphenylglycidate	$C_6H_5C(CH_3)\cdot CH\cdot$ $(CO_2CH_3)\cdot O$	20	1.123	1.5131	XVIII-306
2065	α-methylstyrene (*p*)	$CH_3C_6H_4C(CH_3):CH_2$	18.7	0.902	1.5345	V-490

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
2066	**Methyl**-3-methylene-cyclohex-1-ene (1)	$CH_3C_6H_7:CH_2$	17	0.839	1.4872	*V-64
2067	3-methylenehexane (2)	$C_2H_5CH_2C(:CH_2)\cdot CH(CH_3)_2$	20	0.725	1.414	....
2068	4-methylenehexane (2)	$CH_2:C(C_2H_5)CH_2\cdot CH(CH_3)_2$	20	0.720	1.4105	....
2069	5-methylenehexane (2)	$CH_2:C(CH_3)CH_2\cdot CH_2\cdot CH(CH_3)_2$	20	0.717	1.4105	....
2070	2-methylenehexane (3)	$CH_2:C(CH_3)CH:(CH_3)(C_3H_7)$	20	0.725	1.414	....
2071	4-methylenehexane (3)	$CH_2:C(C_2H_5)CH:(CH_3)(C_2H_5)$	20	0.729	1.4142	....
2072	5-methylenehexane (3)	$CH_2:C(CH_3)CH_2CH:(CH_3)(C_2H_5)$	20	0.720	1.411	....
2073	3-methylene-pentane (2)	$(CH_3)_2CH\cdot C(C_2H_5):CH_2$	20	0.715	1.410	....
2074	naphth-1-aldehyde (4) (m.p. 34°)	$CH_3C_{10}H_6CHO$	38.2	1.125	1.6457	....
2075	naphthalene (α)	$C_{10}H_7CH_3$	20	1.00	1.618	V-566
2076	" (β) (m.p. 37°)	$C_{10}H_7CH_3$	39.9	0.994	1.6026	V-567
2077	naphthyl ether (α)	$CH_3OC_{10}H_7$	13.9	1.096	1.6232	VI-606
2078	naphthyl ketone (α)	$CH_3COC_{10}H_7$	21.5	1.117	1.6280	VII-401
2079	nitroamine	CH_3NHNO_2 (m.p. 38°)	49	1.243	1.4616	IV-567
2080	nonane (2)	$(CH_3)_2CHC_7H_{15}$	20	0.72	1.408	I-168
2081	" (3)	$C_2H_5(CH_3)CHC_6H_{13}$	20	0.735	1.4126	....
2082	" (5)	$(C_4H_9)_2CHCH_3$	20	0.732	1.4116	I-168
2083	*n*-nonyl ketone	$CH_3(CH_2)_8COCH_3$	17.3	0.83	1.4300	I-713
2084	octa-4,6-diene (2)	$CH_3CH:(CH)_2:CH\cdot CH_2CH(CH_3)_2$	18	0.752	1.4543	I-260
2085	octane (2)	$(CH_3)_2CHC_6H_{13}$	20	0.713	1.4031	I-166
2086	" (3)	$(CH_3)(C_2H_5)\cdot CHC_5H_{11}$	20	0.721	1.4062	I-166
2087	" (4)	$C_3H_7CH(CH_3)(C_4H_9)$	20	0.720	1.4061	*I-63
2088	octan-4-ol (3)	$C_2H_5(CH_2)_2CHOH\cdot CH(CH_3)C_2H_5$	20	0.834	1.4317	**I-457
2089	palmitate (m.p. 30°)	$C_{15}H_{31}CO_2CH_3$	80.7	.....	1.4175	II-372
2090	penta-1,3-diene (2) (*cis?*)	$CH_2:C(CH_3)CH:CH\cdot CH_3$	20	0.719	1.446	I-255
2091	penta-1,3-diene (2) (*trans*)	$CH_2:C(CH_3)CH:CH\cdot CH_3$	....	.....	......	....
2092	penta-2,3-diene (2)	$(CH_3)_2C:C:CHCH_3$	20	0.711	1.425	I-255
2093	penta-2,4-diene (2)	$CH_2:CHCH:C(CH_3)_2$	20	0.719	1.451	I-255
2094	penta-3,4-diene (2)	$CH_2:C:CHCH(CH_3)_2$	20	0.708	1.424	**I-232
2095	penta-1,2-diene (3)	$CH_2:C:C(CH_3)C_2H_5$	20	0.715	1.425	I-255
2096	penta-1,3-diene (3) (*cis?*)	$CH_2:CHC(CH_3):CH\cdot CH_3$	20	0.735	1.452	*I-118
2097	penta-1,3-diene (3) (*trans*)	$CH_2:CHC(CH_3):CH\cdot CH_3$	....	.....	......	....
2098	penta-1,4-diene (2)	$CH_2:C(CH_3)CH_2\cdot CH:CH_2$	20	0.694	1.405	....
2099	penta-1,4-diene (3)	$(CH_2:CH)_2CHCH_3$	20	0.695	1.405	....
2100	pentane (2)	$(CH_3)_2CHC_3H_7$	20	0.653	1.3715	I-148
2101	" (3)	$(C_2H_5)_2CHCH_3$	20	0.664	1.3765	I-149

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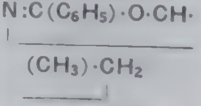
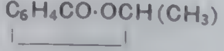
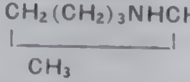
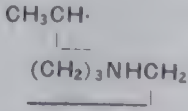
2102	**Methl**-pentan-1-ol (2)	$C_2H_5CH_2CH(CH_3)\cdot CH_2OH$	20	0.829	1.4178	I-409
2103	pentan-3-ol (2)	$(CH_3)_2CHCHOH\cdot C_2H_5$	20	0.824	1.4135	I-410
2104	pentan-4-ol (2)	$CH_3CHOHCH_2\cdot CH(CH_3)_2$	20	0.806	1.4087	I-410
2105	pentan-5-ol (2)	$(CH_3)_2CH(CH_2)_2\cdot CH_2OH$	20	0.816	1.4142	I-411
2106	pentan-2-ol (3)	$CH_3CHOHCH(CH_3)\cdot C_2H_5$	18	0.831	1.4205	I-411
2107	pentan-3-ol (3)	$(C_2H_5)_2COHCH_3$	20	0.824	1.4196	I-411
2108	pentan-4-ol acetate (2)	$CH_3CO_2CH(CH_3)\cdot CH_2CH(CH_3)_2$	20	0.858	1.4008	....
2109	pent-1-ene (2)	$CH_2{:}C(CH_3)CH_2C_2H_5$	20	0.682	1.3925	I-217
2110	pent-2-ene (2)	$(CH_3)_2C{:}CHC_2H_5$	20	0.686	1.4004	I-217
2111	pent-3-ene (2) (*cis?*)	$(CH_3)_2CHCH{:}CH\cdot CH_3$	20	0.672	1.389	*I-90
2112	pent-3-ene (2) (*trans?*)	$(CH_3)_2CHCH{:}CH\cdot CH_3$	20	0.670	1.388	*I-90
2113	pent-4-ene (2)	$CH_2{:}CHCH_2CH{:}(CH_3)_2$	20	0.665	1.384	....
2114	pent-1-ene (3)	$CH_2{:}CHCH(CH_3)\cdot C_2H_5$	20	0.670	1.384	....
2115	pent-2-ene (3) (*cis?*)	$CH_3CH{:}C(CH_3)C_2H_5$	20	0.699	1.4045	I-217
2116	pent-2-ene (3) (*trans?*)	$CH_3CH{:}C(CH_3)C_2H_5$	20	0.694	1.4016	I-217
2117	pent-3-ene-2-ol (2)	$CH_3CH{:}CHCOH{:}(CH_3)_2$	20	0.835	1.4302	I-445
2118	phenylacetate	$C_6H_5CH_2CO_2CH_3$	16	1.044	1.5091	IX-434
2119	1-phenyl-hepta-1,3-diene (6)	$C_6H_5(CH{:}CH)_2CH_2\cdot CH(CH_3)_2$	20	0.951	1.5855	V-525
2120	1-phenyl-hexa-1,3-diene (5)	$C_6H_5(CH{:}CH)_2\cdot CH(CH_3)_2$	20	0.925	1.5873	V-524
2121	phenylhydrazine (α)	$C_6H_5N(CH_3)NH_2$	21.6	1.038	1.5824	XV-117
2122	" (β)	$C_6H_5NHNHCH_3$	23.1	1.03	1.572	XV-118
2123	μ-phenyloxazoline (β)	 $N{:}C(C_6H_5)\cdot O\cdot CH\cdot (CH_3)\cdot CH_2$	22.9	1.070	1.5460	XXVII-51
2124	phenylpropiolate (m.p. 25°)	$C_6H_5C{:}CCO_2CH_3$	30.5	1.077	1.5601	IX-634
2125	*o*-phthalaldehyde-carboxylate	$HCOC_6H_4CO_2CH_3$	20.3	1.195	1.541	*X-316
2126	phthalide	 $C_6H_4CO\cdot OCH(CH_3)$	20	1.158	1.5447	XVII-318
2127	piperidine (*N*)	$C_5H_{10}NCH_3$	20	0.818	1.4464	XX-16
2128	" (2)	 $CH_2(CH_2)_3NHCH\cdot CH_3$	23.6	0.844	1.4464	XX-95
2129	" (3)	 $CH_3CH\cdot (CH_2)_3NHCH_2$	24.3	0.845	1.4463	XX-100

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2130	**Methyl**-piperidine (4)	$CH_2CH_2NHCH_2\cdot$ CH_2CHCH_3	21.6	0.845	1.4378	XX-101
2131	propionate	$C_2H_5CO_2CH_3$	18.9	0.917	1.3770	II-239
2132	propiophenone-*o*-carboxylate	$C_2H_5COC_6H_4CO_2\cdot CH_3$	15.2	1.129	1.5240	*IX-334
2133	2-*iso*-propyl-3-acetoxycoumarone (5)	$CH_3C_6H_3C(O_2C\cdot$ $CH_3):C(C_3H_7)\cdot O$	20	1.081	1.5281	*XVII-69
2134	2-*n*-propylcoumaranone (5)	$CH_3C_6H_3COCH\cdot$ $(C_3H_7)\cdot O$	20	1.064	1.545	....
2135	2-*iso*-propylcoumaranone (5) (m.p. 26°)	$CH_3C_6H_3COCH\cdot$ $(C_3H_7)\cdot O$	13.8	1.071	1.5429	*XVII-69
2136	3-*iso*-propylcyclopentane (1)	$(CH_3)CH\cdot$ $CH(CH_2)_2CH\cdot$ $(CH_3)CH_2$	19	0.773	1.4250	*V-18
2137	4-*iso*-propyl-1-dichloromethylcyclohex-2-ene-6-one (1)	$(C_3H_7)(CH_3)C_5H_5\cdot COCHCl_2$	16.8	1.142	1.5014	VII-138
2138	*n*-propyl ether	$CH_3OCH_2C_2H_5$	14.3	0.74	1.3602	I-354
2139	*iso*-propyl ether	$CH_3OCH(CH_3)_2$	20	0.735	1.3576	I-362
2140	*n*-propyl ketone	$CH_3COCH_2C_2H_5$	20.2	0.81	1.3895	I-676
2141	*iso*-propyl ketone	$CH_3COCH(CH_3)_2$	16.0	0.805	1.3879	I-682
2142	*n*-propyl ketoxime	$CH_3C(NOH)C_3H_7$	20	0.910	1.4450	I-677
2143	6-*iso*-propylphenol (2)	$(CH_3)(C_3H_7):C_6H_3OH$	15.2	0.987	1.5239	VI-526
2144	pseudo-cumenyl ether	$(CH_3)_3C_6H_2OCH_3$ (1,2,4,5)	20	0.964	1.519	VI-510
2145	pyran (*α*)	$CH_3CHCH:CHCH:$ $CH\cdot O$	20	0.917	1.4532	....
2146	pyrazine	$CH_3CCHNCHCHN$	18.7	1.030	1.5067	XXIII-94
2147	pyrazole (1)	$C_4H_6N_2$	13.7	0.993	1.4786	XXIII-40
2148	" (3)	$C_4H_6N_2$	16.3	1.01	1.4971	XXIII-50
2149	" (5)	$N:C(CH_3)CH:$ $CH\cdot NH$	13.7	1.023	1.4941	XXIII-50
2150	pyrrole (1)	$C_4H_4NCH_3$	16	0.915	1.4888	XX-163
2151	quinoline (*α*)	$C_6H_4\cdot CH:CH\cdot C\cdot$ $(CH_3):N$	25.4	1.054	1.6091	XX-388

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2152	**Methyl**-quinoline (3)	$C_6H_4{\cdot}CH{:}C(CH_3){\cdot}$ $CH{:}N$	20	1.067	1.6171	XX-394
2153	" (4)	$C_6H_4{\cdot}C(CH_3){:}CH{\cdot}$ $CH{:}N$	20	1.087	1.6206	XX-395
2154	" (6)	$CH_3C_6H_3(CH)_3{:}N$	20	1.065	1.6157	XX-397
2155	" (7)	$CH_3C_6H_3(CH)_3{:}N$	20.8	1.067	1.6149	XX-400
2156	" (8)	$CH_3C_6H_3(CH)_3{:}N$	20.8	1.072	1.6162	XX-401
2157	*iso*-quinoline (α)	$C_6H_4{\cdot}CH{:}CH{\cdot}N{:}C{\cdot}$ CH_3	20.5	1.076	1.6095	XX-403
2158	ricinoleate	$HOC_{17}H_{32}CO_2CH_3$	22	0.924	1.4588	II-387
2159	salicylate	$HOC_6H_4CO_2CH_3$	18.1	1.186	1.5377	X-70
2160	stilbene (*m*) (m.p. 53°)	$CH_3C_6H_4CH{:}CH{\cdot}C_6H_5$	60.5	0.989	1.6363	*V-311
2161	styrene (α)	$C_6H_5C(CH_3){:}CH_2$	20	0.911	1.5386	V-484
2162	styrene (β) (*cis?*)	$C_6H_5CH{:}CHCH_3$	20	0.911	1.545	V-481
2163	" (β) (*trans?*)	$C_6H_5CH{:}CHCH_3$	....	.....	......	....
2164	styrene (*o*)	$CH_3C_6H_4CH{:}CH_2$	14.1	0.916	1.5477	*V-233
2165	" (*p*)	$CH_3C_6H_4CH{:}CH_2$	16.4	0.900	1.5447	V-485
2166	(α,β-tetrahydro-benz)-2,3-isoxazole (1)	$CH_3C_6H_7{\cdot}CH{:}N{\cdot}O$	20	1.062	1.492	....
2167	(β,γ-tetrahydro-benz)-2,3-isoxazole (1)	$CH_3C_6H_7(:CH{\cdot}O{\cdot}N:)$	20	1.059	1.491	....
2168	tetrahydro-indazole (2)	$CH_3N{\cdot}CH{:}C_6H_8{:}N$	20	1.030	1.517	....
2169	5,6,7,8-tetrahydro-naphthalene (2)	$CH_3C_6H_3(CH_2)_3CH_2$	15.1	0.954	1.5372	**V-394
2170	tetrahydroquinoline (2)	$C_{10}H_{13}N$	20	1.02	1.5727	XX-283
2171	thiocyanate	CH_3SCN	23.8	1.069	1.4680	III-175
2172	*iso*-thiocyanate (m.p. 35°)	CH_3NCS	40	1.07	1.5245	IV-77
2173	thionaphthene (5)	$CH_3C_6H_3CH{:}CH{\cdot}S$	21.7	1.111	1.6148	*XVII-27
2174	thiophene (2)	$CH_3C_4H_3S$	15.3	1.02(?)	1.524	XVII-38
2175	" (3)	$CH_3C_4H_3S$	14.8	1.02(?)	1.524	XVII-38
2176	thymyl ether	$(CH_3)(C_3H_7)C_6H_3{\cdot}OCH_3$	28	0.931	1.5024	VI-536
2177	tolyl carbinol (*m*)	$CH_3CHOHC_6H_4CH_3$	20	0.993	1.5243	*VI-254
2178	" " (*p*)	$CH_3CHOHC_6H_4CH_3$	20	1.003	1.5332	VI-508
2179	tolyl ketone (*o*)	$CH_3COC_6H_4CH_3$	16.8	1.001	1.5242	VII-306
2180	" " (*p*)	$CH_3COC_6H_4CH_3$	22	0.989	1.5283	VII-307
2181	γ,γ,γ-trichloro-β-acetoxybutyrate	$Cl_3CCH(O_2CCH_3){\cdot}CH_2CO_2CH_3$	14.5	1.394	1.4682	*III-117
2182	γ,γ,γ-trichloro-crotonate	$Cl_3CCH{:}CHCO_2CH_3$	21.2	1.397	1.4898	*II-190

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2183	**Methyl**-urethane	$CH_3NHCO_2C_2H_5$	18.9	1.009	1.4200	IV-64
2184	**Methylal**	$CH_2(OCH_3)_2$	20	0.88	1.3534	I-574
2185	**Methylene** chloride	CH_2Cl_2	20	1.336	1.4237	I-60
2186	cyclohexane	$CH_2:C(CH_2)_4CH_2$	20	0.803	1.4528	V-69
2187	heptane (3)	$CH_2:C(C_2H_5)C_4H_9$	20	0.727	1.4157	**I-201
2188	" (4)	$(C_2H_5CH_2)_2C:CH_2$	20	0.724	1.4136	....
2189	hexane (3)	$CH_2:C(C_2H_5)C_3H_7$	20	0.708	1.405	....
2190	iodide	CH_2I_2	15	3.33	1.7425	I-71
2191	pentane (3)	$CH_2:C(C_2H_5)_2$	20	0.689	1.3969	**I-195
2192	**Myrcene**	$C_{10}H_{16}$	20	0.798	1.4707	I-264
2193	**Myristic acid** (m.p. 58°)	$CH_3(CH_2)_{12}CO_2H$	60	0.858	1.4308	II-365
2194	**Naphthaldehyde** (*α*)	$C_{10}H_7CHO$	19.3	1.15	1.6546	VII-400
2195	" (*β*) (m.p. 61°)	$C_{10}H_7CHO$	99.4	1.078	1.6211	VII-401
2196	**Naphthalene** (m.p. 80°)	$C_{10}H_8$	98.4	.....	1.5823	V-531
2197	decahydride	$C_{10}H_{18}$	18	0.895	1.4804	V-92
2198	**Naphthol** (*α*) (m.p. 96°)	$C_{10}H_7OH$	98.7	1.099	1.6206	VI-596
2199	**Naphthonitrile** (*α*) (m.p. 36°)	$C_{10}H_7CN$	17.8	1.11	1.6298	IX-649
2200	**Naphthylamine** (*β*) (m.p. 111°)	$C_{10}H_7NH_2$	98.4	1.061	1.6493	XII-1265
2201	**Naphthylamine** (*α*) (m.p. 50°)	$C_{10}H_7NH_2$	51	1.1	1.6703	XII-1212
2202	**Naphthylene**-diamine (1,6) (m.p. 78°)	$C_{10}H_6(NH_2)_2$	99.4	1.147	1.7083	XIII-204
2203	diamine (1,8) (m.p. 66°)	$C_{10}H_6(NH_2)_2$	99.4	1.127	1.6828	XIII-205
2204	**Neomenthol** (*l*)	$C_{10}H_{20}O$	20	0.900	1.4603	*VI-29
2205	**Nerolidol**	$C_{15}H_{26}O$	20	0.87	1.4898	I-464
2206	**Nicoteine** (*iso*)	$C_{10}H_{12}N_2$	20	1.098	1.5749	....
2207	**Nicotine**	$C_{10}H_{14}N_2$	20	1.009	1.5286	XXIII-111
2208	" (*meta*)	$C_{10}H_{14}N_2$	19.7	1.002	1.5551	....
2209	**Nitric acid**	HNO_3	16.4	.....	1.397	....
2210	**Nitro**-anisole (*o*)	$CH_3OC_6H_4NO_2$	20	1.254	1.5620	VI-217
2211	anisole (*p*) (m.p. 54°)	$CH_3OC_6H_4NO_2$	60	1.219	1.5707	VI-230
2212	benzene	$C_6H_5NO_2$	20	1.21	1.5524	V-233
2213	benzyl chloride (*o*) (m.p. 49°)	$NO_2C_6H_4CH_2Cl$	61.5	.....	1.5557	V-327
2214	benzyl chloride (*m*) (m.p. 45°)	$NO_2C_6H_4CH_2Cl$	61.5	.....	1.5577	V-329
2215	benzyl chloride (*p*) (m.p. 71°)	$NO_2C_6H_4CH_2Cl$	61.5	.....	1.5647	V-329
2216	bromoform	Br_3CNO_2	12.5	2.811	1.5831	I-77
2217	chloroform	Cl_3CNO_2	22.8	1.651	1.4608	I-76
2218	*p*-cresol (2) (m.p. 37°)	$(CH_3)(HO)C_6H_3NO_2$ (1,4,2)	38.6	1.240	1.5763	VI-412
2219	2,6-dimethyl-heptane (2)	$(CH_3)_2C(NO_2)\cdot(CH_2)_3CH(CH_3)_2$	18	0.915	1.4326	I-167
2220	2,5-dimethyl-hexane (2)	$(CH_3)_2C(NO_2)\cdot(CH_2)_2CH(CH_3)_2$	20	0.921	1.4316	I-163

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2221	**Nitro**-2,7-dimethyloctane (1)	$(CH_3)_2CH(CH_2)_4\cdot CH(CH_3)CH_2NO_2$	21	0.925	1.4426	I-169
2222	2,7-dimethyloctane (2)	$(CH_3)_2CNO_2\cdot (CH_2)_4CH(CH_3)_2$	20	0.909	1.4357	I-169
2223	2,4-dimethylpentane (2)	$(CH_3)_2C(NO_2)CH_2\cdot CH(CH_3)_2$	30	0.94	1.4235	I-158
2224	ethane	$CH_3CH_2NO_2$	24.3	1.047	1.3901	I-100
2225	methane	CH_3NO_2	20	1.139	1.3935	I-74
2226	2-methylbutane (4)	$(CH_3)_2CHCH_2\cdot CH_2NO_2$	20.6	0.960	1.4181	I-140
2227	pentane (1)	$CH_3(CH_2)_3CH_2NO_2$	20(?)	0.948	1.4218	I-133
2228	phenetole (*o*)	$C_2H_5OC_6H_4NO_2$	20	1.19	1.5425	VI-218
2229	piperidine (1)	$C_5H_{10}O_2N_2$	26.4	1.152	1.4954	XX-84
2230	propane (1)	$CH_3CH_2CH_2NO_2$	24.3	1.002	1.4003	I-115
2231	toluene (*o*)	$CH_3C_6H_4NO_2$	20.4	1.163	1.5474	V-318
2232	" (*m*)	$CH_3C_6H_4NO_2$	21	1.16	1.5470	V-321
2233	" (*p*) (m.p. 52°)	$CH_3C_6H_4NO_2$	62.5	1.13	1.5346	V-323
2234	**Nitrogen dioxide**	NO_2	−90	.....	1.330	....
2235	**Nitroso**-di-*iso*-butylamine	$[(CH_3)_2CH\cdot CH_2]_2NNO$	21.2	0.892	1.4439	IV-172
2236	ethylurethane	$C_2H_5N(NO)CO_2\cdot C_2H_5$	20	1.071	1.4322	IV-129
2237	methylaniline (*N*)	$C_6H_5N(CH_3)NO$	20	1.124	1.5769	XII-579
2238	piperidine (*N*)	$C_5H_{10}N\cdot NO$	18.5	1.063	1.4933	XX-83
2239	**Nitrous oxide**	N_2O	16	.....	1.193	....
2240	**Nonacosane** (m.p. 64°)	$C_{29}H_{60}$	65	0.77	1.4364	I-176
2241	**Nonane** (*n*)	$CH_3(CH_2)_7CH_3$	20	0.718	1.4055	I-165
2242	**Nonanol** (1)	$CH_3(CH_2)_7CH_2OH$	20	0.828	1.4311	I-423
2243	" (2)	$CH_3(CH_2)_6CHOH\cdot CH_3$	20(?)	0.823	1.4353	I-423
2244	" (3)	$C_2H_5CHOHC_6H_{13}$	20	0.825	1.4308	I-424
2245	" (5)	$(C_4H_9)_2CHOH$	20	0.823	1.430	I-424
2246	**Nondecane** (*n*) (m.p. 32°)	$CH_3(CH_2)_{17}CH_3$	34.6	0.775	1.436	I-174
2247	**Nonylenic** acid (α,β)	$CH_3(CH_2)_5CH:CH\cdot CO_2H$	20	0.930	1.454	II-453
2248	nitrile (α,β)	$C_6H_{13}CH:CHCN$	20	0.833	1.445	**II-417
2249	**Nonylenyl chloride** (α,β)	$CH_3(CH_2)_5CH:CH\cdot COCl$	20	0.967	1.460	*II-194
2250	**Nonyl formate** (γ)	$HCO_2C_9H_{19}$	20	0.869	1.421	**II-32
2251	**Nopinane**	C_9H_{16}	20(?)	0.86	1.4641	*V-42
2252	**Octacosane** (m.p. 65°)	$C_{28}H_{56}$	65	0.77	1.4354	I-176
2253	**Octadecane** (*n*)	$CH_3(CH_2)_{16}CH_3$	35.2	0.77	1.4349	I-173
2254	**Octahydrophenanthrene**	$C_{14}H_{18}$	20	1.025	1.5668	V-527
2255	**Octane** (*n*)	$CH_3(CH_2)_6CH_3$	20	0.703	1.3975	I-159
2256	**Octanol** (1)	$CH_3(CH_2)_6CH_2OH$	20.5	0.826	1.4304	I-418
2257	" (2)	$CH_3CHOHC_6H_{13}$	20	0.822	1.4256	I-419
2258	" (2) †	$CH_3CHOHC_6H_{13}$	20	0.822	1.4244	I-419
2259	**Octene** (1)	$CH_2:CH(CH_2)_5CH_3$	20	0.716	1.4088	I-221
2260	" (2) (*cis*)	$CH_3CH:CHC_5H_{11}$	20	0.724	1.4150	**I-200
2261	" (2) (*trans*)	$CH_3CH:CHC_5H_{11}$	20	0.720	1.4132	**I-200
2262	" (3) (*cis*)	$C_2H_5CH:CHC_4H_9$	20	0.721	1.4135	....

† Mixture of *l* and *dl*.

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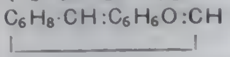
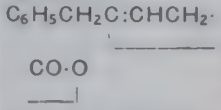
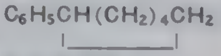
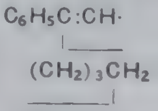
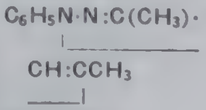
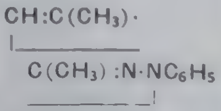
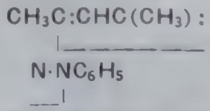
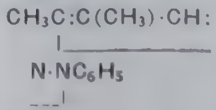
No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2263	**Octene** (3) (*trans*)	$C_2H_5CH{:}CHC_4H_9$	20	0.715	1.4126	....
2264	" (4) (*cis*)	$(C_2H_5CH_2CH{:})_2$	20	0.723	1.4144	....
2265	" (4) (*trans*)	$(C_2H_5CH_2CH{:})_2$	20	0.714	1.4118	....
2266	**Octracenone**	 $C_6H_8{\cdot}CH{:}C_6H_6O{:}CH$	62.4	1.076	1.5707	....
2267	**Octyl** acetate (*n*)	$CH_3CO_2C_8H_{17}$	20	0.88	1.4204	II-134
2268	amine (*n*)	$CH_3(CH_2)_7NH_2$	26.8	0.777	1.43	IV-196
2269	amine (*n*) (*sec*)	$CH_3(CH_2)_5{\cdot}CH(NH_2)CH_3$	24.5	0.771	1.4232	IV-196
2270	fluoride (*n*)	$CH_3(CH_2)_6CH_2F$	20	0.803	1.3947	I-159
2271	formate	$HCO_2C_8H_{17}$	20	0.87	1.414	II-22
2272	iodide (*n*)	$CH_3(CH_2)_6CH_2I$	20	1.333	1.489	I-160
2273	**Octyne** (1)	$CH{:}C(CH_2)_5CH_3$	12.5	0.753	1.4208	I-258
2274	**Oleic** acid	$CH_3(CH_2)_7CH{:}CH{\cdot}(CH_2)_7CO_2H$	17.7	0.895	1.46	II-463
2275	acid ozonide	$C_{18}H_{34}O_5$	20.5	1.028	1.4622	II-466
2276	aldehyde	$C_{17}H_{33}CHO$	20	0.85	1.4557	I-749
2277	**Osmium tetroxide**	OsO_4	45	.....	1.56	....
2278	**Oxalyl chloride**	$(COCl)_2$	12.9	1.489	1.4340	II-542
2279	**Palmitic acid** (m.p. 64°)	$CH_3(CH_2)_{14}CO_2H$	70	0.849	1.4304	II-370
2280	**Palmitone** (m.p. 83°)	$(C_{15}H_{31})_2CO$	93.5	0.79	1.4297	I-719
2281	**Paraldehyde**	$(C_2H_4O)_3$	20	0.994	1.4049	XIX-385
2282	**Patschoulene**	$C_{15}H_{24}$	20	0.930	1.4984	V-470
2283	**Pelargonic** acid	$CH_3(CH_2)_7CO_2H$	20(?)	0.906	1.4306	II-352
2284	aldehyde	$CH_3(CH_2)_7CHO$	18.6	0.827	1.4242	I-708
2285	**Pelletierine** (*pseudo*) (m.p. 49°)	$C_9H_{15}ON$	99.5	1.001	1.4760	XXI-261
2286	**Pentachloro-**ethane	C_2HCl_5	24	1.67	1.5025	I-87
2287	propane (1,1,2,3,3)	$HCCl_2CHClCHCl_2$	20	1.6	1.512	*I-34
2288	**Pentacosane** (m.p. 55°)	$C_{25}H_{52}$	80	0.8	1.4262	I-175
2289	**Pentadiene** (1,2)	$CH_2{:}C{:}CHC_2H_5$	20	0.692	1.421	**I-226
2290	**Pentadiene** (1,3) (*cis*)	$CH_2{:}CHCH{:}CHCH_3$	20	0.691	1.4359	I-251
2291	**Pentadiene** (1,3) (*trans*)	$CH_2{:}CHCH{:}CHCH_3$	20	0.676	1.4299	I-251
2292	**Pentadiene** (1,4)	$(CH_2{:}CH)_2CH_2$	20	0.660	1.388	I-251
2293	**Pentadiene** (2,3)	$(CH_3CH{:})_2C$	20	0.66	1.39	I-251
2294	**Penta-**2,3-**dione**	$CH_3COCOCH_2CH_3$	19	0.957	1.4014	I-776
2295	**Pentaethylbenzene**	$(C_2H_5)_5C_6H$	20.3	0.896	1.52	V-471
2296	**Pentamethyl-benzene** (m.p. 53°)	$(CH_3)_5C_6H$	72.8	0.9	1.5049	V-443
2297	**Pentane** (*n*)	$CH_3(CH_2)_3CH_3$	20	0.626	1.3575	I-130
2298	" (*iso*)	$(CH_3)_2CHC_2H_5$	20	0.620	1.3537	I-134
2299	**Pentan-**1,2-**diol** (*dl*)	$C_3H_7CHOHCH_2OH$	20	0.980	1.441	**I-548
2300	**Pentanol** (3)	$(C_2H_5)_2CHOH$	14.7	0.808	1.4124	I-385
2301	**Pentene** (1)	$CH_2{:}CHCH_2C_2H_5$	20	0.641	1.3714	I-210
2302	" (2) (*cis*)	$CH_3CH{:}CHC_2H_5$	20	0.656	1.3830	I-210
2303	" (2) (*trans*)	$CH_3CH{:}CHC_2H_5$	20	0.648	1.379	I-210
2304	**Pent-1-ene-3-ol**	$CH_2{:}CHCHOHC_2H_5$	20	0.837	1.4240	I-443
2305	**Pent-2-ene-4-ol**	$CH_3CH{:}CHCHOH{\cdot}CH_3$	18	0.839	1.4282	I-443
2306	**Pentenic** acid (α,β)	$C_2H_5CH{:}CHCO_2H$	14.7	0.992	1.454	II-426

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2307	**Pentenic** acid (β,γ)	$CH_3CH{:}CHCH_2CO_2H$	18.8	0.99	1.4357	II-426
2308	**Pentenonitrile** (α,β)	$CH_3CH_2CH{:}CHCN$	20	0.828	1.433	II-426
2309	" (β,γ)	$CH_3CH{:}CHCH_2CN$	20	0.841	1.423	II-427
2310	**Pentenoyl** chloride (α,β)	$C_2H_5CH{:}CHCOCl$	20	1.063	1.465	**II-400
2311	chloride (β,γ)	$CH_3CH{:}CHCH_2COCl$	20	1.064	1.448	....
2312	**Pentyne** (1)	$CH{\vdots}CCH_2C_2H_5$	20	0.691	1.385	I-250
2313	" (2)	$CH_3C{\vdots}CC_2H_5$	20	0.711	1.4039	I-250
2314	**Perchloromethyl mercaptan**	Cl_3CSCl	17.5	1.695	1.5484	III-135
2315	**Petroselinic acid** (m.p. 34°)	$C_{18}H_{34}O_2$	40	0.870	1.4533	II-462
2316	**Phellandral**	$C_{10}H_{16}O$	20	0.93	1.4903	VII-77
2317	**Phellandrene** (α)	$C_{10}H_{16}$	20	0.845	1.4835	V-129
2318	" (β)	$C_{10}H_{16}$	20	0.852	1.4788	V-131
2319	**Phenanthrene** (m.p. 99°)	$(C_6H_4CH)_2$	129	.....	1.6567	V-667
2320	**Phenetole**	$C_6H_5OC_2H_5$	18.8	0.97	1.5084	VI-140
2321	**Phenol** (m.p. 42°)	C_6H_5OH	45	1.07	1.54	VI-113
2322	**Phenyl**-acetaldehyde	$C_6H_5CH_2CHO$	19.6	1.025	1.5255	VII-292
2323	acetate	$CH_3CO_2C_6H_5$	20	1.078	1.503	VI-152
2324	acetic acid (m.p. 77°)	$C_6H_5CH_2CO_2H$	79.8	1.081	1.51	IX-431
2325	acetylene	$C_6H_5C{\vdots}CH$	17.4	0.93	1.5501	V-511
2326	Δ²-angelolactone (δ)	 $C_6H_5CH_2C{:}CHCH_2\cdot CO\cdot O$	20	1.113	1.529	....
2327	buta-1,3-diene (1)	$C_6H_5CH{:}CHCH{:}CH_2$	16	0.931	1.6128	V-517
2328	*iso*-cyanate	$C_6H_5N{:}CO$	19.6	1.096	1.5368	XII-437
2329	cyclohexane	 $C_6H_5CH(CH_2)_4CH_2$	16	0.955	1.589	V-503
2330	cyclohex-1-ene	 $C_6H_5C{:}CH\cdot(CH_2)_3CH_2$	20	0.993	1.5718	V-523
2331	cymene (2)	$(CH_3)(C_6H_5)C_6H_3\cdot CH(CH_3)_2$	15	0.978	1.5680	V-619
2332	2,4-dimethyl-pyrazole (1)	 $C_6H_5N\cdot N{:}C(CH_3)\cdot CH{:}CCH_3$	19.3	1.057	1.5738	XXIII-75
2333	3,4-dimethyl-pyrazole (1)	 $CH{:}C(CH_3)\cdot C(CH_3){:}N\cdot NC_6H_5$	20	1.061	1.587	XXIII-72
2334	3,5-dimethyl-pyrazole (1)	 $CH_3C{:}CHC(CH_3){:}N\cdot NC_6H_5$	20	1.055	1.574	XXIII-75
2335	4,5-dimethyl-pyrazole (1)	 $CH_3C{:}C(CH_3)\cdot CH{:}N\cdot NC_6H_5$	20	1.065	1.575	....
2336	ether	$(C_6H_5)_2O$	24	1.07	1.5826	VI-146
2337	ethyl alcohol (α)	$C_6H_5CHOHCH_3$	20	1.01	1.5211	VI-475

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2338	**Phenyl-**ethyl alcohol (β)	$C_6H_5CH_2CH_2OH$	18	1.02	1.5267	VI-478
2339	ethylamine (β)	$C_6H_5CH_2CH_2NH_2$	24(?)	0.958	1.53	XII-1096
2340	hexa-1,3-diene (1)	$C_6H_5(CH{:}CH)_2\cdot C_2H_5$	20	0.919	1.5989	V-522
2341	hydrazine	$C_6H_5NHNH_2$	20	1.098	1.6081	XV-67
2342	3-hydroxy-but-1-yne (1)	$C_6H_5C\vdots CCHOHCH_3$	12.6	1.036	1.5731	VI-588
2343	3-hydroxy-pent-1-yne (1)	$C_6H_5C\vdots CCHOHCH_2\cdot CH_3$	13	1.014	1.5633	VI-589
2344	3-hydroxy-4,4,4-trichlorobut-1-yne (1)	$C_6H_5C\vdots CCHOHCCl_3$	9.5	1.354	1.5917	VI-588
2345	*p*-menthatriene (2)	$C_{16}H_{18}$	20(?)	0.971	1.5674	V-619
2346	3-methyl-5-chloropyrazole (1)	$ClC{:}CH\cdot C(CH_3){:}$ $N\cdot NC_6H_5$	20	1.193	1.580	XXIII-54
2347	5-methyl-3-chloropyrazole (1)	$CH_3C{:}CH\cdot C(Cl){:}$ $N\cdot NC_6H_5$	20	1.205	1.584	XXIII-55
2348	5-methylpyrazole (1)	$CH_3C{:}CH\cdot CH{:}N\cdot N\cdot$ C_6H_5	20	1.086	1.582	XXIII-52
2349	β-methylstyrene (α) (m.p. 52°)	$(C_6H_5)_2C{:}CHCH_3$	63.5	0.981	1.5791	V-644
2350	nitromethane	$C_6H_5CH_2NO_2$	20	1.16	1.5323	V-325
2351	nitromethane methyl ether	$C_6H_5CH{:}N(OCH_3){:}O$ (***aci***)	15	1.124	1.5871	....
2352	oxazoline (μ)	$N{:}C(C_6H_5)\cdot O\cdot CH_2$ CH_2	23.4	1.122	1.5655	XXVII-47
2353	penta-1,3-diene (1)	$C_6H_5\cdot(CH{:}CH)_2\cdot CH_3$	15.2	0.933	1.6000	V-521
2354	pent-2-ene (1)	$C_6H_5CH_2CH{:}CHC_2H_5$	16.2	0.888	1.5089	V-497
2355	propiolic acetal	$C_6H_5C\vdots CCH(O\cdot C_2H_5)_2$	13	0.994	1.5222	VII-383
2356	propiolic aldehyde	$C_6H_5C\vdots CCHO$	12.6	1.068	1.6079	VII-383
2357	propiolic nitrile (m.p. 41°)	$C_6H_5C\vdots CCN$	41.5	1.005	1.5854	IX-636
2358	pyrazole (1)	$CH{:}CH\cdot CH{:}N\cdot N\cdot$ C_6H_5	20	1.111	1.596	XXIII-40
2359	styrene (α)	$(C_6H_5)_2C{:}CH_2$	20	1.023	1.6085	V-639
2360	tetrahydroindazole (1)	$C_6H_8\cdot CH{:}N\cdot NC_6H_5$	99.9	1.061	1.568	....
2361	tetrahydroindazole (2)	$C_6H_5N\cdot N{:}C_6H_8{:}CH$	99.6	1.054	1.578	....
2362	*iso*-thiocyanate	$C_6H_5N{:}CS$	23.4	1.126	1.6492	XII-453
2363	1-*p*-tolyl-ethane (1)	$CH_3C_6H_4CH(C_6H_5)\cdot CH_3$	17.2	0.985	1.5659	V-614
2364	3,4,5-trimethylpyrazole (1)	$CH_3C{:}C(CH_3)\cdot C\cdot$ $(CH_3){:}N\cdot NC_6H_5$	20	1.044	1.571	XXIII-82
2365	vinyl acetate	$C_6H_5CH{:}CHO_2CCH_3$	22.9	1.066	1.5494	VI-564

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No.	Substance	Formula	t.°C.	d_4^t	n_D^t	Beil. Ref.
2366	**Phenylenediamine** (*m*) (m.p. 63°)	$C_6H_4(NH_2)_2$	57.7	1.107	1.6339	XIII-33
2367	**Phorone** (m.p. 28°)	$[(CH_3)_2C{:}CH]_2CO$	29	0.88	1.4950	I-751
2368	**Phosphenyl chloride**	$C_6H_5PCl_2$	7	1.32	1.6053	XVI-763
2369	**Phosphine**	PH_3	17.5	.....	1.317	....
2370	**Phosphorus** oxychloride	$POCl_3$	25.1	.....	1.460	....
2371	tribromide	PBr_3	26.6	.....	1.697	....
2372	trichloride	PCl_3	14	.....	1.516	....
2373	**Phthalide** (m.p. 73°)	$\underline{C_6H_4CH_2{\cdot}O{\cdot}CO}$	99.1	1.164	1.5356	XVII-310
2374	**Phthalyl** dichloride (*o*) (*sym*)	$C_6H_4(COCl)_2$	20	1.41	1.5692	IX-805
2375	dichloride (*m*) (*sym*) (m.p. 41°)	$C_6H_4(COCl)_2$	46.9	.....	1.5700	IX-834
2376	**Phytol**	$C_{20}H_{39}OH$	20	0.852	1.4638	I-453
2377	**Picoline** (*α*)	$CH_3C_5H_4N$	20	0.95	1.501	XX-234
2378	" (*β*)	$CH_3C_5H_4N$	24	0.95	1.5043	XX-239
2379	**Pinane** (*d*)	$C_{10}H_{18}$	20	0.839	1.4624	V-93
2380	**Pinene** (*α*) (*dl*)	$C_{10}H_{16}$	23.5	0.86	1.4653	V-144
2381	**Pinic acid** (m.p. 102°)	$C_9H_{14}O_4$	109.4	1.093	1.4482	IX-743
2382	**Pinocamphane**	$C_{10}H_{18}$	20	0.855	1.4609	*V-48
2383	**Pinol**	$C_{10}H_{16}O$	20	0.942	1.4715	XVII-45
2384	**Pinylamine**	$C_{10}H_{17}N$	20	0.940	1.5036	XII-54
2385	**Piperidine**	$\underline{CH_2(CH_2)_4NH}$	20	0.860	1.4530	XX-6
2386	**Propargyl** acetate	$CH_3CO_2CH_2C{:}CH$	20	1.005	1.4205	II-140
2387	alcohol	$CH{:}CCH_2OH$	20	0.972	1.4306	I-454
2388	**Propenyl**-anisole (*o*)	$CH_3OC_6H_4CH{:}CH{\cdot}CH_3$	20	0.993	1.5604	VI-565
2389	*p*-cresol (*o*)	$(CH_3)(HO)C_6H_3CH{:}CHCH_3$	9	1.029	1.5777	*VI-287
2390	4-methoxytoluene (2) (*n*)	$(CH_3)(CH_3O)C_6H_3{\cdot}CH{:}CHCH_3$	12.3	0.986	1.5557	*VI-287
2391	4-methoxytoluene (3) (*iso*)	$CH_3C({:}CH_2){\cdot}C_6H_3(OCH_3)(CH_3)$	17.6	0.966	1.5308	*VI-288
2392	phenol (*o*) (m.p. 38°)	$CH_3CH{:}CHC_6H_4OH$	14.3	1.044	1.5837	*VI-279
2393	phenyl ketone	$CH_3CH{:}CHCOC_6H_5$	20	1.028	1.5601	VII-368
2394	**Propio**-*p*-cresol	$(HO)(CH_3)C_6H_3(CO{\cdot}C_2H_5)$ (1,4,2)	13.8	1.084	1.5485	VIII-120
2395	*p*-methoxytoluene (*m*)	$(CH_3O)(CH_3)C_6H_3{\cdot}COC_2H_5$ (4,1,3)	20	1.047	1.5313	VIII-120
2396	phenone-*o*-carboxylic acid (m.p. 93°)	$C_2H_5COC_6H_4CO_2H$	99.1	1.140	1.5177	X-701
2397	thienone (*α*)	$C_2H_5COC{:}\underline{CHCH{:}}$ $\underline{CH{\cdot}S}$	20	1.131	1.556	XVII-295
2398	**Propiolic** acid	$CH{:}CCO_2H$	15	1.139	1.4429	II-477
2399	nitrile	$HC{:}CCN$	17	0.816	1.3870	*II-208
2400	**Propion**-aldehyde	C_2H_5CHO	20	0.807	1.3636	I-629
2401	aldoxime	$C_2H_5CH{:}NOH$	20	0.926	1.4287	I-631
2402	amide	$C_2H_5CONH_2$	20	1.042	1.43	II-243
2403	imidoethyl ether	$HN{:}C(C_2H_5)OC_2H_5$	16.9	0.871	1.4103	II-245

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2404	**Propionic** acid	$C_2H_5CO_2H$	19.9	0.992	1.3874	II-234
2405	anhydride	$(C_2H_5CO)_2O$	20	1.012	1.4038	II-242
2406	nitrile	C_2H_5CN	19	0.78	1.3681	II-245
2407	**Propionyl-**acetone	$C_2H_5COCH_2COCH_3$	20	0.959	1.4516	I-788
2408	acetophenone (ω)	$C_6H_5COCH_2COC_2H_5$	20	1.078	1.5844	VII-687
2409	bromide	C_2H_5COBr	16.4	1.521	1.4578	II-243
2410	camphor (3)	$C_{13}H_{20}O_2$	18.1	1.019	1.4905	VII-697
2411	chloride	C_2H_5COCl	20	1.065	1.4051	II-243
2412	tropein	$C_{11}H_{19}O_2N$	19.6	1.040	1.4743	....
2413	*o*-xylene (*uns*)	$(CH_3)_2C_6H_3CO\cdot C_2H_5$ (1,2,4)	20	0.871	1.5007	*VII-176
2414	**Propyl** acetate	$CH_3CO_2CH_2C_2H_5$	20	0.886	1.3844	II-129
2415	acetate (*iso*)	$CH_3CO_2CH(CH_3)_2$	20	0.872	1.3770	II-130
2416	α′-acetothienone (α)	$C_3H_7C:CHCH:C\cdot(COCH_3)\cdot S$	20	1.061	1.545	XVII-300
2417	acetylacetone	$CH_3COCH(C_3H_7)\cdot COCH_3$	20	0.935	1.4429	**I-846
2418	alcohol (*n*)	$C_2H_5CH_2OH$	20	0.804	1.3854	I-350
2419	alcohol (*iso*)	$(CH_3)_2CHOH$	20	0.785	1.3776	I-360
2420	amine (*n*)	$C_2H_5CH_2NH_2$	16.6	0.72	1.3901	IV-136
2421	amine (*iso*)	$(CH_3)_2CHNH_2$	15.4	0.694	1.3770	IV-152
2422	anisate (*p*)	$CH_3OC_6H_4CO_2C_3H_7$	20	1.09	1.514	....
2423	benzene (*n*)	$C_6H_5CH_2C_2H_5$	20	0.862	1.4920	V-390
2424	benzene (*iso*)	$C_6H_5CH(CH_3)_2$	20	0.862	1.4915	V-393
2425	benzoate (*n*)	$C_6H_5CO_2CH_2C_2H_5$	20.3	1.027	1.5000	IX-112
2426	bromide (*n*)	$C_2H_5CH_2Br$	20	1.354	1.4341	I-108
2427	" (*iso*)	$(CH_3)_2CHBr$	20	1.310	1.4251	I-108
2428	*n*-butyrate (*n*)	$C_2H_5CH_2CO_2CH_2\cdot C_2H_5$	20	0.87	1.4005	II-271
2429	*iso*-butyrate (*n*)	$(CH_3)_2CHCO_2CH_2\cdot C_2H_5$	20	0.87	1.3959	II-291
2430	chloride (*n*)	$C_2H_5CH_2Cl$	20	0.890	1.3884	I-104
2431	" (*iso*)	$(CH_3)_2CHCl$	15	0.868	1.3811	**I-73
2432	chloroformate (*n*)	$ClCO_2CH_2C_2H_5$	20	1.090	1.4035	III-11
2433	1-cyanocyclohexan-2-one (1)	$C_3H_7(CN)\cdot CCO(CH_2)_3CH_2$	20	0.997	1.467	....
2434	cyclohexan-1-ol (*iso*) (1)	$(CH_3)_2CH\cdot COH(CH_2)_4CH_2$	15.5	0.914	1.4642	*VI-15
2435	cyclopentane (*n*)	$C_3H_7\cdot C_5H_9$	20	0.776	1.4263	**V-22
2436	" (*iso*)	$C_3H_7\cdot C_5H_9$	20	0.777	1.4259	**V-22
2437	cymene (2) (1,2,4)	$(CH_3)(C_3H_7)C_6H_3\cdot CH(CH_3)_2$	15	0.869	1.4959	V-452
2438	*n*-decyl ether (*n*)	$C_2H_5CH_2OC_{10}H_{21}$	20	0.797	1.4249	....
2439	dichloroamine (*n*)	$C_2H_5CH_2NCl_2$	23	1.145	1.4525	IV-145
2440	4,6-dimethyl-coumaranone (2, *iso*)	$(CH_3)_2C_6H_2COCH\cdot(C_3H_7)\cdot O$	20	1.048	1.5400	....
2441	ether (*n*)	$(C_2H_5CH_2)_2O$	14.5	0.75	1.3832	I-354
2442	" (*iso*)	$[(CH_3)_2CH]_2O$	23	0.72	1.3678	I-362
2443	formate (*n*)	$HCO_2CH_2C_2H_5$	20	0.901	1.3771	II-21
2444	furfuryl ether (*n*)	$C_2H_5CH_2OCH_2C_4H_3O$	20	0.966	1.4523	XXVII-112

No.	Substance	Formula	*t*,°C.	d_4^t	n_D^t	Beil. Ref.
2445	**Propyl**-furylacrylate (*n*)	$C_4H_3OCH{:}CHCO_2\cdot C_3H_7$	20	1.074	1.5229	....
2446	furylacrylate (*iso*)	$C_4H_3OCH{:}CHCO_2\cdot CH(CH_3)_2$	20	1.050	1.5146	....
2447	glyoxalidine	$C_3H_7C{:}NCH_2CH_2NH$	17	0.964	1.4871	XXIII-35
2448	hepta-1,6-diene-4-ol (4)	$(CH_2{:}CHCH_2)_2COH\cdot CH_2C_2H_5$	21.1	0.865	1.4568	I-462
2449	heptan-4-ol (4)	$(C_2H_5CH_2)_3COH$	21	0.834	1.4356	I-426
2450	hept-1-ene-4-ol (4)	$(C_3H_7)_2COHCH_2\cdot CH{:}CH_2$	19	0.845	1.4445	I-452
2451	2-hydroxydiphenyl (3)	$(C_3H_7)(OH)C_6H_3\cdot C_6H_5$	20	1.047	1.579	....
2452	indazole (1)	$C_2H_5CH_2N\cdot C_6H_4\cdot$ $CH{:}N$	20	1.039	1.563	....
2453	" (1, *iso*)	$(CH_3)_2CHN\cdot C_6H_4\cdot$ $CH{:}N$	20	1.037	1.561	....
2454	" (2, *iso*)	$(CH_3)_2CHN\cdot N{:}$ $C_6H_4{:}CH$	20	1.051	1.580	....
2455	iodide (*n*)	$C_2H_5CH_2I$	20	1.743	1.5055	I-113
2456	" (*iso*)	$(CH_3)_2CHI$	20	1.703	1.4997	I-114
2457	menthatriene (2) †	$C_{13}H_{20}$	15	0.880	1.5027	V-452
2458	nitrate (*n*)	$C_2H_5CH_2ONO_2$	20	1.058	1.3972	I-355
2459	nitrite (*n*)	$C_2H_5CH_2ONO$	20	0.935	1.3613	I-355
2460	nonane (5)	$(C_4H_9)_2CHC_3H_7$	20	0.756	1.4228	**I-134
2461	phenyl ketone (*n*)	$C_2H_5CH_2COC_6H_5$	18.3	0.990	1.5202	VII-313
2462	" " (*iso*)	$(CH_3)_2CHCOC_6H_5$	16.6	0.99	1.5192	VII-316
2463	propenyl-*o*-phenyleneamidine	$C_3H_7N\cdot C_6H_4\cdot N{:}C\cdot$ C_2H_5	20.8	1.034	1.5626	....
2464	propionate (*n*)	$C_2H_5CO_2CH_2C_2H_5$	20	0.883	1.3933	II-240
2465	propylideneamine	$C_2H_5CH{:}NC_3H_7$	17.5	0.760	1.4127	IV-141
2466	*iso*-propylmalonate	$CH_2(CO_2C_3H_7)_2$	20	0.98	1.4259	....
2467	styryl ketone (*n*)	$C_3H_7COCH{:}CHC_6H_5$	24	0.992	1.5680	VII-376
2468	" " (*iso*)	$(CH_3)_2CHCOCH{:}CHC_6H_5$	24.6	0.986	1.5669	VII-376
2469	*iso*-thiocyanate	$C_2H_5CH_2NCS$	16	0.978	1.5085	IV-145
2470	toluene (*o*)	$CH_3C_6H_4CH_2C_2H_5$	20	0.874	1.4993	V-418
2471	" (*m*)	$CH_3C_6H_4CH_2C_2H_5$	20	0.862	1.4951	V-418
2472	" (*p*)	$CH_3C_6H_4CH_2C_2H_5$	20	0.859	1.493	V-419
2473	*p*-tolyl ketone (*n*)	$C_2H_5CH_2COC_6H_4CH_3$	20	0.97	1.5250	VII-330
2474	" " (*iso*)	$(CH_3)_2CHCOC_6H_4\cdot CH_3$	21.2	0.968	1.5187	VII-331
2475	*iso*-valerate (*n*)	$(CH_3)_2CHCH_2CO_2\cdot CH_2C_2H_5$	17.8	0.87	1.4041	II-312
2476	*iso*-valerate (*iso*)	$(CH_3)_2CHCH_2CO_2\cdot CH(CH_3)_2$	20(?)	0.85	1.397	II-312
2477	*o*-xylene (*uns*) (*n*)	$(CH_3)_2C_6H_3C_3H_7$ (1,2,4)	20	0.866	1.4955	V-440
2478	**Propylene** glycol (*α*)	$CH_3CHOHCH_2OH$	27	1.03	1.4293	I-472

† Probably a mixture of isomers.

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2479	**Propylene** mono-acetate (*α*)	$CH_3CO_2CH_2CHOH\cdot CH_3$	20(?)	1.055	1.4197	II-142
2480	**Propylidene** cyclohexane (*iso*)	$(CH_3)_2C:C(CH_2)_4\cdot CH_2$	20	0.836	1.4723	V-77
2481	cyclopentanone (*iso*, 1)	$(CH_3)_2C:CCO\cdot (CH_2)_2CH_2$	20	0.957	1.4932	*VII-52
2482	**Pulegene**	C_9H_{16}	22	0.791	1.4380	V-80
2483	**Pulegol** (*iso*) (*l*)	$C_{10}H_{18}O$	20	0.911	1.4723	**VI-70
2484	" (*iso*)	$C_{10}H_{18}O$	20(?)	0.914	1.4729	VI-65
2485	**Pulegone**	$C_{10}H_{16}O$	20	0.932	1.4880	VII-81
2486	" (*iso*)	$C_{10}H_{16}O$	20	0.919	1.4690	VII-85
2487	**Pulenenone** (*α,β*)	$(CH_3)_2CCOCH:C\cdot (CH_3)CH_2CH_2$	16.5	0.932	1.4796	VII-67
2488	" (*β,γ*)	$(CH_3)_3C_6H_5CO$	17.7	0.906	1.4558	VII-66
2489	**Pulenol** (*dl*)	$C_9H_{18}O$	16.5	0.91	1.4632	VI-22
2490	" (*β,γ*)	$(CH_3)_2CCH:CHCH\cdot (CH_3)CH_2CHOH$	18.5	0.921	1.4740	VI-50
2491	**Pyrazine** (m.p. 53°)	$N:CHCH:NCH:CH$	60.9	1.031	1.4953	XXIII-91
2492	**Pyrazole** (m.p. 70°)	$CH:CHCH:N\cdot NH$	99.8	1.001	1.4703	XXIII-39
2493	**Pyridazine**	$CH:CHCH:CHN:N$	23.5	1.104	1.5231	XXIII-89
2494	**Pyridine**	C_5H_5N	20	0.982	1.509	XX-181
2495	**Pyridyl-*α*-aldehyde**	C_6H_5ON	18.5	1.13	1.5389	*XXI-287
2496	**Pyrone** (1,4) (m.p. 32.5°)	$C_5H_4O_2$	40.3	1.190	1.5238	XVII-271
2497	**Pyrrole**	$(CH:CH)_2NH$	20	0.948	1.5035	XX-159
2498	**Pyruvic acid**	CH_3COCO_2H	15.3	1.3	1.4303	III-608
2499	**Quinoline**	$C_6H_4\cdot CH:CH\cdot CH:N$	18.2	1.09	1.6283	XX-339
2500	" (*iso*)	$C_6H_4\cdot CH:CH\cdot N:CH$	25.1	1.09	1.6223	XX-380
2501	**Quinoxaline** (m.p. 30°)	$C_6H_4N:CH\cdot CH:N$	48	1.133	1.6231	XXIII-176
2502	**Sabinene**	$C_{10}H_{16}$	20	0.842	1.4678	V-143
2503	**Sabinol**	$C_{10}H_{16}O$	20(?)	0.943	1.488	VI-98
2504	**Safrole**	$CH_2:O_2:C_6H_3C_3H_5$	19	1.097	1.5390	XIX-39
2505	" (*iso*) (*trans*)	$CH_3CH:CHC_6H_3:O_2:CH_2$	19.3	1.12	1.5759	XIX-35
2506	**Salicylaldehyde** (*o*)	HOC_6H_4CHO	19.7	1.166	1.5736	VIII-31
2507	**Salicylaldehyde** (*homo*) (*p*) (m.p. 56°)	$HOC_6H_3(CH_3)CHO$ (6,3,1)	59.2	1.091	1.5466	VIII-100
2508	**Santalene** (*α*)	$C_{15}H_{24}$	15	0.913	1.4921	V-462
2509	" (*β*)	$C_{15}H_{24}$	20	0.894	1.4946	V-463
2510	" (*γ*)	$C_{15}H_{24}$	20	0.936	1.5042	V-463
2511	**Santalol** (*α*)	$C_{15}H_{24}O$	20	0.978	1.4992	VI-558

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2512	**Santalol** (β)	$C_{15}H_{24}O$	20	0.972	1.5091	VI-558
2513	**Santene**	C_9H_{14}	20	0.87	1.4644	V-122
2514	**Sebacic acid** (m.p. 134°)	$(CH_2)_8(CO_2H)_2$	133	.....	1.42	II-718
2515	**Sebacyl chloride**	$[(CH_2)_4COCl]_2$	18.3	.....	1.4684	II-719
2516	**Selenium diethyl**	$(C_2H_5)_2Se$	20	1.24	1.4768	I-349
2517	*n*-propyl hydride	$C_2H_5CH_2SeH$	20	1.302	1.4756	I-360
2518	**Silicon** methoxide	$Si(OCH_3)_4$	?	.....	1.368	....
2519	methyl-triethyl	$(CH_3)Si(C_2H_5)_3$	20	0.744	1.4160	....
2520	*n*-propyl trichloride	$(C_3H_7)SiCl_3$	20.3	1.196	1.4312	IV-630
2521	tetra-*n*-butyl	$(C_4H_9)_4Si$	20	0.801	1.4465	....
2522	tetraethyl	$(C_2H_5)_4Si$	20	0.766	1.4268	IV-625
2523	tetramethyl	$(CH_3)_4Si$	18.7	0.648	1.3591	IV-625
2524	tri-*n*-amyl fluoride	$(C_5H_{11})_3SiF$	20	0.839	1.4305	....
2525	tri-*n*-butyl fluoride	$(C_4H_9)_3SiF$	20	0.837	1.4250	....
2526	triethyl-*n*-amyl	$(C_2H_5)_3Si(C_5H_{11})$	20	0.784	1.4377	....
2527	triethyl-*n*-butyl	$(C_2H_5)_3Si(C_4H_9)$	20	0.779	1.4348	*IV-580
2528	triethyl-*n*-decyl	$(C_2H_5)_3Si(C_{10}H_{21})$	20	0.804	1.4472	....
2529	triethyl fluoride	$(C_2H_5)_3SiF$	20	0.835	1.3900	....
2530	triethyl-*n*-heptyl	$(C_2H_5)_3Si(C_7H_{15})$	20	0.791	1.4422	....
2531	triethyl-*n*-hexyl	$(C_2H_5)_3Si(C_6H_{13})$	20	0.788	1.4400	....
2532	triethyl-*n*-octyl	$(C_2H_5)_3Si(C_8H_{17})$	20	0.797	1.4438	....
2533	triethyl-*n*-propyl	$(C_2H_5)_3Si(C_3H_7)$	20	0.772	1.4308	*IV-580
2534	trimethyl-*n*-amyl	$(CH_3)_3Si(C_5H_{11})$	20	0.731	1.4096	....
2535	trimethyl-*n*-butyl	$(CH_3)_3Si(C_4H_9)$	20	0.718	1.4030	*IV-580
2536	trimethyl-*n*-decyl	$(CH_3)_3Si(C_{10}H_{21})$	20	0.771	1.4310	....
2537	trimethyl-*n*-dodecyl	$(CH_3)_3Si(C_{12}H_{25})$	20	0.780	1.4358	....
2538	trimethyl-ethyl	$(CH_3)_3Si(C_2H_5)$	20	0.685	1.3820	*IV-579
2539	trimethyl-*n*-heptyl	$(CH_3)_3Si(C_7H_{15})$	20	0.751	1.4201	....
2540	trimethyl-*n*-hexyl	$(CH_3)_3Si(C_6H_{13})$	20	0.742	1.4154	....
2541	trimethyl-*n*-octyl	$(CH_3)_3Si(C_8H_{17})$	20	0.758	1.4242	....
2542	trimethyl-*n*-propyl	$(CH_3)_3Si(C_3H_7)$	20	0.702	1.3929	*IV-580
2543	trimethyl-*n*-tetradecyl	$(CH_3)_3Si(C_{14}H_{29})$	20	0.791	1.4410	....
2544	tri-*n*-propyl fluoride	$(C_3H_7)_3SiF$	20	0.834	1.4107	....
2545	**Sorbyl chloride**	$CH_3(CH{:}CH)_2COCl$	20	1.065	1.5562	II-484
2546	**Sparteine**	$C_{15}H_{26}N_2$	19	1.024	1.5289	....
2547	" (*iso*)	$C_{15}H_{26}N_2$	17	1.028	1.5332	....
2548	**Spinacene**	$C_{29}H_{48}$	20	0.862	1.4956	*I-129
2549	**Stearic acid** (m.p. 69°)	$CH_3(CH_2)_{16}CO_2H$	70	0.847	1.4335	II-377
2550	**Styrene**	$C_6H_5CH{:}CH_2$	20	0.906	1.5469	V-474
2551	**Suberyl chloride**	$[(CH_2)_3COCl]_2$	20.6	1.172	1.4685	II-694
2552	**Succinic** aldehyde	$(CH_2CHO)_2$	18	1.069	1.4262	I-767
2553	nitrile (m.p. 55°)	$(CH_2CN)_2$	63.1	0.985	1.4165	II-615
2554	**Succinyl chloride**	$(CH_2COCl)_2$	15.2	1.39	1.4735	II-613
2555	**Sulfur** dichloride	SCl_2	14	.....	1.557	....
2556	dioxide	SO_2	20(?)	.....	1.410	....
2557	monobromide	S_2Br_2	....	.....	1.736	....
2558	monochloride	S_2Cl_2	14	.....	1.666	....
2559	**Sulfuric acid**	H_2SO_4	20(?)	.....	1.429	....
2560	**Sulfuryl chloride**	SO_2Cl_2	20(?)	.....	1.444	....
2561	**Sylvestrine**	$C_{10}H_{16}$	20	0.848	1.4757	V-125
2562	**Tellurium** diethyl	$(C_2H_5)_2Te$	15	1.599	1.5182	I-350
2563	diphenyl	$(C_6H_5)_2Te$	15.8	1.603	1.6930	VI-347
2564	**Terpinene** (α)	$C_{10}H_{16}$	19.4	0.836	1.4781	V-126

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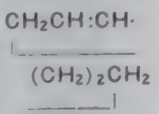
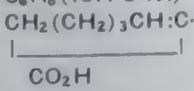
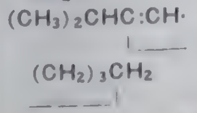
No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
2565	**Terpinene** (β)	$C_{10}H_{16}$	22	0.838	1.4754	V-132
2566	**Terpinenol** (4) (*d*)	$C_{10}H_{18}O$	19	0.93	1.4785	VI-55
2567	" (α)***d***(***l***)	$C_{10}H_{18}O$	16	0.93	1.4762	VI-56
2568	" (α) (***dl***) (m.p. 35°)	$C_{10}H_{18}O$	20	0.936	1.4827	VI-58
2569	**Terpineol** (β) (m.p. 33°)	$C_{10}H_{18}O$	20	0.919	1.4747	VI-62
2570	**Terpineol** (γ) (m.p. 69°)	$C_{10}H_{18}O$	80	0.895	1.47	VI-61
2571	**Terpinolene**	$C_{10}H_{16}$	19	0.855	1.480	V-133
2572	**Tetrabromo**-butane (1,1,4,4)	$Br_2CHCH_2CH_2CHBr_2$	20	2.529	1.6077	I-121
2573	ethane (1,1,1,2)	Br_3CCH_2Br	20	2.875	1.6277	I-94
2574	" (1,1,2,2)	$Br_2CHCHBr_2$	20	2.967	1.6380	I-94
2575	**Tetrachloro**-ethane (1,1,1,2)	CH_2ClCCl_3	23.2	1.58	1.4816	I-86
2576	ethane (1,1,2,2)	$Cl_2CHCHCl_2$	18.5	1.6	1.4921	I-86
2577	ethylene	$Cl_2C{:}CCl_2$	20	1.619	1.5055	I-187
2578	**Tetracosane** (*n*) (m.p. 54°)	$CH_3(CH_2)_{22}CH_3$	65	0.77	1.4303	I-175
2579	**Tetradecane** (*n*)	$CH_3(CH_2)_{12}CH_3$	20	0.765	1.4459	I-171
2580	**Tetraethyl**-benzene (1,2,3,4)	$(C_2H_5)_4C_6H_2$	19.6	0.887	1.5085	V-455
2581	**Tetraethyl**-benzene (1,2,4,5)	$(C_2H_5)_4C_6H_2$	16	0.888	1.5041	V-455
2582	citrate	$C_5H_9O(CO_2C_2H_5)_3$	20	1.102	1.4484	III-568
2583	cyclobutane-2,4-dione	$(C_2H_5)_4C_2(CO)_2$ (1,1,3,3)	17.8	0.946	1.4518	*VII-321
2584	diaminobenzene (*o*)	$C_6H_4[N(C_2H_5)_2]_2$	12.6	0.927	1.5213	....
2585	diaminonaphthalene (1,4) (m.p. 47°)	$C_{10}H_6[N(C_2H_5)_2]_2$	99.6	0.932	1.5394	....
2586	diaminonaphthalene (1,5) (m.p. 41°)	$C_{10}H_6[N(C_2H_5)_2]_2$	26.8	0.989	1.5742	....
2587	diaminonaphthalene (1,8) (m.p. 31°)	$C_{10}H_6[N(C_2H_5)_2]_2$	18	1.012	1.5951	....
2588	dioxalylmalonate	$(C_2H_5O_2CCO)_2C{:}(CO_2C_2H_5)_2$	14.9	1.193	1.4567	*III-199
2589	methane-tetra-carboxylate	$C(CO_2C_2H_5)_4$	17	1.136	1.436	*II-331
2590	oxalylmethane-tricarboxylate	$C_2H_5O_2CCOC(CO_2{\cdot}C_2H_5)_3$	15.5	1.167	1.4403	*III-298
2591	*m*-phenylene-diamine	$C_6H_4[N(C_2H_5)_2]_2$	11.8	0.952	1.5537	....
2592	**Tetrahydro-** benzene	 $CH_2CH{:}CH{\cdot}(CH_2)_2CH_2$	22.1	0.808	1.4451	V-63
2593	benzisoxazole (β,γ)	$C_6H_8(:CH{\cdot}O{\cdot}N:)$	20	1.095	1.498	....
2594	benzoic acid (Δ¹) (m.p. 29°)	 $CH_2(CH_2)_3CH{:}C{\cdot}CO_2H$	47.2	1.072	1.4903	IX-41
2595	cumene	 $(CH_3)_2CHC{:}CH{\cdot}(CH_2)_3CH_2$	15.2	0.83	1.4615	V-77
2596	cumene (*pseudo*)	$(CH_3)_3C_6H_7$ (1,2,4)	16.2	0.808	1.4499	*V-40

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No.	Substance	Formula	t,°C.	$d_4{}^t$	$n_D{}^t$	Beil. Ref.
2597	**Tetrahydro**-furfuryl alcohol	$C_4H_7OCH_2OH$	19	1.052	1.4502	....
2598	furfuryl benzyl ether	$C_4H_7OCH_2OCH_2\cdot C_6H_5$	20	1.048	1.5174	....
2599	furfuryl chloride	$C_4H_7OCH_2Cl$	20	1.110	1.4560	....
2600	furoic acid	$C_4H_7OCO_2H$	20	1.193	1.4585	*XVIII-435
2601	mesitylene	$(CH_3)_3C_6H_7$ (1,3,5)	21	0.797	1.4447	*V-40
2602	naphthalene (1,2,3,4)	$C_6H_4CH_2(CH_2)_2CH_2$	20	0.97	1.5402	V-491
2603	*α*-naphthol (1,2,3,4)	$C_6H_4(CH_2)_3CHOH$	17	1.09	1.5671	....
2604	*α*-naphthylamine (*ar*)	$NH_2C_6H_3CH_2\cdot$ $(CH_2)_2CH_2$	23.1	1.054	1.5896	XII-1197
2605	*β*-naphthylamine (*ac*)	$C_6H_4CH_2CH(NH_2)\cdot$ CH_2CH_2	22.2	1.03	1.5604	XII-1200
2606	*β*-naphthylamine (*ar*) (m.p. 38°)	$NH_2C_6H_3(CH_2)_3CH_2$	22.2	1.029	1.5604	XII-1198
2607	quinoline (1,2,3,4)	$C_6H_4CH_2CH_2CH_2NH$	23.9	1.05	1.5933	XX-262
2608	*iso*-quinoline	$C_9H_{11}N$ (1,2,3,4)	23.1	1.07	1.5798	XX-275
2609	toluene (1,2,5,6)	$CH_3C_6H_9$	16	0.8	1.4443	V-67
2610	" (1,2,3,4)	$CH_3C_6H_9$	20	0.805	1.4454	V-67
2611	" (Δ^1)	$CH_3C_6H_9$	20	0.810	1.4496	V-66
2612	*m*-toluic acid (Δ^1)	$CH_2(CH_2)_2CH\cdot$ $(CH_3)CH{:}CCO_2H$	69	1.013	1.476	IX-47
2613	*o*-xylene (Δ^1)	$(CH_3)_2C_6H_8$	20	0.823	1.4587	V-72
2614	*m*-xylene (1,2,3,4)	$(CH_3)_2C_6H_8$	20	0.798	1.441	V-78
2615	*p*-xylene (1,2,3,6)	$(CH_3)_2C_6H_8$	20	0.802	1.4459	V-74
2616	**Tetramethyl**-benzene (1,2,3,4)	$(CH_3)_4C_6H_2$	20	0.905	1.5201	V-430
2617	benzene (1,2,3,5)	$(CH_3)_4C_6H_2$	20	0.890	1.5125	V-430
2618	" (1,2,4,5)	$(CH_3)_4C_6H_2$	20	0.889	1.512	V-431
2619	butenediol (*cis*) (m.p. 76°)	$[(CH_3)_2C(OH)CH{:}]_2$	69	0.869	1.422	*I-260
2620	butenediol (*trans*) (m.p. 69°)	$[(CH_3)_2C(OH)CH{:}]_2$	99.2	0.863	1.422	*I-261
2621	coumaranone (2,2,4,6) (m.p. 41°)	$(CH_3)_2C_6H_2CO\cdot$ $C(CH_3)_2\cdot O$	20	1.060	1.5428	....
2622	cyclohexa-2,5-diene-4-ol	$(CH_3)_4C_6H_3OH$ (1,1,2,4)	20	0.925	1.4824	**VI-102
2623	cyclohexane (1,2,4,5)	$(CH_3)_4C_6H_8$	13.1	0.791	1.4372	*V-23
2624	cyclohexan-1-ol (1,2,4,5)	$(CH_3)_4C_6H_7OH$	18.1	0.898	1.4595	*VI-30
2625	cyclohexan-2-ol (m.p. 53°)	$(CH_3)_4C_6H_7OH$ (1,1,4,4)	30.2	0.894	1.4571	*VI-30
2626	cyclohexan-2-one (m.p. 18°)	$(CH_3)_4C_5H_6CO$ (1,1,4,4)	14.3	0.893	1.4485	*VII-38

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2627	**Tetramethyl**-cyclohex-1-ene	$(CH_3)_4C_6H_6$ (1,2,4,5)	16.5	0.820	1.4588	*V-45
2628	cyclohexyl-1-chloride	$(CH_3)_4C_6H_7Cl$ (1,2,4,5)	20	0.936	1.4624	*V-24
2629	4-ethylidene-cyclohexa-2,5-diene (1,1,2,5)	$(CH_3)_4C_6H_2:CHCH_3$	20	0.880	1.5125	**V-341
2630	4-methene-cyclohexa-2,5-diene (1,1,2,6)	$(CH_3)_4C_6H_2:CH_2$	20	0.879	1.5149	**V-336
2631	4-methene-cyclohexa-2,5-diene (1,1,2,5)	$(CH_3)_4C_6H_2:CH_2$	20	0.877	1.5147	**V-336
2632	pentane (2,2,3,3)	$(CH_3)_3CC(CH_3)_2\cdot C_2H_5$	20	0.757	1.4234	....
2633	" (2,2,3,4)	$(CH_3)_3CCH(CH_3)\cdot CH(CH_3)_2$	20	0.739	1.4146	....
2634	" (2,2,4,4)	$[(CH_3)_3C]_2CH_2$	20	0.720	1.4068	....
2635	" (2,3,3,4)	$[(CH_3)_2CH]_2C(CH_3)_2$	20	0.755	1.4220	....
2636	piperidine (*N*,2,4,6)	$(CH_3)_4C_5H_7N$	19.7	0.823	1.4430	XX-129
2637	pyrazole (1,3,4,5)	$CH_3C:(C\cdot CH_3)_2:N\cdot N$ ⌊____________⌋ CH_3	20	0.947	1.480	XXIII-82
2638	**Tetranitromethane**	$C(NO_2)_4$	17	1.65	1.4399	I-80
2639	**Tetrolic aldehyde**	$CH_3C\vdots CCHO$	17	0.927	1.4467	*I-388
2640	**Thionaphthene** (m.p. 32°)	$C_6H_4\cdot CH:CH\cdot S$ ⌊____________⌋	36.2	1.15	1.6332	XVII-59
2641	**Thionyl chloride**	$SOCl_2$	10	.....	1.527	....
2642	**Thiophene**	$CH:CHCH:CHS$ ⌊____________⌋	19.7	1.065	1.5287	XVII-29
2643	**Thiophenol**	C_6H_5SH	23.2	1.074	1.5861	VI-294
2644	**Thiophosgene**	$SCCl_2$	15(?)	1.509	1.5442	III-134
2645	**Thujane**	$C_{10}H_{18}$	20	0.814	1.4376	V-93
2646	**Thujene** (*α*)	$C_{10}H_{16}$	20	0.830	1.4515	V-142
2647	" (*β*)	$C_{10}H_{16}$	20	0.821	1.4471	V-143
2648	**Thujone** (*α*)	$C_{10}H_{16}O$	20	0.912	1.4530	VII-93
2649	" (*β*)	$C_{10}H_{16}O$	17.6	0.92	1.4522	VII-93
2650	**Thujyl alcohol**	$C_{10}H_{17}OH$	20	0.921	1.4635	VI-68
2651	**Thymol** (m.p. 52°)	$(CH_3)(C_3H_7):C_6H_3OH$ (1,4,3)	20	0.969	1.5227	VI-532
2652	**Tiglic** acid (*trans*) (m.p. 64°)	$CH_3CH:C(CH_3)\cdot CO_2H$	76	0.964	1.44	II-430
2653	aldehyde	$CH_3CH:C(CH_3)CHO$	9.6	0.88	1.4512	I-733
2654	**Tin** tetraethyl	$(C_2H_5)_4Sn$	19.7	1.199	1.4724	IV-632
2655	tetramethyl	$(CH_3)_4Sn$	20(?)	1.3	1.5201	IV-632
2656	triethyl	$[(C_2H_5)_3Sn]_2$	17.8	1.4	1.5374	IV-638
2657	**Titanium** tetrachloride	$TiCl_4$	10.5	.....	1.61	....
2658	**Tolualdehyde** (*o*)	$CH_3C_6H_4CHO$	19	1.038	1.5485	VII-295
2659	" (*m*)	$CH_3C_6H_4CHO$	21.4	1.02	1.5407	VII-296
2660	" (*p*)	$CH_3C_6H_4CHO$	16.6	1.019	1.5469	VII-297
2661	**Toluene**	$C_6H_5CH_3$	20	0.867	1.4969	V-280
2662	**Toluic** acid (*o*) (m.p. 105°)	$CH_3C_6H_4CO_2H$	114.6	1.062	1.512	IX-462
2663	**Toluic** acid (*m*) (m.p. 110°)	$CH_3C_6H_4CO_2H$	111.6	1.054	1.51	IX-475

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No.	Substance	Formula	*t*,°C.	d_4^t	n_D^t	Beil. Ref.
2664	**Toluidine** (*o*)	$CH_3C_6H_4NH_2$	20	0.999	1.5728	XII-772
2665	" (*m*)	$CH_3C_6H_4NH_2$	22.4	0.99	1.5711	XII-853
2666	" (*p*) (m.p. 45°)	$CH_3C_6H_4NH_2$	59.1	0.97	1.5532	XII-880
2667	**Tolunitrile** (*o*)	$CH_3C_6H_4CN$	23.1	0.99	1.5272	IX-466
2668	**Toluquinoxaline**	$CH_3C_6H_3{\cdot}N:(CH)_2:N$	18.4	1.118	1.6211	XXIII-184
2669	**Tolyl** *iso*-butyrate (*o*)	$(CH_3)_2CHCO_2C_6H_4{\cdot}CH_3$	20	1.001	1.491	....
2670	α-ethylcrotonate (*p*)	$CH_3CH:C(C_2H_5){\cdot}CO_2C_6H_4CH_3$	20	1.009	1.513	....
2671	**Triallyl** citrate	$(CH_2CO_2C_3H_5)_2:C(OH)CO_2C_3H_5$	17.4	1.136	1.4714	*III-197
2672	phenol (*o,o,p*)	$(C_3H_5)_3C_6H_2OH$	20	0.974	1.541	*VI-322
2673	tricarballylate	$(CH_2CO_2C_3H_5)_2:CHCO_2C_3H_5$	15.9	1.097	1.4675	*II-322
2674	**Triamyl**-amine†	$(C_5H_{11})_3N$	22	0.845	1.4128	....
2675	borate†	$(C_5H_{11}O)_3B$	22	0.845	1.4128	I-404
2676	**Triazobenzene**	$C_6H_5N_3$	22.5	1.086	1.5642	V-276
2677	**Triazole** (1,2,5)	$CH:N{\cdot}NH{\cdot}N:CH$	25.3	1.186	1.4854	XXVI-11
2678	**Tribromo**-butane	$CH_3(CHBr)_2CH_2Br$ (1,2,3)	20	2.19	1.567	I-121
2679	ethane (1,1,2)	$BrCH_2CHBr_2$	20	2.579	1.5890	I-93
2680	ethylene	$BrCH:CBr_2$	20	2.708	1.5992	I-191
2681	pentane (1,2,3)	$C_2H_5(CHBr)_2CH_2Br$	20	2.09	1.559	**I-98
2682	propane (1,2,3)	$BrCH_2CHBrCH_2Br$	23	2.436	1.6	I-112
2683	**Tributyl**-amine (*n*)	$(C_4H_9)_3N$	20	0.778	1.4291	IV-157
2684	amine (*iso*)	$(C_4H_9)_3N$	17.3	0.771	1.4252	IV-666
2685	borate (*iso*)	$(C_4H_9O)_3B$	20	0.858	1.4086	I-377
2686	citrate (*n*)	$C_6H_5O_7(C_4H_9)_3$	20	1.04	1.4091	....
2687	phosphate (*n*)	$(C_4H_9O)_3PO$	20	0.979	1.4245	**I-397
2688	**Tricaprin** (m.p. 31°)	$C_{33}H_{62}O_6$	40	0.921	1.4446	II-356
2689	**Trichloro**-benzene	$C_6H_3Cl_3$ (1,2,4)	20	1.45	1.5671	V-204
2690	bromomethane	Cl_3CBr	20	1.94	1.5300	I-67
2691	crotononitrile	$Cl_3CCH:CHCN$	20	1.420	1.5083	**II-398
2692	crotonyl chloride	$Cl_3CCH:CHCOCl$	20	1.528	1.5176	**II-398
2693	1,1-dibromo-ethane (2,2,2)	Br_2CHCCl_3	25.7	2.3	1.5299	I-93
2694	ethane (1,1,1)	CH_3CCl_3	21	1.32	1.4377	I-85
2695	" (1,1,2)	$CH_2ClCHCl_2$	22	1.446	1.4719	I-85
2696	ethylene	$CHCl:CCl_2$	19.8	1.463	1.4777	I-187
2697	furan (2,3,4)	C_4HOCl_3	20	1.547	1.5057	....
2698	methylchloro-formate	$ClCO_2CCl_3$	22	1.65	1.4566	III-18
2699	non-3-yne-2-ol (1,1,1)	$Cl_3CCHOHC\vdots C(CH_2)_4CH_3$	9.9	1.234	1.5000	I-456
2700	**Tricosane** (*n*) (m.p. 47°)	$CH_3(CH_2)_{21}CH_3$	80.8	0.7	1.4236	I-175
2701	**Tricresyl phosphate** (*o*)	$(CH_3C_6H_4O)_3PO$	20	1.17	1.556	VI-358
2702	**Tridecane** (*n*)	$CH_3(CH_2)_{11}CH_3$	16.8	0.76	1.4419	I-171
2703	**Triethanolamine**	$N(CH_2CH_2OH)_3$	20	1.124	1.4852	IV-285
2704	**Triethyl** aconitate	$C_{12}H_{18}O_6$	20	1.106	1.4556	II-852

† Contains amyl group in its various isomeric forms.

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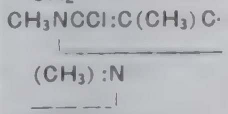
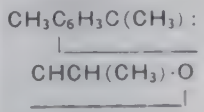
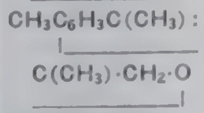
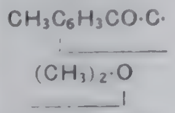
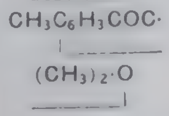
2705	**Triethyl**-acetyl-methanetricarboxylate	$CH_3COC(CO_2C_2H_5)_3$	13.5	1.128	1.4366	*III-294
2706	amine	$(C_2H_5)_3N$	20	0.728	1.4003	IV-99
2707	benzene (1,3,5)	$(C_2H_5)_3C_6H_3$	17	0.86	1.4951	V-449
2708	borate	$(C_2H_5O)_3B$	20	0.88	1.3808	I-335
2709	citrate	$C_3H_5O(CO_2C_2H_5)_3$	20	1.137	1.4455	III-568
2710	methane-tricarboxylate	$HC(CO_2C_2H_5)_3$	16.2	1.108	1.4275	II-810
2711	oxalylmalonate	$C_2H_5O_2CCOCH{:}(CO_2C_2H_5)_2$	16.1	1.160	1.4496	III-850
2712	phosphate	$(C_2H_5O)_3PO$	17.1	1.07	1.4067	I-332
2713	phosphine	$(C_2H_5)_3P$	15	0.800	1.458	IV-582
2714	phosphite	$(C_2H_5O)_3P$	10	0.97	1.4131	I-330
2715	**Trifluoro**-1,2-dibromoethane (1,1,2)	$CBrF_2CHBrF$	14	2.254	1.4145	I-92
2716	1,1,2-tribromo-ethane (1,2,2)	$CFBr_2CBrF_2$	20(?)	2.6	1.4666	I-94
2717	**Triformal**-ethylamine	$(HCH{:}NC_2H_5)_3$	20.2	0.894	1.4604	XXVI-2
2718	methylamine	$(H_2C{:}NCH_3)_3$	19	0.918	1.4632	XXVI-1
2719	propylamine	$(H_2C{:}NC_3H_7)_3$	18.8	0.880	1.4597	XXVI-3
2720	**Trimethyl**-acetic acid (m.p. 35.5°)	$(CH_3)_3CCO_2H$	36.5	0.91	1.3931	II-319
2721	acetophenone (2,4,5)	$(CH_3)_3C_6H_2COCH_3$	14.9	1.004	1.5411	VII-333
2722	acetophenone (2,4,6)	$(CH_3)_3C_6H_2COCH_3$	20	0.975	1.5175	VII-332
2723	benzene (1,2,3)	$(CH_3)_3C_6H_3$	20	0.894	1.5139	V-399
2724	" (1,2,4)	$(CH_3)_3C_6H_3$	20	0.876	1.5049	V-400
2725	" (1,3,5)	$(CH_3)_3C_6H_3$	20	0.865	1.4994	V-406
2726	butane (2,2,3)	$(CH_3)_3CCH(CH_3)_2$	20	0.690	1.3895	**I-121
2727	but-3-ene (2,2,3)	$(CH_3)_3CC(CH_3){:}CH_2$	20	0.705	1.4029	I-221
2728	5-chloropyrazole (1,3,4)	 $CH_3NCCl{:}C(CH_3)C\cdot$ $(CH_3){:}N$	20	1.108	1.487	....
2729	α-chromene (2,4,6)	 $CH_3C_6H_3C(CH_3){:}$ $CHCH(CH_3)\cdot O$	20	1.012	1.5513	....
2730	α-chromene (3,4,6)	 $CH_3C_6H_3C(CH_3){:}$ $C(CH_3)\cdot CH_2\cdot O$	20	1.029	1.5575	....
2731	coumaranone (2,2,5)	 $CH_3C_6H_3CO\cdot C\cdot$ $(CH_3)_2\cdot O$	19.3	1.073	1.5404	*XVII-166
2732	coumaranone (2,2,7) (m.p. 68°)	 $CH_3C_6H_3COC\cdot$ $(CH_3)_2\cdot O$	100.6	1.001	1.507	....

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2733	**Trimethyl**-coumaranone (2,4,6)	$(CH_3)_2C_6H_2COCH\cdot$ $(CH_3)\cdot O$	19.2	1.099	1.5574	*XVII-68
2734	coumarone (2,3,5)	$CH_3C_6H_3C(CH_3):C\cdot$ $(CH_3)\cdot O$	20	1.021	1.5506	....
2735	cyclohexane (1,1,3)	$(CH_3)_3C_6H_9$	25.3	0.787	1.4339	V-42
2736	" (1,2,4)	$(CH_3)_3C_6H_9$	16.9	0.780	1.431	V-42
2737	cyclohexan-2-ol (1,1,2)	$(CH_3)_3C_6H_8OH$	19.9	0.926	1.4679	*VI-16
2738	cyclohexan-5-ol (1,2,4)	$(CH_3)_3C_6H_8OH$	19.2	0.899	1.4585	*VI-17
2739	cyclohexan-1-ol (1,3,5)	$(CH_3)_3C_6H_8OH$	16.3	0.888	1.4537	*VI-17
2740	cyclohexan-4-one (1,1,3)	$(CH_3)_3C_5H_7CO$	19	0.902	1.4545	VII-29
2741	cyclohexan-5-one (1,2,4)	$(CH_3)_3C_5H_7CO$	17.4	0.899	1.4501	*VII-25
2742	cyclohex-2-ene (1,1,2)	$(CH_3)_3C_6H_7$	20.4	0.822	1.4560	*V-39
2743	cyclohex-3-ene (1,1,4)	$(CH_3)_3C_6H_7$	23.2	0.802	1.4442	*V-39
2744	cyclohex-1-ene (1,2,3)	$(CH_3)_3C_6H_7$	11.8	0.835	1.4630	*V-40
2745	cyclohex-1-ene-3-ol (1,3,5)	$(CH_3)_3C_6H_6OH$	19.3	0.913	1.4735	*VI-36
2746	cyclohex-2-ene-4-one (1,1,3)	$(CH_3)_3C_5H_5CO$	16.3	0.933	1.4795	VII-65
2747	cyclohexyl-1-chloride (1,3,5)	$(CH_3)_3C_6H_8Cl$	20	0.929	1.4550	*V-18
2748	cyclopentane (1,1,2)	$(CH_3)_3C_5H_7$	20	0.773	1.4230	V-39
2749	cyclopentane (1,1,3)	$(CH_3)_3C_5H_7$	20	0.748	1.4112	*V-16
2750	cyclopentane (1,2,3) (*cis, cis, cis*)	$(CH_3)_3C_5H_7$	20	0.779	1.4263	V-40
2751	cyclopentane (1,2,3) (*cis, cis, trans*)	$(CH_3)_3C_5H_7$	20	0.770	1.4219	V-40
2752	cyclopentane (1,2,3) (*cis, trans, cis*)	$(CH_3)_3C_5H_7$	20	0.754	1.4144	V-40
2753	cyclopentane (1,2,4) (*cis, cis, cis*)	$(CH_3)_3C_5H_7$	20	0.766	1.422	*V-16
2754	cyclopentane (1,2,4) (*cis, cis, trans*)	$(CH_3)_3C_5H_7$	20	0.763	1.4185	*V-16
2755	cyclopentane (1,2,4) (*cis, trans, cis*)	$(CH_3)_3C_5H_7$	20	0.747	1.4106	*V-16

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No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2756	**Trimethyl-**5-(β,β-dichloroethyl)-benzene (1,2,3)	$(CH_3)_3C_6H_2CH_2\cdot CHCl_2$	20	1.144	1.5439	**V-336
2757	1-dichloromethylcyclohex-3-ene-2-one (1,4,5)	$(CH_3)_3C_5H_4COCHCl_2$	20	1.197	1.5238	....
2758	4-ethylidenecyclohexa-2,5-diene (1,1,3)	$(CH_3)_3C_6H_3{:}CHCH_3$	20	0.879	1.5160	V-442
2759	hexane (2,2,3)	$(CH_3)_3CCH(CH_3)\cdot CH_2C_2H_5$	20	0.729	1.4105	....
2760	" (2,2,4)	$(CH_3)_3CCH_2CH{:}(CH_3)(C_2H_5)$	20	0.716	1.4033	....
2761	" (2,2,5)	$(CH_3)_3CCH_2CH_2\cdot CH(CH_3)_2$	20	0.707	1.3996	*I-64
2762	" (2,3,3)	$(CH_3)_2CHC(CH_3)_2\cdot CH_2C_2H_5$	20	0.738	1.4143	....
2763	" (2,3,4)	$(CH_3)_2CHCH(CH_3)\cdot CH(CH_3)C_2H_5$	20	0.741	1.415	....
2764	" (2,3,5)	$(CH_3)_2CHCH(CH_3)\cdot CH_2CH(CH_3)_2$	20	0.722	1.4060	**I-129
2765	" (2,4,4)	$C_2H_5C(CH_3)_2CH_2\cdot CH(CH_3)_2$	20	0.725	1.4075	....
2766	" (3,3,4)	$C_2H_5C(CH_3)_2CH{:}(CH_3)(C_2H_5)$	20	0.745	1.4178	....
2767	hexan-4-ol (3,3,4)	$(C_2H_5)(CH_3)_2CCOH{:}(CH_3)(C_2H_5)$	20	0.832	1.4345	I-425
2768	2-hydroxystyrene (2′,2′,5)	$(CH_3)(OH)C_6H_3CH{:}C(CH_3)_2$	21.5	0.991	1.5501	*VI-293
2769	isoxazole	$N{:}C(CH_3)C(CH_3){:}$ $C(CH_3)\cdot O$	20	0.981	1.452	XXVII-18
2770	4-methenecyclohexa-2,5-diene	$(CH_3)_3C_6H_3{:}CH_2$ (1,1,2)	20	0.866	1.5139	V-429
2771	2-methoxystyrene (2′,2′,5)	$CH_3(CH_3O)C_6H_3\cdot CH{:}C(CH_3)_2$	17.1	0.968	1.5425	*VI-293
2772	pentane (2,2,3)	$(CH_3)_3CCH(CH_3)\cdot C_2H_5$	20	0.716	1.4030	*I-62
2773	" (2,2,4)	$(CH_3)_3CCH_2CH{:}(CH_3)_2$	20	0.692	1.3915	I-164
2774	" (2,3,3)	$C_2H_5C(CH_3)_2\cdot CH(CH_3)_2$	20	0.726	1.4075	....
2775	" (2,3,4)	$(CH_3)_2CHCH(CH_3)\cdot CH(CH_3)_2$	20	0.719	1.4042	....
2776	pent-1-ene (2,3,3)	$CH_2{:}C(CH_3)C(CH_3)_2\cdot C_2H_5$	20	0.737	1.418	....
2777	" (2,3,4)	$CH_2{:}C(CH_3)CH\cdot (CH_3)CH(CH_3)_2$	20	0.729	1.415	....
2778	pent-4-ene (2,2,3)	$CH_2{:}CHCH(CH_3)\cdot C(CH_3)_3$	20	0.719	1.412	....
2779	" (2,2,4)	$CH_2{:}C(CH_3)CH_2\cdot C(CH_3)_3$	20	0.715	1.4086	....
2780	" (2,3,3)	$CH_2{:}CHC(CH_3)_2\cdot CH(CH_3)_2$	20	0.729	1.414	....
2781	piperidine (2,4,6)	$(CH_3)_3C_5H_8N$	19	0.830	1.4435	XX-126

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2782	**Trimethyl**-pyrazole (1,3,4)	$CH{:}C(CH_3)C\cdot$ $(CH_3){:}N\cdot NCH_3$	20	0.951	1.476	....
2783	“ (1,3,5)	$CH_3C{:}CHC(CH_3){:}$ $N\cdot N(CH_3)$	20	1.034	1.549	XXIII-75
2784	pyrrole (2,3,5)	$CH_3C{:}CHC(CH_3){:}$ $C(CH_3)NH$	15.8	0.935	1.509	XX-177
2785	styrene (*α,β,β*)	$C_6H_5C(CH_3){:}C{:}$ $(CH_3)_2$	20	0.892	1.5164	V-498
2786	**Trimethylene** bromohydrin	$BrCH_2CH_2CH_2OH$	20	1.571	1.4883	I-356
2787	chlorohydrin	$ClCH_2CH_2CH_2OH$	20	1.131	1.4469	I-356
2788	glycol	$HOCH_2CH_2CH_2OH$	20	1.060	1.4398	I-475
2789	**Triphenyl**-methane (m.p. 94°)	$(C_6H_5)_3CH$	99	1.014	1.59	V-698
2790	phosphine (m.p. 79°)	$(C_6H_5)_3P$	69	1.1	1.5248	XVI-759
2791	**Tripropyl**-amine (*n*)	$(C_2H_5CH_2)_3N$	19.4	0.757	1.4176	IV-139
2792	methane	$(C_3H_7)_3CH$	20	0.73	1.414	....
2793	**Trithioacetone**	$(CH_3CSCH_3)_3$	20	1.068	1.542	XIX-389
2794	**Tropacocaine** (m.p. 49°)	$C_{15}H_{19}O_2N$	100	1.043	1.5080	XXI-39
2795	**Tropane**	$C_8H_{15}N$	21.6	0.93	1.4766	XX-141
2796	**Tropidine**	$C_8H_{13}N$	18.4	0.95	1.4904	XX-177
2797	**Tropine** (m.p. 63°)	$C_8H_{15}ON$	99.8	1.016	1.4811	XXI-16
2798	**Tropinone** (m.p. 41°)	$C_8H_{13}ON$	99.6	0.987	1.4621	XXI-258
2799	**Tropylidene**	$HC{:}(CH)_5CH_2$	20	0.888	1.5261	V-280
2800	**Undecane** (*n*)	$CH_3(CH_2)_9CH_3$	20(?)	0.741	1.4158	I-170
2801	**Undecan-2-ol**	$C_9H_{19}CHOHCH_3$	20	0.827	1.4369	I-427
2802	**Undec-1-ene**	$CH_3(CH_2)_8CH{:}CH_2$	20	0.763	1.4284	I-225
2803	**Undec-2-ene**	$C_8H_{17}CH{:}CHCH_3$	15(?)	0.774	1.4333	I-225
2804	**Undecyl** alcohol (*n*)	$CH_3(CH_2)_9CH_2OH$	23	0.833	1.4392	I-427
2805	phenyl ketone (m.p. 47°)	$CH_3(CH_2)_{10}COC_6H_5$	52.4	0.897	1.4850	VII-345
2806	**Undecylenic acid** (*β*)	$CH_3(CH)_2C_7H_{14}\cdot$ CO_2H	24	0.907	1.45	II-458
2807	**Undecylic** acid (m.p. 29°)	$CH_3(CH_2)_9CO_2H$	45.2	.....	1.4294	II-358
2808	aldehyde	$CH_3(CH_2)_9CHO$	23	0.825	1.4322	I-712
2809	**Urethane** (m.p. 49°)	$NH_2CO_2C_2H_5$	52	0.9	1.4144	III-22
2810	**Valeric** acid (*n*)	$C_2H_5CH_2CH_2CO_2H$	19.1	0.94	1.409	II-299
2811	acid (*iso*)	$(CH_3)_2CHCH_2CO_2H$	20	0.93	1.4043	II-309
2812	aldehyde (*n*)	$C_2H_5CH_2CH_2CHO$	20	0.82	1.3882	I-676
2813	“ (*iso*)	$(CH_3)_2CHCH_2CHO$	20	0.802	1.3902	I-684
2814	aldoxime (*iso*)	$C_4H_9CH{:}NOH$	20	0.893	1.4367	I-686
2815	anhydride (*iso*)	$(C_4H_9CO)_2O$	26	0.93	1.4147	II-314
2816	**Valero-*p*-**cresol (*o*) (*iso*)	$(CH_3)_2CHCH_2CO\cdot$ $C_6H_3(OH)(CH_3)$	20	1.028	1.5320	*VIII-557
2817	nitrile (*n*)	$CH_3(CH_2)_3CN$	18	0.801	1.3917	II-301

INDEX OF REFRACTION—LIQUIDS

No.	Substance	Formula	t,°C.	d_4^t	n_D^t	Beil. Ref.
2818	**Valero**-thienone (*α*) (*iso*)	$C_4H_9COC{:}CHCH{:}$ $CH{\cdot}S$	20	1.062	1.536	....
2819	**Valeryl**-aceto-phenone (*ω*) (*iso*)	$C_6H_5COCH_2COCH_2{\cdot}CH(CH_3)_2$	20	1.031	1.5605	VII-690
2820	chloride (*n*)	$CH_3(CH_2)_3COCl$	20	1.01	1.42	II-301
2821	" (*iso*)	$(CH_3)_2CHCH_2COCl$	20	0.989	1.4156	II-315
2822	indazole (2) (*iso*) (*stable*)	$C_{12}H_{14}ON_2$	16.3	1.088	1.555	....
2823	**Veratrole** (*o*)	$C_6H_4(OCH_3)_2$	21	1.08	1.53	VI-771
2824	**Verbenene**	$C_{10}H_{14}$	20	0.882	1.4986	*V-207
2825	**Vinyl**-acetic acid	$CH_2{:}CHCH_2CO_2H$	15	1.013	1.4257	II-407
2826	bromide	$CH_2{:}CHBr$	20(?)	1.5	1.4462	I-188
2827	ethyl alcohol	$C_3H_5CH_2OH$	17.5	0.838	1.4146	I-441
2828	**Water**†	H_2O	20	0.998	1.3330	....
2829	**Xylidine** (*o*) (*vic*)	$(CH_3)_2C_6H_3NH_2$ (1,2,3)	20	0.99	1.570	XII-1101
2830	" (*o*) (*sym*)	$(CH_3)_2C_6H_3NH_2$ (1,3,5)	20	0.972	1.558	XII-1131
2831	" (*m*) (*vic*)	$(CH_3)_2C_6H_3NH_2$ (1,3,2)	20	0.979	1.561	XII-1107
2832	" (*m*) (*uns*)	$(CH_3)_2C_6H_3NH_2$ (1,3,4)	19.6	0.978	1.5607	XII-1111
2833	" (*p*)	$(CH_3)_2C_6H_3NH_2$ (1,4,2)	21.3	0.979	1.5591	XII-1135
2834	**Xylylamine** (*p*)	$CH_3C_6H_4CH_2NH_2$	20	0.952	1.5364	XII-1141
2835	**Zingiberene**	$C_{15}H_{24}$	20	0.873	1.4940	V-461

† See special table.

FORMULA INDEX

For finding compounds listed in the table: *INDEX OF REFRACTION (LIQUIDS)*.

The system used in this formula index is essentially the same as that employed in *Richter's Lexikon der Kohlenstoff Verbindungen*. The succession of the elements combined with carbon is as follows: H, O, N, S, F, Cl, Br, I. All the other elements are placed in alphabetical order. The arrangement depends (1) on the number of carbon atoms, (2) on the number of the other elements which, in addition to carbon, are contained in the compounds, (3) on the kind of elements, which in addition to carbon are contained in the molecule, in accordance with the order as stated above, and (4) on the number of atoms of each element which, in addition to carbon, is contained in the compound. Thus 2 III means two carbon atoms combined with three other elements; *e. g.*, $C_2H_2O_2F_2$ 728, is a compound with 2 carbon atoms and 3 other elements, and it is the 728th compound in the table to which this formula index is a part.

1 I

CCl_4 390
CS_2 388

1 II

CHN 1615
$CHCl_3$ 453
$CHBr_3$ 269
CH_2O_2 1483
CH_2N_2 490
CH_2Cl_2 2185
CH_2I_2 2190
CH_3I 2031
CH_4O 1776
CO_8N_4 2638
$CSCl_2$ 2644
$CSCl_4$ 2314
$CFCl_3$ 1480
CCl_3Br 2690

1 III

CH_3ON 1481
CH_3O_2N 2225
$CH_4O_2N_2$ 2079
CH_5ON 2028
CO_2NCl_3 2217
CO_2NBr_3 2216

2 I

C_2Cl_4 2577

2 II

C_2HCl_3 2696
C_2HCl_5 2286
C_2HBr_3 2680
$C_2H_2O_2$ 1517
$C_2H_2Cl_2$ 39; 40
$C_2H_2Cl_4$ 2575; 2576
$C_2H_2Br_2$ 37; 38
$C_2H_2Br_4$ 2573; 2574
$C_2H_2I_2$ 42
C_2H_3N 13
$C_2H_3N_3$ 2677
$C_2H_3Cl_3$ 2694; 2695
C_2H_3Br 2826
$C_2H_3Br_3$ 2679
C_2H_4O 3; 1448
$C_2H_4O_2$ 5; 1515; 1950
$C_2H_4N_6$ 553
$C_2H_4Cl_2$ 594; 1441
$C_2H_4Br_2$ 560; 1439
C_2H_5Br 1130
C_2H_5I 1302
C_2H_6O 1094
$C_2H_6O_2$ 1512
C_2H_6S 1311
$C_2H_6S_2$ 861
C_2H_6Cd 366
C_2H_6Hg 1730
$C_2H_8N_2$ 938; 939; 1443; 1444
$C_2O_2Cl_2$ 2278
$C_2O_2Cl_4$ 2698
$C_2N_2Br_4$ 497
$C_2F_3Br_3$ 2716
$C_2Cl_2Br_2$ 593

2 III

C_2HOCl_3 408
C_2HFBr_4 1474
$C_2HF_2Br_3$ 735
$C_2HF_3Br_2$ 2715
C_2HCl_2Br 588
$C_2HCl_2Br_3$ 607
$C_2HCl_3Br_2$ 2693
$C_2H_2O_2F_2$ 728
$C_2H_2O_2Cl_2$ 582
$C_2H_2FBr_3$ 1478; 1479
$C_2H_2F_2Br_2$ 732; 733
C_2H_2ClBr 420; 421
$C_2H_2ClBr_3$ 452
C_2H_3ON 1516
C_2H_3OCl 28
C_2H_3OBr 26
$C_2H_3O_2Cl$ 409; 1850
C_2H_3NS 2171; 2172
$C_2H_3FBr_2$ 1468
$C_2H_3F_2Br$ 731
$C_2H_3F_2I$ 734
$C_2H_4OCl_2$ 599
$C_2H_4O_4N_2$ 1025
C_2H_5ON 4
C_2H_5OF 1447
C_2H_5OCl 435; 1442
C_2H_5OBr 249; 1440
C_2H_5OI 1649
$C_2H_5O_2N$ 1843; 2224
$C_2H_5O_3N$ 1366
$C_2H_6ON_2$ 964
$C_2H_6O_2N_2$ 963
$C_2H_6O_4S$ 1014
C_2H_7ON 1060; 1297
$C_2H_{10}ON_2$ 1444

3 I

C_3O_2 389

3 II

C_3HN 2399
$C_3H_2O_2$ 2398
$C_3H_2N_2$ 1717
$C_3H_3Cl_5$ 2287
C_3H_4O 44; 2387
$C_3H_4O_2$ 43
$C_3H_4O_3$ 2498
$C_3H_4N_2$ 2492
$C_3H_4Cl_2$ 592
$C_3H_4Br_2$ 570; 571; 1056
C_3H_5N 1181; 2406
C_3H_5Cl 56
C_3H_5Br 55; 255; 256; 257
$C_3H_5Br_3$ 2682
C_3H_6O 10; 50; 2400
$C_3H_6O_2$ 9; 1254; 1764; 2404
$C_3H_6O_3$ 1669; 1740
$C_3H_6Cl_2$ 604; 605
$C_3H_6Br_2$ 566; 567
$C_3H_6I_2$ 758
C_3H_7N 52
C_3H_7Cl 2430; 2431

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C_3H_7Br 2426; 2427
C_3H_7I 2455; 2456
C_3H_8O 2418; 2419
$C_3H_8O_2$ 1846; 2184; 2478; 2788
$C_3H_8O_3$ 1500
C_3H_8Se 2517
C_3H_9N 2420; 2421
C_3H_9Al 77
C_3H_9Bi 223
C_3H_9Sb 159

3 III

$C_3H_2O_2Cl_2$ 1718
C_3H_3ON 1664
$C_3H_4OCl_2$ 583
C_3H_5ON 1670
C_3H_5OCl 1055; 2411
C_3H_5OBr 2409
$C_3H_5O_2Cl$ 1169; 1847
$C_3H_5O_2Br$ 253
C_3H_5NS 1411; 1412
$C_3H_6OCl_2$ 1501
$C_3H_6OBr_2$ 568; 569
C_3H_7ON 12; 881; 2401; 2402
C_3H_7OCl 442; 443; 1849; 2787
C_3H_7OBr 2786
C_3H_7OI 1652
$C_3H_7O_2N$ 2230; 2459; 2809
$C_3H_7O_3N$ 2458
$C_3H_7NCl_2$ 2439
$C_3H_7Cl_3Si$ 2520
$C_3H_8O_2N_2$ 1938
C_3H_9ON 1786

3 IV

C_3H_6ONCl 798

4 I

C_4H_6 338; 339
C_4H_8 335; 499
C_4N_2 41

4 II

C_4H_4O 1486; 2639
$C_4H_4O_2$ 1627
$C_4H_4N_2$ 2491; 2493; 2553
C_4H_4S 2642
C_4H_5N 59; 485; 2497
C_4H_5Cl 454
C_4H_6O 483
$C_4H_6O_2$ 481; 482; 523; 541; 1774; 1775; 2552; 2825
$C_4H_6O_3$ 6
$C_4H_6O_4$ 978
$C_4H_6N_2$ 2147; 2148; 2149
$C_4H_6Br_2$ 769
$C_4H_6Br_4$ 2572
C_4H_7N 353
C_4H_7Br 238
$C_4H_7Br_3$ 2678
C_4H_8O 340; 341; 488; 501; 524; 1783; 1934; 2827
$C_4H_8O_2$ 8; 344; 345; 1029; 1082; 1446; 2131; 2443
$C_4H_8O_3$ 1062; 2023; 2036
$C_4H_8Br_2$ 559; 563
C_4H_9Cl 300; 301; 302; 303
C_4H_9Br 291; 292; 293; 294
C_4H_9I 314; 315
$C_4H_{10}O$ 275; 276; 277; 278; 1061; 2138; 2139
$C_4H_{10}O_2$ 760; 1259
$C_4H_{10}O_3$ 1514
$C_4H_{10}N_2$ 727
$C_4H_{10}S$ 316; 720
$C_4H_{10}S_2$ 655
$C_4H_{10}Cd$ 365
$C_4H_{10}Hg$ 1729
$C_4H_{10}Se$ 2516
$C_4H_{10}Te$ 2562
$C_4H_{11}N$ 279; 280; 281; 282; 621
$C_4H_{12}Pb$ 1700
$C_4H_{12}Si$ 2523
$C_4H_{12}Sn$ 2655

4 III

C_4HOCl_3 2697
$C_4HO_2Cl_3$ 430; 433
$C_4H_2OCl_4$ 2692
$C_4H_2O_2Cl_2$ 1485
$C_4H_2NCl_3$ 2691
$C_4H_2SBr_2$ 572
$C_4H_3OCl_3$ 591
$C_4H_3NCl_2$ 590
C_4H_3SCl 448
C_4H_3SBr 261
$C_4H_4O_2Cl_2$ 589; 2554
C_4H_5ON 2032; 2033
C_4H_5OCl 487
$C_4H_5OCl_3$ 343
C_4H_5OBr 243
$C_4H_5O_2N$ 1185
$C_4H_5O_2F_3$ 1428
$C_4H_5O_2Cl_3$ 1425
$C_4H_5O_2Br_3$ 1424
C_4H_5NS 73
$C_4H_5N_2Br$ 1812
$C_4H_6ON_2$ 883
$C_4H_6OCl_2$ 423
$C_4H_6O_2N_2$ 1200
$C_4H_6O_2Cl_2$ 1204
$C_4H_6O_2Br_2$ 1201
C_4H_7ON 11
C_4H_7OCl 359; 360
$C_4H_7O_2N_3$ 1423
$C_4H_7O_2F$ 1253
$C_4H_7O_2Cl$ 422; 428; 1159; 2432
$C_4H_7O_2Br$ 247; 248; 1131; 1810; 1811
$C_4H_7O_2I$ 1303
C_4H_7NS 2469
$C_4H_8OCl_2$ 429
$C_4H_8O_3N_2$ 1352
$C_4H_8O_4N_2$ 1351
$C_4H_8N_2S$ 74
$C_4H_8SCl_2$ 595
C_4H_9ON 7; 342; 761; 1935
C_4H_9OCl 336; 425
$C_4H_9O_2N$ 318; 1258; 2183
$C_4H_9O_3N$ 317
$C_4H_9NCl_2$ 306
$C_4H_{10}ON_2$ 697
$C_4H_{10}O_2N_2$ 319; 320
$C_4H_{10}O_3S$ 721; 1250
$C_4H_{10}O_4S$ 719
$C_4H_{11}ON$ 773; 1103
$C_4H_{11}O_2N$ 611
$C_4H_{11}O_3P$ 702
$C_4H_{12}O_4Si$ 2518

5 I

C_5H_6 516
C_5H_8 521; 1813; 1814; 1836; 2289; 2290; 2291; 2292; 2293; 2312; 2313
C_5H_{10} 517; 1815; 1816; 1817; 1867; 2301; 2302; 2303
C_5H_{12} 2297; 2298

5 II

$C_5H_4O_2$ 472; 1487; 1488; 2496
$C_5H_4O_3$ 460
C_5H_5N 2494
C_5H_6O 1951
$C_5H_6O_2$ 146; 147; 1392; 1489; 2386
$C_5H_6N_2$ 1519; 2146
C_5H_6S 2174; 2175
C_5H_7N 2150; 2308; 2309
C_5H_8O 520; 1390; 1449; 2653
$C_5H_8O_2$ 23; 46; 47; 145; 500; 1641; 1713; 2294; 2306; 2307; 2652
$C_5H_8O_3$ 17; 1401; 1712; 1765; 2040; 2600
$C_5H_8O_4$ 950; 1291; 1518
$C_5H_8N_2$ 1006; 1007
C_5H_9N 2817
$C_5H_9Br_3$ 2681
$C_5H_{10}O$ 519; 679; 1099; 1782; 2140; 2141; 2304; 2305; 2812; 2813

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$C_5H_{10}O_2$ 309; 310; 514; 1393; 1837; 1838; 1839; 2414; 2415; 2597; 2720; 2810; 2811
$C_5H_{10}O_3$ 635; 1287; 1305; 2479
$C_5H_{10}N_2$ 641
$C_5H_{10}Cl_2$ 596
$C_5H_{10}Br_2$ 564; 565
$C_5H_{10}I_2$ 757
$C_5H_{11}N$ 2385
$C_5H_{11}F$ 118
$C_5H_{11}Cl$ 108; 109; 110; 438
$C_5H_{11}Br$ 101; 102; 103; 246
$C_5H_{11}I$ 124; 1647
$C_5H_{12}O$ 88; 89; 90; 91; 92; 1395; 1826; 2300
$C_5H_{12}O_2$ 142; 143; 2299
$C_5H_{12}O_3$ 1844
$C_5H_{12}S$ 125; 126
$C_5H_{13}N$ 93; 1818
$C_5H_{14}N_2$ 363; 1827
$C_5H_{14}Pb$ 1708
$C_5H_{14}Si$ 2538

5 III

C_5H_5OCl 1490
$C_5H_5O_2Cl_3$ 2182
$C_5H_6ON_2$ 1631
$C_5H_6O_2Cl_2$ 584; 608; 1520; 1888
$C_5H_6O_3N_2$ 2063
C_5H_7ON 945
C_5H_7OCl 770; 2310; 2311
$C_5H_7O_2N$ 1182
$C_5H_7O_2Cl$ 410; 1848
$C_5H_7NBr_2$ 574
$C_5H_7N_2Cl$ 799; 800
$C_5H_7N_2Br$ 783
$C_5H_8ON_2$ 1344
$C_5H_8O_2Cl_2$ 1207
C_5H_9OCl 2599; 2820; 2821
$C_5H_9O_2Cl$ 304; 1170; 1171
$C_5H_9O_2Br$ 1137
C_5H_9NS 331
$C_5H_{10}ON_2$ 2238
$C_5H_{10}OS_2$ 656
$C_5H_{10}O_2N_2$ 2229
$C_5H_{10}O_2S$ 724
$C_5H_{10}O_3N_2$ 2236
$C_5H_{11}ON$ 680; 2142; 2403; 2814
$C_5H_{11}O_2N$ 129; 130; 673; 1434; 2226; 2227
$C_5H_{11}O_3N$ 128
$C_5H_{11}NCl_2$ 116
$C_5H_{12}O_2N_2$ 1830; 1831

6 I

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$C_{10}H_{16}O_2$ 31; 165; 838; 1110; 1190; 1192; 1198; 1227; 1249; 1410; 1492; 1879; 1902; 2022; 2037; 2054; 2055; 2056; 2057; 2058
$C_{10}H_{16}O_4$ 691; 692; 712; 1042; 1047
$C_{10}H_{16}O_5$ 619; 661; 708; 1345
$C_{10}H_{16}O_6$ 2710
$C_{10}H_{16}N_2$ 1359; 1360; 1361
$C_{10}H_{17}N$ 367; 496; 2384
$C_{10}H_{17}Cl$ 1497
$C_{10}H_{18}O$ 397; 456; 463; 741; 954; 968; 969; 1462; 1715; 1723; 1724; 2448; 2483; 2484; 2566; 2567; 2568; 2569; 2570; 2626; 2650
$C_{10}H_{18}O_2$ 836
$C_{10}H_{18}O_3$ 614; 1791; 2815
$C_{10}H_{18}O_4$ 327; 578; 620; 652; 653; 654; 690; 1109; 2514
$C_{10}H_{18}O_5$ 1046
$C_{10}H_{19}N$ 375; 1496
$C_{10}H_{19}Cl$ 1727; 1728; 2628
$C_{10}H_{20}O$ 377; 396; 464; 977; 1722; 2204; 2450; 2624; 2625
$C_{10}H_{20}O_2$ 140; 141; 376; 1269; 2250; 2267
$C_{10}H_{21}N$ 94; 1726
$C_{10}H_{21}Cl$ 536
$C_{10}H_{21}Br$ 533
$C_{10}H_{21}I$ 538
$C_{10}H_{22}O$ 117; 532; 972; 973; 2449
$C_{10}H_{22}S$ 552
$C_{10}H_{23}N$ 548

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$C_{10}H_{24}Pb$ 1676; 1679; 1684; 1688; 1694; 1703
$C_{10}H_{24}Si$ 2527; 2539

10 III

$C_{10}H_7OCl_3$ 2344
$C_{10}H_9O_2Cl$ 794; 795
$C_{10}H_9N_2Cl$ 2346; 2347
$C_{10}H_{10}ON_2$ 32
$C_{10}H_{10}OS$ 1072
$C_{10}H_{10}O_2N_2$ 1300
$C_{10}H_{11}ON$ 2123
$C_{10}H_{11}OBr$ 241; 242
$C_{10}H_{11}O_2Cl$ 347
$C_{10}H_{12}O_2Cl_2$ 737
$C_{10}H_{13}O_2Cl_3$ 424
$C_{10}H_{14}ON_2$ 33
$C_{10}H_{14}OCl_2$ 1340; 1892; 2757
$C_{10}H_{14}O_2N_2$ 1100; 1101
$C_{10}H_{14}O_2Cl_2$ 373; 374
$C_{10}H_{15}ON$ 2433
$C_{10}H_{15}O_2N$ 1186
$C_{10}H_{15}O_3N$ 86
$C_{10}H_{15}O_4N$ 658
$C_{10}H_{16}O_2Cl_2$ 2515
$C_{10}H_{17}ON$ 1460
$C_{10}H_{17}O_2N$ 36
$C_{10}H_{17}O_3N$ 1907
$C_{10}H_{19}ON$ 1459
$C_{10}H_{21}O_2N$ 2221; 2222

11 I

$C_{11}H_{10}$ 2075; 2076
$C_{11}H_{12}$ 2353
$C_{11}H_{14}$ 2169; 2354; 2785
$C_{11}H_{16}$ 97; 98; 99; 332; 1004; 1312; 1398; 1819; 1820; 1821; 1885; 2038; 2296; 2477; 2630; 2631; 2758
$C_{11}H_{22}$ 2802; 2803
$C_{11}H_{24}$ 2800

11 II

$C_{11}H_7N$ 2199
$C_{11}H_8O$ 2194; 2195
$C_{11}H_{10}O$ 2077
$C_{11}H_{10}O_2$ 200; 1386; 2326
$C_{11}H_{10}O_3$ 1176
$C_{11}H_{12}O$ 759; 801; 940; 941; 1407; 1798; 2034; 2035; 2343; 2734
$C_{11}H_{12}O_2$ 189; 486; 942; 953; 1095; 1116; 1173; 1767; 1768; 1769; 1779; 1801; 1858; 1909; 2047; 2052; 2053; 2408; 2731; 2732; 2733
$C_{11}H_{12}O_3$ 17; 952; 1121; 1289; 1319; 1864; 2043; 2044; 2064; 2132
$C_{11}H_{12}N_2$ 66; 67; 212; 2332; 2333; 2334; 2335
$C_{11}H_{13}Cl$ 1915
$C_{11}H_{14}O$ 75; 270; 322; 323; 1063; 2390; 2391; 2413; 2473; 2474; 2721; 2722; 2768
$C_{11}H_{14}O_2$ 197; 290; 346; 348; 349; 350; 1288; 1947; 1948; 2395; 2669
$C_{11}H_{14}O_3$ 311; 1417; 1626; 1638; 2048; 2422
$C_{11}H_{14}O_4$ 1630
$C_{11}H_{14}O_6$ 718
$C_{11}H_{14}N_2$ 312; 313; 675
$C_{11}H_{14}Cl_2$ 606; 2756
$C_{11}H_{16}O$ 131; 874; 1399; 1523; 1732; 1845; 2176
$C_{11}H_{16}O_2$ 1333
$C_{11}H_{16}O_4$ 640; 676
$C_{11}H_{16}O_6$ 617; 644
$C_{11}H_{16}O_7$ 2711
$C_{11}H_{16}O_8$ 858
$C_{11}H_{18}O_2$ 228; 1028; 1191; 1286; 1307; 1334; 1335; 1336; 1337; 1338; 1484; 1498; 1903; 1954
$C_{11}H_{18}O_4$ 647; 648
$C_{11}H_{18}O_5$ 629; 630; 657; 1244
$C_{11}H_{20}O$ 965; 1367; 1806
$C_{11}H_{20}O_2$ 466; 1368; 2806
$C_{11}H_{20}O_4$ 137; 646; 649; 650; 707; 725
$C_{11}H_{21}N$ 1841
$C_{11}H_{22}O$ 2083; 2808
$C_{11}H_{22}O_2$ 537; 1273; 2807
$C_{11}H_{22}N_2$ 550
$C_{11}H_{24}O$ 1886; 2801; 2804
$C_{11}H_{26}Pb$ 1677; 1687; 1690; 1702
$C_{11}H_{26}Si$ 2526; 2541

11 III

$C_{11}H_{10}O_2S$ 1413
$C_{11}H_{11}O_2Cl$ 1164
$C_{11}H_{11}N_2Cl$ 209; 210
$C_{11}H_{12}ON_2$ 361; 362
$C_{11}H_{13}O_2Br$ 239
$C_{11}H_{16}OCl_2$ 1895; 2137
$C_{11}H_{17}O_2N$ 1432
$C_{11}H_{17}O_3N$ 1433
$C_{11}H_{17}O_4N$ 711
$C_{11}H_{19}ON$ 372
$C_{11}H_{19}O_2N$ 1431; 2412

12 I

$C_{12}H_{10}$ 1; 1031
$C_{12}H_{12}$ 337; 959; 960; 961
$C_{12}H_{14}$ 2330; 2340
$C_{12}H_{16}$ 714; 879; 1016; 1409; 2329
$C_{12}H_{18}$ 1195; 1309; 2629; 2707
$C_{12}H_{26}$ 1049; 2460

12 II

$C_{12}H_8O$ 1037
$C_{12}H_{10}O$ 2074; 2078; 2336
$C_{12}H_{10}O_2$ 1749
$C_{12}H_{10}S$ 1036
$C_{12}H_{10}Te$ 2563
$C_{12}H_{12}O$ 1364; 1365
$C_{12}H_{12}O_2$ 1301
$C_{12}H_{12}O_3$ 766; 1331; 1332
$C_{12}H_{12}O_4$ 1123; 1316; 1330
$C_{12}H_{12}S$ 1805
$C_{12}H_{13}N$ 774; 962; 1104; 1105
$C_{12}H_{14}O$ 51; 546; 872; 947; 1304; 2467; 2468; 2729; 2730
$C_{12}H_{14}O_2$ 357; 705; 870; 871; 1322; 1323; 1324; 1325; 1899; 1900; 2134; 2135; 2621
$C_{12}H_{14}O_3$ 862; 1315; 1329; 1353; 1454; 1780; 1863; 2042; 2059; 2060
$C_{12}H_{14}O_4$ 160; 161; 703; 704
$C_{12}H_{14}N_2$ 206; 2364
$C_{12}H_{16}O$ 132; 772; 2771
$C_{12}H_{16}O_2$ 100; 221; 352; 355; 1157; 1158; 1252; 1378; 1456; 2598; 2816
$C_{12}H_{16}O_3$ 120; 138; 164; 284; 285; 1341
$C_{12}H_{16}N_2$ 121; 122; 2463
$C_{12}H_{18}O_2$ 27; 1748
$C_{12}H_{18}O_3$ 1026; 1199; 1387; 1842
$C_{12}H_{18}O_4$ 848; 849
$C_{12}H_{18}O_6$ 618; 709; 2704
$C_{12}H_{18}O_7$ 634; 2705
$C_{12}H_{20}O$ 1155
$C_{12}H_{20}O_2$ 224; 225; 226; 1027; 1222; 1224; 1494; 1495; 1716; 2583
$C_{12}H_{20}O_3$ 1223
$C_{12}H_{20}O_4$ 667; 668; 669; 670; 688; 689; 793; 1093
$C_{12}H_{20}O_5$ 726

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$C_{12}H_{20}O_7$ 2709
$C_{12}H_{22}O$ 855; 1127
$C_{12}H_{22}O_2$ 134; 465; 1356; 1725
$C_{12}H_{22}O_3$ 1221; 1233
$C_{12}H_{22}O_4$ 222; 551; 580; 715; 723
$C_{12}H_{22}O_6$ 581
$C_{12}H_{24}O$ 854; 1310
$C_{12}H_{24}O_2$ 531; 1270; 1671
$C_{12}H_{24}N_2$ 1445
$C_{12}H_{26}O$ 1196
$C_{12}H_{27}N$ 2683; 2684
$C_{12}H_{27}N_3$ 2719
$C_{12}H_{28}Pb$ 1675; 1677; 1678
$C_{12}H_{28}Si$ 2531
$C_{12}H_{30}Sn_2$ 2656

12 III

$C_{12}H_{10}ON_2$ 168
$C_{12}H_{12}ON_2$ 49
$C_{12}H_{13}O_2Cl$ 1172
$C_{12}H_{14}ON_2$ 2822
$C_{12}H_{14}O_2N_2$ 1245; 1246
$C_{12}H_{14}O_2Cl_2$ 1208; 1339
$C_{12}H_{18}O_2N_2$ 386
$C_{12}H_{21}ON$ 371
$C_{12}H_{23}O_2N$ 1106; 1107
$C_{12}H_{24}O_4N_2$ 671
$C_{12}H_{27}O_3B$ 2685
$C_{12}H_{27}O_4P$ 2687
$C_{12}H_{27}FSi$ 2525

13 I

$C_{13}H_{12}$ 1035
$C_{13}H_{14}$ 1936; 1937
$C_{13}H_{16}$ 202; 2120
$C_{13}H_{20}$ 2437; 2457
$C_{13}H_{28}$ 2702

13 II

$C_{13}H_{10}O$ 184; 185; 186
$C_{13}H_{12}O$ 1772; 1773
$C_{13}H_{12}O_2$ 1362; 1363; 2062
$C_{13}H_{13}N$ 180; 194; 1906
$C_{13}H_{14}O$ 203
$C_{13}H_{14}O_2$ 674; 1096; 1174; 1211; 1212; 1213; 1214; 1346
$C_{13}H_{14}O_3$ 1219; 1321
$C_{13}H_{14}O_4$ 1218; 1235; 1241; 1348
$C_{13}H_{14}N_2$ 2360; 2361
$C_{13}H_{16}O$ 174; 330; 1003; 1825
$C_{13}H_{16}O_2$ 687; 869; 873; 1217; 1240; 2355; 2440; 2670; 2819
$C_{13}H_{16}O_3$ 351; 1234; 1239; 1347; 1904; 2061
$C_{13}H_{18}O$ 71; 72
$C_{13}H_{18}O_3$ 95; 1418; 1628
$C_{13}H_{20}O$ 859; 1660; 1661; 1662; 1663
$C_{13}H_{20}O_2$ 1128; 1255; 1355; 2410
$C_{13}H_{20}O_3$ 21; 1156; 1354
$C_{13}H_{20}O_4$ 645
$C_{13}H_{20}O_6$ 710
$C_{13}H_{20}O_8$ 2589
$C_{13}H_{22}O_2$ 229; 1069; 1225
$C_{13}H_{22}O_4$ 665; 666; 1097; 1778
$C_{13}H_{24}O_2$ 1606
$C_{13}H_{26}O_2$ 540
$C_{13}H_{28}O$ 2438
$C_{13}H_{30}Pb$ 1692; 1711
$C_{13}H_{30}Si$ 2530; 2536

13 III

$C_{13}H_{15}O_3Br$ 240
$C_{13}H_{16}O_2N_2$ 123
$C_{13}H_{17}ON$ 1739
$C_{13}H_{17}O_2N$ 1124
$C_{13}H_{23}O_4N$ 693

14 I

$C_{14}H_{10}$ 2319
$C_{14}H_{12}$ 1949; 2359
$C_{14}H_{14}$ 219; 1033
$C_{14}H_{16}$ 695; 999
$C_{14}H_{18}$ 156; 1000; 2119; 2254
$C_{14}H_{22}$ 2580; 2581
$C_{14}H_{30}$ 2579

14 II

$C_{14}H_9Cl$ 413
$C_{14}H_{10}O$ 1034
$C_{14}H_{10}O_3$ 182
$C_{14}H_{12}O$ 1032
$C_{14}H_{12}O_2$ 196
$C_{14}H_{14}O$ 1092
$C_{14}H_{14}O_2$ 1349
$C_{14}H_{14}O_3$ 1317; 1318
$C_{14}H_{15}N$ 554
$C_{14}H_{16}O$ 1667; 2266
$C_{14}H_{16}O_2$ 1326; 1327; 1328; 1350
$C_{14}H_{16}O_3$ 1215; 2133
$C_{14}H_{16}O_4$ 624; 1342
$C_{14}H_{16}N_2$ 217; 218
$C_{14}H_{17}N$ 622; 622.1
$C_{14}H_{18}O$ 173
$C_{14}H_{18}O_2$ 1430
$C_{14}H_{18}O_3$ 1382
$C_{14}H_{20}O_4$ 1771
$C_{14}H_{20}O_9$ 2590
$C_{14}H_{22}O_2$ 358; 1220
$C_{14}H_{22}O_3$ 1248
$C_{14}H_{24}O_2$ 227
$C_{14}H_{24}O_4$ 631; 632
$C_{14}H_{24}O_7$ 2582
$C_{14}H_{24}N_2$ 2584; 2591
$C_{14}H_{26}O_3$ 1534
$C_{14}H_{28}O_2$ 534; 1306; 1553; 2193
$C_{14}H_{30}O$ 305; 1024
$C_{14}H_{32}Pb$ 1686; 1710
$C_{14}H_{32}Si$ 2532

14 III

$C_{14}H_{15}ON$ 29

15 I

$C_{15}H_{12}$ 1795; 1796
$C_{15}H_{14}$ 2160; 2349
$C_{15}H_{16}$ 555; 2363
$C_{15}H_{18}$ 1896
$C_{15}H_{24}$ 166; 364; 400; 401; 467; 1522; 2282; 2508; 2509; 2510; 2835

15 II

$C_{15}H_{12}O$ 170
$C_{15}H_{12}O_3$ 1802
$C_{15}H_{14}O$ 63
$C_{15}H_{14}O_6$ 706
$C_{15}H_{16}O$ 1910; 2451
$C_{15}H_{18}O$ 60; 2672
$C_{15}H_{18}O_2$ 856
$C_{15}H_{20}O_6$ 2673
$C_{15}H_{20}O_7$ 2671
$C_{15}H_{20}O_{10}$ 2588
$C_{15}H_{22}O_2$ 1455
$C_{15}H_{22}O_3$ 1781
$C_{15}H_{22}O_4$ 643
$C_{15}H_{24}O$ 2511; 2512
$C_{15}H_{26}O$ 1054; 1457; 2205
$C_{15}H_{26}O_2$ 230; 231
$C_{15}H_{26}O_6$ 1503
$C_{15}H_{26}N_2$ 2546; 2547
$C_{15}H_{28}O_2$ 1728.1
$C_{15}H_{33}N$ 2674
$C_{15}H_{34}Pb$ 1696
$C_{15}H_{34}Si$ 2537

15 III

$C_{15}H_{19}O_2N$ 2794
$C_{15}H_{33}O_3B$ 2675
$C_{15}H_{33}FSi$ 2524

16 I

$C_{16}H_{14}$ 1114
$C_{16}H_{18}$ 2331; 2345
$C_{16}H_{26}$ 2295
$C_{16}H_{32}$ 1557

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16 II

$C_{16}H_{16}O_4$ 696
$C_{16}H_{18}O_2$ 612
$C_{16}H_{20}O_5$ 700
$C_{16}H_{22}O_4$ 579; 1210
$C_{16}H_{24}O_5$ 633
$C_{16}H_{26}O$ 539
$C_{16}H_{26}O_3$ 106
$C_{16}H_{27}N$ 549
$C_{16}H_{32}O_2$ 2279
$C_{16}H_{33}I$ 406
$C_{16}H_{34}O$ 405
$C_{16}H_{36}Pb$ 1691; 1698
$C_{16}H_{36}Si$ 2521; 2528

16 III

$C_{16}H_{25}O_3Cl$ 112

17 I

$C_{17}H_{20}$ 204
$C_{17}H_{36}$ 1526

17 II

$C_{17}H_{16}O_2$ 1381
$C_{17}H_{34}O_2$ 2089
$C_{17}H_{38}Pb$ 1685; 1701
$C_{17}H_{38}Si$ 2543

17 III

$C_{17}H_{14}O_2Br_2$ 1202
$C_{17}H_{21}O_4N$ 468; 469

18 I

$C_{18}H_{20}$ 1228
$C_{18}H_{30}$ 1568
$C_{18}H_{38}$ 2253

18 II

$C_{18}H_{15}P$ 2790
$C_{18}H_{18}O_2$ 1125
$C_{18}H_{26}N_2$ 2585; 2586; 2587
$C_{18}H_{28}O$ 2805
$C_{18}H_{28}O_4$ 87; 1437
$C_{18}H_{32}O_7$ 2686
$C_{18}H_{34}O$ 2276
$C_{18}H_{34}O_2$ 1052; 2274; 2315
$C_{18}H_{34}O_5$ 2275
$C_{18}H_{36}O_2$ 404; 1371; 2549
$C_{18}H_{40}Pb$ 1695

19 I

$C_{19}H_{16}$ 2789
$C_{19}H_{20}$ 96
$C_{19}H_{22}$ 738
$C_{19}H_{40}$ 2246

19 II

$C_{19}H_{30}O_2$ 208
$C_{19}H_{36}O_3$ 2158
$C_{19}H_{42}Pb$ 1674

20 I

$C_{20}H_{40}$ 899
$C_{20}H_{42}$ 1051

20 II

$C_{20}H_{28}O_2$ 753; 754; 755
$C_{20}H_{30}O_4$ 308
$C_{20}H_{38}O_3$ 1402
$C_{20}H_{40}O$ 2376
$C_{20}H_{40}O_2$ 535
$C_{20}H_{42}O$ 610
$C_{20}H_{44}Pb$ 1697

21 I

$C_{21}H_{44}$ 1524

21 II

$C_{21}H_{34}O_2$ 213
$C_{21}H_{38}O_6$ 1504

21 III

$C_{21}H_{21}O_4P$ 2701

22 II

$C_{22}H_{42}O_2$ 232; 321; 1057
$C_{22}H_{42}O_3$ 328; 329

23 I

$C_{23}H_{48}$ 2700

23 II

$C_{23}H_{38}O_2$ 215
$C_{23}H_{44}O_2$ 1908
$C_{23}H_{46}O$ 1673

24 I

$C_{24}H_{50}$ 2578

24 II

$C_{24}H_{38}O_4$ 1272
$C_{24}H_{46}O_2$ 1129; 1229

25 I

$C_{25}H_{52}$ 2288

25 II

$C_{25}H_{40}O_2$ 214
$C_{25}H_{42}O_2$ 216

26 I

$C_{26}H_{54}$ 1556

26 II

$C_{26}H_{52}O_2$ 403

27 I

$C_{27}H_{56}$ 1525

27 II

$C_{27}H_{50}O_6$ 1505

28 I

$C_{28}H_{56}$ 2252

29 I

$C_{29}H_{48}$ 2548
$C_{29}H_{60}$ 2240

31 II to 57 II

$C_{31}H_{62}O$ 2280
$C_{32}H_{66}$ 1050
$C_{33}H_{62}O_6$ 2688
$C_{39}H_{74}O_6$ 1507
$C_{44}H_{82}O_3$ 233; 1058
$C_{45}H_{86}O_6$ 1508
$C_{51}H_{98}O_6$ 1510
$C_{57}H_{104}O_6$ 1509
$C_{57}H_{110}O_6$ 1511

Inorganic

H_2O 2828
H_2O_2 1620; 1621
HCl 1617
HBr 1616
HI 1619
H_2S 1622
H_2S_2 1618
H_2SO_4 2559
HSO_3Cl 447
SO_2 2556
$SOCl_2$ 2641
SO_2Cl_2 2560
SCl_2 2555
S_2Cl_2 2558
S_2Br_2 2557
HNO_3 2209
N_2O 2239
NO_2 2234
NH_2OH 1642
N_2H_4 1609
NH_3 81
PH_3 2369
PCl_3 2372
$POCl_3$ 2370
PBr_3 2371
$SbCl_5$ 158
$TiCl_4$ 2657
OsO_4 2277

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The compounds below are arranged in the order of ascending values of refractive index, an arrangement intended to serve as an aid in the identification of liquids. The numbers listed under the bold faced refractive index heading refer to the compounds with corresponding numerical listings in the table *Index of Refraction—Liquids*. Thus, under the refractive index 1.360 is listed *No. 1181* which is *ethyl isocyanide, n 1.36*.

1.193	2239
1.254	1615
1.256	1617
1.306	1428
1.317	2369
1.325	81; 1616
1.329	1776
1.330	2234
1.333	1620; 2828
1.339	3
1.342	728
1.344	1950
1.346	13
1.350	1061
1.353	2184
1.354	2298
1.357	118
1.358	2139; 2297
1.359	10; 1764; 2523
1.360	1181; 1254; 1448; 2138
1.361	1094; 2459
1.364	1447; 1817; 2400
1.368	2406; 2442; 2518
1.369	785
1.370	760; 1395
1.371	1483; 2301
1.372	5; 318; 2100
1.373	341; 1082
1.374	1622
1.375	499; 786; 1581
1.376	789
1.377	1253; 2101; 2131; 2415; 2421; 2443
1.378	1815; 1836; 2419
1.379	282; 1144
1.380	1783; 1826; 2303
1.381	353; 1934; 2431; 2708
1.382	2; 981; 983; 1185; 2538
1.383	1517; 2302; 2441
1.384	340; 1393; 1838; 2113; 2114; 2414
1.385	129; 635; 1366; 1788; 1867; 1995; 2312; 2418
1.386	310; 1552
1.387	130; 303; 621; 1014; 1480; 1816; 1850; 2399; 2404
1.388	273; 278; 1099; 1532; 1586; 2112; 2141; 2292; 2430; 2812
1.389	309; 1996; 2111
1.390	6; 28; 719; 731; 790; 1152; 1435; 1837; 2140; 2224; 2293; 2420; 2529; 2726; 2813

REFRACTIVE INDEX OF LIQUIDS FINDING NUMBERS

1.391

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67; 261; 411; 2604; 2789

1.591

176; 1299; 1802

1.592

1032; 1413; 1808; 1896; 2344

1.593

412; 622; 2607

1.594

1362

1.595

1349; 1363; 2587

1.596

180; 1657; 2358

1.597

695; 1381; 1474

1.598

65; 186; 251; 269; 1365; 1659

1.599

260; 607; 1364; 1658; 2340; 2680

1.600

74; 2353; 2682

1.601

63; 158; 1328; 1936; 2039

1.602

1327

1.603

29; 452; 2076

1.604

1656

1.605

1: 757: 1072: 2368

1.606

184; 1937; 2062

1.607

961; 1655

1.608

185; 437; 557; 1037; 2341; 2356; 2572

1.609

259; 602; 1654; 2151; 2359

1.610

1949; 2157; 2657

1.612

194; 556; 1910

1.613

1174; 1202; 2327

1.614

459

1.615

1034; 1326; 2155; 2173

1.616

959; 960; 2154; 2156

1.617

2152

1.618

2075

1.619

1096; 1906

1.620

457; 1092

1.621

1645; 2153; 2195; 2198; 2668

1.622

2500

1.623

601; 2077; 2501

1.624

603; 962; 1773

1.626

234; 1787

1.627

1772

1.628

388; 1755; 2078; 2499; 2573

1.630

572; 2199

1.632

622.1; 1809

1.633

436; 2640

1.634

444; 600; 2366

1.635
1036

1.636
96; 758; 2160

1.638
2574

1.644
774

1.646
170; 2074

1.647
497

1.648
1104

1.649
2200; 2362

1.653
1749

1.654
1105

1.655
2194

1.657
2319

1.658
250

1.664
168

1.666
1651; 2558

1.670
2201

1.676
1114

1.680
1795

1.683
2203

1.693
2563

1.696
413; 1796

1.697
2371

1.705
1650

1.706
42

1.708
2202

1.736
2557

1.743
2190

1.885
1618

INDEX OF REFRACTION OF WATER AT VARIOUS TEMPERATURES AND FOR VARIOUS WAVE LENGTHS OF LIGHT

From Values Given in the *International Critical Tables, Vol. 7, p. 13.*

t°C.	Wave length of light			
	$n_\alpha(C)$	$n_D(D)$	$n_\beta(F)$	$n_\gamma(G')$
0	....	1.3340	....	....
10	1.3318	1.3337	1.3378	1.3411
20	1.33115	1.33300	1.33714	1.34035
30	1.3302	1.3320	1.3360	1.3392
40	1.3288	1.3306	1.3347	1.3379
50	1.3274	1.3290	1.3332	1.3364
60	1.3257	1.3272	1.3315	1.3346
70	1.3237	1.3252	1.3294	1.3325

INDEX OF REFRACTION OF AQUEOUS HALOGEN ACID SOLUTIONS AT 18°C.

n_D^{18}

Acid	Normality of the acid solution				
	0.1	0.5	1.0	2.0	4.0
HCl	....	1.33753	1.34168	1.34977	1.36480
HBr	1.33452	1.33952	1.34571	1.35805	1.38271
HI	1.33525	1.34346	1.35387	1.37497	....
$HClO_3$	....	1.33773	1.34211	1.35078	....
HIO_3	1.33568	1.34498	1.35642	1.37910	1.42393
HIO_4	....	1.3445*	....	....	....

*At 26°C.

REFRACTIVE INDEX OF AQUEOUS GLYCEROL SOLUTIONS AT 20.0°C.

L. F. Hoyt, *Ind. Eng. Chem. 26, 329 (1934).*

% Glycerol by weight	$n_D^{20°}$	% Glycerol by weight	$n_D^{20°}$	% Glycerol by weight	$n_D^{20°}$
0	1.33303	35	1.37740	70	1.42789
1	1.33416	36	1.37874	71	1.42938
2	1.33530	37	1.38008	72	1.43087
3	1.33645	38	1.38143	73	1.43236
4	1.33762	39	1.38278	74	1.43385
5	1.33880	40	1.38413	75	1.43534
6	1.33999	41	1.38548	76	1.43683
7	1.34118	42	1.38683	77	1.43832
8	1.34238	43	1.38818	78	1.43982
9	1.34359	44	1.38953	79	1.44135
10	1.34481	45	1.39089	80	1.44290
11	1.34604	46	1.39227	81	1.44450
12	1.34729	47	1.39368	82	1.44612
13	1.34834	48	1.39513	83	1.44770
14	1.34980	49	1.39660	84	1.44930
15	1.35106	50	1.39809	85	1.45085
16	1.35233	51	1.39958	86	1.45237
17	1.35361	52	1.40107	87	1.45389
18	1.35490	53	1.40256	88	1.45539
19	1.35619	54	1.40405	89	1.45689
20	1.35749	55	1.40554	90	1.45839
21	1.35879	56	1.40703	91	1.45989
22	1.36010	57	1.40852	92	1.46139
23	1.36141	58	1.41001	93	1.46290
24	1.36272	59	1.41150	94	1.46443
25	1.36404	60	1.41299	95	1.46597
26	1.36536	61	1.41448	96	1.46752
27	1.36669	62	1.41597	97	1.46909
28	1.36802	63	1.41746	98	1.47071
29	1.36936	64	1.41895	99	1.47234
30	1.37070	65	1.42044	100	1.47399
31	1.37204	66	1.42193		
32	1.37338	67	1.42342		
33	1.37472	68	1.42491		
34	1.37606	69	1.42640		

REFRACTIVE INDEX OF AQUEOUS ALCOHOL SOLUTIONS

The table below gives the readings of the Zeiss Immersion Refractomer for various concentrations of ethyl alcohol in water. The values were calculated by B. H. St. John from the data of Doroshevskii and Dvorzhanchik. Reprinted by permission from the Official and Tentative Methods of Analysis, 3d Edition (1930), published by The Association of Official Agricultural Chemists at Washington, D. C.

Scale Reading	20°C.		23°C.		25°C.	
	% by volume	% by weight	% by volume	% by weight	% by volume	% by weight
13.2	....	....	....	....	0.00	0.00
13.4	....	....	....	....	0.18	0.14
13.6	....	....	....	....	0.35	0.28
13.8	....	....	0.10	0.08	0.53	0.42
14.0	....	....	0.28	0.22	0.70	0.56
14.2	....	....	0.45	0.36	0.88	0.70
14.4	....	....	0.63	0.50	1.06	0.85
14.6	0.16	0.13	0.80	0.64	1.24	0.99
14.8	0.34	0.27	0.98	0.78	1.40	1.11
15.0	0.52	0.41	1.16	0.92	1.55	1.23
15.2	0.69	0.55	1.32	1.05	1.71	1.36
15.4	0.85	0.68	1.47	1.17	1.86	1.48
15.6	1.03	0.82	1.62	1.29	2.01	1.60
15.8	1.21	0.96	1.77	1.41	2.17	1.72
16.0	1.36	1.08	1.92	1.53	2.33	1.85
16.2	1.51	1.20	2.08	1.65	2.48	1.97
16.4	1.66	1.32	2.24	1.78	2.62	2.09
16.6	1.81	1.44	2.39	1.90	2.77	2.21
16.8	1.96	1.56	2.53	2.02	2.92	2.33
17.0	2.11	1.68	2.69	2.14	3.06	2.44
17.2	2.26	1.80	2.82	2.25	3.21	2.56
17.4	2.41	1.92	2.97	2.37	3.36	2.68
17.6	2.56	2.04	3.12	2.49	3.51	2.80
17.8	2.70	2.15	3.27	2.61	3.66	2.92
18.0	2.85	2.27	3.42	2.73	3.81	3.04
18.2	3.00	2.39	3.57	2.85	3.96	3.16
18.4	3.15	2.51	3.71	2.96	4.11	3.28
18.6	3.30	2.63	3.86	3.08	4.26	3.40
18.8	3.45	2.75	4.01	3.20	4.41	3.52
19.0	3.59	2.86	4.16	3.32	4.56	3.64
19.2	3.73	2.98	4.31	3.44	4.70	3.76
19.4	3.88	3.10	4.46	3.56	4.85	3.88
19.6	4.03	3.22	4.61	3.68	5.00	4.00
19.8	4.17	3.33	4.75	3.80	5.15	4.12
20.0	4.32	3.45	4.90	3.92	5.29	4.23
20.2	4.47	3.57	5.05	4.04	5.44	4.35
20.4	4.61	3.68	5.20	4.16	5.58	4.47
20.6	4.75	3.80	5.34	4.27	5.72	4.58
20.8	4.90	3.92	5.48	4.39	5.87	4.70
21.0	5.04	4.03	5.62	4.50	6.02	4.81
21.2	5.19	4.15	5.77	4.62	6.16	4.93
21.4	5.33	4.26	5.91	4.73	6.30	5.05
21.6	5.47	4.38	6.06	4.85	6.44	5.16
21.8	5.61	4.49	6.20	4.97	6.59	5.28
22.0	5.76	4.61	6.34	5.08	6.73	5.39
22.2	5.90	4.72	6.49	5.20	6.87	5.51
22.4	6.05	4.84	6.63	5.31	7.01	5.62
22.6	6.19	4.95	6.77	5.43	7.16	5.74
22.8	6.33	5.07	6.91	5.54	7.31	5.86
23.0	6.47	5.18	7.06	5.66	7.45	5.97
23.2	6.61	5.30	7.20	5.77	7.59	6.08
23.4	6.75	5.41	7.34	5.89	7.73	6.20
23.6	6.90	5.53	7.48	6.00	7.87	6.31
23.8	7.04	5.64	7.62	6.11	8.00	6.42

REFRACTIVE INDEX—ALCOHOL

Scale Reading	20°C.		23°C.		25°C.	
	% by volume	% by weight	% by volume	% by weight	% by volume	% by weight
24.0	7.18	5.76	7.76	6.22	8.14	6.53
24.2	7.32	5.87	7.90	6.34	8.28	6.65
24.4	7.46	5.99	8.04	6.45	8.42	6.76
24.6	7.60	6.10	8.17	6.56	8.55	6.87
24.8	7.74	6.21	8.31	6.67	8.69	6.98
25.0	7.88	6.32	8.45	6.79	8.84	7.10
25.2	8.01	6.43	8.59	6.90	8.98	7.21
25.4	8.14	6.54	8.73	7.01	9.12	7.33
25.6	8.28	6.65	8.86	7.12	9.26	7.44
25.8	8.42	6.76	9.00	7.23	9.39	7.55
26.0	8.55	6.87	9.14	7.35	9.53	7.67
26.2	8.69	6.98	9.28	7.46	9.67	7.78
26.4	8.82	7.09	9.42	7.57	9.81	7.90
26.6	8.96	7.20	9.55	7.68	9.95	8.01
26.8	9.10	7.31	9.69	7.79	10.09	8.12
27.0	9.23	7.42	9.83	7.91	10.23	8.24
27.2	9.37	7.54	9.97	8.02	10.37	8.35
27.4	9.51	7.65	10.10	8.13	10.51	8.46
27.6	9.65	7.76	10.24	8.24	10.65	8.57
27.8	9.79	7.87	10.38	8.35	10.79	8.69
28.0	9.92	7.98	10.51	8.46	10.93	8.80
28.2	10.06	8.09	10.65	8.58	11.06	8.91
28.4	10.19	8.20	10.79	8.69	11.20	9.02
28.6	10.32	8.31	10.93	8.80	11.33	9.13
28.8	10.46	8.42	11.06	8.91	11.47	9.24
29.0	10.59	8.53	11.20	9.02	11.61	9.36
29.2	10.73	8.64	11.33	9.13	11.75	9.47
29.4	10.86	8.74	11.47	9.24	11.88	9.58
29.6	10.99	8.85	11.60	9.35	12.01	9.69
29.8	11.12	8.96	11.74	9.46	12.15	9.80
30.0	11.26	9.07	11.87	9.57	12.29	9.91
30.2	11.38	9.18	12.00	9.68	12.42	10.02
30.4	11.51	9.28	12.13	9.79	12.56	10.13
30.6	11.64	9.39	12.27	9.90	12.70	10.24
30.8	11.78	9.50	12.40	10.01	12.84	10.36
31.0	11.91	9.60	12.54	10.12	12.97	10.47
31.2	12.04	9.71	12.67	10.23	13.11	10.58
31.4	12.17	9.82	12.81	10.34	13.24	10.69
31.6	12.30	9.92	12.94	10.45	13.37	10.80
31.8	12.43	10.03	13.07	10.55	13.51	10.91
32.0	12.57	10.14	13.20	10.66	13.64	11.02
32.2	12.70	10.25	13.34	10.77	13.77	11.13
32.4	12.83	10.35	13.47	10.88	13.91	11.24
32.6	12.96	10.46	13.60	10.99	14.04	11.35
32.8	13.09	10.57	13.73	11.10	14.17	11.46
33.0	13.22	10.68	13.86	11.21	14.31	11.57
33.2	13.35	10.79	13.99	11.31	14.44	11.68
33.4	13.48	10.89	14.13	11.42	14.58	11.79
33.6	13.61	11.00	14.26	11.53	14.71	11.90
33.8	13.74	11.10	14.39	11.64	14.85	12.01
34.0	13.86	11.21	14.52	11.75	14.98	12.12
34.2	13.99	11.31	14.65	11.85	15.11	12.23
34.4	14.12	11.41	14.78	11.96	15.25	12.34
34.6	14.25	11.52	14.91	12.07	15.38	12.45
34.8	14.37	11.62	15.05	12.18	15.51	12.56
35.0	14.50	11.73	15.18	12.28	15.65	12.67
35.2	14.62	11.83	15.31	12.39	15.78	12.78
35.4	14.75	11.93	15.44	12.50	15.91	12.89
35.6	14.87	12.04	15.56	12.60	16.05	13.00
35.8	15.00	12.14	15.69	12.71	16.18	13.11

REFRACTIVE INDEX—ALCOHOL

Scale Reading	20°C.		23°C.		25°C.	
	% by volume	% by weight	% by volume	% by weight	% by volume	% by weight
36.0	15.13	12.24	15.82	12.82	16.31	13.21
36.2	15.25	12.35	15.95	12.92	16.44	13.32
36.4	15.38	12.45	16.08	13.03	16.56	13.43
36.6	15.51	12.56	16.21	13.14	16.69	13.53
36.8	15.63	12.66	16.34	13.24	16.82	13.64
37.0	15.76	12.77	16.47	13.35	16.95	13.75
37.2	15.89	12.87	16.60	13.45	17.08	13.86
37.4	16.01	12.97	16.72	13.56	17.21	13.96
37.6	16.14	13.08	16.85	13.66	17.34	14.07
37.8	16.26	13.18	16.98	13.77	17.46	14.17
38.0	16.39	13.28	17.11	13.87	17.59	14.28
38.2	16.51	13.38	17.23	13.98	17.72	14.38
38.4	16.64	13.49	17.36	14.08	17.85	14.49
38.6	16.76	13.59	17.48	14.19	17.97	14.59
38.8	16.89	13.69	17.61	14.29	18.10	14.70
39.0	17.01	13.79	17.74	14.40	18.23	14.80
39.2	17.14	13.90	17.86	14.50	18.35	14.91
39.4	17.26	14.00	17.99	14.60	18.48	15.01
39.6	17.39	14.10	18.11	14.71	18.61	15.12
39.8	17.51	14.21	18.24	14.81	18.73	15.22
40.0	17.63	14.31	18.36	14.92	18.86	15.32
40.2	17.76	14.41	18.49	15.02	18.99	15.43
40.4	17.88	14.51	18.61	15.12	19.11	15.53
40.6	18.01	14.62	18.74	15.23	19.24	15.64
40.8	18.13	14.72	18.86	15.33	19.37	15.74
41.0	18.25	14.82	18.99	15.43	19.49	15.85
41.2	18.37	14.92	19.11	15.53	19.62	15.95
41.4	18.50	15.03	19.24	15.64	19.75	16.06
41.6	18.62	15.13	19.36	15.74	19.87	16.16
41.8	18.74	15.23	19.48	15.84	20.00	16.27
42.0	18.87	15.33	19.61	15.94	20.13	16.37
42.2	18.99	15.43	19.73	16.05	20.25	16.48
42.4	19.11	15.53	19.86	16.15	20.38	16.58
42.6	19.23	15.63	19.98	16.25	20.50	16.69
42.8	19.36	15.74	20.10	16.35	20.63	16.79
43.0	19.48	15.84	20.23	16.46	20.75	16.90
43.2	19.60	15.94	20.35	16.56	20.88	17.00
43.4	19.72	16.04	20.47	16.66	21.01	17.10
43.6	19.85	16.14	20.60	16.76	21.13	17.21
43.8	19.97	16.24	20.72	16.87	21.25	17.31
44.0	20.09	16.34	20.84	16.97	21.38	17.41
44.2	20.21	16.44	20.96	17.07	21.50	17.52
44.4	20.33	16.55	21.09	17.17	21.63	17.62
44.6	20.45	16.65	21.21	17.28	21.75	17.73
44.8	20.58	16.75	21.33	17.38	21.88	17.83
45.0	20.70	16.85	21.45	17.48	22.00	17.93
45.2	20.82	16.95	21.58	17.58	22.13	18.04
45.4	20.94	17.05	21.70	17.68	22.25	18.14
45.6	21.06	17.15	21.82	17.79	22.38	18.25
45.8	21.18	17.25	21.94	17.89	22.51	18.36
46.0	21.30	17.35	22.07	17.99	22.64	18.47
46.2	21.42	17.45	22.19	18.09	22.76	18.57
46.4	21.54	17.55	22.32	18.20	22.89	18.68
46.6	21.66	17.65	22.44	18.30	23.02	18.79
46.8	21.78	17.75	22.57	18.41	23.15	18.90
47.0	21.90	17.85	22.69	18.51	23.28	19.00
47.2	22.02	17.95	22.82	18.62	23.41	19.11
47.4	22.15	18.06	22.94	18.72	23.54	19.22
47.6	22.27	18.16	23.07	18.83	23.67	19.33
47.8	22.39	18.26	23.20	18.93	23.80	19.43

REFRACTIVE INDEX—ALCOHOL

Scale Reading	20°C.		23°C.		25°C.	
	% by volume	% by weight	% by volume	% by weight	% by volume	% by weight
48.0	22.51	18.36	23.32	19.04	23.93	19.54
48.2	22.63	18.46	23.45	19.14	24.06	19.65
48.4	22.75	18.56	23.58	19.25	24.19	19.76
48.6	22.87	18.66	23.71	19.36	24.32	19.87
48.8	22.99	18.76	23.83	19.47	24.45	19.98
49.0	23.12	18.86	23.96	19.57	24.59	20.09
49.2	23.24	18.96	24.09	19.68	24.72	20.20
49.4	23.36	19.07	24.22	19.79	24.85	20.31
49.6	23.48	19.17	24.35	19.89	24.98	20.42
49.8	23.61	19.27	24.48	20.00	25.11	20.54
50.0	23.73	19.38	24.61	20.11	25.25	20.65
50.2	23.85	19.48	24.74	20.22	25.38	20.76
50.4	23.98	19.58	24.86	20.33	25.51	20.87
50.6	24.10	19.69	24.99	20.44	25.65	20.98
50.8	24.22	19.79	25.12	20.55	25.78	21.10
51.0	24.35	19.89	25.25	20.66	25.91	21.21
51.2	24.47	20.00	25.38	20.77	26.05	21.32
51.4	24.59	20.10	25.51	20.87	26.18	21.44
51.6	24.72	20.20	25.64	20.98	26.32	21.55
51.8	24.84	20.31	25.77	21.09	26.45	21.66
52.0	24.96	20.41	25.90	21.20	26.59	21.78
52.2	25.09	20.52	26.03	21.31	26.72	21.89
52.4	25.21	20.62	26.16	21.42	26.86	22.01
52.6	25.34	20.72	26.29	21.53	26.99	22.12
52.8	25.46	20.83	26.42	21.64	27.13	22.24
53.0	25.59	20.93	26.56	21.75	27.27	22.35
53.2	25.71	21.04	26.69	21.86	27.40	22.47
53.4	25.84	21.14	26.82	21.97	27.54	22.58
53.6	25.96	21.25	26.95	22.08	27.67	22.70
53.8	26.09	21.36	27.08	22.20	27.81	22.81
54.0	26.22	21.47	27.21	22.31	27.95	22.93
54.2	26.34	21.57	27.35	22.42	28.08	23.04
54.4	26.47	21.68	27.48	22.53	28.22	23.16
54.6	26.59	21.79	27.61	22.65	28.36	23.27
54.8	26.72	21.90	27.75	22.76	28.49	23.39
55.0	26.85	22.00	27.88	22.87	28.63	23.51
55.2	26.97	22.11	28.01	22.98	28.77	23.62
55.4	27.10	22.21	28.15	23.10	28.90	23.74
55.6	27.23	22.32	28.28	23.21	29.04	23.86
55.8	27.35	22.42	28.41	23.32	29.18	23.97
56.0	27.48	22.53	28.54	23.43	29.31	24.09
56.2	27.60	22.64	28.68	23.54	29.45	24.20
56.4	27.73	22.74	28.81	23.66	29.58	24.32
56.6	27.85	22.85	28.94	23.77	29.72	24.43
56.8	27.98	22.95	29.07	23.88	29.86	24.55
57.0	28.10	23.06	29.20	23.99	29.99	24.66
57.2	28.23	23.17	29.34	24.11	30.13	24.78
57.4	28.35	23.27	29.47	24.22	30.27	24.90
57.6	28.48	23.38	29.60	24.33	30.41	25.01
57.8	28.60	23.49	29.73	24.44	30.55	25.13
58.0	28.73	23.59	29.87	24.55	30.69	25.25
58.2	28.86	23.70	29.99	24.66	30.83	25.37
58.4	28.98	23.81	30.13	24.78	30.97	25.49
58.6	29.11	23.91	30.26	24.89	31.11	25.61
58.8	29.23	24.02	30.40	25.00	31.25	25.73
59.0	29.36	24.13	30.53	25.12	31.40	25.86
59.2	29.49	24.24	30.67	25.24	31.54	25.98
59.4	29.61	24.34	30.81	25.36	31.68	26.10
59.6	29.74	24.45	30.94	25.47	31.83	26.23
59.8	29.87	24.56	31.08	25.59	31.97	26.35

REFRACTIVE INDEX—ALCOHOL

Scale Reading	20°C.		23°C.		25°C.	
	% by volume	% by weight	% by volume	% by weight	% by volume	% by weight
60.0	29.99	24.67	31.22	25.71	32.12	26.48
60.2	30.12	24.77	31.36	25.83	32.27	26.61
60.4	30.25	24.88	31.50	25.95	32.41	26.73
60.6	30.38	24.99	31.64	26.07	32.56	26.86
60.8	30.51	25.10	31.78	26.19	32.71	26.99
61.0	30.64	25.21	31.92	26.31	32.86	27.12
61.2	30.77	25.32	32.06	26.43	33.01	27.24
61.4	30.90	25.44	32.20	26.55	33.16	27.37
61.6	31.03	25.55	32.34	26.67	33.31	27.50
61.8	31.16	25.66	32.49	26.79	33.46	27.63
62.0	31.29	25.77	32.63	26.92	33.60	27.76
62.2	31.43	25.88	32.77	27.04	33.75	27.88
62.4	31.56	25.99	32.91	27.16	33.90	28.01
62.6	31.69	26.11	33.06	27.29	34.05	28.15
62.8	31.83	26.23	33.20	27.41	34.21	28.28
63.0	31.96	26.35	33.35	27.54	34.36	28.42
63.2	32.10	26.46	33.50	27.66	34.52	28.55
63.4	32.23	26.58	33.64	27.79	34.67	28.69
63.6	32.37	26.70	33.79	27.91	34.83	28.82
63.8	32.51	26.82	33.93	28.04	34.98	28.96
64.0	32.65	26.94	34.08	28.17	35.15	29.10
64.2	32.79	27.05	34.23	28.30	35.31	29.24
64.4	32.92	27.17	34.39	28.43	35.48	29.38
64.6	33.06	27.29	34.54	28.57	35.64	29.52
64.8	33.20	27.41	34.69	28.70	35.80	29.67
65.0	33.34	27.53	34.84	28.83	35.97	29.81
65.2	33.48	27.65	34.99	28.96	36.13	29.95
65.4	33.62	27.77	35.15	29.10	36.30	30.10
65.6	33.76	27.89	35.30	29.23	36.46	30.24
65.8	33.90	28.01	35.46	29.37	36.63	30.39
66.0	34.04	28.13	35.62	29.51	36.79	30.54
66.2	34.18	28.26	35.77	29.64	36.96	30.68
66.4	34.33	28.38	35.93	29.78	37.13	30.83
66.6	34.47	28.51	36.09	29.92	37.30	30.98
66.8	34.62	28.64	36.25	30.06	37.48	31.13
67.0	34.76	28.76	36.41	30.20	37.65	31.28
67.2	34.91	28.89	36.57	30.34	37.83	31.44
67.4	35.05	29.01	36.73	30.49	38.00	31.59
67.6	35.20	29.14	36.90	30.63	38.18	31.74
67.8	35.35	29.27	37.06	30.77	38.35	31.89
68.0	35.50	29.41	37.23	30.91	38.53	32.05
68.2	35.65	29.54	37.39	31.06	38.70	32.21
68.4	35.80	29.67	37.56	31.21	38.88	32.37
68.6	35.95	29.80	37.73	31.35	39.06	32.53
68.8	36.10	29.93	37.90	31.50	39.24	32.69
69.0	36.25	30.06	38.07	31.65	39.43	32.86
69.2	36.41	30.20	38.24	31.79	39.61	33.02
69.4	36.56	30.33	38.41	31.94	39.80	33.18
69.6	36.72	30.47	38.58	32.09	39.98	33.34
69.8	36.87	30.61	38.75	32.25	40.17	33.51
70.0	37.02	30.74	38.92	32.41	40.35	33.67
70.2	37.19	30.88	39.10	32.57	40.53	33.84
70.4	37.35	31.01	39.28	32.72	40.72	34.00
70.6	37.51	31.16	39.46	32.88	40.90	34.17
70.8	37.67	31.30	39.64	33.04	41.08	34.33
71.0	37.83	31.44	39.82	33.20	41.27	34.50
71.2	37.99	31.59	40.00	33.36	41.46	34.67
71.4	38.16	31.73	40.18	33.52	41.64	34.83
71.6	38.32	31.87	40.36	33.68	41.83	35.00
71.8	38.49	32.01	40.54	33.84	42.02	35.17

REFRACTIVE INDEX—ALCOHOL

Scale Reading	20°C.		23°C.		25°C.	
	% by volume	% by weight	% by volume	% by weight	% by volume	% by weight
72.0	38.65	32.17	40.72	34.00	42.21	35.34
72.2	38.82	32.32	40.90	34.16	42.40	35.51
72.4	38.98	32.47	41.08	34.33	42.58	35.68
72.6	39.16	32.62	41.26	34.49	42.77	35.85
72.8	39.33	32.77	41.45	34.65	42.96	36.02
73.0	39.50	32.92	41.63	34.81	43.15	36.18
73.2	39.67	33.07	41.81	34.98	43.33	36.35
73.4	39.84	33.22	41.99	35.14	43.52	36.52
73.6	40.02	33.37	42.17	35.31	43.70	36.68
73.8	40.19	33.53	42.36	35.47	43.89	36.85
74.0	40.36	33.68	42.54	35.64	44.08	37.02
74.2	40.53	33.83	42.72	35.80	44.28	37.20
74.4	40.71	33.98	42.91	35.97	44.48	37.38
74.6	40.88	34.14	43.09	36.13	44.67	37.56
74.8	41.05	34.30	43.28	36.30	44.87	37.75
75.0	41.23	34.46	43.46	36.47	45.07	37.93
75.2	41.41	34.61	43.65	36.64	45.29	38.12
75.4	41.58	34.77	43.83	36.81	45.50	38.31
75.6	41.76	34.93	44.02	36.97	45.71	38.50
75.8	41.94	35.09	44.21	37.15	45.92	38.68
76.0	42.12	35.25	44.41	37.33	46.12	38.86
76.2	42.30	35.41	44.60	37.50	46.34	39.08
76.4	42.48	35.58	44.80	37.68	46.56	39.29
76.6	42.66	35.74	44.99	37.86	46.78	39.49
76.8	42.84	35.90	45.19	38.04	47.00	39.69
77.0	43.02	36.07	45.40	38.23	47.23	39.90
77.2	43.20	36.24	45.60	38.42	47.45	40.11
77.4	43.39	36.40	45.81	38.60	47.68	40.32
77.6	43.57	36.57	46.01	38.79	47.91	40.54
77.8	43.76	36.74	46.23	38.98	48.14	40.75
78.0	43.94	36.91	46.45	39.18	48.37	40.97
78.2	44.13	37.08	46.67	39.39	48.60	41.18
78.4	44.32	37.25	46.89	39.59	48.84	41.40
78.6	44.51	37.42	47.11	39.80	49.07	41.62
78.8	44.70	37.59	47.34	40.00	49.31	41.84
79.0	44.89	37.76	47.56	40.21	49.54	42.05
79.2	45.08	37.94	47.79	40.42	49.77	42.27
79.4	45.28	38.11	48.01	40.63	50.01	42.49
79.6	45.48	38.30	48.23	40.84	50.24	42.71
79.8	45.68	38.48	48.46	41.05	50.48	42.93
80.0	45.88	38.67	48.68	41.26	50.71	43.15

CONVERSION OF SCALE DIVISIONS OF THE IMMERSION REFRACTOMETER TO REFRACTIVE INDEX

Originally the immersion instrument was designed with a single prism (*A*) of crown glass which allowed only the range from n_D 1.32 to 1.36 to be covered. By a choice of glass and prism angle it has been found possible with a battery of six prisms to extend the upper limit of the range to 1.54. Each prism of the series overlaps the one immediately above so that there is no lost region from 1.32 to 1.54. The ranges covered by these prisms are: *A*–1.32539 to 1.36674; *B*–1.36428 to 1.40608; *C*–1.39860 to 1.43830; *D*–1.43620 to 1.47562; *E*–1.47320 to 1.51335; *F*–1.50969 to 1.54409. Prism *A* is the standard to which the values in the table below apply. For the other prisms (*B* to *F*) the index of refraction is not standardized as between different manufacturers nor for different lots issued by the same manufacturer. For these prisms (*B* to *F*) it is necessary to use the table supplied with any particular instrument and impossible to publish any conversion tables which would be universally applicable.

Example: Scale division 25.1 on prism *A* corresponds to the refractive index $n_D = 1.33705 + 0.000038 = 1.33709$.

Scale Division	n_D	Scale Division	n_D	Scale Division	n_D
−5	1.32539	33	1.34010	70	1.35388
−4	2578	34	4048	71	5425
−3	2618	35	4086	72	5461
−2	2657	36	4124	73	5497
−1	2696	37	4162	74	5533
0	2736	38	4199	75	5569
1	2775	39	4237	76	5606
2	2814	40	4275	77	5642
3	2854	41	4313	78	5678
4	2893	42	4350	79	5714
5	2932	43	4388	80	5750
6	2971	44	4426	81	5786
7	3010	45	4463	82	5822
8	3049	46	4500	83	5858
9	3087	47	4537	84	5894
10	3126	48	4575	85	5930
11	3165	49	4612	86	5966
12	3204	50	4650	87	6002
13	3242	51	4687	88	6038
14	3281	52	4724	89	6074
15	3320	53	4761	90	6109
16	3358	54	4798	91	6145
17	3397	55	4836	92	6181
18	3435	56	4873	93	6217
19	3474	57	4910	94	6252
20	3513	58	4947	95	6287
21	3551	59	4984	96	6323
22	3590	60	5021	97	6359
23	3628	61	5058	98	6394
24	3667	62	5095	99	6429
25	3705	63	5132	100	6464
26	3743	64	5169	101	6500
27	3781	65	5205	102	6535
28	3820	66	5242	103	6570
29	3858	67	5279	104	6605
30	3896	68	5316	105	6640
31	3934	69	5352		
32	3972				

INDEX OF REFRACTION CALCULATIONS

For Organic Liquids.

Reference: Smiles, *The Relation between Chemical Constitution and some Physical Properties* (1910). Published by Longmans, Green and Co., London.

In the Lorentz and Lorenz formula:

$$\frac{n^2-1}{n^2+2} \times \frac{1}{d} = k$$

n is the index of refraction of a liquid at a given temperature, *d* is the density of the substance at the same temperature, and *k*, which is nearly independent of the temperature, is a constant known as the *specific refraction.* The product $M \times k$, where *M* is the molecular weight of the substance, is the *molecular refraction;* this quantity (Mk) is additive and can be calculated for most organic liquid compounds from empirically deduced atomic and structural refractive constants. Such refractive constants (k) for sodium (D) light are given in the following table:

	k		*k*
C	2.418	N	^{1}2.45; ^{2}3.21; ^{3}2.65; ^{4}3.59; ^{5}3.00; ^{6}4.36; ^{7}2.48; ^{8}2.47; ^{9}3.05; ^{10}3.79; ^{11}3.93; ^{12}2.65; ^{13}2.27; ^{14}2.71; ^{15}3.776; ^{16}3.901; ^{17}4.10; ^{18}3.46
H	1.100		
O	(*a*) 1.525; (*b*) 2.211; (*c*) 1.643; (*d*) 1.64		
S	(*e*) 7.69; (*f*) 7.97; (*g*) 7.91; (*h*) 8.11	NO_2	^{19}7.59; ^{20}7.44; ^{21}6.72; ^{22}7.30; ^{23}7.51
Se	(*i*) 11.17		
Hal.	(*j*) 0.95; (*k*) 1.1; (*m*) 5.967; (*n*) 8.865; (*p*) 13.900	NO	^{24}5.91; ^{25}5.37
Str.	(*q*) 1.733; (*r*) 2.398; (*s*) 0.71; (*t*) 0.48		

In the form of: (a) (OH); (b) C:O; (c) ether OR; (d) ester OR; (e) SH; (f) RSR; (g) RCNS; (h) RSSR; (i) in dialkyl selenides; (j) one F on carbon; F (k) in polyfluorides; (m) Cl; (n) Br; (p) I; (q) double bond; (r) triple bond; (s) 3-membd. ring; (t) 4-membd. ring; (1) aliph. prim. amine; (2) arom. prim. amine; (3) aliph. sec. amine; (4) arom. sec. amine; (5) aliph. tert. amine; (6) arom. tert. amine; (7) hydroxylamine; (8) hydrazine; (9) aliph. cyanide; (10) arom. cyanide; (11) aliph. oxime; (12) prim. amide; (13) sec. amide; (14) tert. amide; (15) imidine; (16) oximido; (17) carbimido; (18) hydrazone; (19) alkyl nitrate; (20) alkyl nitrite; (21) nitro paraffin; (22) nitro arom.; (23) nitramine; (24) nitrite; (25) nitrosoamine.

Example: Allylacetic acid ($CH_2{:}CH \cdot CH_2 \cdot CH_2 \cdot CO \cdot OH$) has the following observed constants: $n_D^{7.5} = 1.4341$; $d_4^{7.5} = 0.9903$; molecular weight = 100.114. From this the calculated value of Mk is found as follows:

5 C	12.090
8 H	8.800
1 O′	1.525
1 O″	2.211
1 =	1.733
Mk_D	26.359

The observed value of Mk as calculated from the Lorentz and Lorenz formula is:

$$100.064 \times \frac{(1.4341)^2-1}{(1.4341)^2+2} \times \frac{1}{0.9903} = 26.332$$

Optical exaltation is characteristic of substances containing conjugated double bonds (single bonds alternating with double bonds); *i.e.*, their molecular refractions (Mk) are usually one or more units in excess of the calculated values.

For Minerals.

Reference: Larsen and Berman, *The Microscopic Determination of the Nonopaque Minerals*, 2d edition (1934); U. S. Geological Survey, Bull. 848. Washington, D. C.

In the Gladstone and Dale formula:

$$\frac{n-1}{d} = K, \text{ and } K = k_1\frac{p_1}{100} + k_2\frac{p_2}{100} + etc.,$$

n is the mean index of refraction, d is the density, K is the specific refractive energy, k_1, k_2, etc. are the specific refractive energies of the components, and p_1, p_2, etc. the weight percentages of the components of a mineral. The mean index of refraction is $\frac{2\omega+\epsilon}{3}$ or $\frac{\alpha+\beta+\gamma}{3}$ unless the substance is highly birefringent when the mean index is better expressed by $\sqrt[3]{\omega^2\epsilon}$ or $\sqrt[3]{\alpha\beta\gamma}$. The specific refractive energies of the chief constituents of minerals are given in the following table:

	Molecular weight	k		Molecular weight	k
H_2O	18	[a]0.3355, [b]0.340, [c].354	As_2O_3	198	[g]0.202, [h]0.225
			Y_2O_3	226	.144
Li_2O	30	.31	Sb_2O_3	228.4	[g].209, [i].232
$(NH_4)_2O$	52	.503	La_2O_3	326	.149
Na_2O	62	.181	Ce_2O_3	328.5	.16
K_2O	94	.189	Bi_2O_3	464	.163
Cu_2O	143	.250	CO_2	44	.217
Rb_2O	187	.129	SiO_2	60	.207
Ag_2O	232	.154	TiO_2	80	.397
Cs_2O	282	.124	SeO_2	111	.147
Hg_2O	416	.189 Li	ZrO_2	122.5	.201
Tl_2O	424	.120	SnO_2	151	.145
BeO	25	.238	SbO_2	152	.198
MgO	40.4	.200	TeO_2	159.5	[e].200 Li
CaO	56	.225	ThO_2	264.5	.12
MnO	71	[d].191, [e].224	N_2O_5	108	.240
FeO	72	.187	P_2O_5	142	.190
NiO	75	.184	Cl_2O_5	151	.218
CoO	75	.184	V_2O_5	182.4	.43
CuO	79.6	[d].191, [e].253 Li	As_2O_5	230	.169
ZnO	81.4	[d].153, [e].183	Br_2O_5	240	.183
SrO	103.6	.143	Cb_2O_5	268	.295
CdO	128.4	.134	Sb_2O_5	320.4	.152, .222 (?)
BaO	153.4	.127	I_2O_5	334	.177
HgO	216	.18	Ta_2O_5	446	.133
PbO	223	[d].137, [e].175 Li	SO_3	80	.177
B_2O_3	70	[g].220	CrO_3	100	.36
C_2O_3	72	.265	SeO_3	127	.165
Al_2O_3	102	.193, [f].214	MoO_3	144	.241 Li
Cr_2O_3	152	.27	TeO_3	175.6	.607
Mn_2O_3	158	[d].300, [e].304 Li	WO_3	235	.133
Fe_2O_3	160	[d].308, [e].36 Li	UO_3	286.5	.134
	Atomic weight	k		Atomic weight	k
H	1	1.256 or 1.44	S	32	[k]0.502, [m]1.00
C	12	.403	Cl	35.5	.303
O	16	.203	Br	80	.214
F	19	.043	I	127	.226

[a] Water and ice.
[b] Average.
[c] Alums, etc.
[d] Calculated from compounds containing the oxide.
[e] Calculated from the oxide.
[f] Calculated from feldspar, feldspathoids, etc.
[g] Isometric oxide.
[h] Monoclinic oxide.
[i] Orthorhombic oxide.
[k] Calculated from native sulfur.
[m] Calculated from sulfides; values vary.

Example: Sodium tetraborate, $Na_2B_4O_7 \cdot 5H_2O$, has the following observed constants: formula, $Na_2O \cdot 2B_2O_3 \cdot 5H_2O$; molecular weight, 292; contains, 21.2% Na_2O; 48% B_2O_3; 30.8% H_2O; d, 1.815; $\omega = 1.461$; $\epsilon = 1.474$. From the table k for Na_2O, 0.181; k for B_2O_3, 0.220; k for H_2O, 0.340. Therefore, $K = 0.181 \times 21.2\% + 0.220 \times 48\% + 0.340 \times 30.8\% = 0.24869$. Substituting in the Gladstone Dale formula:

$$\frac{n-1}{1.815} = 0.24869, \text{ or } n = 1.4514 \text{ by calculation.}$$

$$\text{The observed average value of } n = \frac{2\omega+\epsilon}{3} = \frac{2(1.461)+1.474}{3} = 1.465$$

ISOTROPIC CRYSTALS FOR DETERMINING REFRACTIVE INDICES OF LIQUIDS BY IMMERSION METHODS

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Refr. index	Formula
1.326	NaF
1.340	K_2SiF_6
1.361	KF
1.370	$(NH_4)_2SiF_6$
1.439	$Na_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$
1.456	$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$
1.459	$(NH_4)_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$
1.481	$K_2SO_4 \cdot Cr_2(SO_4)_3 \cdot 24H_2O$
1.488	$(NH_4)_2SO_4 \cdot Fe_2(SO_4)_3 \cdot 24H_2O$
1.490	KCl
1.494	$RbCl$
1.504	$NaC_2H_3O_2 \cdot UO_2(C_2H_3O_2)_2$
1.515	$NaClO_3$
1.544	$NaCl$
1.553	$RbBr$
1.559	KBr
1.571	$Ba(NO_3)_2$
1.588	$Sr(NO_3)_2$

Refr. index	Formula
1.617	$NaBrO_3$
1.640	NH_4Cl
1.641	$NaBr$
1.645	$CsCl$
1.650	RbI
1.657	K_2SnCl_6
1.667	KI
1.678	$(NH_4)_2SnCl_6$
1.698	$CsBr$
1.703	NH_4I
1.755	As_2O_3
1.774	NaI
1.782	$Pb(NO_3)_2$
1.787	CsI
1.827	K_2PtCl_6
2.06	$AgCl$
2.25	$AgBr$

LIQUID MIXTURES FOR REFRACTIVE INDEX DETERMINATIONS

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Refr. Index (daylight, 20-22°C.)	Ethyl alcohol $n = 1.362$	Ethylene glycol ethyl ether ("Cellosolve") $n = 1.407$	Kerosene $n = 1.443$
1.370	50 cc.	9 cc.	.....
1.380	50	30	.....
1.390	35	50	.....
1.400	10	50	.....
1.410	......	50	5 cc.
1.420	......	50	35
1.430	......	35	75
1.440	......	5	75

Refractive indices	Mixtures
1.450-1.475	Kerosene and turpentine.
1.480-1.535	Turpentine and ethylene bromide or clove oil.
1.540-1.635	Clove oil and α-bromonaphthalene.
1.640-1.655	α-Bromonaphthalene and α-chloronaphthalene.
1.650-1.740	α-Bromonaphthalene and methylene iodide.
1.740-1.790	Sulfur dissolved in methylene iodide.
1.790-1.960	Methylene iodide, antimony iodide, arsenic sulfide, antimony sulfide, and sulfur.

REFRACTIVE INDICES (APPROXIMATE) OF VARIOUS SUBSTANCES

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Substance	ω	ε
"Acetate silk"	1.48	1.475
"Bakelite"	1.58—1.63	......
Celluloid	1.53	......
Cellulose fibers (cotton, flax, ramie, etc.)	1.53	1.59
"Collodion silk"	1.52	1.55
Gelatin, dry	1.54	......
Horn	1.56	......
Lacquer, dry ("Duco")	1.54	......
Linseed oil, dry	1.48—1.50	......
Rubber, pale crepe (vulcanized is higher)	1.51+	......
Shellac	1.54	......
Silk	1.54	1.59
Starch	1.53	......
Varnish, dry	1.51—1.54	......
"Viscose silk"	1.525	1.55
Wool	1.54+	1.55+

LIQUID STANDARDS FOR REFRACTIVE INDEX DETERMINATIONS BY IMMERSION METHODS

Reprinted by permission from *Handbook of Chemical Microscopy*, by Chamot and Mason, published by John Wiley & Sons., Inc.

Refr. Ind. (daylight, 20-22°C.)	Liquid
1.32	Methyl alcohol
1.333	Water
1.358	Acetone
1.36	Ethyl alcohol
1.38	Ethyl butyrate
1.39	Hexane
1.394	*iso*-Butyl alcohol
1.40	Heptane
1.40	Ethylene glycol monomethy ether
1.41	Amyl alcohol
1.41	Ethylene glycol monoethyl ether ("Cellosolve")
1.42	Ethylene glycol monobutyl ether
1.44	Chloroform
1.44	Ethylene chloride
1.45	Kerosene
1.46	Carbon tetrachloride
1.47	Cajeput oil
1.47	Glycerol
1.47	Olive oil
1.475	Paraffin oil ("Nujol")
1.475	Turpentine
1.48	Castor oil
1.49	Dibutyl phthalate
1.494	Xylene
1.495	Benzene
1.50	Lubricating oil (automobile)

Refr. Ind. (daylight, 20-22°C.)	Liquid
1.515	Anisole
1.515	Cedar wood oil
1.52	Chlorobenzene
1.53	Clove oil
1.54	Ethylene bromide
1.55	Nitrobenzene
1.56	Tricresyl phosphate
1.56	Bromobenzene
1.57	*o*-Toluidine
1.58	Bromophenol
1.586	Aniline
1.59	Bromoform
1.60	Cassia oil
1.61	Quinaldine
1.615	Cinnamic aldehyde
1.62	Iodobenzene
1.62	Quinoline
1.625	Carbon disulfide
1.63	α-Chloronaphthalene
1.66	α-Bromonaphthalene
1.74	Methylene iodide
1.78	Methylene iodide saturated with sulfur
1.87	Methylene iodide, S. CHI_3 SnI_4, AsI_3, SbI_3
1.64-2.10	Piperine, AsI_3, SbI_3
2.0-2.7	Sulfur-Selenium mixtures

CLASSIFICATION

Reprinted by permission, from "Chapters in Crystal Chemistry for College

			Characteristic Properties
Crystal Type	Crystal Units	Type of Binding	Optical
Ionic	Simple and complex ions	Electrical attraction between ions of opposite signs	Transparent; color if present is due to ions
Silicate	O^{--} or F^- ions; Si^{4+} or Be^{2+} or Al^{3+} and other positive ions	Weak to moderate polarization	Refractivity due to positive ions
Homopolar	Atoms of the fourth group and of groups equidistant on either side of it	Homopolar bonds throughout or strongly polarized ionic bindings	Transparent with high refractivity or opaque metalloidal
Molecular	Inert gas atoms. Non-polar and polar molecules	Van der Waal's forces or residual electric fields	Transparent. Optical properites due to molecules
Layer	Strongly polarizing and easily polarized ions	In layers, homopolar or polarized ionic. Between layers, molecular	As homopolar
Metallic	Positive ions and electron gas	Electrical attraction between positive ions and electron gas	Opaque (due tc free electrons)
Metalloidal	Metal atoms and atoms of the sulfur and arsenic groups	Mixture of homopolar, ionic, and metallic binding	Opaque, metallic or transparent with high refractivity and color

OF CRYSTALS

Freshmen," by C. W. Stillwell; *Jour. Chem. Education*, 10, 598 (1933).

Characteristic Properties			
Electrical	Thermal	Mechanical	Typical Crystals
Moderate insulators; in high fields conduct by transfer of ions	Fairly high melting point; ionization occurs in liquid, vapor	Strength increasing with higher ionization and decrease in distance beweeen ions. Fracture by cleavage	NaCl, CaF_2 $CaCO_3$, K_2SO_4, $(NH_4)_2PtCl_6$
When polarization is slight, dissolve in ionizing solvents (water); when stronger, are insoluble	Very high melting points, glasses formed on cooling of melt	Very hard with tendency to cleave or fracture conchoidally	Olivine, Mg_2SiO_2; Cyanite, Al_2SiO_5; Garnet, $R^{II}_3R^{III}_2$, Si_3O_{12}; Spinel, Al_2MgO_4, Al_2O_3, SiO_2
Diamond is a perfect insulator. The others conduct metalloidally. Very insoluble	Very high melting points with tendency to vaporize except in more metalloidal	Very hard. Hardness less for metalloidal types	Diamond, Zinc Blende, ZnS; Wurtzite, ZnS; Carborundum, CSi. Many intermediate compounds—γ brass
Insulators except when very polar; soluble in non-ionizing (molecular) solvents	Melting point very low with neutral atoms	Very soft, hardness increasing with polarity of molecules	Argon, A; CO_2; Ice, H_2O; Paraffins, C_nH_{2n+2}; Cellulose
Various, similar to both molecular and homopolar	Various, similar to both molecular and homopolar	Cleaving readily in layers which are soft and flexible	Graphite, C; CdI_2
Conductors, conductivity inversely proportional to number of free electrons	Moderate to very high melting points. Long liquid interval	Moderate hardness increased by alloying	Copper, iron, sodium, zinc
Medium to bad conductors. Soluble only with decomposition	Tendency to vaporize or decompose at high temperatures	Moderately hard to soft. Properties a mixture of those of other types	NiAs, FeS, FeS_2

X-RAY EMISSION SPECTRA OF THE K SERIES

Values selected from Siegbahn, *Spektroskopie der Rontgenstrahlen*, 2d. Ed., Julius Springer, Berlin, 1931.

Element	Atomic No.	Wave length in cm. × 10^{-11}					
		α_1	α_2	α_3	β_1	β_2	β'
Sodium	11	11885		11805	11594	....	11704
Magnesium	12	9869.0		9801.3	9539	....	9648
Aluminum	13	8320.5		8266.9	7965	....	8043
Silicon	14	7111.06		7064.9	6754.5	....	6794.2
Phosphorus	15	6142.5		6103.0	5792.1	....	5820.2
Sulfur	16	5361.3	5363.7	5329.4	5021.1	....	5044.7
Chlorine	17	4718.2	4721.2	4688	4394.2	....	4406
Potassium	19	3733.68	3737.07	3711.0	3446.8	....	....
Calcium	20	3351.69	3354.95	3332.3	3083.4	....	3091.1
Scandium	21	3025.03	3028.40	3006 $=\alpha_{3,4}$	2773.9	....	2799.2(?)
Titanium	22	2743.17	2746.81	2726.9 $=\alpha_{3,4}$	2509.0	....	2517.0
Vanadium	23	2498.35	2502.13	2484.6 $=\alpha_{3,4}$	2279.7	....	2287.8
Chromium	24	2285.03	2288.91	2273.3 $=\alpha_{3,4}$	2080.6	....	2085.7
Manganese	25	2097.51	2101.49	2087.9 $=\alpha_{3,4}$	1906.20	....	1910.50
Iron	26	1932.076	1936.012	1923.30 $=\alpha_{3,4}$	1753.013	....	1756.46
Cobalt	27	1785.29	1789.19	1777.4 $=\alpha_{3,4}$	1617.44	....	1620.11
Nickel	28	1654.50	1658.35	1647.6 $=\alpha_{3,4}$	1497.05	1485.61	1499.10
Copper	29	1537.395	1541.232	1530.91 $=\alpha_{3,4}$	1389.35	1378.24	....
Zinc	30	1432.17	1436.03	1428.8 $=\alpha_{3,4}$	1292.55	1281.07	....
Gallium	31	1337.15	1340.87	....	1205.20	1193.8	....
Germanium	32	1251.30	1255.21	....	1126.71	1114.59	....
Arsenic	33	1173.44	1177.43	....	1055.10	1042.81	....
Selenium	34	1102.48	1106.52	....	990.13	977.91	....
		α_1	α_2	α_3	β_1	β_2	β_3
Bromine	35	1037.59	1041.66	....	930.87	918.53	....
Krypton	36	978		....	875	....	....
Rubidium	37	923.64	927.76	....	826.96	814.76	827.49
Strontium	38	873.45	877.61	....	781.30	769.21	781.83
Yttrium	39	827.12	831.32	....	739.19	727.13	739.72
Zirconium	40	784.30	788.51	....	700.28	688.50	700.83
Columbium (Niobium)	41	744.65	748.89	....	664.38	652.80	664.96
Molybdenum	42	707.831	712.805	....	630.978	619.698	631.543
Masurium	43	672	675	....	601	......	601
Ruthenium	44	641.74	646.06	....	571.31	560.51	571.93
Rhodium	45	612.02	616.37	....	544.49	533.96	545.09
Palladium	46	584.27	588.63	....	519.47	509.18	520.09
Silver	47	558.28	562.67	....	496.01	486.03	496.65
Cadmium	48	533.90	538.32	....	474.08	464.20	474.71
Indium	49	511.06	515.48	....	453.58	444.08	454.23
Tin	50	489.57	494.02	....	434.30	424.99	434.95
Antimony	51	469.31	473.87	....	416.23	407.10	416.23
Tellurium	52	450.37	454.91	....	399.26	390.37	399.26
Iodine	53	432.49	437.03	....	383.15	374.71	383.92
Xenon	54	417		....	360	......	......
Cesium	55	399.59	404.11	....	353.62	345.16	354.36
Barium	56	384.43	388.99	....	340.22	332.22	340.89
Lanthanum	57	370.04	374.66	....	327.26	319.66	328.09
Cerium	58	356.47	361.10	....	315.01	307.70	315.72
Praseodymium	59	343.40	348.05	....	303.60	296.25	304.39
Neodymium	60	331.25	335.95	....	292.75	285.73	293.51
Illinium	61	320	324	....	281	......	......
Samarium	62	308.33	313.02	....	272.50	265.75	273.25
Europium	63	297.90	302.65	....	263.07	256.45	263.86

X-RAY EMISSION SPECTRA OF THE K SERIES

Element	Atomic No.	Wave length in cm. ×10⁻¹¹					
		α_1	α_2	α_3	β_1	β_2	β_3
Gadolinium	64	287.82	292.61	....	253.94	247.62	254.71
Terbium	65	278.20	282.86	....	245.51	239.12	246.29
Dysprosium	66	269.03	273.75	....	237.10	231.28	237.87
Holmium	67	260.30	264.99	....	......	......	......
Erbium	68	251.97	256.64	....	222.15	216.71	223.00
Thulium	69	243.87	248.61	....	214.87	......	215.58
Ytterbium	70	236.28	240.98	....	208.34	203.22	209.16
Lutecium	71	228.82	233.58	....	201.71	196.49	202.52
Hafnium	72	221.73	226.53	....	195.15	190.42	195.83
		α_1		α_2	$\alpha_{1.3}$		β_2
Tantalum	73	214.88		219.73	189.91		184.52
Tungsten	74	208.62		213.45	184.22		178.98
Osmium	76	196.45		201.31	173.61		168.75
Iridium	77	190.65		195.50	168.50		163.76
Platinum	78	182.23		190.04	163.70		158.87
Gold	79	179.96		184.83	159.02		154.26
Thallium	81	169.80		174.66	150.11		145.39
Lead	82	165.16		170.04	146.06		141.25
Bismuth	83	160.41		165.25	142.05		136.21
Thorium	90	132.3		136.8	116.9		113.4
Uranium	92	126.40		130.95	111.87		108.42

X-RAY EMISSION SPECTRA OF THE M SERIES

Values selected from Siegbahn, *Spektroskopie der Rontgenstrahlen*, 2d. Ed., Julius Springer, Berlin, 1931.

Element	Atomic No.	Wave length in cm. × 10⁻¹¹						
		γ	β	α_1	α_2	α_{I}	α_{II}	α_{III}
Cerium	58	11511	13755	.....	.....	14030	.....	.....
Praseodymium	59	10975	.....	.....	.....	.....	.....	.....
Neodymium	60	10483	12375	.....	.....	12650	.....	.....
Samarium	62	9580	11238	.....	.....	11406	11475	11532
Europium	63	9192	10723	.....	.....	10932	11003	.....
Gadolinium	64	8826	10233	.....	.....	10394	10428	10508
Terbium	65	8468	9772	.....	.....	9917	9946	9989
Dysprosium	66	8127	9345	.....	.....	9524	9555	9574
Holmium	67	7849	8947	.....	.....	9143	9165	9195
Erbium	68	7530	8576	.....	.....	8783	8794	8810
Ytterbium	70	7009	7893	.....	.....	8122	8138	.....
Lutecium	71	6748	7585	.....	.....	7824	.....	.....
Hafnium	72	6530	7289	7524	.....	.....	.....	.....
Tantalum	73	6299	7008	7237	.....	.....	.....	.....
Tungsten	74	6076	6743	6969	.....	.....	.....	.....
Rhenium	75	5875	6491	6715	.....	.....	.....	.....
Osmium	76	5670	6254	6477	.....	.....	.....	.....
Iridium	77	5490	6025	6249	6262	.....	.....	.....
Platinum	78	5309	5816	6034	6045	.....	.....	.....
Gold	79	5135	5612	5828	5842	.....	.....	.....
Thallium	81	4815	5239	5450	5461	.....	.....	.....
Lead	82	4665	5065	5274	5288	.....	.....	.....
Bismuth	83	4522	4899	5108	5119	.....	.....	.....
Thorium	90	3672	3934	4130	4143	.....	.....	.....
Uranium	92	3473	3708	3902	3916	.....	.....	.....

X-RAY EMISSION SPEC-

Values selected from Siegbahn, *Spektroskopie der*

Element	Atomic No.	Wave length in cm. ×10⁻¹¹ l	η	α_1	α_2	β_1	β_2
Iron	26	20120	19650	17580		17220	....
Cobalt	27	18200	17770	15940		15620	....
Nickel	28	16550	16170	14530		14240	....
Copper	29	15190	14830	13306		13030	....
Zinc	30	13950	13610	12230		11960	....
Gallium	31	12890	12560	11270		11010	....
Germanium	32	11922	11587	10415		10153	....
Arsenic	33	11048	10711	9652		9395	....
Selenium	34	10272	9939	8972		8718	....
Bromine	35	9564	9235	8358		8109	....
Rubidium	37	......	....	......	.....	......	....
Strontium	38	7822	7506	6848.6		6610.0	....
Yttrium	39	......	7031.0	6435.7		6203.9	....
Zirconium	40	6899	6593.9	6056.7		5823.6	5574.2
Columbium (Niobium)	41	6510	6196	5712.0	5718	5480.3	5226.0
Molybdenum	42	....	5836	5395.0	5401	5166.5	4910.0
Ruthenium	44	5486.4	....	4835.7	4843.7	4611.0	4361.9
Rhodium	45	5207.0	4911.2	4587.8	4595.6	4364.0	4122.1
Palladium	46	4939.6	4650.2	4358.5	4366.6	4137.3	3900.7
Silver	47	4697.6	4410.1	4145.6	4153.8	3926.6	3693.8
Cadmium	48	4471.3	4187 5	3947.8	3956.4	3730.1	3506.4
Indium	49	4259.3	3976.1	3763.7	3772.4	3547.8	3331.2
Tin	50	4063.3	3781.8	3592.2	3601.1	3377.9	3167.9
Antimony	51	3880.3	3599.6	3431.8	3440.8	3218.4	3016.6
Tellurium	52	3710.1	....	3282.0	3291.0	3070.0	2876.1
Iodine	53	3549.7	....	3141.7	3150.9	2930.9	2746.1

Element	Atomic No.	Wave length in cm ×10⁻¹¹ l	η	α_1	α_2	β_1	β_2
Cesium	55	3259.6	2983.3	2886.1	2895.6	2677.8	2506.4
Barium	56	3128.7	2857.1	2769.6	2779.0	2562.2	2399.3
Lanthanum	57	3000	2734	2659.7	2668.9	2453.3	2298.0
Cerium	58	2885.7	2614.7	2556.0	2565.1	2351.0	2204.1
Praseodymium	59	2778.1	2507	2457.7	2467.6	2253.9	2114.8
Neodymium	60	2670.3	2404.2	2365.3	2375.6	2162.2	2031.4
Samarium	62	2477	2214	2195.0	2205.7	1993.6	1878.1
Europium	63	2390.3	......	2116.3	2127.3	1916.3	1808.2
Gadolinium	64	2307.1	......	2041.9	2052.6	1842.5	1741.9
Terbium	65	2229.0	......	1971.5	1982.3	1772.7	1679.0
Dysprosium	66	2154.0	1892.2	1904.6	1915.6	1706.6	1619.8
Holmium	67	2082.1	1822.0	1841.0	1852.1	1643.5	1563.7
Erbium	68	2015.1	1754.8	1780.4	1791.4	1583.4	1510.6
Thulium	69	1951.1	1692.3	1722.8	1733.9	1526.8	1460.2
Ytterbium	70	1890	1631	1667.8	1678.9	1472.5	1412.8
Lutecium	71	1831.8	1573.8	1615.51	1626.36	1420.7	1367.2
Hafnium	72	1777.4	1519.7	1566.07	1577.04	1371.1	1323.5
Tantalum	73	1724.9	1467.9	1518.85	1529.78	1324.23	1281.90
Tungsten	74	1675.0	1418.1	1473.36	1484.38	1279.17	1242.03
Rhenium	75	1627.3	1370.6	1429.97	1441.0	1236.03	1204.1

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* For γ_4, γ'_4.

TRA OF THE L SERIES

Rontgenstrahlen, 2d. Ed. Julius Springer, Berlin.

Wave length in cm. $\times 10^{-11}$								No.
β_3	β_4	β_6	γ_1	γ_2	γ_3	γ_4	γ_5	
	15610	......	......	......	......	......	......	26
......	......	......	......	......	......	......	......	27
	13140	......	......	......	......	......	......	28
	12100	......	......	......	......	......	......	29
	11160	......	......	......	......	......	......	30
......	......	......	......	......	......	......	......	31
......	......	......	......	......	......	......	......	32
	8912	......	......	......	......	......	......	33
......	......	......	......	......	......	......	......	34
......	......	......	......	......	......	......	......	35
6769.4	6800.9	6968.1	......		6036.0	......	......	37
6358.2	6391.8	6508.1	......		5637.4	......	6279.6	38
5974.1	6007.7	6085.7	......		5270.3	......	......	39
5618.6	5651.7	5692.7	5373.8		4940.8	......	5481.8	40
5297.1	5330.6	5347.1	5024.8		4646.7	......	......	41
5004.7	5041.0	......	......		4369.5	......	4831.2	42
4476.4	4512.6	4476.4	4172.8		3887.9	......	4276.6	44
4244.7	4280.2	4232.8	3935.7		3681.5	......	4035.2	45
4025.7	4062.3	4007.0	3716.4		3480.9	......	3811.6	46
3824.5	3861.1	3798.6	3514.9		3299.8	......	3607.3	47
3636.4	3674.3	3607.3	3328.0		3131.6	......	3418.1	48
3461.9	3499.0	3428.0	3155.3		2973.6	2919.1	3241.8	49
3298.9	3336.3	3262.2	2994.9		2830.1	2771.3	3077.4	50
3145.1	3184.3	3107.8	2845.1		2695.3	2633.6	2925.6	51
3001.3	3040.0	2964.4	2706.5		2564.9	2505.7	2783.1	52
2868.2	2905.9	2830.5	2577.5		2442.1	2386.2	......	53

Wave length in cm $\times 10^{-11}$									
β_3	β_4	β_6	β_7	γ_1	γ_2	γ_3	γ_4	γ_5	γ_8
2622.9	2660.5	2587.5	2480	2342.5	2232.2	2227.0	2169.1	2411.1	......
2511.0	2549.8	2477.2	2375.6	2236.6	2134.0	2129.5	2071.5	2302.3	2218
2405.3	2443.8	2373.9	2270	2137.2	2041.6	2036.6	1978.7	2200.8	......
2305.9	2344.2	2276.9	2176.3	2044.3	1955.9	1950.9	1895.2	2105.6	2019
2212.4	2250.1	2185.9	2087.4	1956.8	1875.0	1869.9	1815.3	2016.1	1932.2
2122.2	2162.2	2099.3	2004.3	1873.8	1797.4	1792.5	1740.8	1931.3	......
1958.0	1996.4	1942.2	1852.3	1723.1	1655.9	1651.7	1603.3	1775.1	......
1882.7	1922.1	1870.5	1784	1654.3	1593.9	1587.7	1540.7	1705	1629
1810.9	1849.3	1803.1	1719.6	1588.6	1531.0	1525.9	1481.8	1637.6	......
1742.5	1781.4	1737.5	1655.8	1526.6	1473.8	1468.3	1423 9*	1574.2	......
1677.7	1716.7	1677.7	1595.7	1469.7	1420.3	1413.9	1371.4*	1515.2	......
1616.0	1655.3	1618.8	......	1414.2	1367.7	1361.3	1319.7*	1459	......
1557.9	1596.4	1563.6	1489.2	1362.3	1318.4	1311.8	1273.2*	1403	......
1502.3	1541.2	1511.5	......	1312.7	1271.2	1265.3	1226.4*	1352.3	......
1449.4	1488.2	1462.7	......	1264.8	1225.6	1219.8	1182.0*	1303.0	1248.3
1398.2	1437.2	1414.3	1345.9	1220.3	1183.2	1177.5	1141.1*	1256	1202
1349.7	1389.3	1371.1	1303.5	1176.5	1141.3	1135 6	1100.1*	1212.1	......
1304.09	1343.07	1328.4	1261.3	1135.58	1103.0	1097.08	1062.7*	1170.8	......
1259.92	1298.79	1287.0	1221.7	1096.30	1065.88	1059.87	1025.8*	1129.8	1079.1
1217.6	1256.3	1248.1	1183.3	1058.7	1029.9	1023.6	991.0*	1091.2	......

(Completed on the following page.)

X-RAY EMISSION SPEC-

Element	Atomic No.	Wave length in cm. ×10^{-11}					
		ι	η	α_1	α_2	β_1	β_2
Osmium	76	......	......	1388.59	1398.66	1194.90	1168.84
Iridium	77	Cu $K\alpha_{3,4}$	1281.7	1348.47	1359.8	1155.40	1132.97
Platinum	78	1496.4	1240.3	1310.33	1321.55	1117.58	1099.74
Gold	79	1456.9	1200.3	1273.77	1285.02	1081.28	1068.01
Mercury	80	1418.41	1161.6	1238.63	1249.51	1046.52	1037.70
Thallium	81	1381.9	1125.4	1204.93	1216.26	1012.99	1008.22
Lead	82	1347.4	1090.0	1172.58	1184.08	980.83	980.83
Bismuth	83	1313.7	1056.5	1141.50	1153.01	950.02	953.24
Thorium	90	1112.8	852.8	954.05	965.85	763.56	791.92
Protoactinium	91	1088.5	827.8	930.9	942.7	740.7	772.1
Uranium	92	1064.9	803.5	908.74	920.62	718.51	753.07

*For γ_4, γ'_4.

MATERIALS COMMONLY USED FOR X-RAY FILTERS

Target Element	Atomic No.	Emission spectra, K series. λ in cm ×10^{-11}			Minimum voltage Kilovolts	Filter*	
		$\lambda\alpha_1$	$\lambda\alpha_2$	$\lambda\beta_1$		Element	K band
Cr	24	2285.03	2288.91	2080.6	5.98	V	2265.3
Fe	26	1932.08	1936.01	1753.01	7.10	Mn	1889.2
Ni	28	1654.50	1658.35	1497.05	8.29	Co	1601.8
Cu	29	1537.40	1541.23	1389.35	8.86	Ni	1489.0
Zn	39	1432.17	1436.03	1292.55	9.65	Cu	1378.5
Mo	42	707.83	712.81	630.98	20.0	Zr	687.2
Ru	44	641.74	646.06	571.31	22.1	Mo	618.4
Rh	45	612.02	616.37	544.49	23.2	Ru	558.4
Pd	46	584.27	588.63	519.47	24.4	Rh	533.0
Ag	47	558.28	562.67	496.01	25.5	Pd	507.5
							or
						Rh	533.0
Sn	50	489.57	494.02	434.30	29.1	Ag	485.0
							or
						Cd	463.2
W	74	208.62	213.45	184.22	69.3	.....	.....
Pt	78	182.23	190.04	163.70	78.1	W	178.2

* Desirable thickness for X-ray filters are: Mn = 0.005 mm.; Ni = 0.007mm; Zr = 0.03mm.; Pd = 0.03mm.

TRA OF THE L SERIES (Continued)

Wavelength in cm. × 10^{-11}									
β_3	β_4	β_6	β_7	γ_1	γ_2	γ_3	γ_4	γ_5	γ_8
......	......	......	......	1022.96	......	......	......	......	......
1138.47	1177.15	1175.45	1112.6	988.76	963.32	957.13	925.7*	1019.5	971.9
1101.65	1139.86	1141.00	1079.4	955.99	932.33	925.99	895.2*	985.7	938.6
1065.50	1104.22	1108.63	1049.8	924.61	902.48	895.81	865.5*	953.6	907.9
1030.46	1069.2	1076.8	1015.5	894.6	872.4	866.2	836.1*	922.9	......
998.50	1036.99	1047.48	988.0	865.71	845.71	839.34	810.1*	892.9	849.0
967.21	1005.63	1019.06	960.3	838.01	819.17	812.93	784.3*	864.7	822.0
936.66	975.01	991.31	933.0	811.43	794.00	789.46	759.3	837.7	......
753.24	791.92	826.46	772.8	651.76	640.79	634.13	609.5	673.4	637.4
730.7	768.3	806.2	753.0	632.5	622.6	615.6	592.5*	653.6	......
708.79	746.4	786.79	734.6	613.59	603.86	597.11	573.6	634.2	600.0

LATTICE CONSTANTS OF STANDARD CRYSTALS

Values selected from Siegbahn, *Spektroskopie der Rontgenstrahlen*, 2d. Ed., Julius Springer, Berlin, 1931.

Crystal	Lattice Constant in cm. × 10^{-11} at 18°C.		
	First order	Second order	Third order
Calcite	3029.04	3029.34	3029.40
Gypsum	7579.07	7583.29	7584.15
Mica	9927.58	9938.93	9941.04
Quartz	4244.92	4245.74	4245.90
Rock salt	2814.00	....	....

TOTAL MASS ABSORPTION VALUES FROM FORMULA

The values given in the following table make it possible to calculate the mass absorption for any wave length in the given range by substituting in the formula in column 3. The values are those of Richtmyer.

Absorption material	Wave length, λ, in Å	Total mass absorption μ/ρ
Al	0.1 to 0.4	$14.45\lambda^3 + 0.15$
Al	0.4 to 0.7	$14.30\lambda^3 + 0.16$
Fe	0.1 to 0.3	$110\lambda^3 + 0.18$
Co	0.1 to 0.3	$124\lambda^3 + 0.18$
Ni	0.1 to 0.3	$145\lambda^3 + 0.20$
Cu	0.1 to 0.3	$153\lambda^3 + 0.20$
Cu	0.1 to 0.6	$147\lambda^3 + 0.5$
Mo	0.1 to 0.35	$450\lambda^3 + 0.4$
Mo	$> \lambda_K$	$51.5\lambda^3 + 1$
Ag	0.1 to 0.4	$603\lambda^3 + 0.7$
Ag	$> \lambda_K$	$86\lambda^3 + 0.6$
Pb	$> \lambda_K$	$510\lambda^3 + 0.75$

TOTAL MASS ABSORPTION COEFFICIENTS

In the following table, the wave length, λ, is in Angstrom units, ρ is the density as given for each element in the line above the table, while μ/ρ is the total mass absorption coefficient.

CARBON. Atomic No. = 6. Density of diamond = 3.51; of graphite = 2.3

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	0.143	0.50	0.326	1.00	1.5
0.10	0.150	0.631	0.55	1.17	2.4
0.20	0.165	0.709	0.63	1.39	3.8
0.30	0.190	0.80	0.90	1.53	4.9
0.40	0.245	0.90	1.2	1.933	9.2

ALUMINUM. Atomic No. = 13. Density = 2.7

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	0.145	0.90	10.4	2.00	110
0.09	0.160	0.925	11.8	2.50	182
0.10	0.16	1.00	14.2	2.744	248
0.15	0.20	1.09	18.5	3.026	320
0.20	0.27	1.175	22.5	3.353	433
0.30	0.56	1.293	29.8	4.146	771
0.40	1.08	1.39	36.0	4.36	894
0.50	1.96	1.433	40.3	5.394	1480
0.60	3.25	1.54	48.5	6.973	2800
0.631	3.71	1.655	61.5	(the K band)	
0.70	5.07	1.752	73.2	8.32	344
0.709	5.26	1.933	94	9.868	553
0.80	7.48			11.88	767

IRON. Atomic No. = 26. Density = 7.7 to 7.9

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	0.235	0.50	13.8	1.17	160
0.09	0.25	0.60	22.6	1.293	213
0.10	0.27	0.70	35.3	1.433	290
0.15	0.55	0.80	50.7	1.539	330
0.20	1.06	0.90	68.3	1.655	430
0.30	3.15	1.00	102	(the K band)	
0.40	7.25	1.09	128	1.75	56
				1.933	71

COPPER. Atomic No. = 29. Density = 8.9

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	0.27	0.90	98	1.934	99
0.09	0.295	1.00	133	2.00	116
0.10	0.35	1.09	165	2.50	202
0.15	0.72	1.10	176	2.744	262
0.20	1.41	1.17	206	3.026	321
0.30	4.31	1.293	266	3.353	404
0.40	9.92	1.348	287	4.146	621
0.50	18.9	(the K band)		4.359	730
0.60	32.3	1.39	38.0	5.394	1300
0.631	37.8	1.433	42.0	6.973	2120
0.70	49	1.54	50	8.319	3450
0.709	52	1.656	64	9.868	5030
0.80	72	1.752	76	11.884	7550
		1.787	85.6		

TOTAL MASS ABSORPTION COEFFICIENTS

MOLYBDENUM. Atomic No. = 42. Density = 10.2

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.10	1.38	0.40	25.0	0.70	18.1
0.15	2.26	0.50	48.0	0.80	26.7
0.20	4.00	0.60	82.0	0.90	37.5
0.30	11.1	(the K band)		1.0	51.0
		0.631	13.4		

SILVER. Atomic No. = 47. Density = 10.5

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	0.74	1.00	73	3.026	1330
0.09	0.90	1.104	97	(the LI band)	
0.10	1.55	1.17	111	3.353	1310
0.15	2.84	1.293	146	3.432	1460
0.20	5.36	1.389	173	(the LII band)	
0.30	15.8	1.433	192	3.592	1360
0.40	35.9	1.539	225	(the LIII band)	
(the K band)		1.656	280	4.146	461
0.50	9.75	1.752	325	4.359	539
0.60	16.1	1.934	410	5.394	852
0.70	25.0	2.50	696	6.973	1260
0.80	41	2.744	925	9.868	2720
0.90	55				

TIN. Atomic No. = 50. Density = 7.3

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	0.80	0.60	20.4	1.293	176
0.09	0.95	0.70	31.8	1.389	205
0.10	1.58	0.80	47	1.433	235
0.20	5.8	0.90	64	1.539	325(?)
0.30	18.0	1.00	87	1.656	375(?)
0.40	40.0	1.09	110	1.752	385
(the K band)		1.17	132	1.934	490
0.50	12.2				

TUNGSTEN. Atomic No. = 74. Density = 19.1

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	2.40	0.15	7.10	0.50	38.0
0.09	2.80	0.30	9.72	0.631	75
0.10	2.67	0.40	19.8	1.293	105
(the K band)				1.433	130

PLATINUM. Atomic No. = 78. Density = 21.4

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	2.50	0.40	24.5	0.90	169
0.09	2.95	0.50	45.5	(the LII band)	
0.10	3.7	0.60	75.2	1.0	165
0.15	7.8	0.70	107	(the LIII band)	
(the K band)		0.80	150	1.104	81.4
0.20	4.2	(the LI band)		1.17	100
0.30	11.5				

TOTAL MASS ABSORPTION COEFFICIENTS

PLATINUM (Cont.)

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
1.293	131	2.00	408	4.146	1290
1.389	155	2.50	596	(the MIII band)	
1.433	171	2.744	756	5.394	1640
1.539	199	3.026	939	(the MIV MV band)	
1.656	243	3.353	1120	6.973	1190
1.752	280	3.592	1370	8.319	1530
1.787	291	(the MI band)		9.868	2440
1.934	365				

GOLD. Atomic No. 79. Density=19.3

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	2.44	0.80	150	1.17	104
0.09	2.85	0.847	184	1.293	137
0.10	3.07	(the LI band)		1.389	168
0.15	8.37	0.871	166	1.433	179
(the K band)		(the LII band)		1.539	210
0.20	4.01	0.912	165	1.656	265
0.30	11.5	1.0	179	1.752	303
0.50	49.7	(the LIII band)		1.934	386
0.70	110	1.09	88	2.0	427
0.709	122				

LEAD. Atomic No.=82. Density=11.3

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.081	2.53	0.50	58	1.17	120
0.09	3.0	0.60	77	1.293	154
0.10	3.27	0.63	102	1.39	180
(the K band)		0.709	140	1.43	202
0.15	2.31	0.8	147	1.54	230
0.20	4.51	(the L band)		1.65	290
0.30	13.6	1.0	77	1.93	420
0.40	31.8	1.09	98		

URANIUM. Atomic No.=92. Density=18.7

λ in Å.	μ/ρ	λ in Å.	μ/ρ	λ in Å.	μ/ρ
0.095	3.53	0.126	1.90	0.151	3.78
(the K band)		0.14	2.56	0.164	3.24
0.113	1.78				

MELTING POINTS OF COMPOUNDS USEFUL FOR DETERMINING APPROXIMATE MELTING POINTS WITH THE MICROSCOPE

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M.P. °C.	Compound
20	Acetophenone
22	Anethole
27	Diphenylmethane
30	*o*-Cresol
35	*p*-Cresol
41	Phenol
43	Salol
45	*o*-Nitrophenol
48	Chloral hydrate; Urethane
50	α-Naphthylamine
52	Thymol
53	*p*-Dichlorobenzene
58	Trichloroacetic acid
63	*m*-Phenylenediamine
67	Coumarin; Azobenzene
69	Diphenyl
70	Pyrazole
72	*o*-Nitroaniline
74	Hedonal
75	Borax
76	Trional
80	Naphthalene
81	Vanillin
86	Saligenin
87	*p*-Dibromobenzene
90	*m*-Dinitrobenzene
93	Triphenylmethane; Salipyrin
96	α-Naphthol; *m*-Nitrophenol
100	Phenanthrene; Exalgin
104	*o*-Phenylenediamine
105	Pyrocatechin
108	Pyramidon
110	Resorcinol; β-Naphthylamine
112	*m*-Nitroaniline
113	*p*-Nitrophenol
114	Acetanilide; Ammonium acetate
116	Atropine; Quinone
117	*o*-Dinitrobenzene
118	Chrysoidine
119	Iodoform
122	Benzoic acid; Picric acid; β-Naphthol
123	Dionine
128	Sulfonal
129	*o*-Tolidine
131	Maleic acid
133	Urea; Hydrastine
134	Pyrogallol
137	Picrolonic acid
140	*p*-Phenylenediamine
145	Anthranilic acid
148	*p*-Nitroaniline; 2, 4-Dinitroresorcinol
150	Ammonium thiocyanate
153	Citric acid; Methylglyoxime
156	Benzenesulphonimide
159	Salicylic acid
164	Cupferron
169	Hydroquinone
170	Santonin
171	Dimethylamine hydrochloride
172	*p*-Dinitrobenzene
173	Potassium thiocyanate
175	Quinine; Narcotine
178	Brucine
184	Quinine citrate
185	Succinic acid; Cinchonamine
186	Saccharose
189	Nitron
191	Veronal
193	Chrysophanic acid
198	Aniline hydrochloride
202	Salicin; Lactose
210	Cinchonidine
212	Silver nitrate
218	Anthracene
219	Phloroglucinol
228	Saccharin
235	Carbanilide
237	Caffeine
244	Carbazole
246	Dimethylglyoxime
248	Sodium chlorate
261	Phenolphthalein
268	Strychnine
280	Lead acetate (anhydrous)
285	Anthraquinone
288	Sulfanilic acid
290	Alizarin
297	Potassium nitrite
302	Mercurous chloride
324	Sodium acetate (anhydrous)
337	Theobromine
368	Potassium chlorate
398	Potassium dichromate

FLUORESCENCE AND PHOSPHORESCENCE

Ultraviolet radiation causes many substances to emit light; if the emission occurs only when the ultraviolet radiation is present the phenomenon is known as *fluorescence*. If the emission occurs after removal of the ultraviolet radiation the afterglow is termed *phosphorescence*. Fundamentally both fluorescence and phosphorescence are identical.

Exciting agents need not be ultraviolet light. Fluorescence can be due to: heat (*thermoluminescence*); visible light (*photoluminescence*); X-rays; electrical waves; γ rays; radio waves; cathode rays (*cathodoluminescence*); β rays; α rays; molecular beams; neutron and deuteron beams; positrons; streams of various ions (*ionoluminescence*); friction (*triboluminescence*); crystallization (*crystalloluminescence*); cold; pressure; mechanical excitation; sound waves (*sonoluminescence*); oxidation and special chemical reactions (*bio-* and *chemi-luminescence*); flames; electrolysis; and several others. For additional data the references which follow should be consulted.

Fluorescence is characteristic of numerous substances, but in many it is highly variable, depending on the nature, purity, history, and condition of the material. Fluorescence generally occurs best in solution. Actually, only a few very pure and dry substances fluoresce since most substances have impurities which activate luminescence. Water and crystalline condition also predominate as activators. A *phosphor* is a luminescent system consisting of a base and a trace of impurity called an activator: $AB+M$ where A may be Ba, Ca, Na, K, Mg, Li, etc., associated with anion B which may be sulfide, oxide, tungstate, silicate, carbonate, etc. M is the trace of metal which may be U, Mn, Cu, rare earths, etc. A flux may be incorporated with this, and very complex phosphors are built upon this basis. The notation *ZnCuS* represents a typical phosphor-Cu activated ZnS.

The exciting agent used in most studies is usually one of two types of ultraviolet radiation suitably filtered to eliminate visible light. One wavelength is most suited to the study of organic substances and is called *long wavelength radiation*, the tentative standard being Hg = 3650Å. *Short wavelength radiation* is usually best suited for excitation of inorganic substances and its tentative standard wavelength is Hg = 2537Å (*resonance radiation*).

References which have been consulted for data in the following tables include: Dake and De Ment: *Fluorescent Light and Its Applications*, Chemical Publishing Company, New York (1941); Dake and De Ment: *Ultraviolet Light and Its Applications*, Chemical Publishing Company, New York (1942); De Ment and Dake: *Uranium and Atomic Power*, Chemical Publishing Company, New York (1941); De Ment: *Fluorescent Chemicals and Their Applications*, Chemical Publishing Company, New York (1942); Radley and Grant; *Fluorescence Analysis in Ultraviolet Light*, D. Van Nostrand Company, 3d edition, New York (1939).

The arrangement in the following tables is alphabetical with abbreviations for filtered ultraviolet light being L = long $\lambda = 3650$Å, and S = short $\lambda = 2537$Å. The symbol LS is used to indicate both long and short wavelengths. The variability of fluorescent response should always be considered when using these tables. Aqueous solutions are indicated by the abbreviation *soln*.

FLUORESCENT CHEMICALS

In the following table, fluorescence most representative of the substance is listed together with the wavelength which evokes it. As with other substances fluorescence of chemicals may be widely variant, differing with the purity, history, structure, and state of the compound. Solution and alteration in pH markedly affect the fluorescence of many chemicals. However, numerous closely related compounds can easily be discriminated by their fluorescence. Impurities in inorganic substances usually enhance fluorescence but in many organic substances fluorescence is a property of the molecule. Fluorescence is a valuable adjunct in the study of materials and further information can be obtained from the references quoted. Several chemicals which emit ultraviolet light when excited by X-rays are also included in the table.

Name	λ	Fluorescence
Acetamide	L	Medium bluish
Acetanilide	L	Lavender
Acetic acid	L	Milky green
Acetoacetanilide	L	Bright medium blue
Acetone	L	Slight pale bluish
Acetophenone	L	Weak brown
Acetphenetidin	L	Lavender
Acetylaminoxyphenylarsonic acid	L	Medium purple
Acetyl-β-methylcholine bromide	L	Strong lavender
Acetylsalicylic acid	L	Brilliant sea blue
Aconitine	L	Pale blue
Acridine, soln.	L	Bright green
Acridine picrate, soln.	L	Brilliant greenish
Acriflavine, soln.	L	Very bright green
Albumin	L	Strong bluish
Aldehyde bisulfite	L	Rose
Alloxan monohydrate	L	Medium violet
Allylamine picrate	L	Crimson
Allyl thiourea	L	Strong whitish
Aluminum acetate	L	Strong blue
Aluminum bromide	L	Reddish
Aluminum carbide	L	Strong dark green
Aluminum chloride	S	Bluish-green
Aluminum formate	S	Blue-white
Aluminum fluoride	S	Blue
Aluminum iodide	S	Red-lavender
Aluminum oxide	L	Bright crimson
Aluminum palmitate	L	Bluish-white
Aluminum metaphosphate	S	Violet-white
Aluminum monostearate	L	Bright bluish-white
Aluminum potassium tartrate	L	Bluish-white
Amber	L	Bright green-yellow to blue
Ambergris	L	Sometimes bright blue-brown
o-Aminobenzoic acid	†	
p-Aminobenzoic acid	L	Medium purple
2-Amino-1-butanol	L	Slight greenish
2-Amino-2-methyl-1,3-propanediol	L	Bright blue
p-Aminophenol sulfate	L	Violet
Aminophyllin	L	Strong blue-green
Aminopyrine	L	Vivid bluish
Ammonium salts	L	Usually bluish-white
Amyl alcohol (*iso*)	L	Slight gray-green
Amyl naphthalene	L	Deep blue
Amyl salicylate	L	Purple
Anisaldehyde	L	Brown
Anthraquinone	L	Orange
Antipyrine	L	Purple
Apomorphine	L	Deep blue
Atropine sulfate	L	Pale blue
Ascorbic acid	L	Lavender
Auramine, soln.	L	Brilliant yellow
Barium acetate	L	Green
Barium carbonate	L	Brick red
Barium chloride	L	Bluish
Barium dichromate	L	Reddish
Barium formate	L	Violet
Barium hydroxide	S	Bluish
Barium nitrate	S	Bluish-lavender
Barium pyrovanadate	S	Light yellow
Barium succinate	L	Bright violet
Barium stearate	L	Bright blue-white
Barium sulfate	S	Bluish
Barium sulfide	S	Weak reddish
Benzamidine hydrochloride	†	
Benzaldehyde	L	Brownish-green
Benzidrine sulfate	L	Vivid bluish
Benzene-*m*-sodium disulfonate	†	
Benzoflavine, soln.	L	Very bright yellow
Benzoic acid	L	Violet
Benzyl alcohol	L	Pale gray
Benzyl benzoate	L	Grayish
Benzyl salicylate	L	Violet
Berberine	L	Very bright yellow
Berberine hydrochloride	L	Bright yellow-green
Beryllium diphosphate	S	Bluish
Beryllium nitrate	S	Bluish
Beryllium oxide	S	Lavender

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† Emits ultraviolet rays under influence of X-rays.

FLUORESCENT CHEMICALS

Name	λ	Fluorescence
Beryllium salicylate	L	Intense blue
Beryllium stannite	L	Blue to green
Bismuth ethyl camphorate	L	Strong yellow-green
Bismuth sodium tartrate	L	Medium blue
Bismuth subcarbonate	S	Bluish
Bismuth subnitrate	S	Bluish
5-Bromosalicylic acid	L	Whitish
Boric acid	S	Blue-white
Butyryl pyrogallol	L	Strong deep purple
Butanol	L	Slight pale blue
Butyl acetylricinoleate	L	Strong deep blue-green
Butyl citrate, tri-	L	Blue-green
Butyl oleate	L	Greenish-yellow
Butyl ricinoleate	L	Bright yellow-green
Butyl sebacate, di-	L	Bright bluish-white
Butyl stearate, mono-	L	Pale bluish
Cadmium 8-hydroxyquinolinate	L	Bright yellow-green
Cadmium sulfide	S	Yellowish
Cadmium tungstate	S	Bright yellowish (impure)
Calcium acetate	S	Bluish
Calcium benzoate	L	Bright bluish
Calcium carbide	S	Brownish
Calcium *p*-caseinate	L	Vivid yellow-blue
Calcium 8-hydroxyquinolinate	L	Dark greenish
Calcium *o*-iodoxybenzoate	L	Bright white
Calcium lactate	L	Lavender
Calcium mandelate	L	Blue
Calcium molybdate	L	Bright gray-bluish
Calcium nitrate	S	Bluish
Calcium oxalate	S	Bluish
Calcium pantothenate	L	Dull purple
Calcium phosphate	S	Blue to violet
Calcium pyrovanadate	S	Reddish
Calcium tungstate	S	Bright medium blue
Caffeine	L	Strong blue-green
Caffeine citrate	L	Lavender
Camphor	L	Blue-violet
Carbon dioxide, solid	L	Strong blue-white
Carbromal	L	Lavender
Cerous citrate	L	Medium blue
Cerous molybdate	S	Reddish
Cerous nitrate	S	Violet-blue
Cerous nitrite	S	Bluish
Cerous silicate, ortho-	S	Bright blue
Cerous stannite	L	Bluish
Cerous tellurite	L	Medium lavender
Cerous tungstate	S	Blue
Chloral ethanolate	L	Vivid yellow-green
Chloral hydrate	L	Blue-yellowish
o-Chlorobenzoic acid	L	†
Choline	L	Dull blue
Chromium stearate	L	Dark lavender-blue
Chlorophyll	L	Strong deep red
Chrysarobin	L	Bright orange
Cinchonidine	L	Gray-purple
Cinchonidine sulfate	L	Vivid blue
Cinchonine	L	Pale blue
Cinchonine sulfate	L	Whitish
Cinchophen hydroiodide	L	Bright orange-red
Cinchophen monoiodide	L	Cream
Cinchopyrine	L	Dull tan
Cinnamic acid	L	Red-violet
Cinnamic aldehyde	L	Brown
Citronellol	L	Strong brownish-green
Cobaltous stearate	L	Purple-gray
Codeine	L	Yellowish
Colchicine	L	Yellow-green
Columbium pentoxide	S	Bright whitish
Coramine	L	Bluish
Coumaric acid	L	Green
Coumarin	L	Violet
o-Cresol	L	Deep rose
m-Cresol	L	Strong medium blue
p-Cresol	L	Cream-lavender
Crotonic acid	L	Strong bluish
Cupferron	L	Very dull crimson
Curcubocitrin	L	Brilliant blue
Decyl naphthalene	L	Bright blue
Dehydrocholic acid	L	Violet-blue
Desaminocasein	L	Variable; blue-green-yellowish
Diacetone	L	Slight purplish
Diacetylaminoazotoluene	L	Dark red
Diallylbarbituric acid	L	Violet-white
Diamyl naphthalene	L	Blue
Dibutoxymethane	L	Pale bluish
Dibutylamine	L	Slight bluish
Dibutyl oxalate	L	Slight bluish
Dibutyl phthalate	L	Slight bluish
Didodecyl benzene	L	Bluish-yellow
Diethylene glycol monolaurate	L	Bright bluish
Diethylene glycol monooleate	L	Vivid blue
Diethylene glycol monoethylether citrate	L	Bright blue
Diethylene glycol monoethylether phthalate	L	Strong green

† Emits ultraviolet rays under influence of X-rays.

FLUORESCENT CHEMICALS

Name	λ	Fluorescence
Diethylene glycol monoethylether laurate	L	Blue-white
Diethylene glycol monoethylether stearate	L	Bluish
Diethyl oxalate	L	Pale bluish
Dihydroxybenzoic acid	L	Purple
Diiodosalicylic acid	L	Green
Dimethylglyoxime	L	Violet
Dimethyl phthalate	L	Greenish
Dimethyl sebacate	L	Slight bluish
Diphenyl	†	
Diphenylamine	†	
Diphenylamine	L	Very dull violet
Diphenyl carbonate	L	Lavender-blue
Dithiosalicylic acid	L	Blue
1,2-Di(2-Xenoxy)-ethane	L	White
Dodecyl benzene	L	Bluish-yellow
Elastin	L	Strong light blue
Emetine	L	Yellow-red
Eosin, soln.	L	Brilliant red
Erbium aluminate	L	Pale violet
Erbium salicylate	L	Vivid sky blue
Erbium tellurite	L	Whitish
Erbium tungstate	S	Grayish
Erythrosin, soln.	L	Bright green
Erythritol tetranitrate	L	Deep violet
Esculin, soln.	L	Vivid green-brown
Eserin salicylate	L	Lavender
Ethanol	L	Very slight bluish
Ethanolamine hydrochloride	L	Violet
4-Ethoxyacridone	L	Bright green to blue
Ethyl acetate	L	Slight blue
Ethyl borate	L	Pale blue
Ethyl formate	L	Pale blue-green
Ethyl lactate	L	Pale blue-green
Ethyl salicylate	L	Green
Ethylene glycol laurate	L	Very bright blue
Ethylene glycol oleate	L	Blue
Ethylene glycol ricinoleate	L	Greenish-blue
Eugenol	L	Dark brown
Fluorescein, soln.	L	Very bright yellow-green
Fluorescin, soln.	L	Yellow
Furfural	L	Cherry-yellowish-green
Furfurine nitrate	L	Yellowish
Furfuryl alcohol	L	Dark yellow
Gallium chromate	L	Greenish-yellow
Gallium 8-hydroxyquinolinate	L	Bright yellow
Gallium ferrocyanide	L	Deep blue
Gallium molybdate	L	Deep blue-green
Gallium salicylate	L	Grayish-blue
Gallium tetraborate	S	Grayish-white
Gallium tungstate	S	Bluish
Gelatin	L	Light blue
Germanium citrate	L	Pale bluish
Germanium dioxide	S	Violet-blue
Germanium molybdate	S	Bluish
Germanium salicylate	L	Bright sea blue
Germanium stannite	L	Pale violet
Germanium tungstate	L	Reddish
Glutathione	L	Medium lavender
Glycerin	L	Slight bluish
Glyceryl α,γ-dichlorohydrin	L	Pale green
Glyceryl α,γ-di-*iso*-amyl ether	L	Bluish
Glyceryl α,γ-dimethyl ether	L	Blue
Glyceryl α,γ-diphenyl ether	L	Lavender-blue
Glyceryl formal	L	Pale blue
Glyceryl furfural	L	Light yellow-green
Glyceryl α-mono-*iso*-amyl ether	L	Pale blue
Glyceryl α-mono-*n*-butyl ether	L	Blue-green
Glyceryl α-monochlorohydrin	L	Blue-green
Glyceryl α-monomethyl ether	L	Slight bluish
Glyceryl α-monophenyl-ether	L	Lavender-blue
Glyceryl monostearate	L	Bright yellow-blue
Glyceryl monoleate	L	Strong yellow-blue
Glyceryl tristearate	L	Bright violet-blue
Glycollic acid	L	Strong violet
Glycol monoleate *	L	Bright blue-brown
Glycol dilaurate *	L	Yellow-brown
Glycol phthalate *	L	Bright light blue
Glycol monolaurate *	L	Bright medium blue
Glycol monostearate *	L	Brownish-yellow
Heliotropin	L	Bright yellow-brown
Hemin	L	Very dull reddish
Hexamethylenetetramine	L	Violet
Hexamethylenetetramine triguaiacol	†	
Homatropine methylbromide	L	Lavender
Homoveratrol (*iso*)	L	Yellowish
Hydrastine	L	Green
Hydrastine salicylate	L	Greenish-white
Hydrazine hydrochloride	L	Violet

† Emits ultraviolet rays under influence of X-rays.

* Polymerized.

FLUORESCENT CHEMICALS

Name	λ	Fluorescence
Hydrazine sulfate	LS	Whitish, violet
Hydrobenzoin	†	
Hydrocinnamic aldehyde	L	Weak green
Hydrofuramide	L	Bright pink
Hydroxylammonium sulfate	S	Light blue
8-Hydroxyquinoline	L	Strong dark purple
Hydroquinone	L	Violet
Indium cyanide	L	Weak blue-green
Indium *o*-iodoxybenzoate	L	Light lavender
Indium molybdate	L	Pale red-brown
Indium salicylate	L	Bright blue-green
Indium tungstate	L	Grayish
Indole	L	Violet-blue
Inositol	L	Lavender
Iron(ic) 8-hydroxyquinolinate	L	Deep blue-black
Iron(ous) 8-hydroxyquinolinate	L	Blue-brown
Isoquinine	L	Violet
Lactose	L	Lavender
Lanthanum 8-hydroxyquinolinate	L	Pale yellow-green
Lanthanum molybdate	L	Whitish
Lanthanum salicylate	L	Bright light blue
Lanthanum silicate	S	Whitish
Lanthanum tungstate	S	Whitish
Lead acetate	S	Medium blue
Lead bromide	S	Yellowish
Lead carbonate	S	Yellowish
Lead chloride	S	Whitish-yellow
Lead iodide	S	Scarlet
Lead sebacate	L	Lavender-white
Lead monostearate	L	Vivid blue
Lead sulfate	S	Yellowish
Lead naphthenate	L	Brilliant blue-green
Legumin	L	Bright light blue
Leptandrin	L	Red-violet
Linalyl acetate	L	Yellow-green
Lithium benzoate	L	Whitish-violet
Lithium oxalate	L	Lavender
Lithium salicylate	L	Bright blue-green
Lycopodium	L	Strong pinkish
Magnesium ammonium arsenate	L	Whitish
Magnesium oxide	L	Scarlet to reddish
Magnesium 8-hydroxyquinolinate	L	Brilliant golden
Magnesium phosphate	L	Blue
Magnesium salicylate	L	Purple-green
Magnesium stearate	L	Blue-white
Magnesium sulfate	L	Usually blue-white
Manganese acetate	S	Reddish
Manganese bromide	S	Whitish
Manganese formate	L	Bright light blue
Manganese 8-hydroxyquinolinate	L	Bright green
Manganese iodide	S	Yellowish
Manganese stearate	L	Bright deep rose
Manganese oxalate	L	Pale whitish
Mannitol glyceryl monolaurate	L	Deep green-brown
Mannitol glyceryl monoleate	L	Brownish-blue
Mannitol glyceryl monostearate	L	Blue-gray
Mannitol triricinoleate	L	Deep green
Mercurous chloride	L	Bright pinkish
Mercury salicylate	L	Strong lavender
Mercury salicylamide	L	Bluish
Methanol	L	Very slight bluish
Methyl acetophenone	L	Gray-brown
Methylamine	L	Slight bluish
Methyl anthranilate	L	Blue-green
Methyl cinnamate	L	Bright violet
β-Methyl esculin	L	Brilliant blue
Methyl formate	L	Greenish
Methyl lactate	L	Greenish
2-Methyl-1,4-naphthoquinone	L	Lavender-white
Methylglycolphenetidin	L	Violet
2-Methyl-2,4-pentanediol	L	Light blue
Methyl salicylate	L	Green
β-Methylumbelliferone, soln.	L	Brilliant medium blue
Morphine	L	Pale green to lavender
Musk ambrette	L	Yellowish-brown
Musk ketone	L	Yellowish-brown
Musk xylol	L	Yellowish-brown
Narceine	L	Violet-blue
Narcotine	L	Violet
Nembutal	L	Bluish-violet
Neodymium chromate	L	Light yellow
Neodymium cyanide	L	Blue
Neodymium ferrocyanide	L	Deep coral
Neodymium molybdate	S	Coral
Neodymium nitrate	L	Pinkish-white
Neodymium tellurite	L	Rose-blue
Neodymium thiosulfate	L	Rose
Neodymium salicylate	L	Vivid blue-green
Nerolin	L	Violet
Nickelous 8-hydroxyquinolinate	L	Strong brownish

† Emits ultraviolet rays under influence of X-rays.

FLUORESCENT CHEMICALS

Name	λ	Fluorescence	Name	λ	Fluorescence
Nickel stearate	L	Gray-purple	Phthalic anhydride	L	Bright violet
Nicotinamide	L	Bright blue	Pyramidon	L	Bright blue
Nicotinic acid	L	Purple-white	Pyridoxine hydrochloride	L	Strong medium blue
2-Nitro-1-butanol	L	Greenish-orange	Quinine	L	Light blue
Nitroethane	L	Very slight blue	Quinine bisulfate	L	Bright blue-greenish
2-Nitro-2-ethyl-1,3-propanediol	L	Light lavender	Quinine hydrochloride	L	Light blue
Nitrogen iodide	L	Violet-pink	Quinine hydrobromide	L	Lavender
2-Nitro-2-methyl-1,3-propanediol	L	Violet	Quinine sulfate	L	Strong blue
2-Nitro-2-methyl-1-propanol	L	Lavender	Quinine salicylate	L	Bright blue-green
1-Nitropropane	L	Very slight blue	Quinoline	L	Bright blue
α-Nitroso β-naphthol	L	Crimson	Quinone	L	Red-brown
Nuclein	L	Strong bluish	Rhodinol	L	Violet-yellow
Nupercaine	L	Violet	Rhodium diphosphate	L	Blue
Oleic acid	L	Bright blue-green	Rhodium nitrate	L	Pink
Opianic acid	L	Pale blue	Riboflavin	L	Bright orange
Oxyquinoline sulfate	L	Bright crimson	Rotenone	L	Dull violet
Parabanic acid	L	Violet	Salicylic acid	L	Blue
Papaverine	L	Pale yellowish	Samarium chloride	L	Red-orange
Paraldehyde	L	Strong bluish	Samarium diphosphate	L	Blue
Paregoric	L	Bright yellow-green	Samarium ferrocyanide	L	Blue
Pentaerythritol	L	Rose to bluish	Samarium molybdate	L	Pink
Pentamethylenetetrazol	L	Blue-violet	Samarium salicylate	L	Brilliant blue
p-Phenetole sulfonic acid	†		Samarium tellurite	L	Bright blue-green
o-Phenoxyphenyl benzoate	L	Lavender-blue	Samarium tungstate	L	Blue-green
Phenobarbital	L	Whitish	Santonin	L	Pink
Phenobarbital sodium	L	Violet	Silver 8-hydroxyquinolinate	L	Yellowish
Phenolphthalein	L	Purplish	Sodium salts	LS	Usually violet
Phenolphthalin	L	Violet	Sodium acetate	L	Rose
Phenylacetic acid	L	Purple	Sodium acetylsalicylate	L	Pale lavender
Phenylethanol	L	Pale violet	Sodium benzoate	L	Whitish-blue
o-Phenylenediamine	L	Bright violet	Sodium cyanate	L	Violet
p-Phenylenediamine	L	Bright blue	Sodium *m*-hydroxybenzoate	L	Deep violet
Phenyl mercuric chloride	L	Violet	Sodium *p*-hydroxybenzoate	L	Lavender
Phenyl semicarbazide	L	Violet	Sodium hexametaphosphate	L	Violet
Phloroglucinol	L	Bright medium blue	Sodium nitroprusside	L	Dull red
Pilocarpine	L	Whitish	Sodium phenolsulfonphthalein	L	Dull cherry
Pineol resorcinate	L	Brilliant blue-green	Sodium salicylate	L	Brilliant sea blue-green
Piperine	L	Yellowish	Solanine	L	Weak blue
Potassium salts	LS	Usually pink	Sorbitol triricinoleate	L	Green
Potassium benzoate	L	Bluish	Sorbitol lactate	L	Deep blue-green
Potassium opianate	L	Blue	Sorbitol tartrate	L	Bright yellow-blue
Potassium salicylate	L	Bright blue-green	Strontium benzoate	L	Whitish-blue
Praseodymium salicylate	L	Lavender	Strontium 8-hydroxyquinolinate	L	Light green
Praseodymium silicate	L	Strong blue-green	Strontium stearate	L	Blue-white
Propadrine hydrochloride	L	Strong lavender-blue			

† Emits ultraviolet rays under influence of X-rays.

FLUORESCENT CHEMICALS

Name	λ	Fluorescence	Name	λ	Fluorescence
Stannous stearate	L	Cream	Vanadous 8-hydroxyquinolinate	L	Deep green
Sulfanilamide	L	Violet	Vanadous salicylate	L	Lavender
Sulforicinic acid	L	Vivid yellow-blue-green	Vanillin	L	Strong pink
Sulfosalicylic acid	L	Bright blue	Veratric acid	L	Pale blue
Sulfur	L	Crimson-tan	Varatrine sulfate	L	Pale blue
Terpin hydrate	L	Dull violet	Yohimbine hydrochloride	L	Light blue
Tetrahydrofurfuryl alcohol	L	Blue	Yttrium 8-hydroxyquinolinate	L	Strong orange-red
Thebaine	L	Red-yellow	Yttrium molybdate	S	Yellowish-blue
Thiamin chloride, soln.	L	Bright yellowish-green	Yttrium nitrate	S	Pinkish-blue
Theobromine	†		Yttrium phosphate	S	Blue
Theobromine	L	Brilliant blue-green	Yttrium salicylate	L	Bright medium blue
Theobromine calcium salicylate	L	Bright blue	Yttrium silicate	S	Deep blue
Thiochrome	L	Bright bluish	Yttrium tungstate	S	Bluish
Theophyllin ethylenediamine	L	Bright blue-green	Zinc carbonate	S	Light lavender
Thorium 8-hydroxyquinolinate	L	Deep green	Zinc hydroxide	S	Blue-violet
Titanium dioxide	L	Strong violet-white	Zinc 8-hydroxyquinolinate	L	Brilliant green
Titanium stearate	L	Gray-blue-tan	Zinc oxalate	S	Green (if impure)
Tocopherol	L	Bright blue-green	Zinc oxide	S	Yellow-green
Tributyl citrate	L	Weak blue-green	Zinc palmitate	L	Blue-white
Tributyl phosphate	L	Weak blue	Zinc potassium cyanide	S	Lavender
Triethyl phosphate	L	Slight bluish	Zinc sebacate	L	Whitish
Trimethylamine	L	Slight bluish	Zinc stearate	L	Blue
Tris(hydroxymethyl)-aminomethane	L	Deep pink	Zinc sulfanilate	L	Purple-blue
Tris(hydroxymethyl)-nitromethane	L	Greenish-blue	Zirconium nitrate	S	Pale bluish
Uranin, soln.	L	Brilliant yellow	Zirconium nucleate	L	Blue
Uranyl compounds	LS	Generally vivid yellow-green	Zirconium oxide	S	Whitish
			Zirconium tungstate	S	Gray-blue
			Zirconium uranyl nitrate	S	Yellowish

† Emits ultraviolet rays under influence of X-rays.

FLUORESCENT MINERALS AND GEMS

Many mineral species luminesce, but the response often varies according to the locality, history, and exciting agent. A wide variety of fluorescent colors may be noted in the same species, although in a few the response is consistent for all specimens. This also holds for phosphorescence, denoted in the following table by *P*. Therefore, close rules cannot be drawn about luminescence in most minerals.

Name	λ	Fluorescence	Name	λ	Fluorescence
Agate	LS	Variable; green when U containing	Hackmanite	....	Variable; strong orange(S), sometimes pinkish(L), P
Albite	S	Sometimes P			
Alexandrite	S	Feeble reddish	Halite	S	Vivid red, P
Alumnite	L	White	Hanksite	S	P
Alunite	S	Usually whitish	Hexagonite	LS	Reddish

FLUORESCENT MINERALS AND GEMS

Name	λ	Fluorescence
Amethyst	S	Infrequently feeble brownish
Anglesite	S	Yellowish
Anorthoclase	S	Blue
Apatite	S	Variable; blue to whitish
Apophyllite	S	Yellowish
Aragonite	....	Variable; green(S), red(S), P
Autunite	LS	Bright yellow-green
Axinite	S	Medium red
Barite	L	Sometimes whitish P
Barylite	S	Blue
Benitoite	LS	Strong medium blue
Beryl	S	Usually only very feeble
Borax	L	Greenish
Calcite	....	Highly variable; bright red(S), sometimes bright green(S), P
Calcium-larsenite	S	Vivid yellow
Celestite	S	Whitish P
Cerusite	....	Variable; blue(S), yellow (L)
Chalcedony	....	Variable; greenish(S)
Chalcocite	S	Bright yellow-green
Chrysoberyl	S	Usually only feeble
Clinohedrite	S	Brilliant orange
Colemanite	L	Variable; greenish
Cuproscheelite	S	Bright yellow-white
Curtisite	LS	Yellow-green
Dakeite	S	Bright yellowish-green
Diamond	LS	Highly variable; blue, green, red, orange, yellow, P
Dolomite	LS	Whitish to blue, P
Elaterite	L	Brownish
Epsomite	L	Pale bluish
Fluorapatite	S	Orangish
Fluorite	LS	Variable; blue, green, P
Glauberite	....	Sometimes P
Gummite	LS	Variable; dull purple
Gypsum	L	Usually greenish
Gyrolite	LS	Whitish
Uraniferous hyalite	LS	Yellow-green
Uranophane	S	Yellow-green
Uranopilite	S	Strong yellow-green
β-Uranopilite	LS	Brilliant yellow-green
Uranospathite	S	Bright yellow-green
Uranospinite	S	Bright yellow-green
Uranothallite	LS	Bright green
Uranotil	S	Medium yellow
Hiddenite	S	Lilac
Hydromagnesite	L	Medium green
Hydrozincite	S	Vivid blue, sometimes green or yellowish
Ianthinite	....	Rarely fluorescent
Johannite	LS	Strong yellow-green
Kunzite	S	Red or yellow, red-yellow, P
Leucite	L	Orange
Metatorbernite	LS	Brilliant yellow-blue
Meyerhofferite	S	P
Nasonite	S	Blue
Opal	LS	Variable; sometimes greenish or yellow, perhaps P
Ozocerite	L	Bluish
Pearl	LS	Variable; white, blue, or yellowish
Pectolite	S	Yellow, P
Petroleum	LS	Bright blue
Powellite	S	Strong yellowish-white
Priceite	S	Sometimes yellow
Pyromorphite	L	Usually white
Quartz	....	Highly variable; brownish(S), green(S), yellow(LS), sometimes P
Ruby	LS	Variable; usually vivid red
Sapphire	S	Variable; orange-red to red-blue
Scheelite	S	Characteristic bright blue
Selenite	S	Pale yellow, P
Smithsonite	L	Usually greenish
Sodalite	L	Orange-red
Sphalerite	LS	Strong orange
Spinel	S	Strong red
Strontianite	S	White
Sulfur	L	Yellowish
Torbernite	LS	Bright yellow-green
Trona	L	Blue
Uranocircite	S	Bright yellow-green
β-Uranotil	LS	Medium yellow-green
Vesuvianite	L	Yellow
Wavellite	L	Green
Wernerite	LS	Vivid yellow
Willemite	S	Brilliant green
Witherite	L	Yellowish
Wollastonite	S	Yellow-orange, P
Zippeite	LS	Strong yellow-green
Zircon	LS	Variable; pale orange

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

In the following table a selected list of the useful elements is given together with their interferences. In using this table, if no line is to be found at the wavelengths given as ***sensitive lines of an element***, that element can be reported as 0.0%, 0.00%, 0.000%, or 0.0000%, the sensitivity varying with the line chosen, the element, and the mode of excitation. Where a line is to be found at the wavelength given for a ***sensitive line of an element***, that element can be reported as present if it can be shown that no minor line from other elements in the sample is so close to the sensitive line that it cannot be differentiated from it with the instruments available.

All values in the table are taken from Harrison's *M. I. T. Wavelength Tables*, permission to do so having been granted by Professor George R. Harrison and by the Technology Press. The 1939 Edition, published by John Wiley and Sons, Inc., New York, was used.

The ***abbreviations*** used in the following table are those employed in the *M. I. T. Tables*, and are as follows:

bh,	band head
d,	double line
h,	hazy, diffuse
l,	shaded, or displaced to longer wavelengths
r,	narrow self-reversal
R,	wide self-reversal
s,	shaded, or displaced to shorter wavelengths
w,	wide or complex
W,	very wide or complex
I,	line classified as being emitted by the un-ionized atom
II,	line classified as being emitted by the singly ionized atom
?,	line listed in M. I. T. Tables, but not found on a plate made from pure sample of the element in question*

The arrangement of the tables is as follows: The elements to be included are in bold face type and are in alphabetical order of their names. Under each element are listed the sensitive lines for which the interferences are given. These and other wavelengths are in Angstrom units. These sensitive lines, together with their interferences are then listed in order of decreasing wavelength. Each line is followed by its chemical symbol and arc intensity. In this intensity scale the most intense lines are given ratings of 9000, while the faintest lines recorded are assigned the value of 1. Lines of intermediate strength are given twenty-five different values in an effort to approximate their true relationship To facilitate identification, the sensitive line is given in bold face type.

The interfering range is as follows:

Range in Å	Å above and below	Ditto for int. of 100 or more
10,000 to 4,000	1.5	2.5
4,000 to 3,000	1.0	2.0
3,000 to 2,000	0.5	1.0

Because of the fact that their lines do not appear in the arc spectra, all interfering lines due to the eighth group of inert gases, the seventh group of halogens, and to nitrogen, oxygen, and hydrogen have been omitted from the table. Most of the rare earths and other rare elements have also been omitted. The following elements were completely omitted: A, Ac, Br, Cl, Dy, Er, Eu, F, Gd, H, He, Hf, Ho, I, Il, Kr, La, Lu, Ma, N, Nd, Ne, O, Os, Pa, Pd, Po, Pr, Ra, Re, Rn, Ru, Sm, Tb, Tm, Xe, Yb.

All the interfering lines listed in the *M. I. T. Tables'* arc column and due to the following elements are given: Ag, Al, As, Au, B, Ba, Be, Bi, Ca, Cd, Cu, K, Li, Mg, Na, Pb, Sb, Si, Sn, Sr, and Zn. All interfering lines having an intensity of 10 or more in the arc are listed for all the elements. However, if lines under 10 are to be found in the *M. I. T. Tables* within the interfering range, the element symbol is given in parentheses at the end of the tabulation of interferences. For example, since ***Ni I*** is listed after the interferences for ***LEAD, 4057.82***, this line is not to be used for the detection of lead in nickel. If, however, only small amounts of nickel are present, then line 4057.82 can be used.

See also the following table: ***Sensitive Lines of the Elements.***

*** Experimental work of F. H. Emery, Harshaw Chemical Co., Cleveland, Ohio.**

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLES

ALUMINUM

3961.527
3944.032
3092.713
3082.155

3962.28	Ca		3w
.12	Ni	I	10h
.09	Ce		15
3961.59	Zr		500
3961.53	**Al**	**I**	**3000**
.3	Ag		15
.15	Fe	I	25
.00	Co	I	60
3960.91	Ce	II	40
.76	Cr		40

(Also Cb, Fe, Mo, Sb, Th, U, W)

3945.33	Co	I	200
.13	Fe		30
3944.90	Fe	I	15
.38	Ir	I	20
3944.03	**Al**	**I**	**2000**
3943.89	Ce	II	40
.82	U		35
.69	Th		10
.67	Cb		20
.66	V	I	50
.61	Cr	I	18
.35	Fe	I	40
.14	Ce	II	12
.09	Mo		10
.04	Mo		10
3942.44	Fe	I	100

(Also Ni I, Rh, W, Y)

3094.18	Cb	II	100
3093.99	Cu	I	150
.68	Mo		10
.61	Ce		18
.58	Bi	I	10w
.51	W		12
.46	Ca		2
.36	Fe		70
.34	Ce	II	12
.11	V	II	100R
.01	U		20
3092.99	Ta		18
.99	Mg	I	125
.84	Al		50R
.78	Fe		50
.73	Na	II	50
.72	V		100r
3092.71	**Al**	**I**	**1000**
.70	Mo		20
.44	Ta		50
.39	Cd	II	10
.07	Mo		30
.06	Ta		15
3091.92	Ce		20
.84	Mo		10
.58	Fe	I	300

(Also Cr, Ir, Rh I, Sc II, Th, Y, Zr I)

3083.74	Fe	I	500
.05	Th		12
3082.84	Co	I	35
.70	Mn		12
.68	Cd	I	30
.62	Co		150R
.45	Ta		15h
.30	Ce		20
.27	Rb	I	10
.18	Th		10
3082.16	**Al**	**I**	**800**
.11	V	I	80r
.05	Mn		50
.03	Th		12
.01	V	I	15
3081.95	Mo		25
.86	W		10
.85	Ta		50
.66	Th		10
.55	Ca	I	2
.33	Mn		75
.16	Mo		25
3080.83	Cd	I	150
.76	Ni	I	200

(Also Cb, Sc II, Ti I, U, Y II)

ANTIMONY

2877.915
2598.062

2878.45	Cr		20
.38	Mo		20
2877.98	Cr	II	30
2877.92	**Sb**	**I**	**250W**
.91	Ca		1h
.69	Cu	II	5
.69	V		15
.69	Ta		15
.68	Ir	I	20
.52	Pt	II	40
.44	Ti	II	30
.30	Fe	I	200
2876.95	Cb		40W

(Also Ce, U, W, Zr II)

2598.42	W		10
.37	Fe	II	700
.17	Mn		12
2598.06	**Sb**	**I**	**200**
2597.73	W		10
.69	U		25

(Also Ce, Fe, Ir, Ir I, Rh, Rh I, Ta)

ARSENIC

2860.452
2780.197
2349.84

2860.96	Cr	II	60
.85	Zr	I	15
.80	U		15
.76	Rh	I	30
.68	Pt	II	30
.68	Rh	I	30
.67	Ir	I	12
.47	U		35
2860.45	**As**	**I**	**50r**
2859.97	V	I	60

(Also Ce, Fe, Ti I, W)

2780.70	Cr	I	600R
.70	Fe		30
.54	Fe		10
.52	Bi	I	200W
.28	W	II	10
.25	Cb		30
2780.20	**As**	**I**	**75R**
.04	Mo		60
.01	Ce		15
.00	Mn		25
2779.83	Mg		40
.82	Sn		80
.70	Ta		30r
.54	Rh	I	100

(Also Ir I, U, W)

2350.84	Be	I	12
.69	Be	I	25
.54	W		12
.47	Ni		10
.28	Co	I	12
.05	Ir		15
2349.86	Cd		2
.85	Sb		8
2349.84	**As**	**I**	**250R**
.78	Mo		10w
.59	Zr		10
2348.61	Be	I	2000R

(Also Cb, Cu, Fe I, Rh, Ti, Ti II, U, V, Y)

BARIUM

5535.551
4554.042
3071.591

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

BARIUM (Continued)

5535.55	**Ba**	**I**	**1000R**
.41	Fe		50
.24	Ce		15
.04	Rh		80
5534.81	Sr		20
.66	Fe	I	20
5533.05	Mo		200

(Also Rh I, Ta, U, V I, Zr)

4556.35	Ta		200
.13	Fe	I	150
4555.62	Zr	I	30
.49	Ti	I	125
.36	Cs	I	2000R
.30	Cr		15
.13	Zr	I	15
.10	U		20
.09	Cr		15
.08	Ti	I	12
4554.83	Cr		25
.59	Pt		10
.51	Ru	I	1000R
4554.04	**Ba**	**II**	**1000R**
.04	Ce		35s
4553.95	Cr		20
.80	Mo		20
.7	bhPb		6
.69	Ta		200*l*
.33	Co	I	25
.32	Mo		12
.31	Mn		12h
.22	Mo		12
.18	Ni	I	15r
.05	V	I	20
.01	Zr	I	10
4552.55	Fe		10
.53	W		12
4551.95	Ta		400

(Also Cb, Ir, Th, Y I, Zr II)

3072.39	Ce	II	20
.34	Co	I	200R
.12	Th		10
.11	Ti	II	25
.06	Zn	I	200
3071.96	Co		80
.94	Pt	I	60
.62	Ce		18s
3071.59	**Ba**	**I**	**100R**
.59	Ca	I	5
.56	Cb		10
.44	Mo		25
.30	Cr	I	15
.24	Ti	II	12
.11	Ce	II	20s
.03	Rh	I	20
3070.90	Mo		40
.89	V	I	10
.82	Th		12
.27	Mn		100

(Also Fe, Fe II, Ir, Ta, U, W II, Y)

BERYLLIUM

3131.072–3130.416
2348.610

3132.59	Mo		1000R
.07	Zr	I	10
.06	Cr	II	25
.04	Ce		15
3131.83	Hg	I	200
.55	Hg	I	400
.21	Cr		20
3131.07	**Be**	**II**	**200**
.07	Th		12
3130.87	Ce		30
.80	Ti	II	25
.79	Rh	I	60
.79	Cb		100
.73	U		10
.58	Ta		100W
.57	Ba	I	2
.46	W		10
3130.42	**Be**	**II**	**200**
.33	Ce		30
.29	Ta		15*l*
.27	V	II	50
.20	Ce		15
.01	Ag		25h
3129.95	Ta		50
.91	Th		10
.76	Zr	II	10
.55	Ta		50
.48	Co	I	40
.37	Na	II	35
.33	Fe	I	100
.31	Ni	I	125

(Also Fe, Fe II, Ir, Ti I, U, Y II)

2349.84	As	I	250R
.10	Bi	I	10
2348.82	Cu	II	15d
.74	Ni	I	10
2348.61	**Be**	**I**	**2000R**
.59	Zr		15
.30	Ir		20
2347.97	W		10
.58	Ba		30

(Also Cb, Fe II, Mn, Mo, Pt II, U)

BISMUTH

3067.716
2897.975

3069.24	Ta		150
3068.68	Ce		20
.64	Mo		15
.18	Fe	I	.150
.00	Mo		30
3067.94	Fe		15
.76	Sn		10?
3067.73	Th		12
3067.72	**Bi**	**I**	**3000hR**
.64	Mo		10
.31	Rh		80
.24	Fe	I	300
.16	Cr	II	25
.12	V	I	15
.01	Ge		60
.01	Ca	I	6
3066.76	Ta		10
.38	V	I	400r

(Also Ir, U, W, W II, Zr I, Zr II)

2899.04	Ta		200
2898.54	Cr		12
.43	Ta		30
.36	Fe		100
.35	Ir	I	10
.27	Be	I	20
.19	Be	I	15
2897.99	Mn		15
2897.98	**Bi**	**I**	**500WR**
.87	Pt	I	400
.81	Cb		15
.80	Mn		15
.63	Mo		20

(Also Ce, Ir, Rh, Th, U, V, W, Y II, Zr)

BORON

2497.733–2496.778

2498.50	Pt	I	400
.33	Ta		30
.28	Mo		10
.23	V	I	10
2497.86	Mo		20
.82	Fe	II	15
2497.73	**B**	**I**	**500**
.72	Sn		8
.58	Mo		30h
.48	W	II	10
2496.99	Fe		20
2496.78	**B**	**I**	**300**
.77	Sn		10
.64	Ta		20
.64	W	II	10
.53	Fe		40

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

BORON (Continued)

.31	Cr	I	125r
.27	Ir	I	10
2495.86	Fe	I	25
.82	Pt	I	40
.72	Sn		100

(Also Cb, Co, Ge I, Th, V, W, Zr II)

CADMIUM

6438.4696
3610.510
3261.057
2288.018

6440.97	Mn		60
6439.17	Co		80
.07	Ca	I	150
6438.47	**Cd**	**I**	**2000**
6435.16	Y	I	150

(Also Ce, Ta, W, Zr I)

3612.47	Rh	I	200
3611.52	Cs	I	200
.39	U		12
.34	Ce	II	10
.13	Ta		25
.05	Y	II	40
.00	Ba		10
3610.91	Ce		10
.81	Cu	I	25
.70	Fe	I	10
3610.51	**Cd**	**I**	**1000**
.46	Ni	I	1000r
.30	Mn		60
.16	Fe	I	100
.16	Ti	I	100
.05	Cr		20
3609.77	Ir		30
.69	Ce		40
.68	U		15
.59	Ti	I	12
.31	Ni	I	200
3608.86	Fe	I	500

(Also Cb, Co, Mo, Pt, Th, Zr)

3262.33	Sn	I	400h
.01	Fe		30
.01	Ir	I	20
3261.96	Ba	I	40
.88	Cb		10
.72	U		15
.61	Tl	II	70
.33	Fe		25
.17	W		10
.08	V		15
3261.06	**Cd**	**I**	**300**
3260.98	Ce	II	25
.93	Ca		1h
.82	Co	I	70
.74	B	II	4
.56	Cb		15
.48	Mo		10
.26	Fe		20
.26	T	I, II	12
.23	Mn		75
.18	Ta		125
.11	Zr	I	10
3259.99	Fe	I	150

(Also Ce, Pt, Pt I, Th, Zr)

2288.39	Ni	I	12
.19	Pt	II	15
.12	As	I	250R
2288.02	**Cd**	**I**	**1500R**
2287.88	Ir		20
.81	Co		12d
.67	W		10
.08	Ni	II	100

(Also Fe I, Mn, Ta, V)

CALCIUM

4226.728
3968.468
3933.666
3179.332

4227.76	Zr	I	150
.75	Ce		40
.74	V	I	10
.65	Ti	I	18
.43	Fe	I	300
.41	Ce		10
4226.92	W		15
.76	Cr		125
.74	Ir		30
.74	Ce		50
4226.73	**Ca**	**I**	**500R**
.73	Mo		15
.57	Ge	I	200
.55	Mo		10
.43	Fe	I	80
.34	W		10
.29	Mo		20
4225.96	Fe	I	80
.50	Ir		15
.47	Fe	I	80

(Also B, Cb, Th, U, V II, Y)

3970.10	Ta		100
3969.75	Cr	I	200
.26	Sr	I	30
.26	Fe	I	600
.20	W		12
.17	Ir		30
.12	Co	I	100w
.06	Cr	I	80
.00	Th		10
3968.48	Ir		25
.47	Ce		35
3968.47	**Ca**	**II**	**500R**
.43	Y		10
.26	Zr	I	100
.22	Ag		100
.09	V	II	25
3967.97	Fe	I	60
.48	U		10
.42	Fe		125

(Also Cb, Ir I, Mo, Rh I, Y II, Zr)

3934.84	Ir	I	200
.24	Ti	I	30
.23	Rh	I	100
.12	Zr	II	20
.01	V	I	100
3933.91	Co	I	60
.90	Ir		20
.73	Ce		60
3933.67	**Ca**	**II**	**600R**
.66	Ir		20
.65	Co		80
.62	Ag		80
.60	Fe	I	200
.38	Sc	I	60
3932.92	Cu	I	10
.92	Th		10

(Also Cb, Fe, Mo, U, W, Zr I)

3180.95	Ta		100
.76	Fe	I	100
.28	Co	I	10
.23	Fe	I	300
.20	Th		15
.16	Fe	II	10
3179.83	U		12
.73	Rh	I	50
.54	Ta		15h
.42	Y	II	20
.35	B	II	5
3179.33	**Ca**	**II**	**100**
.29	Ti	I	10
.28	Cr		100
.24	Ag		2
.14	Ag		2
.06	W		10
.06	Na	II	6
.05	Th		10
.04	U		10
3178.97	Fe		30
.75	Ce		15
.69	Ir		10
.55	Fe		10
.50	Mn		150
.49	Ce	II	12

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

CALCIUM (Continued)

.02	Fe	I	300

(Also Cb, Ir I, Mo, Pt, V, W II, Zr I)

CARBON

2478.573

2479.13	Cr		20
..05	V		15
2478.66	Hg	I	15h
2478.57	**C**	**I**	**400**
.31	Sb		75
.22	Ta		60

(Also Cb, Co, Fe II, Ir I, Zr)

CERIUM

4186.599

4188.32	Mo		100
.07	U		10
4187.80	Fe	I	200
.32	Ce	II	35
.25	Co	I	50
.04	Fe	I	250
4186.98	U		10
4186.60	**Ce**	**II**	**80**
.36	Cr		50
.28	Mo		15
.12	Ti	I	100
.02	W		12
4185.83	Mo		40
.66	Ir		25
.35	Cr		30
.33	Ce	II	30
4184.90	Fe	I	100

(Also Cb, Ce, Fe, Zr, Zr I, Zr II)

CHROMIUM

4289.721
4254.346
2843.252

4292.13	Mo		100
4291.47	Fe	I	125
.20	Mo		15
.19	Cb		10
.17	Ba		10
.14	Ti		10
4290.94	Ti	I	70
.89	U		15
.87	Fe	I	20
.6	Na	I	3
.38	Fe		35
.23	Ti	II	35
.21	Zr	I	40
.19	Mo		30h
4289.94	Ce		50
.92	Ti	I	15
.88	U		12
4289.72	**Cr**	**I**	**3000R**
.45	Ce	II	25
.44	Cb		10
.42	Mo		20
.36	Ca	I	35
.07	Ti	I	125
4288.84	U		20
.71	Rh	I	400
.67	Ce	II	30
.64	Mo		80
.38	Cr		15
.01	Ni	I	150
4287.41	Ti	I	100

(Also Mn, Pt, Th, V II, W, Y I)

4255.78	Ce		40
.50	Cr		30
.44	Cb		30
.36	Ce	II	10
4254.96	Mo		25
.70	Ce		20
.69	Cb		10
.43	Mo		10
.39	Cb		10
4254.35	**Cr**	**I**	**5000R**
.15	Bi	I	10
4253.85	U		12
.70	Cb		25
.57	Zr	I	20
.5	Sr		2
.36	Ce		40s
.34	Cu	I	7wh
4252.97	Cb		30
.97	Sr	I	2
.31	Co	I	150

(Also Co, Fe, Th, W, V II)

2844.25	Ta		400r
2843.98	Fe	I	300
.95	Ag		5
.78	W		9
.63	Fe	I	125
2843.25	**Cr**	**II**	**125**
2842.83	Ce		25d
.82	Ta		200
.82	Th		12

(Also Cb, Fe, Mo, Ti I, U, Zr II)

COBALT

3453.505
3405.120

3455.23	Co	I	2000R
.22	Rh	I	300
3454.48	Ce		10
.17	Ti	I	15
3453.74	Cr	I	30
3453.51	**Co**	**I**	**3000R**
.33	Cr	I	35
.02	Fe		30
3452.89	Ni	I	600R
.68	Th		10
.65	Cb		15
.62	W		7
.60	Mo		10
.28	Fe	I	150
3451.92	Fe	I	100

(Also Ce II, Pt, Pt I, Ta, U, Y I)

3406.81	Fe	I	100
.13	Cb		30
3405.98	Ce		25
.94	Mo		25
.82	Co		30R
.81	Ce		10
.75	U		12
.66	Bi	I	60
.41	Cb		80
.33	Bi		40
.22	Cr		12
.16	V	I	30
3405.12	**Co**	**I**	**2000R**
.09	Ti	I	20
.03	Ag		3
3404.91	Ce		18
.83	Zr	II	40
.58	Pd	I	2000R
.43	Ce		12
.36	Fe	I	100
.34	Mo		20
.30	Fe	I	25
.13	Ce		18
3403.65	Cd	I	800

(Also Fe, Ta, Th, W)

COLUMBIUM

4079.729
4058.938
3130.786
3094.183

4081.22	Ce		40
.22	Zr	I	150
4080.93	Ba	I	2
.61	U		12
.55	Cu	I	30w
.22	Fe	I	60
.22	Cr		15
.1	bhSr		2
4079.90	Ir		25
.85	Fe	I	80
4079.73	**Cb**	**I**	**500w**
.72	Ti	I	40

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

COLUMBIUM (Continued)

.67	Ce		15
.42	Mn		50
.24	Mn		50
.21	Bi	II	2h
.19	Ta		10
.02	Ce		15
4078.47	Ti	I	125
.36	Fe	I	80
.32	Ce		15
.31	Zr	I	10
4077.81	Hg	I	150
.71	Sr	II	400r
.41	Co	I	100wh

(Also Cb, Ce II, Fe, Mo, Rh I, Th, W, V I, Y I)

4060.27	Ti	I	60
.08	Zr	I	10
4059.88	Ca		2h
.72	Fe		15
.61	Mo		10
.39	Mn		20
.23	Ir		30
4058.96	Mg		2
4058.94	**Cb**	**I**	**1000w**
.93	Mn		80
.93	Ca	I	3d
.77	Cr		80
.76	Fe	I	40
.60	Co	I	100
.46	Ta		10
.24	Ce	II	18
.23	Fe		80
.19	Co	I	100
.16	U		10
.14	Ti	I	50
.0	bhSr		3
4057.95	Mn		80
.87	In		80
.83	V	I	10
.82	Pb	I	2000R
.71	Zn	II	80
.63	Mg	I	10w
.62	Ti	I	40
.58	Mo		10
.20	Co	I	100

(Also Ce, Th, W)

3132.64	Ta		250w
.59	Mo		1000R
.07	Zr	I	10
.06	Cr	II	25
.04	Ce		15
3131.83	Hg	I	200
.55	Hg	I	400
.21	Cr		20
.07	Be	II	200
.07	Th		12
3130.87	Ce		30
.80	Ti	II	25
.79	Rh	I	60
3130.79	**Cb**		**100**
.73	U		10
.58	Ta		100W
.57	Ba	I	2
.46	W		10
.42	Be	II	200
.33	Ce		30
.29	Ta		15 l
.27	V	II	50
.20	Ce		15
.01	Ag		25h
3129.95	Ta		50
.91	Th		10
.33	Fo	I	100
.31	Ni	I	125

(Also Co I, Fe, Fe II, Ir, Ti I, Y II)

3095.86	Cr		125
.10	Ce	II	15
.04	U		12
3094.90	Fe	I	30
.83	U		10
.74	Th		10
.69	V	I	40
.66	Mo		150
.20	V		20
3094.18	**Cb**	**II**	**100**
.01	Ir	I	20
3093.99	Cu	I	150
.88	Fe		40
.87	Ta		50
.81	Fe	I	50
.79	V	I	30
.74	Cd	II	3
.68	Mo		10
.61	Ce		18
.58	Bi	I	10w
.51	W		12
.46	Ca		2
.36	Fe		70
.34	Ce	II	12
.11	V	II	100R
3092.99	Mg	I	125
.72	V		100r
.71	Al	I	1000

(Also Cb, Ir, Rh I, Sc, Ti I, Y II, Zr I, Zr II)

CESIUM

4593.177
4555.355

4594.63	Co	I	400
.40	Cr		10
.11	Mn		12
.11	V	I	30wh
4593.93	Ce		30
.83	Cr		12
4593.18	**Cs**	**I**	**1000R**
4592.66	Fe	I	200
.58	W		15
.54	Cr		25
.53	Ni	I	200
.42	W		20
.21	Mo		20
4591.83	Ba		15
.39	Cr	II	200

(Also Mo, Sc I, Th, U, Y)

4556.87	W		15
.35	Ta		200
.17	Cr		40
.13	Fe	I	150
4555.92	Cu	II	2
.90	Fe	II	12
.52	Zr	I	30
.49	Ti	I	125
4555.36	**Cs**	**I**	**2000R**
.30	Cr		15
.13	Zr	I	15
.10	U		20
.09	Cr		15
.08	Ti	I	12
4554.83	Cr		25
.59	Pt		10
.51	Ru	I	1000R
.04	Ba	II	1000R
.04	Ce		35s
4553.95	Cr		20
.69	Ta		200*l*

(Also Cb, Ir, Mo, Th, V, Y, Y I, Zr II)

COPPER

3273.962
3247.540

3274.95	Ta		200
.86	Ce		35
.66	Ca	I	20
.46	Ta		35
.45	Fe		80
.22	Na	II	15
.06	Ce		10
3273.96	**Cu**	**I**	**3000R**
.96	Mo		20
.96	Ca		2
.93	Co		10
.89	Cb		20r
.88	Th		10

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

COPPER (Continued)

.62	Sc	I	35
.13	Ta		70
.05	Zr	II	50
.03	V	I	30
.02	Mn		20

(Also Ir I, Rh, Ti I, U)

3248.52	Ta		100
.52	Mn		100
.46	Ni	I	150
.43	Ce		12
.28	Ca		1h
.21	Fe	I	200
3247.62	Mo		30
.55	Ce		15
.55	Ag		15
.55	Sb		2h
.54	Mn		125
3247.54	**Cu**	**I**	**5000R**
.47	Cb		50w
.28	Fe	I	20
.27	Cr	I	20
.21	Fe		10
.18	Co	I	80
3247.00	Co	I	35
3246.96	Fe	I	100
.90	Ta		35h
.67	Ce	I,II	35
3245.98	Fe	I	200

(Also Ir I, Pt I, Th, U)

FLUORINE

5291.0

5292.9	bh F		150
.52	Cu	I	50
.14	Rh	I	80
.08	Mo		20
5291.0	**bh F**		**200**
5290.95	Ba		10
.94	Ce		12
.85	Fe	I	15
.72	V		10

(Also Cr, Mn, Th, U, V I, Y II, Zr)

GALLIUM

4032.982
2943.637

4034.49	Mn	I	250r
.26	Th		10
.05	Cr	I	20
4033.91	Ti	I	40
.76	Ir		100
.73	U		12
.54	Sb		70
.43	U		12
.26	Cr	I	30
.19	Sr	I	6
.07	Mn	I	400r
.07	Cr		15
.07	Ta		100
4032.98	**Ga**	**I**	**1000R**
.63	Ti	I	35
.63	Fe	I	80
.54	Th		10
.52	Cb		30
.38	Sr	I	20
.21	Ir		10
4031.97	Fe		80
.83	V	I	10
.75	Ti	I	35
.67	Ce		10d
4030.76	Mn	I	500r
.49	Fe	I	120

(Also In, Ir I, Mn, Mo, Sc I, W, Zr, Zr II)

2944.18	Ga		10
2943.91	Ni	I	50r
.90	U		10
.77	Ta		10
2943.64	**Ga**	**I**	**10**
.57	Fe		12
.48	Co	I	30
.20	V	I	30
.15	Ir	I	30

(Also Ce, Ir, Mn, Mo, V, W)

GERMANIUM

3039.064
2651.575

3040.85	Cr	I	500R
.81	Co	I	10
.60	Mn		50
.47	Ir	I	35
.43	Fe	I	400
.05	Th		12
3039.82	Mo		20
.78	Cr	I	80
.57	Cd		4
.57	Co	I	70
.50	U		10
.36	In	I	1000R
.32	Fe		20
.31	W		10
.26	U		15
.26	Ir	I	25
.21	Ca	I	1h
3039.06	**Ge**	**I**	**1000**
3038.71	V		20
.60	Th		12
.31	Co	I	25
3037.94	Ni	I	800R
.39	Fe	I	700R

(Also Cb, Ce, Ir, Mn II, Sc II, Ti II, W II, Y I)

2652.49	Al	I	150R
.04	Hg	I	100
.01	Ce		10
2651.90	V	I	50
.71	Fe	I	60
2651.58	**Ge**	**I**	**30**
.48	Ta		50
.18	Ge	I	40
2650.86	Pt	I	700

(Also Cb, U, W)

GOLD

2675.95
2427.95

2677.15	Pt	I	800w
2676.83	Ir	I	35
.33	Mn		15
.11	Fe		15w
.11	Rh	I	10
2675.98	Co	I	10w
2675.95	**Au**	**I**	**250R**
.94	Cb		10
.90	Ta		150
.88	U		15
.87	W		12
.76	V	I	12
.40	W		10
.3	bh B		60
.28	Fe		30
.13	W		10
.12	U		15
2674.57	Pt		200

(Also Ce, Cr, Hg I, Th, Ti I, Ti II)

2428.42	Mn		12
.29	Co	II	10
.28	V	I	30r
.23	Ti	I	15
.20	Pt	I	100
.20	Ag	II	1
.10	Sr	I	10h
.04	Pt	I	100
2427.95	**Au**	**I**	**400R**
.64	Ta		150
.62	U		12
.61	Ir	I	25
.49	W	II	10d
.45	U		12
.29	W		10
.00	Co		12
2426.35	Sb		75

(Also Cb, Fe, Fe II, Ir, Th)

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

INDIUM

4511.323
3256.090
3039.356

4512.74	Ti	I	100
.28	Ca	I	10
.15	Mo		25
4511.90	Cr		80
.64	Ce		10
.50	Ta		300
.34	Cd		5
4511.32	**In**	**I**	**5000R**
.30	Sn		200
.17	Tl		40
4510.98	Ta		200W
.54	Th		30
.32	U		20
.01	Cr		15
4509.39	Cu	I	150

(Also Cb, Ir, Mn, Pt I, V, V I. Zr I)

3257.59	Fe	I	100
.0	bh B		100
3256.77	Ta		100
.70	Fe		20
.68	Ce		20
.27	Th		10
.25	Ce		12
.21	Mo		40
.14	Mn		75
3256.09	**In**	**I**	**1500R**
3255.89	Fe	II	20
.81	Ca		1h
.69	Ta		18h
.68	Sc	I	15
.65	V	I	25
.51	Th		10
3254.36	Fe		200
.21	Co	I	300R

(Also Cb, Ir I, Pt, Pt I, U, V, W)

3040.85	Cr	I	500R
.43	Fe	I	400
.05	Th		12
3039.82	Mo		20
.78	Cr	I	80
.57	Cd		4
.57	Co	I	70
.50	U		10
3039.36	**In**	**I**	**1000R**
.32	Fe		20
.31	W		10
.26	U		15
.26	Ir	I	25
.21	Ca	I	1h
.06	Ge	I	1000
3038.71	V		20
.60	Th		12
3037.94	Ni	I	800R
.39	Fe	I	700R

(Also Cb, Ce, Ir, Mn, Mn II, Sc II, Ti II, W II, Y I)

IRIDIUM

3513.645
3220.780
2849.725

3515.05	Ni	I	1000R
3514.62	U		18
3513.93	Ni	I	200
.82	Fe	I	400
.68	U		10
3513.65	**Ir**	**I**	**100h**
.61	Ta		35
.48	Co	I	300R
.10	Rh	I	50
.07	Fe	I	10
3512.83	Ta		15
.64	Co	I	400R

(Also Cb, Ce, Cr, Fe, Ni, Th, V, W, Y I, Zr I, Zr II)

3222.07	Fe	I	200
3221.74	Mo		20
.65	Ni	I	300
.63	Ba	I	2
.38	Ti	I	25
.32	Ta		70
.29	Th		15
.28	Ir		10
.27	Ni	I	35
.21	W		12d
.17	Ce	II	50
3220.93	Cb		10
.87	Ce		30
3220.78	**Ir**	**I**	**100**
.54	Pb		50h
.40	Ce		12s
.30	Th		12
3219.81	Fe	I	100
.58	Fe	I	200

(Also Pt, Rh, U)

2850.49	Ta		200
.04	Co	I	75
2849.84	Cr	II	80
.82	Ta		15Ws
2849.73	**Ir**	**I**	**40h**
.48	U		18
.38	Mo		50
.29	Cr		35

(Also Cb, Fe, Rh, W)

IRON

3719.935
2395.625

3720.77	Cu	I	10
.38	Ti	I	40
.31	Th		15
.25	Mo		10
3719.94	**Fe**	**I**	**1000R**
.93	Ba	I	2
.80	Ce	II	15s
.44	Th		30
.41	W		12
.29	U		12
3718.93	Mn		75

(Also Cb, Ce, Ir, I, Pt, Ta)

2396.09	Ir	I	20
2395.89	Ir	I	15
.79	Cr	I	25
.63	Ag		4
2395.63	**Fe**	**II**	**50**
.61	Ni		10
.32	Cb		15
.25	Mo		12
.20	Sb		50

(Also Co, V I, W, W II)

LEAD

4057.820
3639.580
2833.069
2614.178

4059.23	Ir		30
4058.96	Mg		2
.94	Cb	I	1000w
.93	Mn		80
.93	Ca	I	3d
.77	Cr		80
.76	Fe	I	40
.60	Co	I	100
.46	Ta		10
.24	Ce	II	18
.23	Fe		80
.19	Co	I	100
.16	U		10
.14	Ti	I	50
.0	bhSr		3
4057.95	Mn		80
.87	In		80
.83	V	I	10
4057.82	**Pb**	**I**	**2000R**
.71	Zn	II	80
.63	Mg	I	10w
.62	Ti	I	40
.58	Mo		10
.35	Fe	I	20
.34	Th		10

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

LEAD (Continued)

4057.20	Co	I	100
.10	Ca		2
.07	V	I	20
4056.98	Co	I	20h
.90	Ce		15
.79	Cr		15
.7	Cu	I	8wh
.67	Sr	II	4
.47	Ir		12
.32	Mo		15

(Also Ni I, Rh I, Sc I, W, Zr I)

3641.10	V	I	100h
3640.39	Ba		8
.39	Fe	I	300
.39	Cr	I	30
3639.80	Cr	I	60
3639.58	**Pb**	**I**	**300**
.53	Zn		20
.51	Rh	I	125
.50	U		25
.45	Th		10
.44	Co	I	200
.33	Cb		15
.02	V	I	70
3638.79	Pt	I	250
.79	Cb		10
.30	Fe	I	100

(Also Ce, Ce II, Ir, Mn, Mo, Ti I, W, Y I, Zr, Zr I)

2833.64	Ta		300w
.63	W		15
.40	Fe		10
.31	Ce		50d
2833.07	**Pb**	**I**	**500R**
2832.95	W		10
.44	Fe	I	300

(Also Cb, Ir, Rh I, Th, U, Zr)

2614.67	Mg	I	5
.67	Sb		4
.61	Pt	I	10
.49	Fe	I	40
.20	Ir	I	10
2614.18	**Pb**		**200r**
2614.18	Sn		5
.17	Ta		200wh
.13	Co	I	30
2613.95	U		10
.90	Ce		15
.82	Fe	II	400
.82	W		15
.72	Mo		15
.72	Bi		8
.65	Pb		50R
.59	Mn		12

(Also Cb, Co II, V)

LITHIUM

6707.844
6103.642
3232.61

6709.88	Cb		15
.39	Ta		10
6708.18	W		20
6707.86	Co		200Wh
.85	Mo		300W
6707.84	**Li**	**I**	**3000R**
6705.9	bhSc		6

(Also Ce, V I, Zr I)

6105.47	Co	I	10h
.30	Cb		10
6104.57	Th		12
6103.64	**Li**	**I**	**2000R**
6102.74	Co		10
.72	Ca	I	50
.72	Rh		100
.71	Cr		10
.54	Zn	II	6
.18	Fe	I	15
6101.9	bhSc		30
.87	Mo		40
.65	Au		5
.58	Ta		150

(Also Ce, Fe I, U)

3234.61	Fe	I	200
.52	Ti	II	100
3233.97	Fe	I	300
.54	V	I	10
.54	Be	II	5
.44	Co	II	30
.42	Pt	I	40
3233.25	Ag		5
.23	Cr	I	30
.19	V	I	40
.14	Mo		50
.05	Fe		100
3232.96	Ni	I	300R
.87	Co	I	60
3232.61	**Li**	**I**	**1000R**
.50	Sb	I	150
.35	Pb		30
.29	Ce		15
.28	Ti	II	30
.28	Ta		25
.16	U		12
.06	Os	I	500R
.00	Ir		20
3231.69	Zr	II	10
.67	Ta		18h
3230.97	Fe	I	300
.86	Ta		200

(Also Rh, Rh I, Th, Ti I, V, W, W II, Y II, Zr II)

MAGNESIUM

2852.129
2802.695
2795.53

2852.83	Na	I	100R
.75	U		15
.53	Ag		1
.13	Mo		10h
.13	Ir		20
.13	Fe		150
2852.13	**Mg**	**I**	**300R**
.12	Ce		50d
2851.97	Zr	II	12
.80	Fe	I	200
.75	V	I	30
.65	Mg	I	25
2850.99	Ta		400

(Also Cb, Th, V)

2803.24	Pt	I	400
.17	Fe	I	15
.12	Fe		35
2802.95	W		12d
.80	Mn		12
.80	V		15
2802.71	Co		100
.70	Ta		10
.70	Ce		18
2802.70	**Mg**	**II**	**150**
.68	Cu	I	10
.58	U		15
.49	Ta		15
.41	Mn		12
.35	Mo		15
.27	Ni		50
.07	Ta		300
.00	Pb		250Rh

(Also Cb, Hg, Ni I)

2796.34	Ta		400
2795.85	Fe		15W
.82	Co	I	15
.82	Cr		35
.70	Rh	I	15
.54	Fe	I	90
.53	Ag		10
2795.53	**Mg**	**II**	**150**
.53	Ce		30s
.23	U		18
.01	Fe	I	50
2794.82	Mn		1000R
.82	Co		100R

(Also Cb, W, Zr I)

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

MANGANESE

(4034.490
4033.073
4030.755)
2794.82
2576.104

4035.89	Ta		10
.89	Zr	I	40
.83	Ti	I	50
.73	Mn		50
.63	V	II	40
.55	Co	I	150
.36	W		10
4034.91	Ti	I	25
.52	Cb		10
4034.49	**Mn**		**250r**
.26	Th		10
.05	Cr	I	20
4033.91	Ti	I	40
.76	Ir		100
.73	U		12
.54	Sb		70
.43	U		12
.26	Cr	I	30
.19	Sr	I	6
4033.07	**Mn**	**I**	**400r**
.07	Cr		15
.07	Ta		100
4032.98	Ga	I	1000R
.63	Ti	I	35
.63	Fe	I	80
.54	Th		10
.52	Cb		30
.38	Sr	I	20
.21	Ir		10
4031.97	Fe		80
.83	V	I	10
.75	Ti	I	35
.67	Ce		10d
.40	Sc	I	10
.34	Ce	II	40
.22	V	I	10
.13	Cr		30
4030.86	Th		10
.76	Zr	I	20
4030.76	**Mn**	**I**	**500r**
.68	Cr		40
.67	Ta		10
.66	Sc	I	10
.51	Ti	I	80
.49	Fe	I	120
.38	Sr	I	40
.34	Ce	II	18
.3	Ca		10
.19	Fe	I	20
.04	Zr	I	35
4029.94	Ta		50
.68	Zr	II	40
.64	Fe	I	80
4028.95	Zr	I	40
.79	W		12
.41	Ce	II	35
.35	Ti	II	30

(Also Co, In, Ir I, Mo, Y, Y I, Zr)

2795.53	Mg	II	150
.23	U		18
.01	Fe	I	50
2794.82	**Mn**		**1000R**
.82	Co		100R
.70	Fe	I	50

(Also Cb, Ir I, Mo, Zr I)

2577.26	Pb		100wh
2576.69	Fe	I	40
.69	Th		15
.30	Hg	I	20
2576.10	**Mn**	**II**	**300R**
.10	Co		30
2575.74	Ag		10h
.74	Fe		80
.74	Ir	I	10
.51	Mn		150
.47	Ta		80
2575.47	W		10
.41	Al		30
.10	Al		200R

(Also Cb, Ce, Mo, Rh, Rh I, V, W II, Zr I)

MERCURY

4358.35
2536.519

4359.85	Cb		50
.81	Mn		25
.65	Sc		12
.63	Cr	I	200
.63	Mn		15
.62	Mo		15
.59	Ni	I	100
.58	Ir		12
.55	Ba		15
.43	Co	I	15
.08	Sc		12
.07	Ce		15
4358.74	Zr	I	10
.73	Y	II	60
.65	Ta		10
.65	Sc	I	10
.55	Mo		20w
.51	Fe	I	70
4358.35	**Hg**	**I**	**3000w**
4357 91	Ce		12
.73	Y	I	10
.53	Cr		12
.17	Co	I	10

(Also Fe, Pt I, Th, U, V I, Zr II)

2536.93	V		10
.85	Mo		25
.82	Fe	II	10
.71	Rh		15
.56	Bi		5h
2536.52	**Hg**	**I**	**2000R**
.49	Pt	I	100
.23	Ta		100W
2535.65	P	I	100
.60	Fe	I	1000

(Also Co I, Fe, Ir, Th, U, W)

MOLYBDENUM

3864.110
3798.252
3170.35
2816.154

3865.53	Fe	I	600
.04	Cb		10d
3864.86	V	I	100r
.50	Ti		15
.34	W		12
.34	Zr	I	50
.30	V	I	30
3864.11	**Mo**	**I**	**1000R**
3863.87	Zr	I	20
.87	V	I, II	25
.74	Fe	I	60
.61	Co	I	30
.39	Th		20
.38	Cb		15

(Also Ce, Ce II, Fe, Fe II, U)

3800.12	Ir		150
3799.55	Fe	I	400
.31	Rh	I	25
.27	V	I	10
.26	Mn		50
.22	Th		10
.00	Zn	I	5
3798.84	U		15
.51	Fe	I	400
.31	Ti	I	10
3798.25	**Mo**	**I**	**1000R**
.12	Cb		50
2797.77	U		10
.72	Cr	I	100
.52	Fe		300

(Also Ce, Ce II, Ir I, Ta, W)

3171.35	Fe	I	100
3170.86	U		10

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

MOLYBDENUM (Continued)

.58	Ag		5
.43	Th		10
3170.35	**Mo**		**1000R**
.35	Fe	II	10
.29	Ta		250w
.20	W		15
.07	Ce		12
3169.93	W		10
.85	Ca	I	10
.77	Co		100
.68	Cu	I	50
.58	Cr	I	25

(Also Cb, Fe, Ni I, Ti I)

2817.10	Ta		80d
2816.15	**Mo**	**II**	**200**
.08	Th		10
2815.97	V		12
.91	Mo		20
.60	Mn		12h
.12	Ta		100

(Also Ce, Fe, U)

NICKEL

3524.541
3515.054
3492.956
3414.765

3525.4	bhSr		8
.23	Cb		15w
.16	Ti	I	10
3524.99	Ba	I	20
.72	V	II	10
3524.54	**Ni**	**I**	**1000R**
.54	Mn		15
.54	Zr	I	9
.24	Zr		12
.24	Fe	I	60
.24	Cu	I	40
.07	Fe		50
3523.70	Co	I	15
.59	Cr		10
.44	Ni	I	100
.43	Co	I	300r

(Also Ce, Ir, Mo, Th, Ti, U, W)

3515.95	Ir	I	35
.55	Be	I	30
.42	Cb		20
.11	Zn	I	2h
3515.05	**Ni**	**I**	**1000R**
3514.8	bhCa		4
.62	U		18
3513.93	Ni	I	200
.82	Fe	I	400
.65	Ir	I	100h
.48	Co	I	300R

(Also Ce, Ce II, Fe, Mo, Pt, Ta, Th, V, W, Zr, Zr I, Zr II)

3494.00	U		12
3493.72	Ce	II	18
.53	Th		30
.47	Fe	II	40
.47	Ta		15W
.28	Ti	I	15
.17	V	II	15
.11	Ce		12
3492.96	Mn		10
3492.96	**Ni**	**I**	**1000R**
.25	Ce		12
.0	bhZr		30
3491.99	Co	I	10
.32	Co	I	200R

(Also Cb, Fe, Fe I, Ir I, Mo, W, W II, Zr I)

3415.78	Co	II	100R
.78	Cu		10Wh
.63	Mo		10
.61	Ce		10
.53	Fe	I	60
.53	Co	I	20
.38	Ca		2
.24	Ir		10
3414.77	**Ni**	**I**	**1000R**
.74	Co	I	200W
.66	Zr	II	20
.55	Ag	I	4
.20	V	I	20
.14	Ta		18W
.07	Cb		10
3413.94	Ni	I	300
.48	Ni	I	500
.14	Fe	I	400
3412.63	Co	I	1000R

(Also Ce II, Cr, Ir I, Th, U, W, Y, Zr I)

PHOSPHORUS

2553.28
2535.65–2534.01

2553.82	W		12
.70	Mo		15
.67	V		10
.60	W		10
.56	Cd	I	25
.41	Ag	II	2
.38	Ni	I	20
.37	Co	I	10r
2553.28	**P**	**I**	**80**
.19	Fe		10
.18	Ta		10h
.16	W		12
.06	Cr	I	20
.00	Co	I	40r
2552.98	Tl	I	10R
.96	V		10
.87	Mo		20
.77	Fe		20

(Also Cb, Ce, Fe I, U, Zr II)

2536.52	Hg	I	2000R
.49	Pt	I	100
.23	Ta		100W
2535.97	Ni		25
.97	Pt		25
.96	Co	I	10r
.87	Ti	II	20
2535.65	**P**	**I**	**100**
.60	Fe	I	1000
.60	Ta		50h
.31	Ag	II	10
.10	W		12
2534.97	Ta		30
.95	U		12
.83	V		20
.78	Hg	I	30
.68	W		12
.62	Ti	II	25
.52	V	II	10
.47	Ta		25
.46	Ir	I	100
2534.01	**P**	**I**	**50**
2533.98	W		10
.91	Cd	I	2
.81	V		10
.80	Fe		12
.63	W		10
.13	Ir	I	100

(Also Cb, Ce, Co, Cr II, Fe II, Ir, Rh, Th, V I, W II, Zr II)

PLATINUM

3064.712
2929.794
2659.454

3066.38	V	I	400r
3065.26	Cb		10
.11	Sc	II	12d
.07	Cr		20
.04	Mo		30
3064.94	W		10s
3064.71	**Pt**	**I**	**2000R**
.62	Ni	I	200r
.56	Mo		15
.51	Ir	I	20
.37	Na	II	2
.37	Co	I	100
.30	Al		20

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

PLATINUM (Continued)

.28	Mo		80
.02	Ce		15
3063.93	Fe		40
.88	Ta		18
.73	V	I	35
.73	Cd		2
.42	Cu	I	300

(Also Ir, Sc, U, V, W II, Zr II)

2930.25	Mn		25
.18	Ir	I	12
.15	W		10
2929.79	**Pt**	**I**	**800R**
.62	Fe	I	50
.51	Co	I	75
.35	Ag	II	20
.11	Rh		100
.01	Fe	I	150

(Also Mo, U, V, Y II)

2660.39	Al	I	150R
2659.66	Ta		15
.6	bhC		20
2659.45	**Pt**	**I**	**2000R**
41	Ta		20
2658.98	V		10
.93	Fe		10

(Also Cb, Ce, Ga, Ir, Ir I, Rh I, Th, U)

POTASSIUM

4047.201
4044.140

4048.67	Zr	II	30
.4	Bi	II	3h
4047.79	Sc	I	25
.63	Y	I	50
.61	U		18
.35	Ca		2
.28	Ce		18
4047.20	**K**	**I**	**400**
4046.76	Cr	I	30
.70	W		10
.56	Hg	I	200
.49	Sc	I	10
.34	Ce	I, II	30
4045.82	Ag		10
.82	Fe	I	400
.39	Co	I	400

(Also Cb, Ir, Mo, Ni I, Rh, Th, V, Zr I)

4045.82	Fe	I	400
.61	Zr	II	10
.60	W		12
.39	Co	I	400
.21	Mn		15
.13	Mn		15
4044.82	U		10
.61	Fe	I	70
.56	Zr	I	25
.42	Ca		5d
.42	U		18
.29	W		15
4044.14	**K**	**I**	**800**
4043.91	Fe	I	25
4043.80	Sc	I	12
.78	Ti	I	20
.70	Cr		30
.58	Zr	I	25
.15	Th		10
4042.87	Mo		15
.75	U		40
.64	V	I	15

(Also Cb, Ce, Hg II, Ir)

RHODIUM

3434.893
3396.85

3435.82	Cr		30
.68	Cr	I	20
.56	Sc	I	12
.53	U		15d
.43	Ti		10
.21	Ce		20
.20	U		10
3434.89	**Rh**		**1000r**
.79	Mo		50
.76	Ir	I	10
.65	Ag	I	2h
.61	U		12
.50	Ta		35
.28	Sr	I	2
.11	Cr	I	30
.00	Th		12
3433.97	Cu	I	5h
.56	Ni	I	800R
.04	Co	I	1000R

(Also Fe I, V, W, Zr II)

3397.84	V	I	30
.69	Mo		20
.64	Fe	I	10
.21	Bi	I	100wh
.20	U		12
.08	Ce		12
3396 98	Fe	I	125
3396.85	**Rh**	**I**	**1000w**
.72	Ce		15
.52	V	I	15
.33	Zr	II	12
.32	Cu	I	30
3395.93	Cb		10
.82	W		8
.38	Co	I	400R

(Also Fe, Ni, Ni I, Ta, Th, Y I, Zr)

RUBIDIUM

7800.227
4201.851

7801.30	Si		3h
7800.44	Sc	I	40
7800.23	**Rb**	**I**	**9000R**
.0	Si		4Wh
7799.37	Zn	I	10
7798.26	Ba	I	4h
7797.62	Ni	I	80

(Also Ce, Ta, U, Y I, Zr I)

4203.99	Fe	I	200
.59	Cr	I	100
.22	Ca	I	2
4202.94	Ce	II	40
.76	Fe		10
.52	Sr	I	6
.03	Fe	I	400
4201.85	**Rb**	**I**	**2000R**
.76	Mn		40
.72	Ni	I	30
.52	Cb		10
.46	Zr	I	50
4200.93	Fe	I	80
.75	Ti	I	35
.57	Mo		15
.46	Ni	I	40
4199.10	Fe	I	300

(Also Ce, Ir, Pt I, Ta, Th, U, V II)

SCANDIUM

4023.688
3630.740

4026.17	Cr		100
4025.15	Ce		12
.14	Ti	II	15
.01	Cr		100
4024.92	Zr	I	25
.74	Fe	I	120
.68	Ca		3wh
.57	Ti	I	80
.57	Cr	I	20
.49	Co		15
.09	Mo		30
4023.98	Zr	I	30
.74	Cr		40
4023.69	**Sc**	**I**	**100**
.43	Cr	I	15
.40	Co	I	200
.38	V	II	10

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

SCANDIUM (Continued)

.22	Sc	I	60
.14	Rh	I	10
4022.66	Cu	I	400
.27	Ce		15
.26	Cr		80
4021.87	Fe	I	200
.83	Ti	I	100

(Also Cb, Ni I, Th, U, W, V I, Zr, Zr II)

3631.71	Ir	I	10
.69	Cr	II	10
.46	Fe	I	500
.39	Co	I	50W
.27	Na	II	12
.19	Ce	I, II	50
.10	Fe	I	25
3630.95	Ca	I	10
.75	Ca	I	150
3630.74	**Sc**	**II**	**50**
.64	Ba		15
.35	Fe	I	40
.32	W		10
.02	Zr	II	15
3629.92	Sb	II	2
.79	Cu	I	15
.76	Ir	I	15
.74	Mn		100

(Also Cb, Ce, Ni I, Ti, U)

SELENIUM

4730.78
2039.851

4732.47	Ni	I	100
.30	Sc	I	10
.06	Co	I	40
4731.81	Ni	I	100
.60	U		40
.44	Mo		100
.17	Ti	I	50
4730.78	**Se**	**I**	**1000Spk**
.71	Cr		100
.36	Mn		15
.16	Mg	I	2
.12	Ta		100
4729.72	Cr		30
.70	Fe	I	25
.65	W		30
.53	V	I	15
.47	Sr	I	4h
.29	Ni	I	10
.23	Sc	I	100
4728.86	Ir		150

(Also Cb, Fe II, Ir, Rh, Th, Zr I)

2040.33	Pt		15
2039.85	**Se**	**I**	**1000Spk**
.79	Te		300
.70	Pt		12
.60	Sb		15
.43	Ir		25
.31	Cr		25h

(Also Rh, W, Zr)

SILICON

2881.578
2528.516
2516.123
2506.899

2882.37	Rh		80
.01	Th		10
2881.58	**Si**	**I**	**500**
.58	Ce		40
.25	Rh	I	20
.23	Ta		30
.23	Cd	I	50R
.16	Ir		15
.15	Th		10
.14	Cr		25
.14	Na	II	8
.13	Ce		12
2880.77	Cd	I	200R

(Also Co, Cr, Ir I, Ti I, U, W)

2529.13	Fe	I	80R
.13	Mn		80
2528.97	Ni		20
.97	Co	I	50R
.84	V		25
.70	Mn		12
.54	Sb	I	300R
2528.52	**Si**	**I**	**400**
.47	V		50
.29	Ce		15
.24	Cr	I	30
.10	U		10
.05	Ni	I	20
.01	Cr	I	35
2527.99	Ti	I	15

(Also Co II, Fe, Mo, Ta, W)

2516.58	W		12
.57	Fe	I	10
2516.12	**Si**	**I**	**500**
.12	V		25
.11	Mo		25
2515.81	Zn	I	150w
.75	Rh	I	60
.69	Bi	I	100
.66	Mo		10
.58	Pt	I	500

(Also Ta, U, W II)

2507.45	Ta		150
.33	Cr		15
2506.91	V	I	50r
2506.90	**Si**	**I**	**300**
.88	Ag	II	2
.88	Co	I	10w
.60	Ir		10
.60	Ag	II	15
.57	Fe		10
.46	Co	II	50w
2505.93	Pt		150

(Also Cb Fe II, U)

SILVER

3382.891
3280.683

3383.98	Fe	I	200
.80	Cb		15
.76	Ti	II	70
.70	Fe	I	100
.69	Ce		20
.39	Ce		12
.14	Sb		40
3382.89	**Ag**		**1000R**
.68	Cr	II	35
.61	W		10
.48	Mo		15
.41	Fe	I	50
.31	Ti	I	30
.29	Mo		10
.28	Bi		2
.08	Cr		30
.00	Au	II	6
3381.50	Co	I	100W

(Also Cb, Pt, Th, U, Y, Zr)

3281.50	Ba	I	25
.48	Ca		1h
.30	Fe	II	15
.10	Ce		18
.07	Mo		25
3280.76	Mn		60
.69	Cu		10
3280.68	**Ag**	**I**	**2000R**
.68	Eu		1000R
.55	Rh	I	30R
.49	Ce	II	15
.37	Th		10
.26	Fe		150
.00	Ti	II	10
3279.85	V		20
.84	Ce	I, II	30
.82	Cu	I	25

(Also Cb, Co, Ta, U, Y II, Zr II)

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

SODIUM

5895.923
5889.953
3302.323

5895.92	**Na**	**I**	**5000R**
.70	Pb		20h*l*
5894.35	Zn	II	3
.07	Ir	I	20
5893.9	bhY		10

(Also Fe, Mo, Sc I, Ta)

5891.61	W		12
.56	Mo		25h
5889.99	Cr		12
.98	Mo		50h
5889.95	**Na**	**I**	**9000R**
5888.68	Ti		15
.33	Mo		150
.01	Cr		20

(Also Co I, Ta, Th)

3303.28	Mn		40
.23	Ce	II	10
3302.99	Na	I	300R
.94	Zn		700R
.94	Ca		4
.91	Ce		10W
.88	Cr		30
.77	Ta		50
.67	Zr	II	10
.59	Zn	I	800
.55	Bi		150
3302.32	**Na**	**I**	**600R**
.19	Cr		50h
.13	Pa	I	1000wh
3301.91	Ce		10
.90	Ta		25
.86	Pt	I	300
.75	U		10
.73	Sr	I	100
.52	Ca		4

(Also Cb, Fe II, Ir I, Mo, Pt, Th, Ti II, W II, Y)

STRONTIUM

4607.331
4077.714

4608.71	Mo		10
.12	Rh	I	15
4607.65	Fe	I	50
.63	Mn		50
.34	Au	I	30
4607 33	**Sr**	**I**	**1000R**
4606.8	bhSc		10
.77	Cb		50
4606.40	Ce		12
.38	Cr		15
.23	Ni	I	100
.2	bhSr		2
.15	V	I	30
4605.36	Mn		150
4604.99	Ni	I	300

(Also Co, Th, Ti, U, V, W, Y II)

4079.72	Cb	I	500w
.24	Mn		50
.21	Bi	II	2h
.19	Ta		10
.02	Ce		15
4078.58	Sc	I	10
.47	Ti	I	125
.36	Fe	I	80
.32	Ce		15
.31	Zr	I	10
4077.81	Hg	I	150
.79	U		15
.72	Sn		2
.72	Cu		5
4077.71	**Sr**	**II**	**400r**
.68	Cr		30
.47	Ce	II	18
.41	Co	I	100wh
.37	Y	I	50
.15	Ti	I	18
.09	Cr		35
4076.64	Fe	I	80
.55	Ir		25
.53	Zr	I	10
.38	Ti	I	15
.35	Y		30
.33	Au	II	4
.24	Ce		12
.19	Mo		25
.13	Co	I	70

(Also Cb, Fe, Rh I, V I, W, Zr II)

SULFUR

4695.45
4694.13

4695.45	**S**	**I**	**30Spk**
.15	Cr		50
4694.66	W		12
4694.13	**S**	**I**	**50Spk**
.09	Th		15
4693.95	Cr		50
.93	Mo		20
.73	W		50
.68	Ti	I	25
.35	Ta		150
.21	Co	I	500
4692.7	bhSr		5
4691.9	Ta		400
.62	Ba		100

(Also Cb, Ce, U, Zr I)

TANTALUM

3318.840
3311.162

3320.26	Ni	I	400w
3319.83	Co	I	35
.68	Cu	I	60
.59	Mo		10
.48	Co		80
.25	Fe		70
.21	U		10
.16	Co	I	60
.03	Zr	II	25
.02	V	I	15
3318.98	Cb		10
.96	Ce	II	15
3318.84	**Ta**		**125**
.65	Au		3
.53	Ta		70
.53	Y	II	12
.40	Co	I	35
.36	Ti	I	12
.08	Cr		80wh
.03	Na	II	6
.03	Ti	II	60
3317.93	Ta		200
.80	Ce		15
.31	Mn		100
.12	Fe	I	100

(Also Ir, Ir I, Th, W)

3312.15	Co	I	60
.13	Ir	I	25
.08	Cr	I	10
3311.91	Mn		75
.85	Sr		1
.72	U		10d
.50	Ce		15
.38	W		15*l*
.30	Cr	I	8
3311.16	**Ta**		**300w**
.00	Cu	I	3
3310.88	Ce		10
.77	Mo		20
.62	U		10
.53	Ir	I	30
.51	Ag	I	2
.50	Fe		50
.34	Fe		100
.20	Ni	I	50

(Also Cb, Cr, Cr II, Fe I Sc II, Th, Zr, Zr II)

TELLURIUM

2385.76–2383.25

2386.19	Cr	I	20
.15	Ir		15
.14	Rh		80

TELLURIUM (Continued)

2385.86	Ir		20
2385.76	**Te**	**I**	**600**
.74	Cr	I	25
.23	Y		12
.01	Ni		10
2384.86	Co	I	10R
.82	W		12
.65	Rh		25
.39	Fe		20
.38	Ni	I	15
.28	V	I	15
.17	Zr		25
.05	Mn		40
2383.79	Ir		15
.64	Pt	I	30
.63	Sb		75
.52	Mo		12
.46	Co	II	15
.40	Rh		50
.33	Cr	I	20
2383.25	**Te**	**I**	**500**
.17	Ir		10
2382.99	W		15
.89	Rh		50

(Also Cb, Co, Fe I, Fe II, Ta, U, V, W II)

THALLIUM

5350.46
3519.24
3229.75

5353.49	Co	I	500w
5352.68	Cu	I	6
.35	Mo		10
.1	bhF		10
.05	Co	I	500w
5351.90	W		20
.08	Ti	I	50
5350.74	Cb		150
5350.46	**Tl**	**I**	**5000R**
.45	W		18
5349.88	Mn		20
.62	Ba		7
.57	Ta		30
.47	Ca	I	12
.31	Rh		20
.29	Sc	I	30
.09	Ta		80
.09	Co	I	80
5348.95	W		30
.32	Cr	I	150R

(Also Fe I, Th, U, Zr, Zr I, Zr II)

3521.26	Fe	I	300
3520.08	Co	I	100W
.07	Sb		4
.06	Cb		20
.03	Cu	I	30
3519.77	Ni	I	500h
.74	Ce		18
.61	Zr	I	100
.54	Rh	I	40
3519.24	**Tl**	**I**	**2000R**
.18	Bi		10
.17	V	I	10
.08	Ce		25
3518.88	Fe	I	10
.63	Ni	I	90
.48	W		10
.37	Ce		12
.35	Co	I	200w

(Also Co, Cr, Fe, Ir I, Mo, Th, Ti I, V II)

3230.97	Fe	I	300
.86	Ta		200
.72	Mn		75
.65	V	I	20
.64	Au	I, II	15
.29	Pt	I	100
.21	Fe	I	100
.08	Ce		10
3229.99	Fe		20
.99	Ag		1
.88	Ta		35h
.87	Fe		10
.79	Mo		25
3229.75	**Tl**	**I**	**2000**
.69	Be	I	15
.61	V	I	15
.60	Ce		10
.59	Fe		10
.50	U		18
.42	Ti	II	15
.37	Mg	I	25
.36	Ce	II	25
.28	Ir	I	35
.23	Ta		300w
.20	Cr		35
.19	Ti	II	30
.12	Fe	I	80
.12	Ce		25
3228.97	Th		12
.91	Fe		80
.81	Zr	II	10
.25	Fe	I	100
.09	Mn		100
3227.75	Fe	II	200

(Also Cb, W, W II)

THORIUM

4019.137
3290.59 Spk

4020.91	Co	I	500w
.46	Mo		10
.40	Sc	I	50
.1	bhSr		2
.09	Mn		10
.03	Ir		80
4019.79	Mo		10
.64	Pb		6
.30	Co	I	80
.23	W		18
4019.14	**Th**		**8**
.04	Ce		15
4018.99	U		25
.28	Fe	I	50
.20	Cr	I	35
.12	Zr		25
.10	Mn		80
4017.77	Ti	I	70h
.72	U		25

(Also Cb, Ce II, Fe, Ni I, Zr II)

3292.59	Fe	I	300
.02	Fe		150
3291.34	U		12
.06	Cb		10
3290.99	Cr		30wh
.99	Fe	I	125
.99	Mn		10
.82	Mo		40
.72	Fe		15
3290.59	**Th**		**40h Sp**
.54	Cu	I	25
.42	Ca		1h
3290.34	Ce	II	20
.22	Pt	I	150
.01	Cb		10
3289.85	Y		15
.84	Mo		10
.84	Ta		25
.64	Rh		50r
.14	Rh	I	150

(Also Ce, Ir, Ir I, Ti I, V, W

TIN

3262.328
3175.019
2863.327
2839.989

3263.24	V	I	40
.21	Co	I	30
.14	Rh	I	200
.11	U		25
.07	Ce	II	10
.00	Ta		20
3262.67	Th		12
.63	Mo		15
.35	Pb		20h

TIN (Continued)

3262.33	**Sn**	**I**	**400h**
.29	Os	I	500R
.28	Fe		50
.28	Ba	I	3
.06	V	I	10
.01	Fe		30
.01	Ir	I	20
3261.96	Ba	I	40
.88	Cb		10
.72	U		15
.61	Ti	II	70
.33	Fe		25
.06	Cd	I	300

(Also Ce, Co, Pt, W)

3175.99	Fe		12
.84	Mg	II	5
.73	Th		12
.45	Fe	I	200
.11	Te	I	30
.06	Ce		10
3175.02	**Sn**	**I**	**500h**
3174.91	Co	I	80
.65	Mn		15h
.17	Th		10
.14	Co	I	20
.08	Ce		15

(Also Cb, Mo, Pt I, Ta, U, V, W II)

2863.88	W		10
.86	Fe	I	125
.84	Ir	I	15
.81	Mo		30
.75	Bi	I	80w
.44	Fe		100
.34	Ce		12
2863.33	**Sn**	**I**	**300R**
.05	V	I	20
2862.94	Rh	I	150
.84	Mo		10
.79	Ce	II	15
.50	Fe	I	100

(Also Co, Fe, Mn, Sc II, U, V)

2840.42	Fe	I	125
.22	Ir	I	15
.02	Cr		25
.00	Mn		20
2839.99	**Sn**	**I**	**300R**
.89	U		18
.59	Mo		25
.56	Na	II	2
.44	V	I	12

(Also Cb, Ce, Fe II, Ta, Th, V, W, W II)

TITANIUM

3372.800
3349.035
3199.92

3374.22	Ni	I	400
3373.75	W		10
.73	Ce	II	25
.73	U		10
.46	Ce		25
.42	Zr	II	12
.23	Co	I	60
.00	Pd	I	800r
.00	Pt		10
3372.80	**Ti**	**II**	**80**
.77	Y		15
.68	Ca		1
.56	Cb		10h
.53	Rh	I	10
.51	Ag	II	1
.25	Rh	I	300
.21	Ti	II	10
.08	Fe	I	40
.00	Ca		2
3371.99	Ni	I	400
.45	Ti	I	100
3370.79	Fe		300

(Also Mo, Th, Sc II)

3350.89	Rb	I	150
3349.97	Ce	II	30
.52	Cb		30
.41	Ti	II	100
.40	Au		15
.32	Cr		35
.29	Cu	I	70
.07	Cr		125
.06	Cb		80
3349.04	**Ti**	**II**	**125**
3348.84	Ti	II	12
.72	Rb	I	100
.72	Cs	I	15
.11	Co	I	80
3347.93	Fe	I	150

(Also Ce, Co, Fe, Mo, Sc I, Th, Ti I, U, W)

3200.89	Ag		1h
.89	Ir	I	10
.84	Ca		1
.78	Fe	I	25
.71	Pt	I	100
.52	Ce		10
.48	Fe	I	150
.42	Ni		30
.27	Y	II	30
.22	Sr	I	2h
.14	U		15
3199.92	**Ti**	**I**	**200**
.82	V	I	25
.53	Fe	I	300
.32	Co	I	35
.28	Ce		25
3198.99	Sr	I	10
.97	Th		10
.92	Ir	I	30
.67	Ta		125
.01	V	I	100r

(Also Cb, Mo, Pt, Sc II, W, Zr II)

TUNGSTEN

4302.108
4008.753
2944.395

4303.53	V		15
.24	Co	I	15
.17	Fe	II	12
4302.98	Ti	I	10
.98	Ta		125W
.89	Zr	I	100
.77	Cr		40
.7	bhSr		4
.65	Ce		10
.53	Ca	I	50
.29	Y	I	30
.19	Fe	I	50
.14	Bi	II	2h
4302.11	**W**	**I**	**60**
4301.93	Ti	II	25
.93	Mo		10
.60	Ir		200
.53	Ce		10
.47	U		15
.26	Mo		20
.18	Cr		100
.09	Ti	I	150
4300.99	Cb		30
.86	Ce		15
.64	Ir		10
.57	Ti	I	125
.51	Cr		100
4299.72	Cr	I	100

(Also Th, V I)

4010.26	Ca		2
.14	Ce		15
4009.72	Fe	I	120
.66	Ti	I	60
.37	Mo		20
.07	Th		10
.06	Ce		12*l*
4008.93	Ti	I	80
4008.75	**W**	**I**	**45**
.22	Th		10
.06	Ti	I	50

TUNGSTEN (Continued)

.05	Ir	I	12
.02	Mn		15
4007.60	Zr	I	25
.59	Ce		15
.27	Fe	I	80

(Also Cb, Co I, Fe, Ni I, U, V II, Zr)

2945.06	Fe		100
2944.75	Pt	I	15
.57	V	II	50
.40	Fe	II	70
2944.40	**W**		**30**
.35	Ce		18
.29	Bi		5
.21	Mo		25
.18	Ga		10
2943.91	Ni	I	50r
.90	U		10

(Also Cb, Mn, V I, Zr II)

URANIUM

4241.669
3552.172

4242.85	Cr	I	15
.80	Mo		15
.72	Ce	II	15
.63	Cb		10
4242.62	Ba		10
.47	Mg	II	4
.26	Co	I	20
.01	Ce		10
4241.77	Au	I	40
.69	Zr	I	100
4241.67	**U**		**40**
.6	Na	I	3
.45	W		30
.32	V	I	15
.20	Zr	I	100
.19	Cr		10
.11	U		10
4240.83	Mo		30
.8	bhCa		3
.71	Cr		200
.59	U		10
.54	Sr	II	1
.49	Ir		15
.46	Ca	I	10
.37	Fe		30
.36	V	I	15
.34	Zr	I	100
.28	Mo		25
4239.72	Mn		100
.31	Zr	I	100

(Also Co I, Cr II, Fe I, Th)

3553.74	Fe		100
3552.99	Co	I	20
.83	Fe	I	80
.73	Ce	II	18s
.72	Mn		12
.72	Co	I	20
.45	Ba	II	1
3552.17	**U**		**8**
.12	Fe		10
.10	Ir	I	20
3551.95	Zr	II	30
.78	Ce		10
.66	Ce	II	10
.54	V	I	25
.53	Ni	I	50
.43	Ce		10
3550.60	Co	I	200

(Also Cb, Cr, Mo, Th, W, Y I, Zr I)

VANADIUM

4379.238
3185.396–3183.982

4381.64	Mo		150
4380.59	Mo		15
.55	V	I	15
.29	Mo		30
.27	U		12
.06	Ce		30
4379.92	Rh	I	60
.78	Cr	I	15
.78	Zr	II	10
.4	Bi	II	25
.25	Ag		5
4379.24	**V**	**I**	**200R**
4378.82	Ta		40
.49	W		25
.20	Cu	I	200w
4377.96	Cb		10
.01	Ir		100

(Also Co I, Cr, Th, Y I)

3186.45	Ti	I	150
.35	Co	I	70
.32	U		10
.13	Ce		40
3185.95	Co	I	40
.71	U		12
.59	Rh	I	100
3185.40	**V**	**I**	**500R**
.10	Mo		20
3184.90	Th		10
.90	Fe	I	200
.72	Ce		10
.62	Fe	I	60
.62	Ce		12
.55	Ta		70
.42	W		10
.41	Ba		3
.37	Ni	I	150
.21	Ce	II	20
.04	W		10
3183.98	**V**	**I**	**500R**
.97	Th		12
.97	Ti		12
.95	Ba	I	2
.52	Ce		40
.41	V	I	200R
.25	Ni	I	25
.16	Ba	I	5
.03	Mo		10
3182.98	Fe		125

(Also Cb, Cr, Fe II, Ir, Ir I, Ti II, W II, Y I, Zr I)

YTTRIUM

3710.290
3242.280

3711.23	Fe	I	80
.07	Na	II	8
3710.52	Sb	II	2
.45	Cb		15
3710.29	**Y**	**II**	**80**
.14	Mo		20
3709.96	Ti	I	80
.93	Ce		25
.29	Ce		25
.25	Fe	I	600
.25	Ag	I	10

(Also Cr, Fe, Ir I, Ta, Th, U, W)

3244.19	Fe	I	300
3243.84	Co	I	100
.78	Mn		100
.27	V	I	20
.16	Cu	I	15
.11	Fe		50
.06	Ni	I	400R
3242.83	Ta		125
.70	Pd	I	2000wh
3242.28	**Y**	**II**	**60**
.14	Ce	II	12
.05	Ta		125
.03	W		10
3241.99	U		10
.99	Ti	II	60
.84	Be	II	5
.76	Ca		1
.65	Be	II	5
.52	Ir	I	100

(Also Cb, Ce, Th, Zr I, Zr II)

QUALITATIVE SPECTROGRAPHIC ANALYSIS TABLE

ZINC

4722.159
3345.020
3302.588—see under *SODIUM*
2138.56

4724.42	Cr		125
4723.17	Ti	I	40
.10	Cr		125
.06	Mo		10
4722.88	Ta		200
.87	V	I	20
.83	Bi	I	10
.73	U		40
.62	Ti	I	80
.55	Bi	I	1000
.28	Sr	I	30
.19	Bi	I	10
4722.16	**Zn**	**I**	**400w**
4721.51	V	I	15

(Also Cb, Co, Ir, Rh I, Sc I, Th, V)

3346.94	Co	I	100
.74	Cr		150R
.02	Cr		35
3345.93	Zn	I	150
.89	U		12
.86	W	II	10
.57	Zn	I	500
.54	U		12
.45	Be	I	2
.44	Ce		20
.37	Cr		18
.35	Mn		15
.15	Cr		15
3345.02	**Zn**	**I**	**800**
3344.79	Zr	II	15
.76	Ce	II	50
.75	Mo		50
.51	Ca	I	100
.51	Cr		20
.22	Ir	I	10
.20	Rh	I	100
3343.90	Pt	I	100

(Also Fe, Ta, Th, Ti I, W, Y)

2138.97	Co	I	15
.58	Ni	II	10
.57	Ir	I	15
2138.56	**Zn**	**I**	**800R**
.53	As		2
.51	Cu	I	25wh
.15	W	II	10

(Also Cb, Fe I, V II)

ZIRCONIUM

3496.210
3438.230
3391.975

3497.84	Fe	I	200
.11	Fe	I	200
.03	Sc		12w
3496.94	V	I	12
.81	Mn	II	10
.79	Co	I	30
.68	Co	I	150R
.35	Ni	I	15
.33	Ce		12
3496.21	**Zr**	**II**	**100**
.08	Y	II	20
.07	Co		10
.03	Cb		10
3495.96	Ti	I	10
.94	Ce	II	15
.84	Mn	II	25
.75	Ti	I	25
.73	Ce		10
.70	Th		10
.69	Co	I	1000R
.48	Ce		10
.38	Cr	II	12
.29	Fe	I	100
.25	W		12

(Also Fe, Ir I, Mo, U, Zr I)

3439.31	Ti	I	18
3438.97	Mn	II	20
.95	Th		10
.91	Co	I	30
.87	Mo		20
.71	Co	I	80W
.31	Fe		10
3438.23	**Zr**	**II**	**250**
.07	Ce		15
3437.95	Fe		15
.81	Ce		10
.69	Co	I	150Wh
.50	Ir	I	30
.49	Sb		2h
.32	Ce		12
.28	Ni	I	600R
.22	Mo		25

(Also Cb, Ta, U, V I, W, W II, Y)

3392.99	Ni	I	600R
.99	Cu	I	5
.99	Cr	II	10
.81	Ca		1
.78	Ce	II	10
.71	Ti	I	20
.66	Fe	I	300
.34	Cb		20r
.31	Fe	I	125
.17	Mo		15
.04	Th		10
.02	Cu	I	7
.01	Fe		20
3391.98	**Zr**	**II**	**300**
.59	Ce		10
.53	W		10
.37	Cr		12
.10	W		10
.05	Ni	I	400

(Also Ir, Ir I, Rh I, Th, Ti, U, V I)

SENSITIVE LINES OF THE ELEMENTS

In the following table the sensitive lines of the elements are arranged in order of decreasing wavelengths. The **abbreviations** are the same as those used in the preceding table, ***Qualitative Spectrographic Analysis Tables,*** which see. In addition, in the column headed ***Sensitivity*** the most sensitive line of the neutral or un-ionized atom is indicated by U1, and other lines by U2, U3, etc. in order of decreasing sensitivity. For the singly ionized atom, the corresponding designations are V1, V2, V3, etc. In cases where U1 is not given, the most sensitive lines lie outside the range of 10,000 to 2,000 Å.

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Wave-length	Element	Intensity		Sensitivity	Wave-length	Element	Intensity		Sensitivity
		Arc	Spk [Dis]				Arc	Spk [Dis]	
9237.49	S I	....	[200]	U6	5777.665	Ba I	500R	100R	U2
9228.11	S I	....	[200]	U5	5688.224	Na I	300	....	..
9212.91	S I	....	[200]	U4	5682.657	Na I	80	....	..
8943.50	Cs I	2000R	....	U2	5679.56	N II	....	[500]	V2
8521.10	Cs I	5000R	....	U1	5676.02	N II	....	[100]	V4
8115.311	A I	....	[5000]	U2	5666.64	N II	....	[300]	V3
7947.60	Rb I	5000R	....	U2	5608.8	Pb II	....	[40]	V2
7800.227	Rb I	9000R	....	U1	5570.2895	Kr I	....	[2000]	U3
7775.433	O I	....	[100]	U4	5535.551	Ba I	1000R	200R	U1
7774.138	O I	....	[300]	U3	5519.115	Ba I	200R	60R	U3
7771.928	O I	....	[1000]	U2	5465.487	Ag I	1000R	500R	U4
7698.979	K I	5000R	....	U2	5464.61	I II	....	[900]	..
7664.907	K I	9000R	....	U1	5460.740	Hg I	....	[2000]	..
7503.867	A I	....	[700]	U4	5455.146	La I	200	1	U3
7450.00	Rn I	....	[600]	U2	5424.616	Ba I	100R	30R	U4
7067.217	A I	....	[400]	U3	5400.562	Ne I	....	2000	..
7055.42	Rn I	....	[400]	U3	5350.46	Tl I	5000R	2000R	U1
6965.430	A I	....	[400]	U3	5291.0	bhCaF	200	....	..
6902.46	F I	....	[500]	U3	5218.202	Cu I	700	....	U3
6856.02	F I	....	[1000]	U2	5209.067	Ag I	1500R	1000R	U3
6707.844	Li I	3000R	200	U1	5208.436	Cr I	500R	100	U4
6562.79	H I	....	[3000]	U2	5206.039	Cr I	500R	200	U5
6438.4696	Cd I	2000	1000	..	5204.518	Cr I	400R	100	U6
6402.246	Ne I	....	[2000]	..	5183.618	Mg I	500wh	300	..
6362.347	Zn I	1000Wh	500	..	5172.699	Mg I	200wh	100wh	..
6249.929	La I	300	....	U1	5167.343	Mg I	100wh	50	..
6243.36	Al II	....	100	V3	5161.188	I II	....	[300]	..
6231.76	Al II	....	30	..	5153.235	Cu I	600	....	U4
6103.642	Li I	2000R	300	U3	5105.541	Cu I	500	....	U5
5930.648	La I	250	....	U2	5007.213	Ti I	200	40	..
5895.923	Na I	5000R	500R	U2	4999.510	Ti I	200	80	..
5889.953	Na I	9000R	1000R	U1	4991.066	Ti I	200	100	..
5875.618	He I	....	[1000]	U3	4981.733	Ti I	300	125	U1
5870.9158	Kr I	....	[3000]	U2	4962.263	Sr I	40	....	U4
5852.488	Ne I	....	[2000]	..	4934.086	Ba II	400h	400h	V2

SENSITIVE LINES OF THE ELEMENTS

Wavelength	Element	Intensity		Sensitivity	Wavelength	Element	Intensity		Sensitivity
		Arc	Spk [Dis]				Arc	Spk [Dis]	
4889.17	Re I	2000w	....	U2	4420.468	Os I	400R	100	..
4872.493	Sr I	25	....	U3	4390.865	Sm II	150	150	..
4861.327	H I	....	[500]	U3	4389.974	V I	80R	60R	..
4832.075	Sr I	200	8	U2	4384.722	V I	125R	125R	..
4825.91	Ra I	....	[800]	U1	4379.238	V I	200R	200R	U1
4819.46	Cl II	....	[200]	V4	4358.35	Hg I	3000w	500	..
4816.71	Br II	....	[300]	V3	4305.447	Sr II	40	....	..
4810.534	Zn I	400w	300h	..	4303.573	Nd	100	40	..
4810.06	Cl II	....	[200]	V3	4302.108	W I	60	60	U1
4794.54	Cl II	....	[250]	V2	4294.614	W I	50	50	U2
4785.50	Br II	....	[400]	V2	4289.721	Cr I	3000R	8000r	U3
4772.312	Zr I	100	....	..	4274.803	Cr I	4000R	800r	U2
4742.25	Se I	....	[500]	U6	4267.27	C II	....	500	V2
4739.478	Zr I	100	....	..	4267.02	C II	....	350	V3
4739.03	Se I	....	[800]	U5	4254.346	Cr I	5000R	1000	U1
4730.78	Se I	....	[1000]	U4	4241.669	U	40	50	..
4722.552	Bi I	1000	100	..	4226.728	Ca I	500R	50W	U1
4722.159	Zn I	400w	300h	..	4226.570	Ge I	200	50	..
4710.075	Zr I	60	....	..	4225.327	Pr	50	40	..
4704.86	Br II	....	[250]	V1	4215.556	Rb I	1000R	300	U4
4696.25	S I	....	[15]	U9	4215.524	Sr II	300r	400W	V2
4695.45	S I	....	[30]	U8	4211.719	Dy	200	15	..
4694.13	S I	....	[500]	U7	4205.046	Eu II	200R	50	..
4687.803	Zr I	125	....	U4	4201.851	Rb I	2000R	500	U3
4685.75	He II	....	[300]	..	4189.518	Pr	100	50	..
4682.28	Ra II	....	[800]	V2	4186.599	Ce II	80	25	..
4680.138	Zn I	300w	200h	..	4179.422	Pr	200	40	..
4674.848	Y I	80	100	U1	4177.321	Nd	15	25	..
4671.226	Xe I	....	[2000]	U2	4172.056	Ga I	2000R	1000R	U1
4643.695	Y I	50	100	U2	4167.966	Dy	50	12	..
4624.276	Xe I	....	[1000]	U3	4165.606	Ce II	40	6	..
4607.331	Sr I	1000R	50R	U1	4137.095	Cb I	100	60	U5
4603.00	Li I	800	....	U4	4130.664	Ba II	50r	60Wh	V3
4593.177	Cs I	1000R	50	U4	4129.737	Eu II	150R	50R	..
4555.355	Cs I	2000R	100	U3	4123.810	Cb I	200	125	U4
4554.042	Ba II	1000R	200	V1	4123.228	La II	500	500	V4
4524.741	Sn	500wh	50	..	4109.98	N I	....	[1000]	U2
4518.57	Lu	300	40	..	4103.37	N III	....	[80]	..
4511.323	In I	5000R	4000R	U1	4101.773	In I	2000R	1000R	U2
4500.977	Xe I	....	[500]	U4	4100.923	Cb I	300w	200w	U3
4454.781	Ca I	200	....	U2	4099.94	N I	....	[150]	U3
4434.960	Ca I	150	....	U3	4097.31	N III	....	[100]	..
4434.321	Sm II	200	200	V2	4093.161	Hf II	25	20	..
4425.441	Ca I	100	....	U4	4079.729	Cb I	500w	200w	U2
4424.342	Sm II	300	300	V1	4077.974	Dy	150r	100	..

SENSITIVE LINES OF THE ELEMENTS

Wave-length	Element	Intensity		Sensitivity	Wave-length	Element	Intensity		Sensitivity
		Arc	Spk [Dis]				Arc	Spk [Dis]	
4077.714	Sr II	400r	500W	V1	3774.332	Y II	12	100	..
4077.340	La II	600	400	V3	3768.405	Gd	20	20	..
4062.817	Pr	150	50	..	3761.917	Tm	200	120	..
4058.938	Cb I	1000w	400w	U1	3761.333	Tm	250	150	..
4057.820	Pb I	2000R	300R	U1	3748.264	Fe I	500	200	U4
4047.201	K I	400	200	U4	3748.17	Ho	60	40	..
4046.561	Hg I	200	300	..	3745.903	Fe I	150	100	U5
4045.983	Dy	150	12	..	3745.564	Fe I	500	500	U3
4044.140	K I	800	400	U3	3737.133	Fe I	1000r	600	U2
4040.762	Ce II	70	5	..	3719.935	Fe I	1000R	700	U1
4034.490	Mn I	250r	20	U3	3710.290	Y II	80	150	V1
4033.073	Mn I	400r	20	U2	3694.203	Yb	500R	1000R	..
4032.982	Ga I	1000R	500R	U2	3692.652	Er	20	12	..
4030.755	Mn I	500r	20	U1	3692.357	Rh I	500hd	150wd	..
4023.688	Sc I	100	25	U3	3683.471	Pb I	300	50	U2
4020.399	Sc I	50	20	U4	3672.579	U	8	15	..
4019.137	Th	8	8	..	3663.276	Hg I	500	400	U5
4012.388	Ce I, II	60	20	..	3657.987	Rh I	500W	200W	..
4008.753	W I	45	45	U3	3654.833	Hg I	....	[200]	U4
4000.454	Dy	400	300	..	3653.496	Ti I	500	200	U2
3987.994	Yb	1000R	500R	..	3650.146	Hg I	200	500	U3
3968 468	Ca II	500R	500R	V2	3646.196	Gd	200w	150	..
3961.527	Al I	3000	2000	U1	3642.785	Sc II	60	50	V3
3951.154	Nd	40	30	..	3642.675	Ti I	300	125	..
3949.106	La II	1000	800	V2	3639.580	Pb I	300	50h	..
3944.032	Al I	2000	1000	U2	3635.463	Ti I	200	100	..
3933.666	Ca II	600R	600R	V1	3634.695	Pd	2000R	1000R	U3
3911.810	Sc I	150	30	U1	3633.123	Y II	50	100	..
3907.476	Sc I	125	25	U2	3630.740	Sc II	50	70	V2
3906.316	Er	25	12	..	3613.836	Sc II	40	70	V1
3905.528	Si I	20	15W	..	3613.790	W II	10	30	..
3902.963	Mo I	1000R	500R	U3	3610.510	Cd I	1000	500	..
3891.785	Ba II	18	25	V4	3609.548	Pd I	1000R	700R	..
3891.02	Ho	200	40	..	3601.193	Zr I	400	15	U1
3888.646	He I	....	[1000]	U2	3601.040	Th	8	10	..
3874.18	Tb	200	200	..	3600.734	Y II	100	300	..
3864.110	Mo I	1000R	500R	U2	3596.179	Ru I	30	100	U3
3848.75	Tb	100	200	..	3572.473	Zr II	60	80	V4
3838.258	Mg I	300	200	U2	3561.74	Tb	200	200	..
3832.306	Mg I	250	200	U3	3554.43	Lu	50	150	..
3829.350	Mg I	100w	150	U4	3552.172	U	8	12	..
3814.42	Ra II	....	[2000]	V1	3547.682	Zr I	200	12	U2
3798.252	Mo I	1000R	1000R	U1	3538.75	Th	....	50	..
3788.697	Y II	30	30	..	3529.813	Co I	1000R	30	U3
3775.72	Tl I	3000R	1000R	U2	3524.541	Ni I	1000R	100wh	..

SENSITIVE LINES OF THE ELEMENTS

Wave-length	Element	Intensity		Sensitivity	Wave-length	Element	Intensity		Sensitivity
		Arc	Spk [Dis]				Arc	Spk [Dis]	
3519.605	Zr I	100	10	U3	3302.988	Na I	300R	150R	U4
3519.24	Tl I	2000R	1000R	U3	3302.588	Zn I	800	300	U3
3516.943	Pd I	1000R	500R	..	3302.323	Na I	600R	300R	U3
3515.054	Ni I	1000R	50h	..	3290.59	Th	....	40h	..
3513.645	Ir I	100h	100	U2	3289.37	Yb	500R	1000R	..
3509.17	Tb	200	200	..	3282.333	Zn I	500R	300	U4
3499.104	Er	18	15	..	3280.683	Ag I	2000R	1000R	U1
3498.942	Ru I	500R	200	U1	3273.962	Cu I	3000R	1500R	U2
3496.210	Zr II	100	100	V3	3269.494	Ge I	300	300	U3
3492.956	Ni I	1000R	100h	U2	3267.945	Os I	400R	30	..
3474.887	Sr II	80	50	..	3267.502	Sb I	150	150Wh	..
3472.48	Lu	50	150	..	3262.328	Sn I	400h	300h	U3
3466.201	Cd I	1000	500	..	3262.290	Os I	500R	50	..
3465.800	Co I	2000R	25	U2	3261.057	Cd I	300	300	..
3464.57	Sr II	200	200	..	3258.564	In I	500R	300R	U5
3462.21	Tm	200	100	..	3256.090	In I	1500R	600R	U3
3460.47	Re I	1000W	....	U1	3247.540	Cu I	5000R	2000R	U1
3453.505	Co I	3000R	200	U1	3242.280	Y II	60	100	..
3451.41	B II	5	30	V2	3232.61	Li I	1000R	500	U2
3438.230	Zr II	250	200	V2	3232.499	Sb I	150	250wh	..
3437.015	Ir I	20	15	..	3229.75	Tl I	2000	800	..
3436.737	Ru I	300R	150	U2	3225.479	Cb II	150w	800wr	..
3434.893	Rh	1000R	200r	U1	3220.780	Ir I	100	30	U1
3421.24	Pd I	2000R	1000R	U2	3215.560	W I	10	9	..
3414.765	Ni I	1000R	50wh	U1	3194.977	Cb II	30	300	..
3406.664	Ta	70w	18s	..	3185.396	V I	500R	400R	U2
3405.120	Co I	2000R	150	..	3183.982	V I	500R	400R	..
3404.580	Pd I	2000R	1000R	U1	3183.406	V I	200R	100R	..
3403.653	Cd I	800	500h	..	3179.332	Ca II	100	400w	V3
3397.07	Lu	50	20r	..	3175.019	Sn I	500h	400hr	..
3396.85	Rh I	1000w	500	..	3163.402	Cb II	15	8	..
3391.975	Zr II	300	400	V1	3158.869	Ca II	100	300w	V4
3383.761	Ti II	70	300R	..	3134.718	Hf II	80	125	..
3382.891	Ag I	1000R	700R	U2	3131.072	Be II	200	150	V2
3380.711	Sr II	150	200	..	3130.786	Cb II	100	100	..
3372.800	Ti II	80	400R	V3	3130.416	Be II	200	200	V1
3361.213	Ti II	100	600R	V2	3125.284	V II	80	200R	..
3349.035	Ti II	125	800R	V1	3118.383	V II	70	200R	V4
3345.020	Zn I	800	300	U2	3110.706	V II	70	300R	V3
3323.092	Rh I	1000	200	..	3102.299	V II	70	300R	V2
3321.343	Be I	1000r	30	U2	3094.183	Cb II	100	1000	V1
3321.086	Be I	100	....	U3	3093.108	V II	100R	400R	V1
3321.013	Be I	50	....	U4	3092.713	Al I	1000	1000	U3
3318.840	Ta	125	35	..	3082.155	Al I	800	800	U4
3311.162	Ta	300w	70w	U1	3072.877	Hf I	80	18	..

SENSITIVE LINES OF THE ELEMENTS

Wave-length	Element	Intensity		Sensitivity	Wave-length	Element	Intensity		Sensitivity
		Arc	Spk [Dis]				Arc	Spk [Dis]	
3071.591	Ba I	100R	50R	U5	2837.602	C II	....	40	V5
3067.716	Bi I	3000hR	2000wh	U1	2836.710	C II	....	200	V4
3064.712	Pt I	2000R	300R	U1	2835.633	Cr II	100	400r	V1
3058.66	Os I	500R	500	..	2833.069	Pb I	500R	80R	..
3039.356	In I	1000R	500R	U4	2830.295	Pt I	1000R	600r	..
3039.064	Ge I	1000	1000	U2	2820.224	Hf II	40	100	..
3034.121	Sn I	200wh	150wh	..	2816.179	Al II	10	100	V2
3009.147	Sn I	300h	200h	..	2816.154	Mo II	200	300h	V1
2997.967	Pt I	1000R	200r	..	2809.625	Bi I	200w	100	..
2989.029	Bi I	250wh	100wh	..	2802.695	Mg II	150	300	V2
2976.586	Ru	60	200	..	2802.19	Au	....	200	..
2965.546	Ru	60	200	..	2795.53	Mg II	150	300	V1
2945.668	Ru	60	300	..	2780.521	Bi I	200w	100	..
2943.637	Ga I	10	20r	U3	2780.197	As I	75R	75	U5
2940.772	Hf I	60	12	..	2773.357	Hf II	25	60	..
2938.298	Bi I	300w	300w	..	2769.67	Te I	....	[30]	..
2936.77	Ho	....	1000R	..	2767.87	Tl I	400R	300R	..
2929.794	Pt I	800R	200w	..	2748.58	Cd II	5	200	..
2924.792	Ir I	25wh	15	..	2712.410	Ru	80	300	..
2918.32	Tl I	400R	200R	..	2709.626	Ge I	30	20	..
2916.481	Hf I	50	15	..	2692.065	Ru	8	200	..
2911.39	Lu	100	300	..	2678.758	Ru	100	300	..
2909.116	Mo II	25	40h	V5	2675.95	Au I	250R	100	U2
2909.061	Os I	500R	400	U1	2669.166	Al II	3	100	V1
2904.408	Hf I	30	6	..	2659.454	Pt I	2000R	500R	U2
2898.71	As I	25r	40	..	2658.722	Pd II	20	300	..
2898.259	Hf I	50	12	..	2651.575	Ge I	30	20	..
2897.975	Bi I	500WR	500WR	U2	2651.178	Ge I	40	20	..
2894.84	Lu	60	200	..	2650.781	Be I	25	....	U5
2890.994	Mo II	30	50h	V4	2641.406	Hf II	40	125	..
2881.578	Si I	500	400	U1	2631.553	Al II	....	40	..
2877.915	Sb I	250W	150	..	2614.178	Pb	200r	80	..
2874.244	Ga I	10	15r	U4	2605.688	Mn II	100R	500R	V3
2871.508	Mo II	100	100h	V3	2598.062	Sb I	200	100	..
2863.327	Sn I	300R	300R	U2	2593.729	Mn II	200R	1000R	V2
2860.934	Cr II	60	100	V5	2589.167	W II	15d	25	..
2860.452	As I	50r	50	..	2576.104	Mn II	300R	2000R	V1
2855.676	Cr II	60	200Wh	V4	2573.09	Cd II	3	150	..
2854.581	Pd II	4	500h	..	2557.958	Zn II	10	300	V3
2852.129	Mg I	300R	100R	U1	2554.93	P I	60	[20]	..
2849.838	Cr II	80	150r	V3	2553.28	P I	80	[20]	U3
2849.725	Ir I	40h	20h	..	2536.519	Hg I	2000R	1000R	U2
2848.232	Mo II	125	200h	V2	2535.65	P I	100	[30]	U2
2843.252	Cr II	125	400r	V2	2534.01	P I	50	[20]	..
2839.989	Sn I	300R	300R	U1	2530.70	Te I	....	[30]	..

SENSITIVE LINES OF THE ELEMENTS

Wave-length	Element	Intensity		Sensitivity	Wave-length	Element	Intensity		Sensitivity
		Arc	Spk [Dis]				Arc	Spk [Dis]	
2528.535	Sb I	300R	200	..	2307.857	Co II	25	50w	..
2528.516	Si I	400	500	U2	2304.235	Ba II	60R	80R	..
2519.822	Co II	40	200	..	2296.89	C III	....	200	..
2516.881	Hf II	35	100	..	2288.12	As I	250R	5	U3
2516.123	Si I	500	500	U3	2288.018	Cd I	1500R	300R	U1
2513.028	Hf II	25	70	..	2287.084	Ni II	100	500	V1
2506.899	Si I	300	200	U4	2286.156	Co II	40	300*l*	V1
2505.739	Pd II	3	30	..	2276.578	Bi I	100R	40	..
2502.001	Zn II	20	400w	V4	2270.213	Ni II	100	400	V2
2498.784	Pd II	4	150h	..	2265.017	Cd II	25d	300	V2
2497.733	B I	500	400	U1	2264.457	Ni II	150	400	V3
2496.778	B I	300	300	U2	2253.86	Ni II	100	300	V4
2488.921	Pd II	10	30	..	2246.995	Cu II	30	500	V3
2478.573	C I	400	[400]	U2	2246.412	Ag II	25	300hs	V3
2456.53	As I	100r	8	U4	2203.505	Pb II	50W	5000R	V1
2437.791	Ag II	60	500wh	V2	2192.260	Cu II	25	500h	V2
2427.95	Au I	400R	100	U1	2175.890	Sb I	300	40	U2
2413.309	Fe II	60	100h	V5	2169.994	Pb I	1000R	1000R	..
2410.517	Fe II	50	70h	V4	2144.382	Cd II	50	200R	V1
2404.882	Fe II	50	100wh	V3	2142.75	Te I	60R	....	..
2397.091	W II	18	30	..	2138.56	Zn I	800R	500	U1
2395.625	Fe II	50	100wh	V2	2135.976	Cu II	25	500w	V1
2388.918	Co II	10	35	..	2068.38	Sb I	300R	3	U1
2385.76	Te I	600	[300]	U2	2062.788	Se I	....	[800]	U3
2383.25	Te I	500	[300]	U3	2062.38	I	....	[900]	..
2382.039	Fe II	40r	100R	V1	2061.91	Zn II	100	100	V2
2378.622	Co II	25	50w	..	2061.70	Bi I	300R	100	..
2370.77	As I	50r	3	..	2039.851	Se I	....	[1000]	U2
2369.67	As I	40r	....	..	2025.51	Zn II	200	200	V1
2363.787	Co II	25	50	..					
2349.84	As I	250R	18	U3					
2348.610	Be I	2000R	50	U1					
2335.269	Ba II	60R	100R	..					
2312.84	Cd II	1	200	..					
2311.469	Sb I	150R	50	..					

SINGLE ELECTRODE POTENTIALS AT 25°C

It is convenient to consider that the total emf of a cell is the sum of two "single electrode potentials." That is,

$$(1)\quad E_{\text{cell}} = E_{\text{ox}} + E_{\text{red}}$$

Where E_{ox} is the single electrode potential of the electrode forming the negative pole of the cell, and E_{red} is the single electrode potential of the electrode forming the positive pole of the cell. An oxidation process always occurs at the negative pole of a primary cell, while a reduction process occurs at the positive pole. If a particular substance is more easily oxidized than hydrogen, its E_{ox} is assigned a positive value and its E_{red} a negative value. If a substance is not oxidized as easily as hydrogen, its E_{ox} is negative and E_{red} is positive in sign.

The values given in the table below are E°_{red} values, where E° is the single electrode potential when each substance involved in the electrode reaction is at unit "activity." Values of E°_{ox} may be obtained merely by changing the sign of the E°_{red} values.

If the half reaction involves H^+ as product or reactant, the solution is acid. Half reactions involving OH^-, NH_3, CN^-, CO_3^{--}, or S^{--} are reactions occurring in an alkaline solution.

Not all of the E° values in this table were determined by emf measurements. Some were calculated from free energy data. For details, see Latimer, "The Oxidation States of the Elements," Prentice-Hall, Inc., New York, 1938.

One substance on the left side of each half reaction is an oxidizing agent, and one substance on the right side of each half reaction is a reducing agent. As one proceeds downward in the table the oxidizing agents increase in strength, and the reducing agents decrease in strength. In general, if two half reactions are represented by the following equations:

$$\text{ox. agent}_1 + ne = \text{red. agent}_1$$
$$\text{ox. agent}_2 + ne = \text{red. agent}_2$$

and the second equation occurs lower in the table than the first equation, then a reaction may occur between ox. agent_2 and red. agent_1, whereas no reaction is possible between ox. agent_1 and red. agent_2. For example, considering the half reactions:

$$I_2 + 2e = 2I^- \; (E^\circ_{\text{red}} = 0.535 \text{ volt})$$
$$Cu^{++} + I^- + e = CuI \; (E^\circ_{\text{red}} = 0.877 \text{ volt})$$

from the rule, Cu^{++} should react with I^-, and no reaction should occur between I_2 and CuI.

To obtain the overall reaction between two half reactions, the half reaction which is higher in the table is reversed. Each equation is multiplied through by the proper numbers so that the number of electrons lost in the reversed upper equation is equal to the number of electrons gained in the lower half reaction. The two half-reactions are then added. For the reaction between Cu^{++} and I^- the overall reaction is obtained as follows:

$$\begin{array}{ll} 2I^- = I_2 + 2e & \text{(upper half reaction reversed)} \\ \underline{2Cu^{++} + 2I^- + 2e = 2CuI} & \text{(reaction multiplied by two)} \\ 2Cu^{++} + 4I^- = I_2 + 2CuI & \text{(overall reaction)} \end{array}$$

If two or more reactions between two substances are possible, usually the reaction involving half reactions which are farthest apart in the table will occur first.

To calculate the single electrode potential, E_{red}, when the concentration of ions involved in the electrode reaction is other than unit activity, the following equation is used:

$$(2)\quad E_{\text{red}} = E^\circ_{\text{red}} - \frac{0.000198322T}{n} \log_{10} \frac{(a_{\text{p}})^x}{(a_{\text{r}})^y}$$

where n number of electrons (e) involved in the half reaction; a_{p} activity of products, a_{r} activity of reactants; and, a and b are the coefficients of products and reactants, respectively, in the half reaction *written as a reduction reaction;* T is the absolute temperature; the value of $0.000198322T$ at 25° C is 0.05912.

SINGLE ELECTRODE POTENTIALS AT 25°C

Examples

For the cell: $^{(-)}\text{Zn}, \text{Zn}^{++}(a = 1) \parallel \text{Cu}^{++}(a = 1), \text{Cu}, ^{(+)}$

$$E^\circ_{\text{red}} = -0.761 \text{ or } \qquad E^\circ_{\text{red}} = 0.344$$

$$E^\circ_{\text{ox}} = 0.761$$

$$E_{\text{cell}} = E^\circ_{\text{ox}} + E^\circ_{\text{red}} = 0.761 + 0.344 = 1.105 \text{ volts.}$$

To calculate the emf and overall cell reaction for the cell:

$$\begin{array}{ll} ^{(-)}(\text{Pt})\text{Sn}^{++}(a = 0.2) & \Big\| \; \text{Mn}^{++}(a = 0.3)\,^{(+)} \\ \text{Sn}^{++++}(a = 0.8) & \Big\| \; \text{MnO}_4^-(a = 0.9)(\text{Pt}) \\ & \Big\| \; \text{H}^+(a = 0.5) \\ E^\circ_{\text{red}} = 0.14 \text{ or} & \quad E^\circ_{\text{red}} = 1.52 \\ E^\circ_{\text{ox}} = -0.14 & \end{array}$$

The upper half of the two reactions, involving Sn, is reversed to give the oxidation half reaction

$$\text{Sn}^{++} = \text{Sn}^{++++} = 2e$$

$$E_{\text{ox}} = -0.14 - \frac{0.05912}{2} \log_{10} \frac{0.8}{0.2} = -0.14 - 0.018 = -0.158$$

The MnO_4^- half reaction is written as a reduction reaction:

$$\text{MnO}_4^- + 8\text{H} + 5e = \text{Mn}^{++} + 4\text{H}_2\text{O}$$

$$E_{\text{red}} = 1.52 - \frac{0.05912}{5} \log_{10} \frac{(0.3)}{(0.9)(0.5)^8} = 1.52 - 0.023 = 1.497$$

$$E_{\text{cell}} = E_{\text{ox}} + E_{\text{red}} = 0.158 + 1.497 = 1.339 \text{ volts}$$

$5\text{Sn}^{++} = 5\text{Sn}^{++++} + 10e$ (oxidn. reaction multiplied by 5)

$2\text{MnO}_4^- + 16\text{H}^+ + 10e = 2\text{Mn}^{++} + 8\text{H}_2\text{O}$ (red. reaction multiplied by 2)

$5\text{Sn}^{++} + 2\text{MnO}_4^- + 16\text{H}^+ = 5\text{Sn}^{++++} + 2\text{Mn}^{++} + 8\text{H}_2\text{O}$ (complete reaction)

Electrode	Electrode Reaction	E°_{red} (volts)
Li^+, Li	$\text{Li}^+ + e = \text{Li}$	−3.024
Cs^+, Cs	$\text{Cs}^+ + e = \text{Cs}$	−3.02
$\text{Ca(OH)}_2, \text{Ca}, \text{OH}^-$	$\text{Ca(OH)}_2 + 2e = \text{Ca} + 2\text{OH}^-$	−3.02
Rb^+, Rb	$\text{Rb}^+ + e = \text{Rb}$	−2.99
$\text{Sr(OH)}_2 \cdot 8\text{H}_2\text{O}, \text{Sr}, \text{OH}^-$	$\text{Sr(OH)}_2 \cdot 8\text{H}_2\text{O} + 2e = \text{Sr} + 2\text{OH} + 8\text{H}_2\text{O}$	−2.99
$\text{Ba(OH)}_2 \cdot 8\text{H}_2\text{O}, \text{Ba}, \text{OH}^-$	$\text{Ba(OH)}_2 \cdot 8\text{H}_2\text{O} + 2e = \text{Ba} + 2\text{OH} + 8\text{H}_2\text{O}$	−2.97
K^+, K	$\text{K}^+ + e = \text{K}$	−2.924
$\text{Ba}^{++}, \text{Ba}$	$\text{Ba}^{++} + 2e = \text{Ba}$	−2.90
$\text{Sr}^{++}, \text{Sr}$	$\text{Sr}^{++} + 2e = \text{Sr}$	−2.89
$\text{Ca}^{++}, \text{Ca}$	$\text{Ca}^{++} + 2e = \text{Ca}$	−2.87
$\text{La(OH)}_3, \text{La}, \text{OH}^-$	$\text{La(OH)}_3 + 3e = \text{La} + 3\text{OH}$	−2.76
Na^+, Na	$\text{Na}^+ + e = \text{Na}$	−2.714
$\text{Mg(OH)}_2, \text{Mg}, \text{OH}^-$	$\text{Mg(OH)}_2 + 2e = \text{Mg} + 2\text{OH}$	−2.67
$\text{La}^{+++}, \text{La}$	$\text{La}^{+++} + 3e = \text{La}$	−2.37
$\text{AlO}_2^-, \text{Al}, \text{OH}^-$	$\text{AlO}_2^- + 2\text{H}_2\text{O} + 3e = \text{Al} + 4\text{OH}$	−2.35
$\text{Mg}^{++}, \text{Mg}$	$\text{Mg}^{++} + 2e = \text{Mg}$	−2.34
$\text{Ti}^{++}, \text{Ti}$	$\text{Ti}^{++} + 2e = \text{Ti}$	−1.75
....	$\text{SiO}_3^{--} + 3\text{H}_2\text{O} + 4e = \text{Si} + 6\text{OH}^-$	−1.73
....	$\text{HPO}_3^{--} + 2\text{H}_2\text{O} + 3e = \text{P} + 5\text{OH}^-$	−1.71
$\text{Be}^{++}, \text{Be}$	$\text{Be}^{++} + 2e = \text{Be}$	−1.70
$\text{Al}^{+++}, \text{Al}$	$\text{Al}^{+++} + 3e = \text{Al}$	−1.67
$\text{Mn(OH)}_2, \text{Mn}, \text{OH}^-$	$\text{Mn(OH)}_2 + 2e = \text{Mn} + 2\text{OH}^-$	−1.47
$\text{ZnS}, \text{Zn}, \text{S}^{--}$	$\text{ZnS} + 2e = \text{Zn} + \text{S}^{--}$	−1.44
$\text{MnCO}_3, \text{Mn}, \text{CO}_3^{--}$	$\text{MnCO}_3 + 2e = \text{Mn} + \text{CO}_3^{--}$	−1.35
$\text{Cr(OH)}_3, \text{Cr}, \text{OH}^-$	$\text{Cr(OH)}_3 + 3e = \text{Cr} + 3\text{OH}^-$	−1.3

SINGLE ELECTRODE POTENTIALS AT 25°C

Electrode	Electrode Reaction	E°_{red} (volts)
$Zn(CN)_4^{--}$, Zn, CN^-	$Zn(CN)_4^{--} + 2e = Zn + 4CN^-$	−1.26
CdS, Cd, S^{--}	$CdS + 2e = Cd + S^{--}$	−1.23
ZnO_2^{--}, Zn, OH^-	$ZnO_2^{--} + 2H_2O + 2e = Zn + 4OH^-$	−1.216
CrO_2^-, Cr, OH^-	$CrO_2^- + 2H_2O + 3e = Cr + 4OH^-$	−1.2
(Pt) HCO_2^-, HCHO, OH^-	$HCO_2^-(aq) + 2H_2O + 2e = HCHO(aq) + 3OH^-$	−1.14
NiS, Ni, S^{--}	$NiS + 2e = Ni + S^{--}$	−1.07
$ZnCO_3$, Zn, CO_3^{--}	$ZnCO_3 + 2e = Zn + CO_3^{--}$	−1.07
(Pt) PO_4^{---}, HPO_3^-, OH^-	$PO_4^{---} + 2H_2O + 2e = HPO_3^{--} + 3OH^-$	−1.05
....	$N_2O + 5H_2O + 4e = 2NH_2OH + 4OH^-$	−1.05
Mn^{++}, Mn	$Mn^{++} + 2e = Mn$	−1.05
$Zn(NH_3)_4^{++}$, Zn, $NH_3(aq)$	$Zn(NH_3)_4^{++} + 2e = Zn + 4NH_3$	−1.03
FeS, Fe, S^{--}	$FeS + 2e = Fe + S^{--}$	−1.00
PbS, Pb, S^{--}	$PbS + 2e = Pb + S^{--}$	−0.98
(Pt) CNO^-, CN^-, OH^-	$CNO^- + H_2O + 2e = CN^- + 2OH^-$	−0.96
(Pt) $Sn(OH)_6^{--}$, $HSnO_2^-$, OH^-	$Sn(OH)_6^{--} + 2e = HSnO_2^- + 3OH^- + H_2O$	−0.96
Cu_2S, Cu, S^{--}	$Cu_2S + 2e = 2Cu + S^{--}$	−0.95
(Pt) CO_3^{--}, HCO_2^-, OH^-	$CO_3^{--} + 2H_2O + 2e = HCO_2^- + 3OH^-$	−0.95
CoS, Co, S^{--}	$CoS + 2e = Co + S^{--}$	−0.93
Te, Te^{--}	$Te + 2e = Te^{--}$	−0.92
$Cd(CN)_4^{--}$, Cd, CN^-	$Cd(CN)_4^{--} + 2e = Cd + 4CN^-$	−0.90
(Pt) SO_4^{--}, SO_3^{--}, OH^-	$SO_4^{--} + H_2O + 2e = SO_3^{--} + 2OH^-$	−0.90
$Fe(OH)_2$, Fe, OH^-	$Fe(OH)_2 + 2e = Fe + 2OH^-$	−0.877
NiS, Ni, S^{--}	$NiS + 2e = Ni + S^{--}$	−0.86
....	$2NO_3^- + 2H_2O + 2e = N_2O_4 + 4OH^-$	−0.85
(Pt) $Co(CN)_6^{---}$, $Co(CN)_6^{----}$	$Co(CN)_6^{---} + e = Co(CN)_6^{----}$	−0.83
PtS, Pt, S^{--}	$PtS + 2e = Pt + S^{--}$	−0.83
(Pt) H_2, OH^-	**$2H_2O + 2e = H_2 + 2OH^-$**	**−0.828**
$Cd(OH)_2$, Cd, OH^-	$Cd(OH)_2 + 2e = Cd + 2OH^-$	−0.815
$CdCO_3$, Cd, CO_3^{--}	$CdCO_3 + 2e = Cd + CO_3^{--}$	−0.80
$HSnO_2^-$, Sn, OH^-	$HSnO_2^- + H_2O + 2e = Sn + 3OH^-$	−0.79
....	$Se + 2e = Se^{--}$	−0.78
Zn^{++}, Zn	$Zn^{++} + 2e = Zn$	−0.761
CuS, Cu, S^{--}	$CuS + 2e = Cu + S^{--}$	−0.76
$FeCO_3$, Fe, CO_3^{--}	$FeCO_3 + 2e = Fe + CO_3^{--}$	−0.755
$Co(OH)_2$, Co, OH^-	$Co(OH)_2 + 2e = Co + 2OH^-$	−0.73
Ag_2S, Ag, S^{--}	$Ag_2S + 2e = 2Ag + S^{--}$	−0.71
(Pt) AsO_4^{---}, AsO_2^-, OH^-	$AsO_4^{---} + 2H_2O + 2e = AsO_2^- + 4OH^-$	−0.71
Cr^{+++}, Cr	$Cr^{+++} + 3e = Cr$	−0.71
HgS, Hg, S^{--}	$HgS + 2e = Hg + S^{--}$	−0.70
AsO_2^-, As, OH^-	$AsO_2^- + 2H_2O + 3e = As + 4OH^-$	−0.68
SbO_2^-, Sb, OH^-	$SbO_2^- + 2H_2O + 3e = Sb + 4OH^-$	−0.66
$Ni(OH)_2$, Ni, OH^-	$Ni(OH)_2 + 2e = Ni + 2OH^-$	−0.66
$CoCO_3$, Co, CO_3^{--}	$CoCO_3 + 2e = Co + CO_3^{--}$	−0.632
(Pt) SO_3^{--}, S^{--}, OH^-	$SO_3^{--} + 3H_2O + 6e = S^{--} + 6OH^-$	−0.61
$Au(CN)_2^-$, Au, CN^-	$Au(CN)_2^- + e = Au + 2CN^-$	−0.60
$Cd(NH_3)_4^{++}$, Cd, $NH_3(aq)$	$Cd(NH_3)_4^{++} + 2e = Cd + 4NH_3(aq)$	−0.597
(Pt) HCHO(aq), $CH_3OH(aq)$, OH^-	$HCHO(aq) + 2H_2O + 2e = CH_3OH(aq) + 2OH^-$	−0.59
(Pt) SO_3^{--}, $S_2O_3^{--}$, OH^-	$2SO_3^{--} + 3H_2O + 4e = S_2O_3^{--} + 6OH^-$	−0.58
PbO, Pb, OH^-	$PbO + H_2O + 2e = Pb + 2OH^-$	−0.578
(Pt) $Fe(OH)_3$, $Fe(OH)_2$, OH^-	$Fe(OH)_3 + e = Fe(OH)_2 + OH^-$	−0.56
$HPbO_2^-$, Pb, OH^-	$HPbO_2^- + H_2O + 2e = Pb + 3OH^-$	−0.54
Ga^{+++}, Ga	$Ga^{+++} + 3e = Ga$	−0.52
....	$S + 2e = S^{--}$	−0.508

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Electrode	Electrode Reaction	E°_{red} (volts)
$PbCO_3$, Pb, CO_3^{--}	$PbCO_3 + 2e = Pb + CO_3^{--}$	−0.506
....	$2CO_2(gas) + 2H^+ + 2e = H_2C_2O_4(aq)$	−0.49
$Ni(NH_3)_6^{++}$, Ni, $NH_3(aq)$	$Ni(NH_3)_6^{++} + 2e = Ni + 6NH_3(aq)$	−0.48
....	$NO_2^- + H_2O + e = NO + 2OH^-$	−0.46
$NiCO_3$, Ni, CO_3^{--}	$NiCO_3 + 2e = Ni + CO_3^{--}$	−0.45
Fe^{++}, Fe	$Fe^{++} + 2e = Fe$	−0.441
$Co(NH_3)_6^{++}$, Co, $NH_3(aq)$	$Co(NH_3)_6^{++} + 2e = Co + 6NH_3(aq)$	−0.422
(Pt) $\mathbf{H}^+(10^{-7}M)$, $\mathbf{H}_2$	$\mathbf{2H}^+(10^{-7}M) + 2e = \mathbf{H}_2$	**−0.414**
(Pt) Cr^{+++}, Cr^{++}	$Cr^{+++} + e = Cr$	−0.41
Cd^{++}, Cd	$Cd^{++} + 2e = Cd$	−0.4021
$Hg(CN)_4^{--}$, Hg, CN^-	$Hg(CN)_4^{--} + 2e = Hg + 4CN^-$	−0.37
PbI_2, Pb, I^-	$PbI_2 + 2e = Pb + 2I^-$	−0.365
Cu_2O, Cu, OH^-	$Cu_2O + H_2O + 2e = 2Cu + 2OH^-$	−0.361
$PbSO_4$, Pb, SO_4^{--}	$PbSO_4 + 2e = Pb + SO_4^{--}$	−0.355
Tl(OH), Tl, OH^-	$Tl(OH) + e = Tl + OH^-$	−0.345
In^{+++}, In	$In^{+++} + 3e = In$	−0.340
Tl^+, Tl	$Tl^+ + e = Tl$	−0.338
$Ag(CN)_2$, Ag, CN^-	$Ag(CN)_2^- + e = Ag + 2CN^-$	−0.29
$PbBr_2$, Pb, Br^-	$PbBr_2 + 2e = Pb + 2Br^-$	−0.280
Co^{++}, Co	$Co^{++} + 2e = Co$	−0.277
$PbCl_2$, Pb, Cl^-	$PbCl_2 + 2e = Pb + 2Cl^-$	−0.268
Ni^{++}, Ni	$Ni^{++} + 2e = Ni$	−0.250
$Cu(OH)_2$, Cu, OH^-	$Cu(OH)_2 + 2e = Cu + 2OH^-$	−0.224
(Pt) V^{+++}, V^{++}	$V^{+++} + e = V$	−0.20
(Pt) H_3PO_4, H_3PO_3, H^+	$H_3PO_4 + 2H^+ + 2e = H_3PO_3 + H_2O$	−0.20
CuI, Cu, I^-	$CuI + e = Cu + I^-$	−0.187
AgI, Ag, I^-	$AgI + e = Ag + I^-$	−0.152
....	$CO_2(gas) + 2H^+ + 2e = HCOOH(aq)$	−0.14
Sn^{++}, Sn	$Sn^{++} + 2e = Sn$	−0.140
(Pt) $CH_3CO_2H(aq)$, $CH_3CHO(aq)$, H^+	$CH_3CO_2H(aq) + 2H^+ + 2e = CH_3CHO(aq) + H_2O$	−0.13
Pb^{++}, Pb	$Pb^{++} + 2e = Pb$	−0.126
(Pt) CrO_4^{--}, $Cr(OH)_3$, OH^-	$CrO_4^{--} + 4H_2O + 3e = Cr(OH)_3 + 5OH^-$	−0.12
$Cu(NH_3)_4^{++}$, Cu, $NH_3(aq)$	$Cu(NH_3)_4^{++} + 2e = Cu + 4NH_3(aq)$	−0.05
(Pt) $Tl(OH)_3$, TlOH, OH^-	$Tl(OH)_3 + 2e = TlOH + 2OH$	−0.05
....	$N_2O + H_2O + 6H^+ + 4e = 2NH_3OH^+$	−0.05
Hg_2I_2, Hg, I^-	$Hg_2I_2 + 2e = 2Hg + 2I^-$	−0.0405
AgCN, Ag, CN^-	$AgCN + e = Ag + CN^-$	−0.04
Fe^{+++}, Fe	$Fe^{+++} + 3e = Fe$	−0.036
(Pt) $HCO_2H(aq)$, $HCHO(aq)$, H^+	$HCO_2H(aq) + 2H^+ + 2e = HCHO(aq) + H_2O$	−0.01
(Pt) $\mathbf{H}^+$, $\mathbf{H}_2$	$\mathbf{2H}^+ + 2e = \mathbf{H}_2$	**0.0000**
(Pt) NO_3^-, NO_2^-, OH^-	$NO_3^- + H_2O + 2e = NO_2^- + 2OH^-$	0.01
(Pt) SeO_4^{--}, SeO_3^{--}, OH^-	$SeO_4^{--} + H_2O + 2e = SeO_3^{--} + 2OH^-$	0.03
CuBr, Cu, Br^-	$CuBr + e = Cu + Br^-$	0.033
$CuCO_3$, Cu, CO_3^{--}	$CuCO_3 + 2e = Cu + CO_3^{--}$	0.053
AgBr, Ag, Br^-	$AgBr + e = Ag + Br^-$	0.071
AgCNS, Ag, CNS^-	$AgCNS + e = Ag + CNS^-$	0.09
HgO, Hg, OH^-	$HgO + H_2O + 2e = Hg + 2OH^-$	0.098
....	$N_2H_4 + 4H_2O + 2e = 2NH_4OH + 2OH^-$	0.1
CuCl, Cu, Cl^-	$CuCl + e = Cu + Cl^-$	0.124
Hg_2Br_2, Hg, Br^-	$Hg_2Br_2 + 2e = 2Hg + 2Br^-$	0.1397
(Pt) Sn^{++++}, Sn^{++}	$Sn^{++++} + 2e = Sn$	0.14
....	$S + 2H^+ + 2e = H_2S$	0.141
....	$2NO_2^- + 3H_2O + 4e = N_2O + 6OH^-$	0.15

SINGLE ELECTRODE POTENTIALS AT 25°C

Electrode	Electrode Reaction	E°_{red} (volts)
$Pt(OH)_2$, Pt, OH^-	$Pt(OH)_2+2e=Pt+2OH^-$	0.16
(Pt) Cu^{++}, Cu^+	$Cu^{++}+e=Cu^+$	0.167
(Pt) ClO_4^-, ClO_3^-, OH^-	$ClO_4^-+H_2O+2e=ClO_3^-+2OH^-$	0.17
(Pt) $S_4O_6^{--}$, $S_2O_3^{--}$	$S_4O_6^{--}+2e=2S_2O_3^{--}$	0.17
(Pt) SO_4^{--}, H_2SO_3, H^+	$SO_4^{--}+4H^++2e=H_2SO_3+H_2O$	0.20
SbO^+, Sb, H^+	$SbO^++2H^++3e=Sb+H_2O$	0.212
AgCl, Ag, Cl^-	$AgCl+e=Ag+Cl^-$	0.2222
. . . .	$HCHO(aq)+2H^++2e=CH_3OH(aq)$	0.24
Saturated calomel	$\mathbf{Hg_2Cl_2}+2e=\mathbf{2Hg}+\mathbf{2Cl}^-$ (satd. KCl)	**0.244-0.245**
(Pt) IO_3^-, I^-, OH^-	$IO_3^-+3H_2O+6e=I^-+6OH^-$	0.26
Hg_2Cl_2, Hg, Cl^-	$Hg_2Cl_2+2e=2Hg+2Cl^-$ (unit activity)	0.2676
Normal calomel	$\mathbf{Hg_2Cl_2}+2e=\mathbf{2Hg}+\mathbf{2Cl}^-$ (N KCl)	**0.280-0.282**
BiO^+, Bi, H^+	$BiO^++2H+3e=Bi+H_2O$	0.32
. . . .	$C_2N_2(gas)+2H^++2e=2HCN$	0.33
0.1 Normal calomel	$\mathbf{Hg_2Cl_2}+2e=\mathbf{2Hg}+\mathbf{2Cl}^-$(0.1$N$ KCl)	**0.335-0.336**
Cu^{++}, Cu	$Cu^{++}+2e=Cu$	0.344
Ag_2O, Ag, OH^-	$Ag_2O+H_2O+2e=2Ag+2OH^-$	0.344
(Pt) ClO_3^-, ClO_2^-, OH^-	$ClO_3^-+H_2O+2e=ClO_2^-+2OH^-$	0.35
(Pt) $Fe(CN)_6^{---}$, $Fe(CN)_6^{----}$	$Fe(CN)_6^{---}+e=Fe(CN)_6^{----}$	0.36
$AgIO_3$, Ag, IO_3^-	$AgIO_3+e=Ag+IO_3^-$	0.37
$Ag(NH_3)_2^+$, Ag, $NH_3(aq)$	$Ag(NH_3)_2^++e=Ag+2NH_3(aq)$	0.373
$Hg(IO_3)_2(s)$, Hg, IO_3^-	$Hg(IO_3)_2+2e=Hg+2IO_3^-$	0.40
(Pt) H_2SO_3, $S_2O_3^{--}$, H^+	$2H_2SO_3+2H^++4e=3H_2O+S_2O_3^{--}$	0.40
(Pt) O_2, OH^-	$O_2+2H_2O+4e=4OH^-$	0.401
. . . .	$NH_2OH+2H_2O+2e=NH_4OH+2OH^-$	0.42
Ag_2CrO_4, Ag, CrO_4^{--}	$Ag_2CrO_4+2e=2Ag+CrO_4^{--}$	0.446
. . . .	$H_2SO_3+4H^++4e=S+3H_2O$	0.45
Ag_2CO_3, Ag, CO_3^{--}	$Ag_2CO_3+2e=2Ag+CO_3^{--}$	0.47
AuI, Au, I^-	$AuI+e=Au+I^-$	0.50
Cu^+, Cu	$Cu^++e=Cu$	0.522
(Pt) I_2, I^-	$I_2+2e=2I^-$	0.535
(Pt) I_3^-, I^-	$I_3^-+2e=3I^-$	0.5355
(Pt) MnO_4^-, MnO_4^{--}	$MnO_4^-+e=MnO_4^{--}$	0.54
$AgBrO_3$, Ag, BrO_3^-	$AgBrO_3+e=Ag+BrO_3^-$	0.55
(Pt) H_3AsO_4, $HAsO_2$, H^+	$H_3AsO_4+2H^++2e=HAsO_2+2H_2O$	0.559
(Pt) Cu^{++}, CuCl, Cl^-	$Cu^{++}+Cl^-+e=CuCl$	0.566
Te^{++++}, Te	$Te^{++++}+4e=Te$	0.568
(Pt) MnO_4^-, MnO_2, OH^-	$MnO_4^-+2H_2O+3e=MnO_2+4OH^-$	0.57
(Pt) ClO_2^-, ClO^-, OH^-	$ClO_2^-+H_2O+2e=ClO^-+2OH^-$	0.59
(Pt) BrO_3^-, Br^-, OH^-	$BrO_3^-+3H_2O+6e=Br^-+6OH^-$	0.61
Hg_2SO_4, Hg, SO_4^{--}	$Hg_2SO_4+2e=2Hg+SO_4^{--}$	0.615
(Pt) ClO_3^-, Cl^-, OH^-	$ClO_3^-+3H_2O+6e=Cl^-+6OH^-$	0.62
$PdCl_4^{--}$, Pd, Cl^-	$PdCl_4^{--}+2e=Pd+4Cl^-$	0.64
. . . .	$Sb_2O_5+6H^++4e=2SbO^++3H_2O$	0.64
Ag_2SO_4, Ag, SO_4^{--}	$Ag_2SO_4+2e=2Ag+SO_4^{--}$	0.653
(Pt) Cu^{++}, CuBr, Br^-	$Cu^{++}+Br^-+e=CuBr$	0.657
(Pt) O_2, H_2O_2, H^+	$O_2+2H^++2e=H_2O_2$	0.682
$Au(CNS)_2^-$, Au, CNS^-	$Au(CNS)_2^-+e=Au+2CNS^-$	0.69
(Pt) Quinhydrone, H^+	$C_6H_4O_2+2H^++2e=C_6H_6O_2$	0.6994
$IrCl_6^{---}$, Ir, Cl^-	$IrCl_6^{---}+3e=Ir+6Cl^-$	0.72
$PtCl_4^{--}$, Pt, Cl^-	$PtCl_4^{--}+2e=Pt+4Cl^-$	0.73
. . . .	$H_2SeO_3+4H^++4e=Se+3H_2O$	0.74
. . . .	$2NH_2OH+2e=N_2H_4+2OH^-$	0.74
(Pt) ClO_2^-, Cl^-, OH^-	$ClO_2^-+2H_2O+4e=Cl^-+4OH^-$	0.76
. . . .	$2NO+H_2O+2e=N_2O+2OH^-$	0.76

SINGLE ELECTRODE POTENTIALS AT 25°C

Electrode	Electrode Reaction	E°_{red} (volts)
(Pt) $(CNS)_2, CNS^-$	$(CNS)_2 + 2e = 2CNS^-$	0.77
(Pt) Fe^{+++}, Fe^{++}	$Fe^{+++} + e = Fe^{++}$	0.77
Hg_2^{++}, Hg	$Hg_2^{++} + 2e = 2Hg$	0.7986
Ag^+, Ag	$Ag^+ + e = Ag$	0.799
....	$2NO_3^- + 4H^+ + 2e = N_2O_4 + 2H_2O$	0.81
(Pt) $O_2, H^+(10^{-7}M)$	$O_2 + 4H^+(10^{-7}M) + 4e = 2H_2O$	0.815
Pd^{++}, Pd	$Pd^{++} + 2e = Pd$	0.83
Hg^{++}, Hg	$Hg^{++} + 2e = Hg$	0.854
$AuBr_4^-, Au, Br^-$	$AuBr_4^- + 3e = Au + 4Br^-$	0.87
(Pt) Cu^{++}, CuI, I^-	$Cu^{++} + I^- + e = CuI$	0.877
....	$N_2O_4 + 2e = 2NO_2^-$	0.88
(Pt) Hg^{++}, Hg_2^{++}	$2Hg^{++} + 2e = Hg_2^{++}$	0.910
(Pt) NO_3^-, HNO_2, H^+	$NO_3^- + 3H^+ + 2e = HNO_2 + H_2O$	0.94
(Pt) ClO^-, Cl^-, OH^-	$ClO^- + H_2O + 2e = Cl^- + 2OH^-$	0.94
....	$NO_3^- + 4H^+ + 3e = NO + 2H_2O$	0.96
$AuBr_2^-, Au, Br^-$	$AuBr_2^- + e = Au + 2Br^-$	0.96
....	$HNO_2 + H^+ + e = NO + H_2O$	0.99
$Pt(OH)_2, Pt, H^+$	$Pt(OH)_2 + 2H^+ + 2e = Pt + 2H_2O$	0.99
$AuCl_4^-, Au, Cl^-$	$AuCl_4^- + 3e = Au + 4Cl^-$	1.00
(Pt) ClO_4^-, ClO_3^-, H^+	$ClO_4^- + 2H^+ + 2e = ClO_3^- + H_2O$	1.00
(Pt) $IrCl_6^{--}, IrCl_6^{---}$	$IrCl_6^{--} + e = IrCl_6^{---}$	1.021
....	$N_2O_4 + 4H^+ + 4e = 2NO + 2H_2O$	1.03
(Pt) $Br_2(liq), Br^-$	$Br_2(liq) + 2e = 2Br^-$	1.0652
....	$N_2O_4 + 2H^+ + 2e = 2HNO_2$	1.07
(Pt) IO_3^-, I^-, H^+	$IO_3^- + 6H^+ + 6e = I^- + 3H_2O$	1.085
(Pt) $Br_2(aq), Br^-$	$Br_2(aq) + 2e = 2Br^-$	1.087
(Pt) $SeO_4^{--}, H_2SeO_3, H^+$	$SeO_4^{--} + 4H^+ + 2e = H_2SeO_3 + H_2O$	1.15
....	$ClO_2 + e = ClO_2^-$	1.15
(Pt) IO_3^-, I_2, H^+	$IO_3^- + 6H^+ + 5e = \frac{1}{2}I_2 + 3H_2O$	1.195
Pt^{++}, Pt	$Pt^{++} + 2e = Pt$	*ca.* 1.2
(Pt) Tl^{+++}, Tl^+	$Tl^{+++} + 2e = Tl^+$	1.21
(Pt) O_2, H^+	$O_2 + 4H^+ + 4e = 2H_2O$	1.229
(Pt) $ClO_3^-, HClO_2$	$ClO_3^- + 3H^+ + 2e = HClO_2 + H_2O$	1.23
(Pt) $N_2H_5^+, NH_4^+, H^+$	$N_2H_5^+ + 3H^+ + 2e = 2NH_4^+$	1.24
....	$O_3 + H_2O + 2e = O_2 + 2OH^-$	1.24
(Pt) MnO_2, Mn^{++}, H^+	$MnO_2 + 4H^+ + 2e = Mn^{++} + 2H_2O$	1.28
....	$2HNO_2 + 4H^+ + 4e = N_2O + 3H_2O$	1.29
(Pt) Au^{+++}, Au^+	$Au^{+++} + 2e = Au^+$	*ca.* 1.29
(Pt) ClO_4^-, Cl_2, H^+	$ClO_4^- + 8H^+ + 7e = \frac{1}{2}Cl_2 + 4H_2O$	1.34
(Pt) NH_3OH^+, NH_4^+, H^+	$NH_3OH^+ + 2H^+ + 2e = NH_4^+ + H_2O$	1.35
(Pt) Cl_2, Cl^-	$Cl_2 + 2e = 2Cl^-$	1.3583
(Pt) $Tl^{+++}, TlCl, Cl^-$	$Tl^{+++} + Cl^- + 2e = TlCl$	1.36
(Pt) $Cr_2O_7^{--}, Cr^{+++}, H^+$	$Cr_2O_7^{--} + 14H^+ + 6e = 2Cr^{+++} + 7H_2O$	1.36
Au_2O_3, Au, H^+	$Au_2O_3 + 6H^+ + 6e = 2Au + 3H_2O$	1.363
Au^{+++}, Au	$Au^{+++} + 3e = Au$	1.42
(Pt) BrO_3^-, Br^-, H^+	$BrO_3^- + 6H^+ + 6e = Br^- + 3H_2O$	1.44
(Pt) HIO, I_2, H^+	$HIO + H^+ + e = \frac{1}{2}I_2 + H_2O$	1.45
(Pt) ClO_3^-, Cl^-, H^+	$ClO_3^- + 6H^+ + 6e = Cl^- + 3H_2O$	1.45
(Pt) PbO_2, Pb^{++}, H^+	$PbO_2 + 4H^+ + 2e = Pb^{++} + 2H_2O$	1.46
(Pt) $NH_3OH^+, N_2H_5^+, H^+$	$2NH_3OH^+ + H^+ + 2e = N_2H_5^+ + 2H_2O$	1.46
(Pt) ClO_3^-, Cl_2, H^+	$ClO_3^- + 6H^+ + 5e = \frac{1}{2}Cl_2 + 3H_2O$	1.47
(Pt) $HClO, Cl^-, H^+$	$HClO + H^+ + 2e = Cl^- + H_2O$	1.49
(Pt) Mn^{+++}, Mn^{++}	$Mn^{+++} + e = Mn^{++}$	1.51
(Pt) BrO_3^-, Br_2, H^+	$BrO_3^- + 6H^+ + 5e = \frac{1}{2}Br_2 + 3H_2O$	1.52
(Pt) MnO_4^-, Mn^{++}, H^+	$MnO_4^- + 8H^+ + 5e = Mn^{++} + 4H_2O$	1.52

SINGLE ELECTRODE POTENTIALS AT 25°C

Electrode	Electrode Reaction	E°_{red} (volts)
(Pt) $HClO_2$, Cl^-, H^+	$HClO_2+3H^++4e=Cl^-+2H_2O$	1.56
(Pt) $HBrO$, Br_2, H^+	$HBrO+H^++e=\frac{1}{2}Br_2+H_2O$	1.59
....	$2NO+2H^++2e=N_2O+H_2O$	1.59
(Pt) Ce^{++++}, Ce^{+++}	$Ce^{++++}+e=Ce^{+++}$	1.61
(Pt) $HClO$, Cl_2, H^+	$HClO+H^++e=\frac{1}{2}Cl_2+H_2O$	1.63
(Pt) $HClO_2$, Cl_2, H^+	$HClO_2+3H^++3e=\frac{1}{2}Cl_2+2H_2O$	1.63
(Pt) MnO_4, MnO_2, H^+	$MnO_4^-+4H^++3e=MnO_2+2H_2O$	1.67
Au^+, Au	$Au^++e=Au$	1.68
PbO_2, $PbSO_4$, SO_4^{--}, H^+	$PbO_2+SO_4^{--}+4H^++2e=PbSO_4+2H_2O$	1.685
(Pt) Pb^{++++}, Pb^{++}	$Pb^{++++}+2e=Pb^{++}$	1.69
(Pt) NiO_2, Ni^{++}, H^+	$NiO_2+4H^++2e=Ni^{++}+2H_2O$	1.75
(Pt) H_2O_2, H^+	$H_2O_2+2H^++2e=2H_2O$	1.77
(Pt) Co^{+++}, Co^{++}	$Co^{+++}+e=Co^{++}$	1.82
(Pt) $S_2O_8^{--}$, SO_4^{--}	$S_2O_8^{--}+2e=2SO_4^{--}$	2.05
....	$O_3+2H^++2e=O_2+H_2O$	2.07
....	$F_2+2e=2F^-$	2.85
....	$F_2+2H^++2e=2HF$	3.03

ELECTROMOTIVE SERIES OF THE METALS

Lithium
Rubidium
Potassium
Barium
Strontium
Calcium
Sodium
Magnesium
Beryllium
Aluminum
Manganese
Zinc
Chromium
Iron
Cadmium
Cobalt
Nickel
Tin
Lead
HYDROGEN
Antimony
Arsenic
Bismuth
Copper
Mercury (ous)
Silver
Palladium
Mercury (ic)
Platinum
Gold

AN ELECTROMOTIVE SERIES OF METALS AND ALLOYS

In general, when two metals are connected to each other and are immersed in sea water, or other salt solutions which are not too acid or alkaline, there will be a small or not appreciable action if the two metals are in the same group as given in the table below. If one metal is in one group and the other metal is in a different group, the metal in the group coming *first* in the table will be anodic to (*i.e.*, corroded by) the metal in the group coming later in the table. Thus, Aluminum 38 would probably be corroded by contact with lead or tin. For details, *cf.* La Que and Cox, *Proc. Amer. Soc. for Testing Materials*, 40, *17* (*1940*).

Magnesium
Magnesium alloys

Zinc
Galvanized steel
Galvanized wrought iron

Aluminum 52SH, 4S, 3S, 2S, or 53S-T
Alclad

Cadmium

Aluminum A17S-T, 17S-T, 24S-T

Mild steel
Wrought iron
Cast iron

Ni-Resist

13% Chromium stainless steel, type 410 (active)

50-50 lead tin solder

18-8 Stainless steel, type 304 (active)

18-8-3 Stainless steel, type 316 (active)

Lead
Tin

Muntz metal
Manganese bronze
Naval brass

Nickel (active)
Inconel (active)

Yellow brass
Admiralty brass
Aluminum bronze
Red brass
Copper
Silicon bronze
Ambrac
70-30 Copper nickel
Comp. G-bronze
Comp. M-bronze

Nickel (passive)
Inconel (passive)

Monel

18-8 Stainless steel, type 304 (passive)
18-8-3 Stainless steel, type 316 (passive)

COMPOSITION AND emf OF VOLTAIC CELLS

Compiled in collaboration with George W. Heise

Single-Fluid Cells

Name of cell	emf volts	Anode*	Electrolyte	Cathode
Air depolarized:				
Alkaline type	1.46	Amalg. zinc	20% NaOH	Carbon
Leclanche type	1.4±	Amalg. zinc	$NH_4Cl + ZnCl_2$	Carbon
Drumm (storage)	1.86	Zinc	$KOH + K_2Zn_2O_3$	Nickel oxide
Edison (storage)	1.5	Iron	21% KOH + 5% LiOH	Nickel oxide + nickel (or graphite)
Cadmium (storage)	1.35	Cadmium	KOH + LiOH	Nickel oxide
Lalande-Chaperon (Edison-Lalande)	0.95	Amalg. zinc	20% NaOH	CuO
Lead storage battery	2.1	Lead	H_2SO_4	PbO_2
Leclanche:				
Wet cell	1.5	Amalg. zinc	Sat'd. NH_4Cl	$C + MnO_2$
Dry cell	1.6	Amalg. zinc	$NH_4Cl + ZnCl_2$	$C + MnO_2$
Main (Reynier) (primary or storage)	2.5	Amalg. zinc	H_2SO_4	PbO_2
Magnesium (reserve type)	1.8	Magnesium	$MgCl_2$†	AgCl
Mercuric oxide	1.35	Amalg. zinc	$KOH + K_2Zn_2O_3$	HgO
Perchloric acid	2.31	Lead	$HClO_4$	PbO_2
Poggendorf (Bunsen)	2.0	Amalg. zinc	12 parts $K_2Cr_2O_7$ + 25 parts H_2SO_4 + 100 parts H_2O	Carbon
Silver chloride	1.02	Amalg. zinc	NH_4Cl	Ag + AgCl
Volta	0.98	Zinc	NaCl	Ag (or Cu)

Two-Fluid Cells

Name of cell	emf volts	Anode	Anolyte	Catholyte	Cathode
Bunsen (modified Grove)	1.9±	Zinc	H_2SO_4	HNO_3	Carbon
Clark (standard cell)	1.4328 at 15°C	Zinc amalg.	$ZnSO_4$	Hg_2SO_4	Hg
Daniell	1.08±	Zinc	$ZnSO_4$ or $MgSO_4$	$CuSO_4$	Cu
Fuller	2.0	Amalg. zinc	H_2SO_4	$K_2Cr_2O_7 + H_2SO_4$	C
Grove	1.93	Amalg. zinc	H_2SO_4	HNO_3	Pt
Weston (standard)	1.01827 at 20°C	Cd amalg.	$CdSO_4$	Hg_2SO_4	Hg

* For all except the original Volta pile (1800) zinc anodes may be considered as being amalgamate

† Activated by addition of water; $MgCl_2$ formed during discharge: $Mg + 2AgCl = MgCl_2 + 2Ag$.

ELECTROMETRIC DETERMINATION OF pH

MEASUREMENT OF pH WITH THE HYDROGEN ELECTRODE

The "pH" values of aqueous solutions are expressed on an arbitary scale. Sorensen originally considered pH to be equal to $-\log C_{H+}$ where C_{H+} is the hydrogen ion concentration of the solution. This relation is now considered to be only an approximate one. Moreover, pH is not exactly equal to $-\log a_{H+}$ where a_{H+} is the thermodynamic "activity" of the hydrogen ions in solution. This is due to the uncertainty of the magnitude and constancy of the liquid-junction potential which exists in the cell (See Hitchcock and Taylor, *J. Am. Chem. Soc.*, 59, *1812* (*1937*); MacInnes, Belcher and Shedlovsky, *ibid.*, **60**, *1094* (*1938*); Malcolm Dole, "*The Glass Electrode*", John Wiley and Sons, Inc., New York, (1941), pp. 280-304). The pH of an aqueous solution is *defined* by the following equation:

$$\mathrm{pH} = \frac{E_{\mathrm{cell}} + E_{\mathrm{b}} - E^{\circ}}{0.000198322\, T}$$

in which E_{cell} is the emf of a cell such as:

$$^{(-)}(Pt)\ H_2,\ H^{+}\ (in\ aq.\ soln.),\ KCl\ (satd.),\ Hg_2Cl_2(s),\ Hg^{(+)}$$

The cell is at absolute temperature, T; E_{b} is a small barometric voltage correction of the hydrogen electrode potential; and E° is the single electrode potential of the reference electrode (a saturated calomel electrode in the cell shown above) as a *reduction* electrode (see the table *Single Electrode Potentials at 25°C*). The numerical value of E° has been determined by Hitchcock and Taylor, and by MacInnes, Belcher and Shedlovsky, and by others, so as to make the values of pH as calculated from equation (*1*) correspond as closely as is possible to the relationship

$$pH = -\log a_{H+}$$

Values of E_{b} are given in Table I. They are "E_{red}" values (see *Single Electrode Potentials*) and are to be added algebraically to the emf of the whole cell. Values of *0.000198322 T* for various temperatures are given in Table II. Values of E° for various calomel reference electrodes are given in Table III. They are E_{red} values and include the liquid junction potential between the calomel half cell, and the solution whose pH is being determined.

Example of Calculation of pH

To calculate the pH of a solution where E_{cell} of a H_2-satd. calomel cell at 25°C and 765 mm corrected barometer reading is equal to 0.6138 volt. From Table I, $E_{\mathrm{b}} = 0.0003$ volt. From Table II, the value at 25°C is found to be 0.059120. From Table III, an average value for the E° of the saturated calomel electrode at 25°C is taken as 0.2445.

$$\text{Then pH} = \frac{0.6138 + 0.0003 - 0.2445}{0.059120} = 6.25$$

Table I

Barometric Corrections, Eb for Hydrogen Electrode Potentials

Values in this table were calculated from the equation

$$E_{\mathrm{b}} = \frac{0.000198322\, T}{2} \log_{10} \frac{760}{x}$$

n which x is the corrected barometer reading minus the vapor pressure of water t absolute temperature T.

ELECTROMETRIC DETERMINATION OF pH

Corrected barometer reading in mm. Hg	E_b in Volts at t°C.							
	5°	10°	15°	20°	25°	30°	35°	40°
780	−.0002	−.0002	−.0001	.0000	+.0001	+.0002	+.0004	+.0006
775	−.0001	−.0001	.0000	.0000	+.0002	+.0003	+.0005	+.0007
770	−.0001	.0000	+.0001	+.0001	+.0002	+.0004	+.0006	+.0008
765	.0000	+.0001	+.0001	+.0002	+.0003	+.0005	+.0007	+.0009
760	+.0001	+.0002	+.0002	+.0003	+.0004	+.0006	+.0008	+.0010
755	+.0002	+.0002	+.0003	+.0004	+.0005	+.0007	+.0009	+.0011
750	+.0003	+.0003	+.0004	+.0005	+.0006	+.0007	+.0010	+.0012
745	+.0003	+.0004	+.0005	+.0006	+.0007	+.0008	+.0010	+.0013
740	+.0004	+.0005	+.0006	+.0006	+.0008	+.0009	+.0011	+.0014
735	+.0005	+.0006	+.0006	+.0007	+.0009	+.0010	+.0012	+.0015

Table II

Values for 0.000198322 T at Various Temperatures

t°C.	Value	t°C.	Value	t°C.	Value	t°C.	Value
0	0.054162	17	0.057533	23	0.058723	29	0.059913
5	0.055153	18	0.057732	24	0.058921	30	0.060111
10	0.056145	19	0.057930	25	0.059120	35	0.061103
14	0.056938	20	0.058128	26	0.059318	38	0.061698
15	0.057137	21	0.058327	27	0.059516	50	0.064078
16	0.057335	22	0.058525	28	0.059715	70	0.068044

Table III

Values of E° of Calomel Electrodes as Reduction Electrodes

The values given include the liquid junction potential between the calomel half cell, and the solution whose pH is being determined.

Cf. Hitchcock and Taylor, *loc. cit.*, MacInnes, Belcher and Shedlovsky, *loc. cit.*; Hamer, *Trans. Electrochem. Soc.*, 72, *45-70* (*1937*); Malcolm Dole, *loc. cit.*, p. 284.

Common name	Electrode	E°_{red} at 25° C.
0.1 *N* calomel	Hg, $Hg_2Cl_2(s)$, 0.1 *N* KCl, satd. KCl	0.3359 to 0.3362
Satd. calomel	Hg, $Hg_2Cl_2(s)$, satd. KCl	0.2441 to 0.2450

Notes on Hydrogen Electrode

Directions for preparing the hydrogen electrode may be found in Clark's "*The Determination of Hydrogen Ions*," 3d edition, 1928, Williams and Wilkins Co., publishers, Baltimore, Md.

The hydrogen electrode cannot be used in the presence of salts of heavy metals, nor easily reduced substances in general. Thus, unsaturated organic acids, some alkaloids, etc., are reduced by hydrogen in the presence of the finely divided noble metal electrode which acts as a catalyst for the reduction. The electrode is very sensitive to traces of oxygen, so that highly purified hydrogen must be used in generous amounts. The commercial compressed hydrogen, however, is generally sufficiently pure for practical work. The hydrogen electrode is always negative with respect to all calomel electrodes, and the cell must be connected to the potentiometer with the former attached to the (−) binding post and the latter to the (+).

ELECTROMETRIC DETERMINATION OF pH

A Direct-Reading Table for pH Determinations

The pH may be read directly from Table IV if the emf is measured of a cell consisting of a hydrogen electrode immersed in the solution, the pH of which is to be determined, and this solution being coupled with a saturated calomel electrode. For example, if $E_{cell} = 0.6138$ volt at 25°C, and the corrected barometer reading is 735 mm, then one obtains $E_b = 0.0009$ volt. $E_{cell} + E_b = 0.6147$. In Table IV the nearest emf to 0.6147 is 0.6123 at 25°C. This corresponds to pH = 6.2, or to pH of 6.24 if interpolated between pH 6.2 and pH 6.3. If the saturated calomel electrode was not prepared with materials of high purity, the pH values obtained by use of Table IV may be in error by as much as 0.1 to 0.2 pH units. A method for compensating this error is described in connection with Table VI.

*Table IV

pH vs. emf of Hydrogen-Saturated Calomel Cell

The table gives pH values at various temperatures corresponding to $(E_{cell} + E_b)$ values of the cell;

$^{(-)}$(Pt) H_2, H^+ in aq. soln., KCl (satd.), $Hg_2Cl_2(s)$, $Hg^{(+)}$

pH	Volt 5° C	Volt 10° C	Volt 15° C	Volt 20° C	Volt 25° C	Volt 30° C	Volt 35° C	Volt 40° C
0	0.2610	0.2572	0.2534	0.2496	0.2458	0.2420	0.2382	0.2344
.1	.2665	.2628	.2591	.2554	.2517	.2480	.2443	.2406
.2	.2720	.2684	.2648	.2612	.2576	.2540	.2504	.2468
.3	.2775	.2740	.2705	.2670	.2635	.2600	.2565	.2530
.4	.2831	.2797	.2763	.2728	.2694	.2660	.2626	.2592
.5	.2886	.2853	.2820	.2787	.2754	.2721	.2687	.2654
.6	.2941	.2909	.2877	.2845	.2813	.2781	.2749	.2717
.7	.2996	.2965	.2934	.2903	.2872	.2841	.2810	.2779
.8	.3051	.3021	.2991	.2961	.2931	.2901	.2871	.2841
.9	.3106	.3077	.3048	.3019	.2990	.2961	.2932	.2903
1.0	.3161	.3133	.3105	.3077	.3049	.3021	.2993	.2965
1.1	.3217	.3190	.3162	.3135	.3108	.3081	.3054	.3027
1.2	.3272	.3246	.3220	.3193	.3167	.3141	.3115	.3089
1.3	.3327	.3302	.3277	.3252	.3226	.3201	.3176	.3151
1.4	.3382	.3358	.3334	.3310	.3286	.3261	.3237	.3213
1.5	.3437	.3414	.3391	.3368	.3345	.3322	.3298	.3275
1.6	.3492	.3470	.3448	.3426	.3404	.3382	.3360	.3337
1.7	.3548	.3526	.3505	.3484	.3463	.3442	.3421	.3399
1.8	.3603	.3582	.3562	.3542	.3522	.3502	.3482	.3462
1.9	.3658	.3639	.3619	.3600	.3581	.3562	.3543	.3524
2.0	.3713	.3695	.3677	.3658	.3640	.3622	.3604	.3586
2.1	.3768	.3751	.3734	.3717	.3699	.3682	.3665	.3648
2.2	.3823	.3807	.3791	.3775	.3758	.3742	.3726	.3710
2.3	.3878	.3863	.3848	.3833	.3818	.3802	.3787	.3772
2.4	.3934	.3919	.3905	.3891	.3877	.3863	.3848	.3834
2.5	.3989	.3975	.3962	.3949	.3936	.3923	.3909	.3896
2.6	.4044	.4032	.4019	.4007	.3995	.3983	.3971	.3958
2.7	.4099	.4088	.4077	.4065	.4054	.4043	.4032	.4020
2.8	.4154	.4144	.4134	.4123	.4113	.4103	.4093	.4082
2.9	.4209	.4200	.4191	.4182	.4172	.4163	.4154	.4145
3.0	.4264	.4256	.4248	.4240	.4231	.4223	.4215	.4207
3.1	.4320	.4312	.4305	.4298	.4291	.4283	.4276	.4269
3.2	.4375	.4368	.4362	.4356	.4350	.4343	.4337	.4331
3.3	.4430	.4425	.4419	.4414	.4409	.4403	.4398	.4393
3.4	.4485	.4481	.4476	.4472	.4468	.4464	.4459	.4455
3.5	.4540	.4537	.4534	.4530	.4527	.4524	.4520	.4517

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(Continued on following page.)

Table IV (Continued)

pH vs. emf of Hydrogen-Saturated Calomel Cell

pH	Volt 5° C	Volt 10° C	Volt 15° C	Volt 20° C	Volt 25° C	Volt 30° C	Volt 35° C	Volt 40° C
3.6	.4595	.4593	.4591	.4588	.4586	.4584	.4581	.4579
3.7	.4650	.4649	.4648	.4647	.4645	.4644	.4643	.4641
3.8	.4706	.4705	.4705	.4705	.4704	.4704	.4704	.4703
3.9	.4761	.4761	.4762	.4763	.4763	.4764	.4765	.4765
4.0	.4816	.4818	.4819	.4821	.4823	.4824	.4826	.4828
4.1	.4871	.4874	.4876	.4879	.4882	.4884	.4887	.4890
4.2	.4926	.4930	.4933	.4937	.4941	.4944	.4948	.4952
4.3	.4981	.4986	.4991	.4995	.5000	.5005	.5009	.5014
4.4	.5036	.5042	.5048	.5053	.5059	.5065	.5070	.5076
4.5	.5092	.5098	.5105	.5111	.5118	.5125	.5131	.5138
4.6	.5147	.5154	.5162	.5170	.5177	.5185	.5192	.5200
4.7	.5202	.5211	.5219	.5228	.5236	.5245	.5254	.5262
4.8	.5257	.5267	.5276	.5286	.5296	.5305	.5315	.5324
4.9	.5312	.5323	.5333	.5344	.5355	.5365	.5376	.5386
5.0	.5367	.5379	.5391	.5402	.5414	.5425	.5437	.5448
5.1	.5423	.5435	.5448	.5460	.5473	.5485	.5498	.5510
5.2	.5478	.5491	.5505	.5518	.5532	.5545	.5559	.5573
5.3	.5533	.5547	.5562	.5576	.5591	.5606	.5620	.5635
5.4	.5588	.5603	.5619	.5635	.5650	.5666	.5681	.5697
5.5	.5643	.5660	.5676	.5693	.5709	.5726	.5742	.5759
5.6	.5698	.5716	.5733	.5751	.5768	.5786	.5803	.5821
5.7	.5753	.5772	.5790	.5809	.5827	.5846	.5864	.5883
5.8	.5809	.5828	.5848	.5867	.5887	.5906	.5926	.5945
5.9	.5864	.5884	.5905	.5925	.5946	.5966	.5987	.6007
6.0	.5919	.5940	.5962	.5983	.6005	.6026	.6048	.6069
6.1	.5974	.5996	.6019	.6041	.6064	.6086	.6109	.6131
6.2	.6029	.6053	.6076	.6100	.6123	.6146	.6170	.6193
6.3	.6084	.6109	.6133	.6158	.6182	.6207	.6231	.6256
6.4	.6139	.6165	.6190	.6216	.6241	.6267	.6292	.6318
6.5	.6195	.6221	.6247	.6274	.6300	.6327	.6353	.6380
6.6	.6250	.6277	.6305	.6332	.6359	.6387	.6414	.6442
6.7	.6305	.6333	.6362	.6390	.6419	.6447	.6475	.6504
6.8	.6360	.6389	.6419	.6448	.6478	.6507	.6537	.6566
6.9	.6415	.6446	.6476	.6506	.6537	.6567	.6598	.6628
7.0	.6470	.6502	.6533	.6565	.6596	.6627	.6659	.6690
7.1	.6525	.6558	.6590	.6623	.6655	.6687	.6720	.6752
7.2	.6581	.6614	.6647	.6681	.6714	.6748	.6781	.6814
7.3	.6636	.6670	.6705	.6739	.6773	.6808	.6842	.6876
7.4	.6691	.6726	.6762	.6797	.6832	.6868	.6903	.6938
7.5	.6746	.6782	.6819	.6855	.6891	.6928	.6964	.7001
7.6	.6801	.6839	.6876	.6913	.6951	.6988	.7025	.7063
7.7	.6856	.6895	.6933	.6971	.7010	.7048	.7086	.7125
7.8	.6911	.6951	.6990	.7029	.7069	.7108	.7148	.7187
7.9	.6967	.7007	.7047	.7088	.7128	.7168	.7209	.7249
8.0	.7022	.7063	.7104	.7146	.7187	.7228	.7270	.7311
8.1	.7077	.7119	.7162	.7204	.7246	.7288	.7331	.7373
8.2	.7132	.7175	.7219	.7262	.7305	.7349	.7392	.7435
8.3	.7187	.7232	.7276	.7320	.7364	.7409	.7453	.7497
8.4	.7242	.7288	.7333	.7378	.7424	.7469	.7514	.7559
8.5	.7298	.7344	.7390	.7436	.7483	.7529	.7575	.7621
8.6	.7353	.7400	.7447	.7494	.7542	.7589	.7636	.7684
8.7	.7408	.7456	.7504	.7553	.7601	.7649	.7697	.7746
8.8	.7463	.7512	.7561	.7611	.7660	.7709	.7758	.7808
8.9	.7518	.7568	.7619	.7669	.7719	.7769	.7820	.7870
9.0	.7573	.7624	.7676	.7727	.7778	.7829	.7881	.7932

Table IV (Continued)

pH vs. emf of Hydrogen-Saturated Calomel Cell

pH	Volt 5° C	Volt 10° C	Volt 15° C	Volt 20° C	Volt 25° C	Volt 30° C	Volt 35° C	Volt 40° C
9.1	.7628	.7681	.7733	.7785	.7837	.7890	.7942	.7994
9.2	.7684	.7737	.7790	.7843	.7896	.7950	.8003	.8056
9.3	.7739	.7793	.7847	.7901	.7956	.8010	.8064	.8118
9.4	.7794	.7849	.7904	.7959	.8015	.8070	.8125	.8180
9.5	.7849	.7905	.7961	.8018	.8074	.8130	.8186	.8242
9.6	.7904	.7961	.8019	.8076	.8133	.8190	.8247	.8304
9.7	.7959	.8017	.8076	.8134	.8192	.8250	.8308	.8367
9.8	.8014	.8074	.8133	.8192	.8251	.8310	.8369	.8429
9.9	.8070	.8130	.8190	.8250	.8310	.8370	.8431	.8491
10.0	.8125	.8186	.8247	.8308	.8369	.8430	.8492	.8553
10.1	.8180	.8242	.8304	.8366	.8428	.8491	.8553	.8615
10.2	.8235	.8298	.8361	.8424	.8488	.8551	.8614	.8677
10.3	.8290	.8354	.8418	.8483	.8547	.8611	.8675	.8739
10.4	.8345	.8410	.8476	.8541	.8606	.8671	.8736	.8801
10.5	.8400	.8467	.8533	.8599	.8665	.8731	.8797	.8863
10.6	.8456	.8523	.8590	.8657	.8724	.8791	.8858	.8925
10.7	.8511	.8579	.8647	.8715	.8783	.8851	.8919	.8987
10.8	.8566	.8635	.8704	.8773	.8842	.8911	.8980	.9049
10.9	.8621	.8691	.8761	.8831	.8901	.8971	.9041	.9112
11.0	.8676	.8747	.8818	.8889	.8960	.9032	.9103	.9174
11.1	.8731	.8803	.8875	.8948	.9020	.9092	.9164	.9236
11.2	.8786	.8860	.8933	.9006	.9079	.9152	.9225	.9298
11.3	.8842	.8916	.8990	.9064	.9138	.9212	.9286	.9360
11.4	.8897	.8972	.9047	.9122	.9197	.9272	.9347	.9422
11.5	.8952	.9028	.9104	.9180	.9256	.9332	.9408	.9484
11.6	.9007	.9084	.9161	.9238	.9315	.9392	.9469	.9546
11.7	.9062	.9140	.9218	.9296	.9374	.9452	.9530	.9608
11.8	.9117	.9196	.9275	.9354	.9433	.9512	.9591	.9670
11.9	.9173	.9253	.9332	.9412	.9492	.9572	.9652	.9732
12.0	.9228	.9309	.9390	.9471	.9552	.9633	.9714	.9795
12.1	.9283	.9365	.9447	.9529	.9611	.9693	.9775	.9857
12.2	.9338	.9421	.9504	.9587	.9670	.9753	.9836	.9919
12.3	.9393	.9477	.9561	.9645	.9729	.9813	.9897	.9981
12.4	.9448	.9533	.9618	.9703	.9788	.9873	.9958	1.0043
12.5	.9503	.9589	.9675	.9761	.9847	.9933	1.0019	1.0105
12.6	.9559	.9645	.9732	.9819	.9906	.9993	1.0080	1.0167
12.7	.9614	.9702	.9790	.9877	.9965	1.0053	1.0141	1.0229
12.8	.9669	.9758	.9847	.9936	1.0024	1.0113	1.0202	1.0291
12.9	.9724	.9814	.9904	.9994	1.0084	1.0174	1.0263	1.0353
13.0	.9779	.9870	.9961	1.0052	1.0143	1.0234	1.0325	1.0415
13.1	.9834	.9926	1.0018	1.0110	1.0202	1.0294	1.0386	1.0477
13.2	.9889	.9982	1.0075	1.0168	1.0261	1.0354	1.0447	1.0540
13.3	.9945	1.0038	1.0132	1.0226	1.0320	1.0414	1.0508	1.0602
13.4	1.0000	1.0095	1.0189	1.0284	1.0379	1.0474	1.0569	1.0664
13.5	1.0055	1.0151	1.0247	1.0342	1.0438	1.0534	1.0630	1.0726
13.6	1.0110	1.0207	1.0304	1.0401	1.0497	1.0594	1.0691	1.0788
13.7	1.0165	1.0263	1.0361	1.0459	1.0557	1.0654	1.0752	1.0850
13.8	1.0220	1.0319	1.0418	1.0517	1.0616	1.0714	1.0813	1.0912
13.9	1.0275	1.0375	1.0475	1.0575	1.0675	1.0775	1.0874	1.0974
14.0	1.0331	1.0431	1.0532	1.0633	1.0734	1.0835	1.0935	1.1086

ELECTROMETRIC DETERMINATION OF pH

Use of Standard Buffer Solutions in the Determination of pH

The pH of several buffer solutions has been determined by Hitchcock and Taylor, and by MacInnes, Belcher and Shedlovsky. They used the concept of pH as expressed in Equaton *1*. The pH of each of these buffer solutions is given in Table V. Any one of these buffer solutions may be used in a hydrogen-saturated calomel cell as a source of hydrogen ions. The E_{cell} is measured at 25°C, or at 38°C. Knowing the pH of the buffer solution employed, one *calculates* E° by a rearrangement of Equation *1* to give $E^\circ = E_{\text{cell}} + E_b - (0.000198322\ T)\ (\text{pH})$ (2).

This calculated value of E° is then used in Equation *1* to obtain the pH of any other solution. The temperature of succeeding emf measurements must be at 25°C, or at 38°C if the calibration of E° with the standard buffer solution was made at 38°C. Since the pH of a buffer solution changes only slightly with temperature, E° may be determined at any temperature from about 20° to 40°C and that E° value used for pH measurements at the same temperature.

Example

The voltage, E_{cell}, of a H_2-satd. calomel cell at 25°C was found to be 0.5238 volt, with the hydrogen electrode immersed in a buffer solution which was 0.1 *M* in $HC_2H_3O_2$ and 0.1 *M* in $NaC_2H_3O_2$. The corrected barometer reading was 740 mm.

From Table V, the pH of the buffer solution is 4.64 at 25°C. Using Equation 2, $E^\circ = 0.5238 + 0.0009 - (0.05912)(4.64) = 0.2504$. When a solution of unknown pH was placed in the same cell at 25°C the emf was 0.6560 volt. Using

$$\text{Equation } 1\text{:}\quad \text{pH} = \frac{0.6560 + 0.0009 - 0.2504}{0.05912} = 6.88$$

Table V

pH of Standard Buffer Solutions

The salts or acids used must be of high purity. Dole, *loc. cit.*, p. 298, recommends the use of 0.05 *M* potassium acid phthalate as a standard. The primary-standard grade of potassium acid phthalate from the Bureau of Standards should be employed.

Moles per liter	pH at 25° C.	pH at 38° C.
0.1000 HCl	1.09	1.08
0.1000 $KH_3(C_2O_4)_2 \cdot 2H_2O$ (K acid tetroxalate)	1.48	1.50
0.0100 HCl + 0.0900 NaCl	2.06	. . .
0.0100 HCl + 0.0900 KCl	2.08	2.08
0.0300 $KHC_4H_4O_6$ (K acid tartrate)	3.57	. . .
0.1000 $KH_2C_6H_5O_7$ (K acid citrate)	3.72	. . .
0.0500 $KHC_8H_4O_4$ (K acid phthalate)	4.00	4.02
0.1000 $HC_2H_3O_2$ + 0.1000 $NaC_2H_3O_2$	4.64	4.66
0.0100 $HC_2H_3O_2$ + 0.0100 $NaC_2H_3O_2$	4.70	4.71
0. 025 KH_2PO_4 + 0.025 $Na_2HPO_4 \cdot 2H_2O$	6.86	6.84
0.05 $Na_2B_4O_7$	9.18	9.07

ELECTROMETRIC DETERMINATION OF pH

Accurate pH Measurements with Impure Calomel Electrodes

If the calomel electrode is not made with the purest of materials its E° will not be the same as the E° values used in the construction of Table IV. However, accurate pH measurements can be obtained if the approximate pH values read from Table IV are corrected by the use of Table VI. To make this correction one must first calculate the E° of a H_2-saturated calomel cell by measuring the emf of the cell when the hydrogen electrode is immersed in a buffer solution of known pH. The E° is then calculated from Equation 2. The ΔE of Table VI is the difference between the E° calculated from Equation 2, and the E° of Table VI, subtracted so as to give a positive number. The E° and the E°_{IV} values should be for the same temperature. Knowing ΔE for a particular temperature, one obtains the "pH correction" by the use of Table VI.

From the observed value of $(E_{cell}+E_b)$ when the hydrogen electrode is immersed in a solution of unknown pH, the approximate pH is obtained from Table IV. If E° is *greater* than E°_{IV}, the "pH correction" is subtracted from the approximate pH to give the accurate pH. If E° is *less* than the E°_{IV} the "pH correction is added. The pH correction will remain unchanged for all subsequent measurements made at the same temperature. It is desirable to redetermine the pH correction about once a day.

Example

Using the data of the previous example, $E^\circ=0.2504$ at 25°C. Then, $\Delta E=E^\circ-E^\circ_{IV}=0.2504-0.2458=0.0046$. From Table VI, the pH correction corresponding to $\Delta E=0.0046$ at 25°C is 0.08 pH. $(E_{cell}+E_b)=0.6560+0.0009=0.6569$ volt. From Table IV, the approximate pH is 6.95. Since E° is greater than E°_{IV}, the pH correction is subtracted. The correct pH $=6.95-0.08=6.87$.

Table VI

Any other pH correction may be calculated by use of the following equation:

$$\text{"pH Correction"}=\frac{\Delta E}{0.000198322\,T}$$

	ΔE				
pH Correction	15° C	20° C	25° C	30° C	35° C
.02	.0011	.0012	.0012	.0012	.0012
.04	.0023	.0023	.0024	.0024	.0024
.06	.0034	.0035	.0035	.0036	.0037
.08	.0047	.0047	.0047	.0048	.0049
.10	.0057	.0058	.0059	.0060	.0061
.12	.0068	.0070	.0071	.0072	.0073
.14	.0080	.0081	.0083	.0084	.0086
.16	.0091	.0093	.0095	.0096	.0098
.18	.0103	.0105	.0106	.0108	.0110
.20	.0114	.0116	.0118	.0120	.0122
.22	.0125	.0128	.0130	.0132	.0134
.24	.0137	.0140	.0142	.0144	.0147
.26	.0148	.0151	.0154	.0156	.0159
.28	.0160	.0163	.0166	.0168	.0171
.30	.0171	.0174	.0177	.0180	.0183
.32	.0183	.0186	.0189	.0192	.0196
.34	.0194	.0198	.0201	.0204	.0208
.36	.0206	.0209	.0213	.0216	.0220
.38	.0217	.0221	.0225	.0228	.0232
.40	.0229	.0233	.0236	.0240	.0244
E°_{IV}	.2534	.2496	.2458	.2420	.2382

ELECTROMETRIC DETERMINATION OF pH

Measurement of pH with the Quinhydrone Electrode

In the measurement of pH with the quinhydrone electrode a bright platinum or gold electrode is usually employed. It is immersed in a solution of known or unknown pH. The solution is saturated with quinhydrone, an equimolecular mixture of quinone and hydroquinone. A saturated calomel electrode usually forms the other pole of the cell. Below a pH of about 7.7 the quinhydrone electrode (Pt) is the positive electrode (reduction electrode), while the saturated calomel electrode forms the negative electrode (oxidation electrode). In this case the cell may be written:

$$^{(-)}Hg,\ Hg_2Cl_2(s),\ \textit{satd. KCl, soln. containing } H^+ \textit{ and quinhydrone } (Pt)^{(+)}$$

The quinhydrone single electrode reduction reaction is:

$$\tfrac{1}{2}C_6H_4O_2(\text{quinone}) + H^+ + e = \tfrac{1}{2}C_6H_4(OH)_2(\text{hydroquinone})$$

Substituting in Equation *2* of "*Single Electrode Potentials at 25°C*",

$$E_{\text{red., quin.}} = E^\circ_{\text{red., quin.}} - \frac{0.000198322\,T}{1}\log_{10}\frac{(C_6H_4(OH)_2)^{\frac{1}{2}}}{(C_6H_4O_2)^{\frac{1}{2}}(H^+)} \qquad (3)$$

Also,

$$E_{\text{cell}} = E^\circ_{\text{ox., cal.}} + E_{\text{red., quin.}} \qquad (4)$$

Substituting Equation *3* into Equation *4*, setting $\log_{10}\frac{1}{H^+} = \text{pH}$, cancelling the concentrations of hydroquinone and quinone in equation *3* since they are equal in quinhydrone, and using $E^\circ_{\text{ox., cal.}} = -E^\circ_{\text{red., cal.}}$, one obtains:

$$\text{pH} = \frac{E^\circ_{\text{red., quin.}} - E^\circ_{\text{red., cal.}} - E_{\text{cell}}}{0.000198322\,T} \qquad (5)$$

Equation 5 is valid only when the quinhydrone electrode is the positive electrode. If the quinhydrone electrode is the negative electrode, E_{cell} is *added* instead of being subtracted as in Equation 5. Values of $E^\circ_{\text{red., quin.}}$ at various temperatures are given in Table VII. Values for $E^\circ_{\text{red., cal.}}$ may be taken as those of E°_{IV} of Table VI, if a saturated calomel electrode is employed. Values of *0.000198322 T* are given in Table II.

Examples

(*a*) The emf of a quinhydrone-saturated calomel cell was 0.2070 volt at 30°C with the quinhydrone forming the positive electrode. Then from Equation 5:

$$\text{pH} = \frac{0.6955 - 0.2420 - 0.2070}{0.060111} = 4.10$$

(*b*) The emf of a quinhydrone-saturated calomel cell was 0.0466 volt at 20°C, with the quinhydrone forming the negative electrode. Then, using Equation 5 but adding E_{cell}:

$$\text{pH} = \frac{0.7029 - 0.2496 + 0.0466}{0.058128} = 8.60$$

Table VII

Standard Electrode Potential, E_{oq}, for the Quinhydrone Electrode

$E_{oq} = 0.7177 - 0.00074t°C$									
t°C.	E_{oq}	t°C.	E_{oq}	t°C.	E_{oq}	t°C.	E_{oq}	t°C.	E_{oq}
15	0.7066	19	0.7036	23	0.7007	27	0.6977	35	0.6918
16	.7059	20	.7029	24	.6999	28	0.6970	38	.6896
17	.7051	21	.7022	25	.6992	29	0.6952	40	.6881
18	.7044	22	.7014	26	.6985	30	0.6955		

Notes on the Quinhydrone Electrode

An electrode having an area of at least one square centimeter is desirable. If the platinum is sealed in glass with mercury for a connection, the seal is quite certain to crack sooner or later and the electrode then becomes unreliable. Platinum electrodes should be clean and free from stains, but need not be highly polished. Methods of cleaning platinum electrodes include (1) heating in fresh cleaning solution (sulfuric acid and potassium dichromate mixture), washing well with water and drying in air for twenty minutes; (2) boiling in nitric acid, then in 5 to 10% sodium acid sulfite, rinsing well with water and using at once. With a platinum electrode treated by method (2), very little quinhydrone is necessary, four drops of a saturated solution in acetone being sufficient for 50 milliliters of solution, for correct potentials in two minutes. Commercial quinhydrone is usually satisfactory. It should not be exposed to light or heated, as it decomposes with loss of quinone. The quinhydrone electrode cannot be used in the presence of active reducing or oxidizing agents, and it is also subject to protein and salt errors. Above pH 8.5 it becomes unreliable, both because hydroquinone has acid properties (K'_a is approximately 10^{-10}), and because it is appreciably oxidized by air in alkaline solutions.

A Direct-Reading Table for pH Measurements with the Quinhydrone Electrode

Table VIII gives pH values corresponding to observed emf values of quinhydrone-saturated calomel cells. It is based on Equation 5, using $E^{\circ}_{\text{red., quin.}}$ values from Table VII, and $E^{\circ}_{\text{red., cal.}}$ values as those of E°_{IV} at the bottom of Table VI. It is to be noted that the table is divided into two parts, depending upon whether the quinhydrone electrode is the positive or the negative pole of the cell.

Examples

(*a*) If the emf = 0.1992 at 25°C with the quinhydrone a positive electrode, then reading from Table VIII the pH is 4.3.

(*b*) If the emf = 0.0352 at 35°C with the quinhydrone a negative electrode, then reading from Table VIII the pH is 8.0.

ELECTROMETRIC DETERMINATION OF pH

*Table VIII

pH vs. emf of Quinhydrone-Saturated Calomel Cell

I. Quinhydrone electrode is the POSITIVE pole.

pH	Volt 5° C	Volt 10° C	Volt 15° C	Volt 20° C	Volt 25° C	Volt 30° C	Volt 35° C	Volt 40° C
0	0.4530	0.4531	0.4532	0.4533	0.4534	0.4535	0.4536	0.4537
.1	.4475	.4475	.4475	.4475	.4475	.4475	.4475	.4475
.2	.4420	.4419	.4418	.4417	.4416	.4415	.4414	.4413
.3	.4365	.4363	.4361	.4359	.4357	.4355	.4353	.4351
.4	.4309	.4306	.4303	.4300	.4298	.4295	.4292	.4289
.5	.4254	.4250	.4246	.4242	.4238	.4234	.4230	.4227
.6	.4199	.4194	.4189	.4184	.4179	.4174	.4169	.4164
.7	.4144	.4138	.4132	.4126	.4120	.4114	.4108	.4102
.8	.4089	.4082	.4075	.4068	.4061	.4054	.4047	.4040
.9	.4034	.4026	.4018	.4010	.4002	.3994	.3986	.3978
1.0	.3978	.3970	.3961	.3952	.3943	.3934	.3925	.3916
1.1	.3923	.3913	.3904	.3894	.3884	.3874	.3864	.3854
1.2	.3868	.3857	.3846	.3835	.3825	.3814	.3803	.3792
1.3	.3813	.3801	.3789	.3777	.3765	.3754	.3742	.3730
1.4	.3758	.3745	.3732	.3719	.3706	.3693	.3681	.3668
1.5	.3703	.3689	.3675	.3661	.3647	.3633	.3619	.3606
1.6	3648	.3633	.3618	.3603	.3588	.3573	.3558	.3543
1.7	.3592	.3577	.3561	.3545	.3529	.3513	.3497	.3481
1.8	.3537	.3520	.3504	.3487	.3470	.3453	.3436	.3419
1.9	.3482	.3464	.3446	.3429	.3411	.3393	.3375	.3357
2.0	.3427	.3408	.3389	.3370	.3352	.3333	.3314	.3295
2.1	.3372	.3352	.3332	.3312	.3292	.3273	.3253	.3233
2.2	.3317	.3296	.3275	.3254	.3233	.3213	.3192	.3171
2.3	.3261	.3240	.3218	.3196	.3174	.3152	.3131	.3109
2.4	.3206	.3184	.3161	.3138	.3115	.3092	.3070	.3047
2.5	.3151	.3127	.3104	.3080	.3056	.3032	.3008	.2985
2.6	.3096	.3071	.3046	.3022	.2997	.2972	.2947	.2923
2.7	.3041	.3015	.2989	.2964	.2938	.2912	.2886	.2860
2.8	.2986	.2959	.2932	.2905	.2879	.2852	.2825	.2798
2.9	.2931	.2903	.2875	.2847	.2820	.2792	.2764	.2736
3.0	.2875	.2847	.2818	.2789	.2760	.2732	.2703	.2674
3.1	.2820	.2791	.2761	.2731	.2701	.2672	.2642	.2612
3.2	.2765	.2734	.2704	.2673	.2642	.2611	.2581	.2550
3.3	.2710	.2678	.2647	.2615	.2583	.2551	.2520	.2488
3.4	.2655	.2622	.2589	.2557	.2524	.2491	.2459	.2426
3.5	.2600	.2566	.2532	.2499	.2465	.2431	.2397	.2364
3.6	.2544	.2510	.2475	.2440	.2406	.2371	.2336	.2302
3.7	.2489	.2454	.2418	.2382	.2347	.2311	.2275	.2240
3.8	.2434	.2398	.2361	.2324	.2287	.2251	.2214	.2177
3.9	.2379	.2341	.2304	.2266	.2228	.2191	.2153	.2115
4.0	.2324	.2285	.2247	.2208	.2169	.2131	.2092	.2053
4.1	.2269	.2229	.2189	.2150	.2110	.2070	.2031	.1991
4.2	.2214	.2173	.2132	.2092	.2051	.2010	.1970	.1929
4.3	.2158	.2117	.2075	.2034	.1992	.1950	.1909	.1867
4.4	.2103	.2061	.2018	.1975	.1933	.1890	.1847	.1805
4.5	.2048	.2005	.1961	.1917	.1874	.1830	.1786	.1743
4.6	.1993	.1948	.1904	.1859	.1815	.1770	.1725	.1681
4.7	.1938	.1892	.1847	.1801	.1755	.1710	.1664	.1619
4.8	.1883	.1836	.1789	.1743	.1696	.1650	.1603	.1556
4.9	.1828	.1780	.1732	.1685	.1637	.1590	.1542	.1494
5.0	.1772	.1724	.1675	.1627	.1578	.1529	.1481	.1432

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(Continued on following page)

Table VIII (Continued)

pH vs. emf of Quinhydrone-Saturated Calomel Cell

I. Quinhydrone electrode is the POSITIVE pole.

pH	Volt 5° C	Volt 10° C	Volt 15° C	Volt 20° C	Volt 25° C	Volt 30° C	Volt 35° C	Volt 40° C
5.1	.1717	.1668	.1618	.1568	.1519	.1469	.1420	.1370
5.2	.1662	.1611	.1561	.1510	.1460	.1409	.1359	.1308
5.3	.1607	.1555	.1504	.1452	.1401	.1349	.1298	.1246
5.4	.1552	.1499	.1447	.1394	.1342	.1289	.1236	.1184
5.5	.1497	.1443	.1390	.1336	.1282	.1229	.1175	.1122
5.6	.1441	.1387	.1332	.1278	.1223	.1169	.1114	.1060
5.7	.1386	.1331	.1275	.1220	.1164	.1109	.1053	.0998
5.8	.1331	.1275	.1218	.1162	.1105	.1049	.0992	.0936
5.9	.1276	.1218	.1161	.1103	.1046	.0988	.0931	.0873
6.0	.1221	.1162	.1104	.1045	.0987	.0928	.0870	.0811
6.1	.1166	.1106	.1047	.0987	.0928	.0868	.0809	.0749
6.2	.1111	.1050	.0990	.0929	.0869	.0808	.0748	.0687
6.3	.1055	.0994	.0932	.0871	.0809	.0748	.0687	.0625
6.4	.1000	.0938	.0875	.0813	.0750	.0688	.0625	.0563
6.5	.0945	.0882	.0818	.0755	.0691	.0628	.0564	.0501
6.6	.0890	.0825	.0761	.0697	.0632	.0568	.0503	.0439
6.7	.0835	.0769	.0704	.0638	.0573	.0508	.0442	.0377
6.8	.0780	.0713	.0647	.0580	.0514	.0447	.0381	.0315
6.9	.0724	.0657	.0590	.0522	.0455	.0387	.0320	.0253
7.0	.0669	.0601	.0532	.0464	.0396	.0327	.0259	.0190
7.1	.0614	.0545	.0475	.0406	.0337	.0267	.0198	.0128
7.2	.0559	.0489	.0418	.0348	.0277	.0207	.0137	.0066
7.3	.0504	.0432	.0361	.0290	.0218	.0147	.0076	.0004
7.4	.0449	.0376	.0304	.0232	.0159	.0087	.0014	
7.5	.0394	.0320	.0247	.0173	.0100	.0027		
7.6	.0338	.0264	.0190	.0115	.0041			
7.7	.0283	.0208	.0133	.0057				
7.8	.0228	.0152	.0075					
7.9	.0173	.0096	.0018					
8.0	.0118	.0039						
8.1	.0063							
8.2	.0007							

(*Continued on following page*)

Table VIII (Continued)

pH vs. emf of Quinhydrone-Saturated Calomel Cell

II. Quinhydrone electrode is the NEGATIVE pole.

pH	Volt 5° C	Volt 10° C	Volt 15° C	Volt 20° C	Volt 25° C	Volt 30° C	Volt 35° C	Volt 40° C
7.4	....	....	....	....	....	....	....	.0058
7.5	....	....	....	....	....	....	.0047	.0120
7.6	....	....	....	....	....	.0033	.0108	.0182
7.7	....	....	....	....	.0018	.0094	.0169	.0244
7.8	....	....	....	.0001	.0077	.0154	.0230	.0306
7.9	....	....	....	.0059	.0136	.0214	.0291	.0368
8.0	....	....	.0039	.0117	.0196	.0274	.0352	.0431
8.1	....	.0017	.0096	.0175	.0255	.0334	.0413	.0493
8.2	....	.0073	.0153	.0233	.0314	.0394	.0474	.0555
8.3	.0048	.0129	.0210	.0292	.0373	.0454	.0535	.0617
8.4	.0103	.0185	.0267	.0350	.0432	.0514	.0597	.0679
8.5	.0158	.0241	.0325	.0408	.0491	.0574	.0658	.0741
8.6	.0213	.0297	.0382	.0466	.0550	.0635	.0719	.0803
8.7	.0268	.0354	.0439	.0524	.0609	.0695	.0780	.0865
8.8	.0323	.0410	.0496	.0582	.0668	.0755	.0841	.0927
8.9	.0379	.0466	.0553	.0640	.0728	.0815	.0902	.0989
9.0	.0434	.0522	.0610	.0698	.0787	.0875	.0963	.1051
9.1	.0489	.0578	.0667	.0757	.0846	.0935	.1024	.1114
9.2	.0544	.0634	.0725	.0815	.0905	.0995	.1085	.1176
9.3	.0599	.0690	.0782	.0873	.0964	.1055	.1147	.1238
9.4	.0654	.0747	.0839	.0931	.1023	.1115	.1208	.1300
9.5	.0710	.0803	.0896	.0989	.1082	.1176	.1269	.1362
9.6	.0765	.0859	.0953	.1047	.1141	.1236	.1330	.1424
9.7	.0820	.0915	.1010	.1105	.1201	.1296	.1391	.1486
9.8	.0875	.0971	.1067	.1164	.1260	.1356	.1452	.1548
9.9	.0930	.1027	.1124	.1222	.1319	.1416	.1513	.1610
10.0	.0985	.1083	.1182	.1280	.1378	.1476	.1574	.1672
10.1	.1040	.1140	.1239	.1338	.1437	.1536	.1635	.1735
10.2	.1096	.1196	.1296	.1396	.1496	.1596	.1696	.1797
10.3	.1151	.1252	.1353	.1454	.1555	.1656	.1758	.1859
10.4	.1206	.1308	.1410	.1512	.1614	.1717	.1819	.1921
10.5	.1261	.1364	.1467	.1570	.1674	.1777	.1880	.1983
10.6	.1316	.1420	.1524	.1629	.1733	.1837	.1941	.2045
10.7	.1371	.1476	.1582	.1687	.1792	.1897	.2002	.2107
10.8	.1427	.1533	.1639	.1745	.1851	.1957	.2063	.2169
10.9	.1482	.1589	.1696	.1803	.1910	.2017	.2124	.2231
11.0	.1537	.1645	.1753	.1861	.1969	.2077	.2185	.2293
11.1	.1592	.1701	.1810	.1919	.2028	.2137	.2246	.2356
11.2	.1647	.1757	.1867	.1977	.2087	.2197	.2308	.2418
11.3	.1702	.1813	.1924	.2035	.2146	.2258	.2369	.2480
11.4	.1757	.1870	.1982	.2094	.2206	.2318	.2430	.2542
11.5	.1813	.1926	.2039	.2152	.2265	.2378	.2491	.2604

Alternate Method for Determination of pH from the emf of a Quinhydrone-Saturated Calomel Cell

In the range 18° to 30°C, the expression ($E^\circ_{\text{red., quin.}} - E^\circ_{\text{red., cal.}}$) is practically constant and may be designated as "A". Thus, if the cell temperature is between 18° and 30°C, one may simplify Equation *5* to give:

$$\text{pH} = \frac{A - E_{\text{cell}}}{0.000198322\ T} \quad \text{(quinhydrone electrode positive)} \qquad (6)$$

$$A = E_{\text{cell}} + (0.000198322\ T)(\text{pH}) \quad \text{(quinhydrone electrode positive)} \qquad (7)$$

$$\text{pH} = \frac{A + E_{\text{cell}}}{0.000198322\ T} \quad \text{(quinhydrone electrode negative)} \qquad (8)$$

Between 18° and 30°C the average value of A is 0.4534.

If one determines E_{cell} of a quinhydrone-saturated calomel cell containing one of the standard buffer solutions of Table V, of pH *lower* than 7, then a value for A can be calculated by using Equation *7* above. This calculated value of A can be used subsequently in Equations *6* or *8* to obtain accurate pH values.

Another method is to find the approximate pH from E_{cell} by reference to Table VIII. Then find the difference between A (as calculated by use of Equation *7*) and 0.4534, subtracting the two numbers so as to obtain a positive number. This difference may be designated as ΔA. This ΔA is used in Table VI instead of ΔE to find the "pH correction". This pH correction must be *added* to the pH read from Table VIII if the calculated value of A is *greater* than 0.4534. If the calculated value of A is *less* than 0.4534, the pH correction must be *subtracted* from the pH as read from Table VIII.

Example of Use of Tables VI and VIII

Using a 0.05 M potassium acid phthalate buffer solution (pH = 4.00, see Table V) and with the quinhydrone electrode as the positive electrode, the emf of a quinhydrone-saturated calomel cell was found to be 0.2369 volt at 25°C. From Equation *7*.

$$A = 0.2369 + (0.05912)(4.00) = 0.4734$$

With a solution of unknown pH in the same cell at 25°C and with the quinhydrone electrode the negative electrode, the emf was 0.0255 volt. Using Equation *8*,

$$\text{pH} = \frac{0.4734 + 0.0255}{0.05912} = 8.44$$

From Table VIII, the pH corresponding to 0.0255 volt is 8.10 (quinhydrone, negative), and $\Delta A = 0.4734 - 0.4534 = 0.0200$. From Table VI, for ΔA (or ΔE) equal to 0.0200 at 25°C, the pH correction is 0.34. Since the calculated value of "A" is greater than 0.4534, the pH correction is added. Thus,

$$\text{pH} = 8.10 + 0.34 = 8.44$$

ELECTROMETRIC DETERMINATION OF pH

Measurement of pH with the Glass Electrode

A typical cell for pH measurements with a "glass electrode" is:

$$\underset{a}{Ag, AgCl(s),}\ 0.1\ N\ HCl \underset{b}{|}\ glass\ \underset{c}{|}\ test\ sample\underset{d}{,}\ satd.\ KCl,\ \underset{e}{Hg_2Cl_2(s)},\ Hg$$

The emf of the cell is the sum of the potentials developed at *a*, *b*, *c*, *d*, and *e*, plus a small "asymmetry potential" in the glass electrode. If the 0.1 *N* HCl in contact with the silver-silver chloride electrode is never changed, potentials *a* and *b* will remain constant. Potential *e* is constant also and the liquid junction potential, *d*, is small and nearly constant if the liquid junction is made properly. Therefore E_{cell} is a function of the potential "*c*" between the glass and the test sample providing there is no change in the "asymmetry potential" of the glass electrode. If Corning 015 glass is used in the construction of the glass electrode, potential "*c*" is a function of the pH of the test sample. The equation relating E_{cell} and the pH is:

$$\text{pH} = \frac{E_{cell} - B}{0.000198322\ T} \tag{9}$$

Values of 0.000198322 *T* are given in Table II. To determine "*B*" of Equation *9*, E_{cell} must be determined at a particular temperature using as test sample one of the standard buffer solutions of known pH listed in Table V. Succeeding measurements of E_{cell} with solutions of unknown pH as test samples should be made at the same temperature as that used in the determination of "*B*". The value of "*B*" should be determined at least once daily to correct for small changes in "asymmetry potential", and small changes in other potentials besides "*c*" which may have occurred. If the cell shown above is used, "*B*" is approximately −0.108 at 25°C. For complete information concerning the glass electrode and its applications, see Malcolm Dole, *loc. cit.* In practice glass electrodes have been found satisfactory in sensitivity and speed in reaching equilibrium and to remain stable for considerable lengths of time. It is possible to operate with very small volumes of sample solution, and the glass electrode appears to function solely as a pH indicator, without complication from oxidation-reduction potentials shown by metal electrodes.

Sodium, Lithium and Potassium Errors—Sodium, lithium and potassium salts in solution will cause appreciable errors in the alkaline pH range. These errors are small below 9 pH and 25° C., but increase appreciably above 25° C. and cause the emf reading to be too low. Potassium errors are less than 0.005 volt up to 11 pH and 25° C. Lithium and sodium errors may be much greater. It is not recommended that a glass electrode be used for absolute pH measurements above 9 pH and 25° C. in solutions containing appreciable amounts of the above named salts. If measurements of such solutions must be made, it is necessary to calibrate the glass electrode with some suitable secondary electrode, in the solution in question, at the same temperature and pH as subsequent measurement are to be made. A hydrogen gas electrode may be used as a secondary electrode for many solutions, but must not be used in oxidizing or reducing solutions.

If a suitable secondary electrode can be found and the proper correction once established for a specific solution, temperature, and pH, then subsequent glass electrode measurements may be corrected by adding the voltage correction to the observed E_{cell} to give a corrected E_{cell} which is used in Equation *9*.

ELECTROMETRIC DETERMINATION OF HYDROGEN ION CONCENTRATION

MEASUREMENT OF pH WITH THE ANTIMONY ELECTRODE

The relationships involved in the metal oxide system may be expressed by the following equations:

$$Sb+3H_2O=Sb(OH)_3+3H^++3e^-$$

$$E=E_o-\frac{RT}{3F}\ln\frac{(Sb(OH)_3)(H^+)^3}{(H_2O)^3}$$

The E.M.F. relationships can be expressed in another equation:

$$E=E_o-\frac{RT}{F}\log K_w+\frac{RT}{nF}\log K_s+\frac{RT}{F}\log(H^+)$$

where K_w is the ionization constant of water and K_s is the solubility product of the sparingly soluble metal compound. For the equation to reduce to the form

$$E=constant+\frac{RT}{F}\log(H^+)$$

it is necessary that the activity of the water remain constant and the solution remain saturated with the oxide. For an industrial electrode of moderate accuracy when used in aqueous solutions in contact with air, there is evidence that enough oxide is formed according to the equation $4Sb+3O_2+xH_2O=2Sb_2O_3\cdot xH_2O$, so that further addition of the metal oxide to the aqueous solution is unnecessary.

For an antimony-saturated calomel electrode system used in air-saturated, agitated buffer solutions at 25°C., the following equations apply:

From 3 to 7 pH: $E=-0.008+0.059pH$
From 7 to 11pH: $E=0.050+0.051pH$

When involved in low salt concentrations, as in water treatment applications at 25°C., the following equations apply:

From 3 to 6 pH: $E=-0.024+0.056pH$
From 6 to 8 pH: *A non-linear relationship*
From 8 to 11pH: $E=-0.071+0.060pH$

The temperature coefficient of the antimony-saturated calomel electrode system varies with the pH value of the buffer and is of the order of 0.00115 volt per 1°C. at 3 pH, 0.00210 volt per 1°C. at 7 pH, and 0.00344 volt per 1°C. at 12 pH.

Reproducible pH measurements may be made in ordinary solutions to ± 0.15 pH over the pH range of 3 to 11. The electrode is rugged and, since the electrode system is of low resistance, the problem of electrical leakage and pick-up is minimized.

NOTES ON THE ANTIMONY ELECTRODE

Impurities in the metal electrode tend to decrease the stability of the electrode system especially in the acid range. The presence of small amounts of copper is particularly harmful. Antimony of sufficient purity can be obtained by electrol
a solution composed of antimony oxide dissolved in hydrofluoric acid.

The E.M.F. -pH relationships of the antimony electrode are influenc
the nature of the electrode surface; (2) concentration of dissolved air or
agitation at the electrode surface; (4) nature and concentration of dissol
(5) temperature of the system. and alcohol.

The E.M.F. of the electrode system gradually drifts until the surf ement of *pH*
trode has become etched. Continuous exposure to aqueous solution should be ap-
results in a deeply etched surface with the possibility of occluding medium

ELECTROMETRIC DETERMINATION OF HYDROGEN ION CONCENTRATION

The tendency towards instability in the acid range when the concentration of dissolved oxygen is low, and the failure of the electrode to follow the Nernst equation in the alkaline range when dissolved oxygen is present, is characteristic of the antimony electrode. The extent of the influence of agitation depends upon the pH, the temperature, the nature of the solution, and the concentration of the dissolved oxygen and is more critical in a solution of low salt content.

Dilute solutions of hydrogen peroxide, potassium permanganate, and sodium chromate result in low pH values. Good results have been reported with dilute solutions of sodium sulfide and sulfite. Traces of copper in acid solution cause large deviations and for reliable results the copper content should be below 0.1 part per million. The presence of metals less electropositive than antimony cause a similar behavior. As yet, no systematic study of the possible salt errors of the antimony electrode has been published but there are indications that these errors may be serious with concentrations above one molar.

Cf. Perley, *Ind. Eng. Chem., Anal. Ed. 11, 316–23 (1939).*

COMPOSITION AND *pH* OF MacILVAINE'S BUFFER MIXTURES

Cf. T. C. MacIlvaine, *J. Biol. Chem., 49, 183 (1921)*;
C. J. Schollenberger, *The Chemist-Analyst, 19 No. 3, 8 (1930)*.

Stock solution A, 0.2*M* disodium phosphate: Dissolve 145 g. C. P. clear crystals in 2 liters CO_2-free water. Titrate 10 ml. with 0.1 *N* HCl and a drop of methyl orange indicator to match the tint shown by 30 ml. of a solution containing 2.28 g. C. P. KH_2PO_4 and 1.00 g. C. P. NaCl in 250 ml. H_2O. Adjust solution **A** to require 20.00 ml. 0.1 *N* HCl in a repeating titration.

Stock solution B, 0.1*M* citric acid: Dissolve 45 g. C. P. clear crystals and dilute to 2 liters. Titrate 10 ml. with 0.1 *N* NaOH (carbonate-free) and phenolphthalein indicator, and adjust solution **B** to require 30.00 ml. in a repeating titration. To preserve solutions **A** and **B**, about 0.1% of toluene may be added.

To prepare the buffer mixtures, measure into a test tube the required volume of solution **A** for the desired *pH*, as shown in the table below, and add sufficient solution **B** to make the total volume exactly 10.00 ml.

pH	ml. A	*pH*	ml. A	*pH*	ml. A	*pH*	ml. A	*pH*	ml. A
2.2	0.20	3.4	2.85	4.6	4.67	5.8	6.05	7.0	8.24
2.4	0.62	3.6	3.22	4.8	4.93	6.0	6.32	7.2	8.70
2.6	1.09	3.8	3.55	5.0	5.15	6.2	6.61	7.4	9.09
2.8	1.58	4.0	3.85	5.2	5.36	6.4	6.92	7.6	9.37
3.0	2.05	4.2	4.14	5.4	5.57	6.6	7.27	7.8	9.58
3.2	2.47	4.4	4.41	5.6	5.80	6.8	7.72	8.0	9.73

esta
electro
observed

ACID—BASE INDICATORS

An acid-base indicator is a weak acid or a weak base, the undissociated form of which has another color and constitution than the iogenic form. An indicator does not change its color from the purely acid to the purely alkaline side at a definite hydrogen concentration, but the color change takes place over a certain range of hydrogen ion concentrations. This range is called the color change interval and is expressed in the term of *pH* (the negative logarithm of the hydrogen ion concentration). A great number of substances show indicator properties although relatively few of them are practically applied for neutralization reactions and *pH* determinations.

COLOR CHANGE AND pH INTERVAL OF THE MOST IMPORTANT INDICATORS

(See also Indicator Chart which follows)

Scientific Name	Trade Name	Solvent	Color		*pH* Interval
			Acid	Basic	
Sodium salt of diphenylaminoazo-*p*-benzenesulfonic acid	Tropeolin 00	Water	Red	Yellow	1.3–3.0
Thymolsulfonphthalein	Thymol blue	Water (+NaOH)	Red	Yellow	1.2–2.8
p-Dimethylaminoazobenzene	Methyl yellow	90% alcohol	Red	Yellow	2.9–4.0
Sodium salt of *p*-dimethylaminoazobenzene-sulfonic acid	Methyl orange	Water	Red	Orange-yellow	3.1–4.4
Tetrabromophenoltetrabromosulfonphthalein	Tetrabromophenol blue	Water (+NaOH)	Yellow	Blue	3.0–4.6
Tetrabromophenolsulfonphthalein	Bromophenol blue	Water (+NaOH)	Yellow	Blue-violet	3.0–4.6
Tetrabromo-*m*-cresolsulfonphthalein	Bromocresol-green	Water (+NaOH)	Yellow	Blue	3.8–5.4
Dimethylaminoazobenzene-*o*-carboxylic acid	Methyl red	Water (+NaOH)	Red	Yellow	4.4–6.2
Dichlorophenolsulfonphthalein	Chlorophenol red	Water (+NaOH)	Yellow	Red	4.8–6.4
Dibromophenolsulfonphthalein	Bromophenol red	Water (+NaOH)	Yellow	Red	5.4–7.0
Dibromothymolsulfonphthalein	Bromothymol blue	Water (+NaOH)	Yellow	Blue	6.0–7.6
Phenolsulfonphthalein	Phenol red	Water (+NaOH)	Yellow	Red	6.4–8.0
Dimethyldiaminophenazinechloride	Neutral red	90% alcohol	Red	Yellow-orange	6.8–8.0
m-Cresolsulfonphthalein	*m*-Cresol purple	Water (+NaOH)	Yellow	Purple	7.4–9.0
Thymolsulfonphthalein	Thymol blue	Water (+NaOH)	Yellow	Blue	8.0–9.6
Phenolphthalein	....	90% alcohol	Colorless	Red	8.0–9.8
Thymolphthalein	....	90% alcohol	Yellow	Blue	9.3–10.5
Sodium salt of *p*-nitranilineazosalicylic acid	Alizarine yellow	Water	Yellow	Red	10.1–12.0

It should be emphasized that the intervals as given above hold for aqueous solutions. The characteristics of indicators vary with different solvents; e. g., in mixtures of water and alcohol. Therefore, in the measurement of *pH* in tinctures, a correction should be applied for the effect of the medium

ACID—BASE INDICATORS

Preparation and Properties of Indicator Solutions.—A useful concentration of the indicator in the solution is of the order of 0.05 to 0.1%. Ordinarily the addition of 0.1 to 0.2 cc. of such an indicator solution to 10 cc. of the liquid to be investigated will give satisfactory results. Five of the indicators listed above (tropeolin 00, methyl yellow, methyl orange, methyl red, and neutral red) behave like weak bases, whereas the others behave like weak acids. The sulfonphthaleins originally introduced by Clark and Lubs (1917) and later extended by others (especially Barnett Cohen), are all indicators with very sharp color changes from yellow to intense red, blue or purple. Bromophenol blue in its tranition interval shows a so-called "*dichroism*," the color of the indicator depending upon its concentration and the depth of the layer observed. It appears blue in a thin layer of the solution, and purple when viewed through a greater depth. In the colorimetric determination of *pH* this dichroism is very objectionable. Often the solution under examination contains substances which affect the light absorption of the indicator (alcohol, alkaloids; in alcoholic medium the color change is from yellow to blue); moreover, the indicator cannot be used in turbid solutions. When a layer of the liquid is viewed only a small amount of light from the bottom of the cell reaches the eye. Most of the light enters the cell through the side, is reflected by the particles and thus produces the effect of a thin layer of liquid with the accompanying blue color. A comparison of the color with that of the indicator in a clear buffer solution is scarcely possible, for a thin layer of fluid would have to be taken. Fortunately, Harden and Drake (*Jour. Am. Chem. Soc.*, 51, 562 (1929)) found that tetrabromophenol - tetrabromosulfonphthalein is a good substitute for bromophenol blue since it shows the same color change without the objectional dichroism.

As a rule, water can be used as a solvent for indicators, but methyl yellow and the phthaleins must be dissolved in 90% alcohol. The various sulfonphthaleins and methyl red must be neutralized with sodium hydroxide before they are soluble in water. The former behave as dibasic acids, the indicator properties being determined by the magnitude of the second ionization constant. For most purposes it is sufficient to neutralize the strong sulfonic group, except that in cases where the *pH* of practically unbuffered solutions have to be measured, then more attention must be paid to the proper preparation of the indicator solution. To prepare an indicator solution, 100 mg. of the indicator are rubbed in an agate mortar with the amount of 1/20*N* sodium hydroxide specified in the table below. After solution of the indicator has taken place, sufficient water is added to make the volume 100 cc. (0.1%) or 200 cc. (0.05%).

Indicator	Molecular Weight	cc. 1/20 *N* NaOH per 100 mg. of Indicator
Thymol blue	466	4.3
Tetrabromophenol blue	986	2.0
Bromophenol blue	669	3.0
Bromocresol green	698	2.9
Methyl red	269	7.4
Chlorophenol red	423	4.7
Bromothymol blue	624	3.2
Phenol red	354	5.7
m-Cresol purple	382	5.2

Colorimetric Determination of *pH* with Selected Buffer Mixtures.—The colorimetric determination of *pH* is based upon the principle that if an indicator be added to different solutions and it assumes the same transition shade, then such solutions are supposed to have the same *pH*. To the solutions, the *pH* of which is to be determined, a measured volume of a suitable indicator is added and the color compared with that of the same indicator in solutions of known *pH*. The method, therefore, is a comparison procedure the accuracy of which depends primarily upon the correctness of the standard reference solutions. The *pH* of the latter is determined by means of the hydrogen electrode. The standardization according to the potentiometric method is, therefore, the primary procedure upon which the colometric procedure rests. Such standard reference solutions are called "*buffer-mixtures.*" Buffer solutions of various compositions have been described in the literature (compare Clark, *The Determination of Hydrogen Ions*, Baltimore, Md., 1928; Kolthoff, *Indicators*, translated by Furman); the most popular set of buffers is that of Clark and Lubs which is given below.

Preparation of Buffer Solutions.—Purity of Materials.

Hydrochloric acid, 0.2 N and 0.1 N, ordinary C. P. grade prepared and standardized according to the usual volumetric procedure. (Cf. Section on Standard Solutions.)

Sodium hydroxide, 0.1 N, prepared carbonate free and standardized according to the usual volumetric procedure.

Potassium acid phthalate, $KHC_8H_4O_4$, $M = 204.2$. The C. P. product commercially available is of sufficient purity. It can be recrystallized from water and dried at 110-120°C. The purity of the material must be checked by a titration with standardized sodium hydroxide using phenolphthalein or thymol blue as an indicator. A 0.1 molar solution of the salt is prepared as a stock solution.

Monopotassium phosphate, KH_2PO_4, $M = 136.2$. The C. P. salt commercially available is recrystallized twice from water and dried at 110-120°C. A 0.1 molar solution of the salt is prepared as a stock solution.

Potassium chloride, KCl, $M = 74.6$, The C. P. product is recrystallized twice from water and is dried at 120°.

Boric acid, H_3BO_3, $M = 62.0$. The C. P. product is recrystallized from water and dried in the air. A 0.1 molar solution of boric acid in 0.1 molar potassium chloride is prepared as a stock solution.

COMPOSITION AND pH OF CLARK AND LUBS BUFFER MIXTURES AT 20°C.

Composition	*pH*
48.5 cc 0.2 N HCl + 25 cc 0.2 N KCl diluted to 100 cc	1.0
32.25 cc " " " " " "	1.2
20.75 cc " " " " " "	1.4
13.15 cc " " " " " "	1.6
8.3 cc " " " " " "	1.8
5.3 cc " " " " " "	2.0
3.35 cc " " " " " "	2.2
46.70 cc 0.1 N HCl + 50 cc 0.1 M $KHC_8H_4O_4$ diluted to 100 cc	2.2
39.60 cc " " " " " "	2.4
32.95 cc " " " " " "	2.6
26.42 cc " " " " " "	2.8
20.32 cc " " " " " "	3.0
14.70 cc " " " " " "	3.2
9.90 cc " " " " " "	3.4
5.97 cc " " " " " "	3.6
2.63 cc " " " " " "	3.8
0.40 cc 0.1 N NaOH + 50 cc 0.1 M $KHC_8H_4O_4$ diluted to 100 cc	4.0
3.70 cc " " " " " "	4.2
7.50 cc " " " " " "	4.4
12.15 cc " " " " " "	4.6
17.70 cc " " " " " "	4.8
23.85 cc " " " " " "	5.0
29.95 cc " " " " " "	5.2

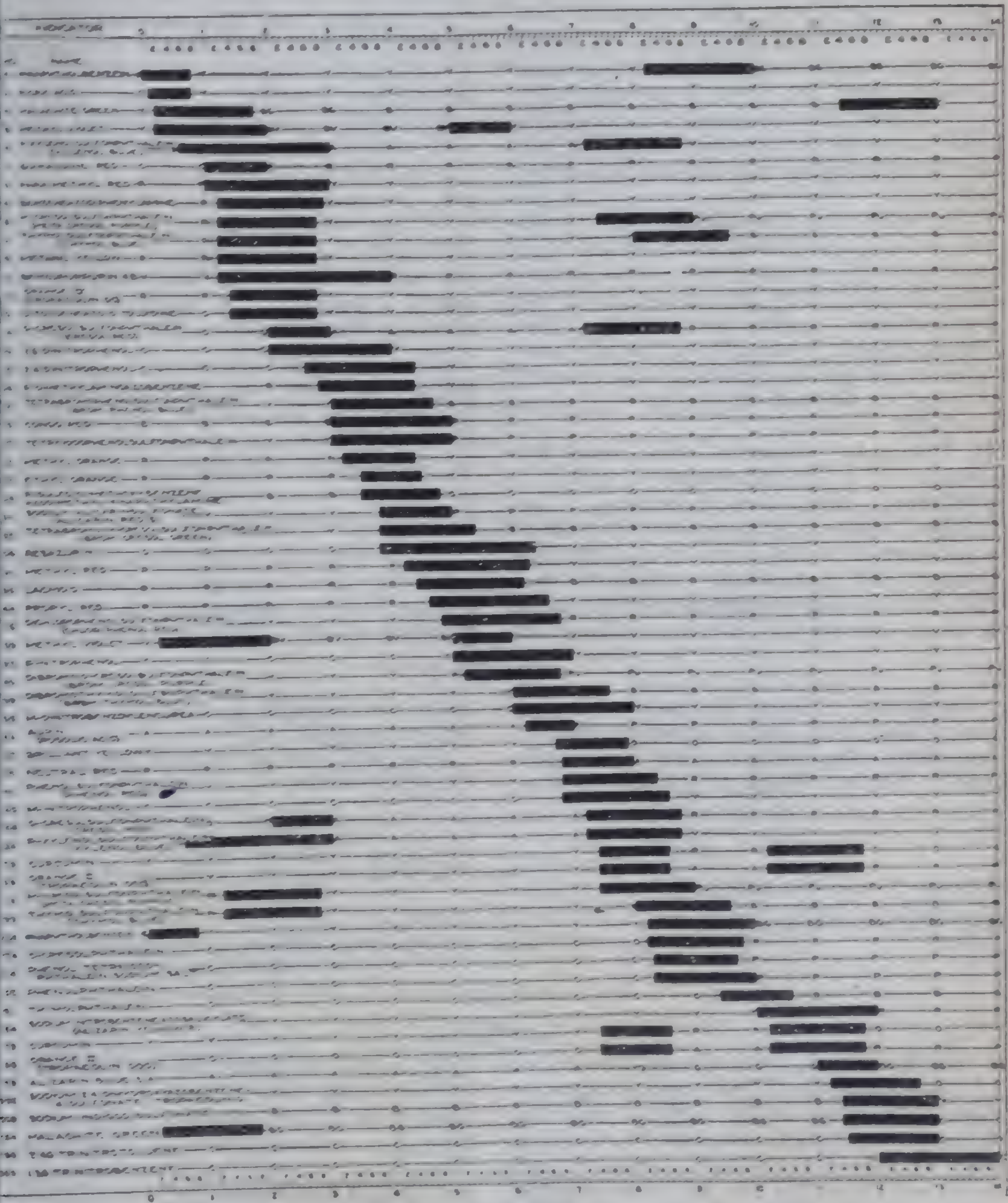
Composition	pH
35.45 cc 0.1 *N* NaOH + 50 cc 0.1 *M* $KHC_8H_4O_4$ diluted to 100 cc	5.4
39.85 cc " " " " " "	5.6
43.00 cc " " " " " "	5.8
45.45 cc " " " " " "	6.0
5.70 cc 0.1 *N* NaOH + 50 cc 0.1 *M* KH_2PO_4 diluted to 100 cc	6.0
8.60 cc " " " " " "	6.2
12.60 cc " " " " " "	6.4
17.80 cc " " " " " "	6.6
23.65 cc " " " " " "	6.8
29.63 cc " " " " " "	7.0
35.00 cc " " " " " "	7.2
39.50 cc " " " " " "	7.4
42.80 cc " " " " " "	7.6
45.20 cc " " " " " "	7.8
46.80 cc " " " " " "	8.0
2.61 cc 0.1 *N* NaOH + 50 cc 0.1 *M* H_3BO_3 diluted to 100 cc	7.8
3.97 cc " " " " " "	8.0
5.90 cc " " " " " "	8.2
8.50 cc " " " " " "	8.4
12.00 cc " " " " " "	8.6
16.30 cc " " " " " "	8.8
21.30 cc " " " " " "	9.0
26.70 cc " " " " " "	9.2
32.00 cc " " " " " "	9.4
36.85 cc " " " " " "	9.6
40.80 cc " " " " " "	9.8
43.90 cc " " " " " "	10.0

Measurement of pH.—If the approximate value of the *pH* of a solution is unknown, the order of its magnitude must first be approximated in order to select the correct indicator for a more accurate evaluation. As a rule, a few simple tests will supply this information. For example, if a solution remains colorless after the addition of a drop of phenolphthalein, it indicates that the *pH* of the solution is less than 8.0 (cf. table of indicators); if now a second test is made with methyl orange or bromophenol blue and the solution assumes the alkaline color of the indicator, it means that the *pH* is greater than 4.5. Therefore, such a solution has a *pH* value between 4.5 and 8.0. A few more tests with methyl red (*pH* interval 4.4 to 6.0); bromothymol blue (*pH* interval 6.0 to 7.2) and phenol red (*pH* interval 6.8 to 7.0) would serve to show the approximate *pH* value and suggest which indicators should be used for the exact determination. Instead of testing small amounts of the liquid with indicator solutions, indicator papers (litmus, congo, phenolphthalein, thymol blue, etc., papers) as a rule may be used by application of the spot method.

When the approximate value of *pH* is known, 3, 5, or 10 cc (depending upon the amount of liquid available) are measured out by means of a graduated cylinder and transferred into a test tube of pyrex glass or any other resistant glass. Soft glass should not be used because of the possibility of an alkaline reaction of the glass, the tubes should all be of the same inner size with a diameter of 1.5 cm and a length of 15 cm. A measured amount of the indicator solution is added carefully from a pipette of 1 cc volume which is graduated in 0.01 cc. As a rule, 0.1 to 0.2 cc of 0.05% indicator solution to 10 cc liquid will be the proper amount. Then some buffer solutions (4 to 5 cc) the *pH* of which overlaps that of the unknown are taken and treated in exactly the same way. Especially if one-color indicators are used, it is extremely important to add to the unknown and to the buffer solutions exactly the same amount of indicator. The best way of judging the color is to observe, against

ACID—BASE INDICATORS

white back-ground, the light trans-itted through the whole length of the be. A suitable colorimeter may be ed as well, although it is not necessary routine work. Enough reference lutions must be taken so that the lor of the unknown falls between two the series and not beyond them. If buffer solutions are used with *pH* differences of 0.2 respectively, the *pH* of the unknown can be approximated very easily to within 0.1, and with some practice to 0.05. With buffer solutions that differ by 0.1 *pH* unit or less, the *experimental* error can be reduced to 0.01 to 0.02 in *pH*.



INDICATOR CHART
Reprinted by permission of the Eastman Kodak Co.
The pH ranges shown are approximations and are intended to aid in selecting the proper indicator. he first column on the left gives the catalog number for ordering the indicator from the Eastman dak Co. The following abbreviations are used: A, amber; B, blue; C, colorless; BG, blue green; V, blue violet; G, green; O, orange; P, pink; Pu, purple; R, red; V, violet; Y, yellow.

AN OUTLINE FOR QUALITATIVE ANALYSIS

By R. C. Hummell, Ph. D.

Preparation of Solution for Metal Analysis

A. If the sample to be analyzed is already in solution, acidify with nitric acid unless it is already acid.

B. If the sample is solid and metallic in appearance indicating a metal or alloy, dissolve in dilute nitric acid. (A few metals and alloys dissolve better in hydrochloric acid.) If a white residue remains from the treatment with nitric acid filter it off and dissolve it in boiling concentrated hydrochloric acid and test this solution for tin and antimony only.

C. If solid and non-metallic try to dissolve the sample first with water (cold and boiling), then if a residue is left, filter it and next try dilute nitric and hydrochloric acids successively, then concentrated hydrochloric acid, then aqua regia and if a residue still remains it must be filtered off and treated as an insoluble material.

D. Insoluble Material. (Cf. note following D2.) If a platinum crucible is available, mix the powdered "Insoluble" with about ten times its bulk of a mixture of equal parts of sodium carbonate and potassium carbonate and then fuse in the platinum crucible using a blast burner or Meeker burner. If a platinum crucible is not available an iron crucible may be substituted in which case a piece of sodium hydroxide about twice the size of a pea is substituted for the potassium carbonate. Heat the crucible and its contents for five minutes after a clear fusion is obtained. Then pour the melt on to a small piece of sheet-iron to solidify. Digest this with water until entirely disintegrated. Filter and treat the residue as directed in D1 and the filtrate as in D2.

D1. Dissolve the residue in dilute nitric acid and test for metals as outlined.

D2. Add the filtrate from digestion of the fusion above to the solution prepared especially for acid analysis as given in the tests for acid radicals.

Note. If the "insoluble" is white, before fusion its solubility in ammonium hydroxide or ammonium acetate should be tested as it might be silver chloride or lead sulfate and the ammonium hydroxide and ammonium acetate are solvents respectively for these.

All of the solutions prepared according to the directions given above, except D2 are to be analyzed for metals as directed in the following outline.

GROUP I

Add cold dilute hydrochloric acid drop by drop until precipitation is complete. Precipitate: $PbCl_2$, $HgCl$, $AgCl$. Filter. Wash with cold water. Save the filtrate to test for the subsequent groups.

Precipitate. Boil with 10 cc of water. Filter while hot.

<table>
<tr>
<td rowspan="2">Filtrate—$PbCl_2$. Add $K_2Cr_2O_7$ or K_2CrO_4 solution. Yellow ppt.—$PbCrO_4$ indicates Pb.</td>
<td colspan="2">Precipitate—$HgCl$ and $AgCl$
Pour 5 cc NH_4OH over the precipitate.</td>
</tr>
<tr>
<td>Residue—If black indicates Hg.</td>
<td>Filtrate—Just acidify with HNO_3. White ppt. of $AgCl$ indicates Ag.</td>
</tr>
</table>

GROUP II

To the filtrate from Group I add 1 cc of concentrated HNO_3 and evaporate just to dryness being careful near the end of the evaporation not to overheat any of the dry residue. Dissolve this residue with 2½ cc of concentrated HCl and 5 cc of water. Heat to boiling and pass H_2S into the solution for 5 minutes Dilute to 40 cc and again pass in H_2S for 5 minutes. Filter 2 cc of this solution and dilute it to 5 cc and test with H_2S. If no precipitate forms then filter the main solution. If a precipitate does form, dilute the main solution to 100 cc and again pass in H_2S until precipitation is complete. Filter. Wash with hot water. Save the filtrate for subsequent groups.

AN OUTLINE FOR QUALITATIVE ANALYSIS

Precipitate: Sulfides of Hg, Pb, Bi, Cu, Cd, As, Sb, and Sn. To the precipitate add 15 cc of 2*N* NaOH, warm and stir. Filter. Wash with hot water.

Residue—Sulfides of Hg, Pb, Bi, Cu and Cd. Boil with 15 cc dilute HNO_3. Filter. Wash.

Residue—HgS. Dissolve in aqua regia. Boil out excess Cl_2. Add $SnCl_2$. A white or gray ppt. indicates Hg.

Filtrate—Make just alkaline with NaOH, then add 7 cc of 6**N** NaOH in excess. Warm and stir. Filter.

Filtrate—Na_2PbO_2. Acidify with acetic acid. Add K_2CrO_4. Yellow ppt. $PbCrO_4$. Indicates Pb.

Precipitate — Hydroxides of Bi, Cu, Cd. Dissolve in dilute HNO_3. Make strongly alkaline with NH_4OH. Filter.

Precipitate—$Bi(OH)_3$. Treat on filter with freshly prepared sodium stannite solution.* Immediate black coloration indicates Bi.

Filtrate— Ammoniated salts of Cu and Cd. If solution is deep blue Cu is present. If doubtful take a small portion and make acid with acetic acid, then add potassium ferrocyanide solution. Filter. A red ppt. on the white filter indicates Cu and is $Cu_2Fe(CN)_6$. If Cu is present add KCN to the main bulk of the filtrate until the solution is decolorized. Pass in H_2S. A yellow ppt. indicates Cd. If Cu is not present omit the addition of KCN.

Filtrate—Sodium thio-salts of As, Sb, Sn. Make just acid with acetic acid. Filter. Discard filtrate. Precipitate—Sulfides of As, Sb, Sn. Treat the well drained ppt. with 10 cc of hot conc. HCl. Stir thoroughly but do not boil. Dilute with 5 cc of water and filter.

Residue — Sulfides of As. Dissolve in NH_4OH adding a few drops of H_2O_2. Add magnesia mixture. A fine feathery ppt., slow in forming, indicates As and is $MgNH_4AsO_4$

Filtrate—Chlorides of Sb and Sn. Evaporate to a few cc. Place a few drops of this solution on a silver coin or platinum foil. Place a piece of tin so it touches the solution on the coin and the coin itself. A black coating on the coin indicates Sb. The main bulk of the solution is heated and some metallic iron added. After this reacts for a minute or so, decant off the clear solution and add to it $HgCl_2$. A white ppt. of HgCl or a gray ppt. of Hg indicates Sn.

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*Sodium stannite solution is prepared by adding sodium hydroxide solution to a few cc of stannous chloride solution until the white precipitate which is formed at first just dissolves.

GROUP III

Evaporate the filtrate from Group II to 10 cc. Test 1 cc for phosphates by adding to it 2 cc of conc. HNO_3 and 2 cc of ammonium molybdate reagent. Warm and allow to stand for at least 5 minutes. A fine yellow precipitate indicates phosphates. If phosphates are present remove them from the main solution as follows. First make the solution neutral with NH_4OH then add 3 cc of acetic acid and 5 cc of 50% ammonium acetate solution. Add to this sufficient $FeCl_3$ solution until no more precipitate forms and the solution becomes reddish in color. Dilute to 70 cc and boil until a condition is obtained where the precipitate on settling leaves the solution free from the reddish brown color. If necessary add more ammonium acetate to get this result. Filter.

Precipitate—Phosphates of Fe and possibly Al and Cr. Test for Al and Cr. Add 10 cc of dilute NaOH and 1 g Na_2O_2 to the ppt. Boil and then filter. Discard the ppt. Divide the filtrate into two parts.

First portion—Make acid with HCl, then alkaline with NH_4OH. White flocculent ppt. indicates Al.

Second portion—Make acid with acetic acid, then add lead acetate. Yellow ppt. indicates Cr.

Filtrate—Group III except possibly Fe, Al and Cr. Analyze according to procedure given for Group III with phosphates absent.

GROUP III

Phosphates Absent.

If phosphates are absent, or after removing them if present, add 1 g of NH_4Cl to the solution, then make it alkaline with NH_4OH and pass in H_2S to complete precipitation. Filter. Wash. Save filtrate for subsequent groups.

Precipitate—Sulfides of Co, Ni, Mn, Zn, Fe and the hydroxides of Al and Cr. Digest cold with 25 cc of 1 **N** HCl. Filter. Wash.

- Residue—CoS and NiS. Make a borax bead test on this residue. Blue bead indicates Co. Brown bead indicates Ni. Then dissolve residue in aqua regia and divide into two parts.
    - First portion—Add $NaHCO_3$ (solid) until effervescence ceases. Then add H_2O_2; development of deep green color indicates Co.
    - Second portion — Make alkaline with NH_4OH and add dimethylglyoxime. A red or scarlet ppt. indicates Ni.
- Filtrate—Chlorides of Fe, Mn, Al, Cr and Zn. Evaporate to about 5 cc. add 5 cc of 30% NaOH solution and 3 cc of H_2O_2 and boil. Filter. Wash.
    - Precipitate — Hydroxides of Fe and Mn. Make a Na_2CO_3 bead test on this ppt. for Mn using a little $KClO_3$ in the bead in the last part of the fusion. Bluish-green bead indicates Mn. Dissolve the remainder of the ppt. in HCl and add NH_4CNS solution. Blood red color indicates Fe. If iron was added to remove phosphates a little of the original sample can be tested for Fe by boiling with HCl and testing with NH_4CNS.
    - Filtrate—$NaAlO_2$, $NaCrO_4$, Na_2ZnO_2. Make acid with HCl, then just alkaline with NH_4OH. Filter.
        - Precipitate — $Al(OH)_3$. This ppt. should be white and flocculent. If in doubt remove the paper from the funnel, roll it up, drop 2 drops of dil. HCl down the top, then 2 drops of dil. $Co(NO_3)_2$ soln. Coil a wire around the rolled paper and burn to an ash. Blue ash indicates Al.
        - Filtrate—Make acid with acetic acid. Add 2 cc ammonium acetate solution, then 2 cc of $BaCl_2$ solution. Filter.
            - Precipitate — Yellow ppt. indicates Cr. If a white ppt. formed it is to be disregarded.
            - Filtrate—Pass in H_2S. A white or gray ppt. composed of fine curdy particles indicates Zn. A milky suspension but not curdy is due to sulfur.

GROUP IV

Make the filtrate from Group III acid with acetic acid and evaporate to 10 cc. Filter if necessary and discard the precipitate. To the filtrate or clear solution add NH_4OH until alkaline, then add 15 cc of 95% ethyl alcohol and 15 cc of ammonium carbonate solution. Filter. Wash. Save the filtrate for subsequent group.

Precipitate—Carbonates of Ba, Ca, Sr and Mg. Dissolve in acetic acid. Add 5 cc of ammonium acetate solution and about 10 cc of potassium dichromate solution. Filter.

- Precipitate—$BaCrO_4$. Moisten this ppt. with HCl and make a flame test with a platinum wire. Green flame indicates Ba.
- Filtrate — Acetates of Sr, Ca, Mg and excess $K_2Cr_2O_7$. Make alkaline with NH_4OH and add 5 cc of alcohol. Filter.
    - Precipitate—$SrCrO_4$ and possibly some $CaCrO_4$. Boil with $(NH_4)_2CO_3$ and $(NH_4)_2C_2O_4$. Filter. Discard filtrate. Treat residue with acetic acid. Filter.
        - Residue—CaC_2O_4
        - Filtrate — Add Na_2SO_4 solution. White ppt. indicates Sr.
    - Filtrate—Ca and Mg salts. Add $(NH_4)_2C_2O_4$ solution. Filter.
        - Precipitate — CaC_2O_4 and possibly some MgC_2O_4. Treat with dil. H_2SO_4. Filter. To the solution add 5 cc of alcohol. Ppt. indicates Ca.
        - Filtrate — Add Na_2HPO_4 solution. White ppt. indicates Mg.

GROUP V

Evaporate the filtrate from Group IV to dryness. Heat the dry residue just short of a red heat until all of the ammonium salts have been expelled. Cool. Moisten with HCl and make a flame test with a platinum wire. An intense yellow flame indicates Na. A pale violet flame indicates K. If flame is intense yellow view it through a small bottle containing a 10% solution of $KCr(SO_4)_2$ or several thicknesses of cobalt glass. A red flame as thus viewed indicates K. To test for NH_4^+—Take about 1 g of the original sample in a small beaker, add sodium hydroxide solution in excess, cover the beaker with a watch glass containing on the under side a moist piece of red litmus paper. Warm and observe the litmus paper. If it changes slowly and evenly from red to blue, NH_4^+ is present.

ACIDIC CONSTITUENTS

Detection of Groups of Acidic Constituents.

The following acid ions are provided for in this procedure: Chlorides, bromides, iodides, ferrocyanides, ferricyanides, thiocyanates, sulfates, sulfites, thiosulfates, chromates, fluorides, silicates, oxalates, tartrates, sulfides, carbonates, phosphates, borates, nitrates, nitrites, acetates, and permanganates.

Preliminary Examination. Detection of some acid radicals.—

1. Moisten with concentrated H_2SO_4 and observe results both cold and when heated.
   (a) Tartrates heated with H_2SO_4 turn brownish black and give odor of burnt sugar.
   (b) Carbonates give off colorless, odorless gas which will cloud a drop of lime water held over the reacting materials.
   (c) Some sulfides readily give off H_2S with H_2SO_4 and this can be detected by the odor or the darkening of a piece of paper moistened with $Pb(C_2H_3O_2)_2$.
   (d) Nitrites will give off brown fumes immediately.
   (e) Bromides will oxidize slowly with the formation of free bromine which can be recognized by the reddish brown color of the gas.
   (f) Iodides will liberate free iodine which is recognized by the purple color.
   (g) Sulfites will liberate SO_2 which is colorless but has the characteristic, sharp pungent odor of burning sulfur.
   (h) Oxalates, when heated with H_2SO_4, give off CO and CO_2. The CO can be ignited.
   (i) Thiosulfates liberate SO_2 and form a residue of sulfur.
   (j) Acetates heated with H_2SO_4 liberate acetic acid which is recognized by the odor of vinegar.
2. Moisten a gram of the solid in an evaporating dish (if Cu and Ba are absent) with conc. H_2SO_4, add a few drops of alcohol and ignite the alcohol. A green flame indicates borates. If Cu or Ba are present use a test tube fitted with a stopper and short constricted outlet tube instead of the evaporating dish. In either case heat to help expel the volatile ethyl borate which will burn in the alcohol vapor with a green flame.
3. Add cold dilute HCl solution. An immediate evolution of brown fumes indicates nitrites.
4. If the sample is yellow or deep purple in color heat with dilute alcohol.
   (a) If the yellow color is changed to green and the metal analysis shows Cr present then chromates are present.
   (b) If the purple color is discharged and manganese was found in the metal analysis this test indicates the presence of permanganates.
5. The test for phosphates was made at the beginning of the analysis for Group III and need not be repeated at this point.

Preparation of Special Solution for Detection of Acidic Groups.—Take about 2 g of the powdered sample and boil with 25 cc of a saturated solution of sodium carbonate for 15 minutes. If a fusion was made in the analysis for metals, add the water extract from D2, dilute to 40 cc and filter. Use this solution for the following acid tests. Take 20 cc of this "prepared solution," make acid with dilute acetic acid and then add 1 cc of the acid in excess, boil gently to expel CO_2 and any H_2S which might be present. Test the vapor for H_2S by holding a piece of paper moistened with lead acetate in the vapors evolved during the boiling. A dark coloration

AN OUTLINE FOR QUALITATIVE ANALYSIS

indicates sulfides. If a white gelatinous precipitate forms at this point test it for silicic acid by the microcosmic bead test as follows: Filter, ignite the residue in a crucible, make a bead of microcosmic salt, dip it in the residue and fuse. If undissolved particles float in the bead while melted, Si is indicated. Make the filtrate from the procedure above neutral or slightly alkaline. Add a mixture of $Ca(NO_3)_2 + Ba(NO_3)_2$ solution and filter. Precipitate see Group I. Filtrate see Group II.

Precipitate—Group I acids. Add 5 cc acetic acid, warm and stir. Filter. The filtrate contains $CaHPO_4$, $CaC_4H_4O_6$. This filtrate is discarded as these groups were tested for previously.
Residue—CaF_2, CaC_2O_4, $BaSO_4$, $BaCrO_4$. Treat with 5 cc dilute HCl. Filter.

Precipitate—CaF_2, $BaSO_4$. Divide into two parts.

First portion — Add conc. HCl and boil for a few minutes. Dilute White ppt. indicates SO_4''.

Second portion — Dry over a low flame. Mix with a little sand. Place in a test tube and moisten with conc. H_2SO_4. Hold a film of water in a glass loop just above the mixture and warm. A ppt. in the water film indicates fluorides.

Filtrate—If yellow, chromates are present. As confirming this recall whether the filtrate from Group I metals was yellow and then turned green when H_2S was passed in and a formation of colloidal sulfur formed. To test for oxalates take 2 cc of the prepared solution, boil with a small excess of acetic acid, filter, make alkaline with NH_4OH, add $Ca(NO_3)_2$, filter, treat with 5 cc acetic acid, filter, wash. Then treat with dilute H_2SO_4, warm and add dilute $KMnO_4$ solution. Color destroyed indicates C_2O_4''.

Filtrate—Sodium salts of Group II. Make exactly neutral with HNO_3. Add $Zn(NO_3)_2$ solution. Filter.

Precipitate—$Zn_3(FeC_6N_6)_2$ brownish yellow and $Zn_2Fe(CN)_6$ white. Divide into 2 parts.

First portion—Dissolve in NH_4OH. Brown coloration indicates $(FeC_6N_6)'''$.

Second portion—Dissolve in HCl and add $FeCl_3$ solution. Deep blue indicates $(FeC_6N_6)''''$.

Filtrate—Take out a few drops to test for CNS.

To the few drops add $FeCl_3$ soln. Blood red color that remains on heating indicates CNS.

To the remainder of the solution add HNO_3 until acid and then add $AgNO_3$ solution. Filter. Discard filtrate. Add "chloride reagent" (described below). **Filter.

Filtrate—Acidify with HNO_3. White ppt. indicates chlorides.

Precipitate—Place a small amount in a test tube. Add 2 cc CS_2 or CCl_4, then some chlorine water (see below)*. Shake vigorously. Purple color in CS_2 indicates iodine. Brown color in CS_2 indicates bromine. If purple at first, continue to add Cl water until the purple color is discharged. If the brown color presists both iodine and bromine are present.

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*Chlorine water for this test should be freshly prepared by adding one or two small crystals of $KClO_3$ to a few cc of dilute hydrochloric acid and then warming the solution.

**Chloride Reagent: Dissolve 1.7 grams of $AgNO_3$ and 25 grams of KNO_3 in an amount of water less than a liter, add 17cc of conc. NH_4OH, and dilute to a liter.

OTHER TESTS FOR ACIDIC CONSTITUENTS

Nitrates—If iodides, bromides, ferrocyanides, ferricyanides, chromates and nitrites are absent, take 2 cc of the "Prepared solution," make just acid with acetic acid, boil, filter if any precipitate forms, add 3 cc of ferrous sulfate solution, then tip the test tube to an angle of 45° and slowly pour a few cc of concentrated H_2SO_4 down the side of the tube. Bring the tube back to an upright position without stirring the contents. A brown ring forming at the junction of the two layers indicates NO_3'. If any of the acids which interfere with test and which are mentioned above are present they can be removed as follows: make 5 cc of the "prepared solution" as nearly neutral as possible (do not permit the solution to become acid) with acetic acid, boil with 5 cc $(NH_4)_2SO_4$ solution. This removes nitrites. Acidify the boiled solution with H_2SO_4 and add $AgSO_4$ solution which removes Br′, I′, $Fe(CN)_6'''$ and $Fe(CN)_6''''$. Filter. To the filtrate add Na_2SO_3 and allow to stand for a few minutes. This reduces the chromates. Boil to expell SO_2, then make alkaline with NH_4OH to precipitate Cr. Filter and test the filtrate as directed above for nitrates $(NO_3)'$.

Sulfides—Some sulfides are left in the residue from boiling the "prepared solution" with acetic acid and do not evolve H_2S in this step. If this residue is placed in a test tube with some sulfur-free zinc and heated with HCl the H_2S will be liberated and can be detected with lead acetate paper.

Phosphates — Arsenates, arsenites, chromates and permanganates are usually detected in the course of the metal analysis.

A few unusual interfering combinations may be met with which because of the nature of this treatise are not discussed.

FLAME TESTS

The substance is heated on a piece of charcoal with a blow-pipe, or held in the outer flame of a Bunsen burner on a loop of platinum wire.

Blue:— *Azure*, Pb, Se, $CuCl_2$ or other copper compounds that have been moistened with hydrochloric acid.
Light blue, As and some of its compounds.
Greenish blue, $CuBr_2$, Sb.

Green:— *Emerald green*, copper compounds other than the halides.
Blue-green, phosphates when moistened with H_2SO_4, B_2O_3.
Faint green, Sb and NH_4 compounds.

White:— *White-green*, Zn.

Red:— *Carmine*, Li compounds. Masked by Ba or Na.
Scarlet or *Crimson*, Sr compounds. Masked by Ba.
Yellow-red, Ca compounds. Masked by Ba.

Violet:— K compounds other than borates, phosphates and silicates. Masked by Na or Li.
Purple-red given by K in the presence of Na when viewed through a blue glass, the blue glass cutting out the yellow caused by Na. Rb and Cs are the same as K compounds.

Yellow:— Na compounds even in small traces. *Caution*—Most compounds contain traces of Na which will color the flame. The appearance of a yellow flame is not a test for Na unless it persists and is not perceptibly increased in intensity on the addition of about 1% of NaCl to the dry compound.

BEAD TESTS

A clear bead is made by fusing a little borax or microcosmic salt on a loop of platinum wire. This bead is touched to the dry unknown material and again held in the flame of a Bunsen burner. The outer part of the flame is the oxidizing flame, while the inner cone is the reducing flame. The abbreviations used below are h., hot; c., cold; *h. c.*, hot or cold; *s.*, saturated; *n. s.*, not saturated; and *sprs.*, supersaturated.

Color of the Bead	Borax Bead, $Na_2B_4O_7 \cdot 10H_2O$		Microcosmic Salt Bead, $NaNH_4HPO_4$	
	Oxidizing Flame	Reducing Flame	Oxidizing Flame	Reducing Flame
Colorless	*h.c.*: Al, Si, Sn, Bi, Cd, Mo, Pb, Sb, Ti, V, W. *n.s.*: Ag, Al, Ba, Ca, Mg, Sr.	Al, Si, Sn, alk. earths and earths. *h.*: Cu. *h.c.*: Ce, Mn.	Si (undissolved) Al, Ba, Ca, Mg, Sn, Sr. *n.s.*: Bi, Cd, Mo, Pb, Sb, Ti, Zn.	Si (undissolved) Ce, Mn, Sn. Al, Ba, Ca, Mg, Sr (*sprs.*, not clear)
Gray and Opaque	*sprs.*: Al, Si, Sn.	Ag, Bi, Cd, Ni, Pb, Sb, Zn. *s.*: Al, Si, Sn. *sprs.*: Cu.	*s.*: Al, Ba, Ca, Mg, Sn, Sr.	Ag, Bi, Cd, Ni, Pb, Sb, Zn.
Blue	*c.*: Cu. *h. c.*: Co.	*h. c.*: Co.	*c.*: Cu. *h.c.*: Co.	*c.*: W. *h. c.*: Co.
Green	*c.*: Cr, Cu. *h.*: Cu, Fe+ Co.	Cr. *h.c.*: U. *sprs.*: Fe. *c.*: Mo, V.	U. *c.*: Cr. *h.*: Cu, Mo, Fe+ (Co or Cu)	*c.*: Cr. *h.*: Mo, U.
Red	*c.*: Ni. *h.*: Ce, Fe.	*c.*: Cu.	*h.*, *s.*: Ce, Cr, Fe, Ni.	*c.*: Cu. *h.*: Ni, Ti+Fe.
Yellow or Brownish	*h.*, *n.s.*: Fe, U, V. *h.*, *sprs.*: Bi, Pb, Sb.	W. *h.*: Mo, Ti, V.	*c.*: Ni. *h.*, *s.*: Co, Fe, U.	*c.*: Ni. *h.*: Fe, Ti.
Violet	h.: Ni+Co. *h. c.*: Mn.	*c.*: Ti.	*h. c.*: Mn.	*c.*: Ti.

ORGANIC REAGENTS FOR INORGANIC ANALYSIS

Compiled by

WAYNE E. WHITE, ALUMINUM COMPANY OF AMERICA

with the assistance of

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Abbreviations used in the table: AcOH-acetic acid; addn.-addition; alc.-alcohol; alk.-alkaline; amm.-ammonia, ammonium, ammoniacal; aq.-aqueous; colmtc.-colorimetric; conc.-concentrated; concn.-concentration; contg.-containing; detc.-detection; detg.-determining; detn.-determination; dil.-dilute; estn.-estimation; g.-gram; gravmtc.-gravimetric; intfr.-interfere; mcg.-microgram; mg.-milligram; ml.-milliliter; ppm-parts per million; ppt.-precipitate; pptn.-precipitation; qual.-qualitative; quant.-quantitative; reagt.-reagent; recomm.-recommended; satd.-saturated; sepg.-separating; sepn.-separation; sl.-slight; soln.-solution; volmtc.-volumetric; xs.-excess.

References.—The references in some cases do not include a citation of the original publication because the aim has been to be utilitarian rather than historically complete in choice. The following standard works are frequently referred to under abbreviations as follows:

A. P. H. A.—Standard Methods of Water Analysis, Eighth Ed. 1936, published by American Public Health Association (New York City).

A. O. A. C.—Official and Tentative Methods of Analysis of the Association of Official Agricultural Chemists, Fifth Ed. 1940, published by The Association (Washington, D. C.)

C. A.—Chemical Abstracts.

Feigl—Qualitative Analysis by Spot Tests, by F. Feigl, translated by J. Matthews, Second English Ed. 1939, published by Nordemann (New York).

I. C.—Tables of Reagents for Inorganic Analysis, Report of International Committee, 1939, published by Akademische Verlagsgesellschaft (Leipzig).

Prodinger—Organic Reagents Used in Quantitative Inorganic Analysis, by W. Prodinger, translated by S. Holmes, 1940, published by Elsevier Publishing Co., Inc. (New York).

Snell—Colorimetric Methods of Analysis, by Snell and Snell, 1936, published by Van Nostrand (New York).

Yoe I and *Yoe II*—Photometric Chemical Analysis, by J. H. Yoe, Vol. I (1928), Vol. II (1929), published by Wiley (New York).

ACETATE

o-**NITROBENZALDEHYDE** is used in freshly prepd. satd. soln. in 2 *N* NaOH. Unknown is heated with $Ca(OH)_2$ or $CaCO_3$ to form acetone if acetate is present; the acetone is detected by a blue coloration (due to formation of indigo) on filter paper moistened with reagt. Specific. Recomm. (*I. C.*) *Feigl, p. 331.*

ALUMINUM

AURIN TRICARBOXYLIC ACID, AMM. SALT (ALUMINON), 0.1% aq. soln., forms a red lake with $Al(OH)_3$. Extensively used for detc. and colmtc. detn. (0.01–1.0 mg.). Optimum lake formation at pH 4.5 to 6.0; dil. HCl soln. buffered with amm. acetate, elevated temp. After cooling, satd. $(NH_4)_2CO_3$ added to raise pH to 7.1–7.3 which decolorizes xs. reagt. Detc. Al in baking powders, cf. *A. O. A. C., p. 190.* Colmtc. detn. Al in alloys, in tissue, and in water, cf. *Snell pp. 260–6.* Fe

(III) and Cr (III) give violet and red colors, resp., but these intfr. may be avoided by extraction of Al as aluminate. Much PO_4 intfr. For Al in foods cf. Cox et al., *Ind. Eng. Chem.* **24**, *403* (*1932*). For test paper, absorb soln. of 0.1% reagt. and 1.0% amm. acetate in filter paper, dry, add drop of acid test soln. After about one minute, expose to ammonia vapors to get rose pink of Al lake. W. E. Thrun, *J. Chem. Education* **14**, *281* (*1937*). Reagt. recomm. (*I. C.*)

SODIUM ALIZARIN SULFONATE (ALIZARIN S), 0.1 to 1.0% aq. soln., is used for detc. by spot and test tube methods, and also for colmtc. detn. In the latter case starch glycerite is useful to prevent pptn.; cf. Thrun, *Ind. Eng. Chem.*, (*Anal. Ed.*) **2**, *8–9* (*1930*). The reagt. is added to a sl. acid soln. which should contain between 0.005 and 0.05 mg. Al; after standing, the soln. is made more acid with AcOH to obtain a red coloration. Fe, Cu, Co, and Mn must be absent. For the spot test cf. *Feigl, pp. 115.* For the colmtc. detn. cf. *Snell, pp. 259–60; Yoe I, pp. 119–20.* An alc. soln. of **ALIZARIN** may be used in much the same way as the alizarin S; the former may be used for impregnating paper for Al tests; cf. *Feigl, p. 116.* Recomm. (*I. C.*).

ERIOCHROMCYANINE R, 0.1% aq. soln., when used in a soln. contg. AcOH at pH 4.6 to 5.6 gives a bluish-red color with Al; in the absence of Al, the color is orange. Fe, Mn, Mg, much PO_4 intfr. It may also be used for a spot test, cf. Eegriwe, *Z. anal. Chem.* **76**, *438–43* (*1929*), or for colmtc. estn., cf. *Snell, pp. 271–3.* Recomm. (*I. C.*).

8-HYDROXYQUINOLINE (OXINE), in dil. AcOH soln., may be used to separate Al quantitatively from Mg and Be by pptn. in acetic acid-acetate soln.; the ppt. may be dried at 110° C. and weighed for detn. of Al, or may be ignited and weighed as the oxide; when the ppt. is small the detn. is better made by titration with $KBrO_3$; cf. Berg. *Z. anal. Chem.* **70**, *341; ibid.* **71**, 171 (*1927*), *et al.* There are many references to the use of this reagt. in the detn. of Al and other metals; cf. *Hillebrand and Lundell, p. 114 ff.* and *C. A.* indexes. For the colmtc. detn. the Al hydroxyquinolate is pptd. and coupled with diazotized sulfanilic acid; cf. *Snell, p. 267.*

MORIN, satd. methyl alcohol soln. In a neutral or sl. acid soln., minute amounts of Al give a green fluorescence in ultraviolet light; cf. *Feigl, p. 113.* For adaptation to quant. method and discussion of intfrnces., cf. White and Lowe, *Ind. Eng. Chem.*, (*Anal. Ed.*) **12**, *229–31* (*1940*). Recomm. **QUERCETIN** used in manner similar to Morin said to be satisfactory, cf. *C. A.* **36**, *363* (*1942*).

UREA may be used in hot acid soln. which causes its slow hydrolysis and consequent pptn. of basic Al salts in presence of sulfate or succinic acid. Ppt. may then be ignited to oxide. Ppts. thus formed are easily filtered and free from contamination. Willard and Tang; *Ind. Eng. Chem.*, (*Anal. Ed.*) **9**, *357–63* (*1937*).

AMMONIUM

SILVER NITRATE, MANGANESE NITRATE and **BENZIDINE.** A soln. of $AgNO_3$ and $Mn(NO_3)_2$ made 0.1*M* in respect to each salt is neutralized to sl. ppt. with dil. NaOH. The soln. is then filtered and kept in dark bottle. Additional hydroxyl as from NH_3 collected on filter paper moistened with this soln. gives black or gray spot which may be intensified by formn. of blue coloration on addn. of benzidine soln. in AcOH. This test may be highly sensitive. *Feigl, p. 154.* Recomm. (*I. C.*).

SILVER NITRATE AND FORMALIN reagt. is prepared by mixing 10 ml. of 20% silver nitrate soln. with 5 drops of 40% formalin and a few drops of dil. NaOH soln., filtering off any ppt. which may form. The filtrate is immediately absorbed upon strips of filter paper. Ammonia vapor causes the treated filter paper to turn gray or black; the test paper is compared with a blank left exposed to air. **TANNIC ACID** may be substituted for the formalin. A test is obtainable with as little as 0.0001 mg. NH_3; cf. *Feigl, p. 154.* The color may be produced in soln. and used for estn. of NH_3; cf. *Snell, p. 659*; cf. also K. G. Makris, *Z. anal. Chem.* **81**, *212–4* (*1930*); *ibid.* **84**, *241–2* (*1931*). The $AgNO_3$—HCHO reagt. recomm. (*I. C.*).

ORGANIC REAGENTS FOR INORGANIC ANALYSIS

p-**NITROBENZENEDIAZONIUM CHLORIDE (RIEGLER'S REAGENT)** is prepared by diazotization of *p*-**NITRANILINE.** The test may be made on a spot plate by using a drop of neutral or sl. acid unknown soln., adding a drop of reagt. and a little piece of solid CaO. In the presence of as much as 0.0007 mg. NH_3 a red zone is produced around the CaO; cf. *Feigl, p. 152.* Recomm. (*I. C.*).

HEMATOXYLIN, in alc. soln. for impregnating paper. NH_3 gives a red to bluish-red color; cf. G. Gutzeit, *Helv. Chim. Acta* **12,** *730* (*1929*).

PHENOL AND SODIUM HYPOCHLORITE, 4% aq. soln. of the former and 5% aq. soln. of the latter. A blue color results when the two reagts. are mixed and warmed in the presence of as little as 0.0001 mg. of ammonia as the salt. The color may be used for estimating the amount of ammonium. The accuracy of the detn. is less than with the Nessler reagt. but the method requires only 4 minutes; Ca does not intfr.; xs. free acid must be neutralized; cf. *Snell, p. 658.* **CHLORAMINE T** may be used instead of NaOCl as a source of Cl; to 2 ml. of sample add 1 ml. of phenol soln. (25 g. phenol in 50 ml. 40% NaOH and dild. to 100 ml.) and 3 ml. 5% Chloramine T. Ammonia free water must be used. After heating mixture for 10 min. the blue color is compared to standards, cf. Crismer, *Bull. soc. chim. biol.* **19,** *1000–9* (*1937*); *C. A.* **31,** *7796* (*1937*).

THYMOL, 25% soln. in alcohol. To 5 ml. of the test soln. are added 1 ml. of the reagt. with mixing, then 12 ml. of bromine water and 6 ml. of 2*N* NaOH. After 2 or 3 minutes, xylene is added, the mixture shaken and color observed in the xylene layer; cf. Lapin and Hein, *Z. anal. Chem.* **98,** *236–40* (*1934*). For colmtc. detn. of NH_3, cf. Hansen and Nielsen, *J. Biol. Chem.* **131,** *309* (*1939*).

ANTIMONY

RHODAMINE B, 0.01% aq. soln., is suitable as a spot or test tube test to detect Sb in the presence of Sn. The Sb is oxidized to pentavalent form by the addn. of KNO_2 to the acidified soln. and, on the addn. of a few drops of reagt., the soln. color changes from bright red to violet. Bi, Hg, and tungstate give similar coloration; cf. Eegriwe, *Z. anal. Chem.* **70,** *400–3* (*1927*); *Feigl, p. 56.* For colmtc. detn. of 0.1 to 300 mcg. Sb, cf. W. G. Frederick, *Ind. Eng. Chem.*, (*Anal. Ed.*) **13,** *922–4* (*1941*). Recomm. (*I. C.*).

POTASSIUM IODIDE and **PYRIDINE,** in acid solns., give a yellow color or ppt. in the presence of Sb. As and Sn do not intfr.; cf. Clarke, *Analyst* 53, *373* (*1928*). The color may be used for detg. from 0.05 to 3.0 mg. Sb in Sn.; cf. *Snell, p. 253.* Recomm. (*I. C.*).

PYROGALLOL, in aq. soln. gives a white ppt. with Sb in dil. HCl contg. tartrate to give antimonyl tartrate ion. Procedure may be used for detn. of Sb and sepg. it from As; cf. Feigl, *Z. anal. Chem.* **64,** *41–47* (*1924*); *C. A.* **18.** *3016; Prodinger, p. 115.*

9-METHYL-2,3,7-TRIHYDROXYFLUORONE, 0.5% soln. in ethyl alc. gives red ppt. with Sb (III); may be used as test tube or spot test. Test is sensitive and is apparently specific at pH 4.0 and in pres. of F ion. Wenger, Duckert, and Blancpain, *Helv. Chim. Acta* **20,** *1427–45* (*1937*); *C. A.* **32,** *1205* (*1938*). Prepn. of reagt.: triacetyl derivative made from *p*-quinone with acetic anhydride and H_2SO_4, and then it is mixed with acetaldehyde in ratio of 1 mol. of former to 1.2 of latter. The mixture is heated on water bath at 50°–60° for 1 hr. with 5 parts by wt. of ethyl alc. and one part of 5–10% H_2SO_4. Reagt. is pptd. by adding water. R. Duckert, *Helv. Chim. Acta* **20,** *362–7* (*1937*).

ARSENIC

COCAINE-MOLYBDATE is prepared by mixing 1 part by vol. of 1% potassium molybdate soln., 2 parts of 0.1 *N* HCl, and 1 part of 2% cocaine soln. Pentavalent As in a soln. slightly acid with HCl gives a turbidity suitable for nephelometric detn. of amts. of As between 0.0005 and 0.06 mg. Phosphates must be absent and errors are small (2–3%). The method is said to be convenient and more exact than those involving evolution of arsine; cf. *Yoe II, pp. 107–16.* **STRYCHNINE** may be used instead of cocaine; cf. *Snell, p. 241;* also **QUININE-ARSENOMOLYBDATE** may be used in a similar manner; cf. *Snell, p. 242; Yoe I, pp. 128–30.*

***N*-ETHYL-8-HYDROXYTETRAHYDROQUINOLINE HYDROCHLORIDE (KAIRIN)**, 0.5% aq. soln. A drop of the test soln. is put on filter paper, allowed to dry, then moistened with HCl and a drop of the reagt. soln., a drop of $FeCl_3$ soln. is added and the spot is warmed. In the presence of as much as 6×10^{-7} mg. As (III) a reddish-brown coloration appears. Hg, Pb, and Cu must be absent; cf. W. Reppmann, *Z. anal. Chem.* **99,** *180–2* (*1934*).

BARIUM

SODIUM RHODIZONATE, freshly prepd. 5% aq. soln. For spot test, place drop of neutral or sl. acid test soln. on filter paper and add drop of reagt. soln. A red to brown stain, becoming more red with dil. HCl, indicates Ba. Metals of H_2S and $(NH_4)_2S$ groups intfr. and should be removed before making test. Recomm. (*I. C.*). *Feigl, p. 137.* **TETRAHYDROXYQUINONE** gives a similar reaction and is considerably more stable than the rhodizonate; cf. under the heading *sulfate.*

BERYLLIUM

MORIN, 20 mg. in 100 ml. of acetone, is a valuable reagt. for detc. and detn. of minute amts. of Be. In 0.01 to 0.1 *N* NaOH soln. Be gives a yellow-green fluorescence visible in daylight or better in ultraviolet light. Estn. of minute amts. may be made by comparison with standards. Only Li, Ca, Zn, and Sc give fluorescence to intfr.; these may be masked or removed. Oxidizing agts. destroy reagt. and must be avoided. Recomm. (*I. C.*) E. B. Sandell, *Ind. Eng. Chem.*, (*Anal. Ed.*) **12,** *674, 762–4* (*1940*).

1-AMINO-4-HYDROXYANTHRAQUINONE, 0.1% in alc., gives a red fluorescence with Be in alk. soln. This reagt. is said to be less sensitive but more nearly specific than morin. White and Lowe, *Ind. Eng. Chem.*, (*Anal. Ed.*) **13,** *809* (*1941*).

QUINALIZARIN (1,2,5,8-TETRAHYDROXYANTHRAQUINONE), satd. alc. soln. or freshly prepared 0.05% soln. in 0.1 *N* NaOH. In alkaline soln. Be changes the color of the reagt. from reddish-violet to a distinct blue; it may be used as a test on spot plate as well as in other detc. methods; cf. *Feigl, p. 120.* A blank should be run along with the test. In solns. alkaline with NaOH, a moderate xs. of Al does not intfr.; Fe intfr. may be prevented by tartrate but the sensitivity is diminished by the latter. PO_4 should be absent. Mg gives the same color as Be; the latter, however, loses its color on addn. of bromine water while the Mg lake remains unaffected. The reagt. may be used for estn. of Be by adding xs. to unknown and titrating back to clear, pure, blue end point with standard Be soln.; cf. H. Fischer, *Z. anal. Chem.* **73,** *54–64* (*1928*). As little as 0.1 mg. Be may be detd. After sepn. of Al, Be may be detd. colmtcly.; cf. *Snell, p. 399;* cf. also *C. A.* **30,** *2132* (*1936*), and **31,** *3815* (*1937*). Recomm. (*I. C.*) **ALKANNIN** or **NAPHTHAZARIN** may be used instead of quinalizarin although they are not as sensitive; cf. *C. A.* **30,** *5143* (*1936*).

CURCUMIN, 0.1% alc. soln., forms an orange-red lake in faintly alkaline soln. contg. Be; the blank is yellow to brown in color. Pptn. occurs in concns. over 50 mg. Be per liter. For solns. contg. 0.05 to 1 mg. per liter, the reagt. may be used for colmtc. estn.; Fe and Al are removed before detn. by adding xs. NaF to sl. acid soln.; cf. Kolthoff, *J. Am. Chem. Soc.* **50,** *393–5* (*1928*); *Snell, p. 398.* The addn. of starch glycerite increases sensitivity of colmtc. detn. W. E. Thrun, *Ind. Eng. Chem.*, (*Anal. Ed.*) **2,** *8* (*1930*).

***p*-NITROBENZENEAZO-ORCINOL,** 0.025% soln. in dil. NaOH, is used for a spot test on filter paper giving an orange-red color. In testing, a drop of the reagt. is placed on the paper, then a little of the test soln. is applied to the middle of the spot, followed by another drop of reagt. In the presence of as much as 0.0002 mg. Be an orange-red spot is obtained. Zn gives a similar color but the color disappears on the addn. of KCN soln.; Mg and Al are both inactive; cf. Komarowskii and Poluektov, *Mikrochemie* 14, *315–7* (*1934*); *Feigl, p. 121.* Recomm. (*I. C.*)

8-HYDROXYQUINOLINE (OXINE), in acetic acid soln., may be used to precipitate quantitatively Al, Fe, and Zn in acetic acid-amm. acetate soln. leaving Be unaffected which may be detd. by suitable means in the filtrate; cf. Lundell and Knowles, *Bur. Stand. J. Research* 3, *91* (*1929*).

AURIN TRICARBOXYLIC ACID (ALUMINON), 0.1% aq. soln., gives a reaction similar to that with Al (q.v.); cf. Middleton, *J. Am. Chem. Soc.* 48, *2125* (*1926*); Kolthoff, *J. Am. Chem. Soc.* 50, *353–5* (*1928*).

BISMUTH

CINCHONINE POTASSIUM IODIDE reagt. is prepared by mixing 5 g. cinchonine with enough conc. HNO_3 to make a paste, dissolving the paste in water, diluting to about 50 ml., adding to 250 ml. KI soln. contg. 10 g. KI, diluting to 500 ml., allowing to stand 48 hrs., and then filtering. The reagt. is stable for long periods and any suspended matter which appears on standing should be filtered off before use. In a slightly acid soln. of Bi the reagt. gives an orange-red color or ppt. As a spot test, Bi may be recognized even in the presence of Cu, Pb, and Hg by different colors and a zoning effect when all are present. Cd does not intfr.; cf. *Feigl, p. 33.* The reagt. may be used for colmtc. detn. of 0.03 to 0.15 mg. Bi; cf. *Snell, p. 218.* **QUININE** with the iodide ion may be used instead of the cinchonine; cf. *Snell, p. 221, Yoe I, p. 133.* **GLYCEROL** has also been used with KI to keep the Bi colored compd. in suspension for colmtc. estn.; cf. P. Planes, *J. Soc. Chem. Ind.* 22, *1259* (*1903*). **8-HYDROXYQUINOLINE (OXINE)** with KI is also suitable for detc. of as little as 0.5×10^{-5} mg. Bi and for colmtc. estn. of amounts up to 0.25 mg.; cf. *Snell, p. 221*, and *C. A.* 26, *2391* (*1932*). Cinchonine recomm. (*I. C.*).

THIOUREA, solid or satd. aq. soln., gives a yellow color suitable for colmtc. detn. as well as for detc. Xs. reagt. is used to ppt. other metals from a test soln. strongly acid with HNO_3; cf. C. Mahr, *Z. anal. Chem.* 94, *161–6* (*1933*); *Snell, p. 220.* For use of thiourea in detn. of Bi in refined leads and tins, cf. *C. A.* 34, *5778* (*1940*). Recomm. (*I. C.*).

PYROGALLOL, conc. aq. soln., will ppt. Bi quant. from a hot, slightly acid soln.; the yellow crystalline ppt., containing 62.84% Bi, may be washed, filtered off and dried for detn.; cf. Feigl, *Z. anal. Chem.* 65, *448* (*1925*). The reagt. is also useful for sepg. Bi from Pb and Cu; cf. E. A. Ostroumov, *Zavodskaya Lab.* 4, *1016–20* (*1935*); *C. A.* 30, *1684* (*1936*); *Prodinger, p. 116.*

DIMERCAPTOTHIODIAZOLE and numerous similar compounds have been suggested for detc. and detn. of Bi; cf. J. V. Dubsky, A. Okac, B. Okac, and J. Trtilek, *Z. anal. Chem.* 98, *184–93* (*1934*); *ibid.*, 100, *408–18* (*1935*), recomm. (*I. C.*); cf. also *Prodinger, p. 114* for use of **MERCAPTOBENZOTHIAZOLE.** 1% alc. soln. of **2-METHYL BENZOTHIAZOLE** with KI used for detc. of Bi in qual. scheme; B. Naiman, *J. Chem. Education* 14, *484–6* (*1937*).

CUPFERRON (AMMONIUM NITROSOPHENYLHYDROXYLAMINE) has been used for the sepn. and detn. of Bi; cf. Pinkus and Dernier, *C. A.* 23, *53* (*1929*); *Prodinger, p. 79.*

DIPHENYLTHIOCARBAZONE (DITHIZONE), 25–50 mg. per liter of $CHCl_3$ or CCl_4 has been used for detc. and colmtc. detn. of minute amounts of Bi. The green color of the reagt. is changed to orange-red in the presence of Bi in a slightly alk. soln. Pb, Sn (II), Tl interference may be removed by making the soln. acid; cf. H. Fischer, *Z. angew. Chem.* 47, *685–92* (*1934*); Willoughby, Wilkins and Kraemer, *Ind. Eng. Chem.*, (*Anal. Ed.*) 7, *285–6* (*1935*); *A. O. A. C., p. 405.* For detn. of Bi in biological material, cf. D. M. Hubbard, *Ind. Eng. Chem.*, (*Anal. Ed.*) 11, *343* (*1939*).

CAFFEINE as sulfate or nitrate used to ppt. Bi which is subsequently detd. by a volmtc. method. Of the common ions only Ag, Cu, and Hg (I) intfr. Beale and Chandlee, *Ind. Eng. Chem.*, (*Anal. Ed.*) 14, *43* (*1942*).

BORON, BORATE

TURMERIC paper and solution, **CURCUMIN** paper and solution. Turmeric soln. made by extraction of the powder with cold alc.; curcumin soln. 0.1% in alc. Papers made by immersion in solns. and drying. To test for a borate, the test paper is immersed in the sample acidified with HCl and then allowed to dry; a brownish-red color which is intensified on drying and which turns to a dark blue-green with NH_4OH indicates borate; cf. *U. S. Pharmacopoeia XI, p. 449; A. O. A. C., p. 459, 542.* Test papers are used for estn. of small amounts of B (under 0.1 mg. B_2O_3). B separated by volatilization as the methyl ester, absorbed in NaOH soln., evaporated, made acid, and tested with papers. Length of red stain permits estn. of boron; cf. *Snell, pp. 527–8; Yoe I, p. 134.* Solns. of turmeric or curcumin may be added to borate soln. or to residue after evaporation for colmtc. estn.; cf. *Snell, p. 526; Yoe I, p. 135.* Fe (III), Mo, Ti, Cb, Ta, Zr, give red colorations with these reagts. but differ in that NH_4OH does not cause the usual change in color. Oxidizing substances must be absent; phosphate and silicate ions diminish the sensitivity of the reaction; cf. *Feigl, p. 223.*

METHYL ALCOHOL.—In the absence of Cu, B may be easily detected and roughly estimated by adding the reagt. and H_2SO_4 (5 vol.: 1 vol.) and igniting the vapor contg. methyl borate to obtain a green bordered flame; cf. *U. S. Pharmacopoeia XI, p. 449;* W. Stahl, *Z. anal. Chem.* **101,** *342–56 (1935).*

MANNITOL or **GLYCEROL** can be used for the detn. of borate by titrating the test soln. to about pH 7, adding the reagent which makes the test soln. acid in proportion to the amount of borate present, and titrating back to neutrality with dil. standard NaOH; cf. *A. P. H. A., pp. 30–4; A. O. A. C., pp. 13, 460.*

p-**NITROBENZENEAZOCHROMOTROPIC ACID (CHROMOTROPE 2B),** 0.005% soln. in conc. H_2SO_4. As little as 8×10^{-5} mg. B may be detected by evaporating a drop of slightly alk. test soln. in a porcelain dish and adding 2 drops of the reagt. while the dish is still hot; on cooling, a violet to green color indicates B; cf. *Feigl, p. 225;* Komarowskii and Poluektov, *Mikrochemie* **14,** *317–20 (1934).* Recomm. *(I. C.).*

QUINALIZARIN (1,2,5,8-TETRAHYDROXYANTHRAQUINONE), 0.01% soln. in conc. H_2SO_4; other concentrations are better for colmtc. determinations; cf. literature reference. The violet color of the reagt. changes to blue in the presence of minute amounts of borate; cf. Feigl and Krumholz, *Mikrochemie, Pregl-Festschrift 77–86 (1929).* For detn. of B in soils and plants see Berger and Truog, *Ind. Eng. Chem., (Anal. Ed.)* **11,** *540–5 (1939).* For detn. of B in steel, cf. H. A. Kar, *Metals and Alloys* **9,** *175–7 (1938).*

TITAN YELLOW (CLAYTON YELLOW) in aq. soln. may be used to impregnate filter paper upon which sl. acid test soln. is dropped. In pres. of H_3BO_3 the spot is yellow and addn. of Na_2CO_3 or NH_4OH soln. turns it red. Mg, PO_4, and organic anions intfr. L. Robin, *Compt. rend.* **138,** *1046–8 (1904).* Recomm. *(I. C.).*

BROMINE, BROMIDE

FLUORESCEIN becomes eosin with change in color from greenish-yellow to pink by action of bromine liberated by suitable oxidizing agent. Test may be made on paper impregnated with reagt. and held over mouth of tube contg. unknown and oxidizing agent; *Feigl, p. 162.* Iodine giving similar reactions must be absent. For colmtc. detn. of bromide by fluorescein; cf. *Snell, p. 548.* **PHENOL RED,** 10 mg. per 100 ml. very dil. NaOH soln., reacts in a similar way but has several advantages. At pH 5.0 to 5.4 the color is changed from yellow to red or violet by 0.001 to 0.018 mg. Br. Iodide must be removed by boiling with $NaNO_2$ in acid soln.; cf. Stenger and Kolthoff, *J. Am. Chem. Soc.* **57,** *831–3 (1935).*

FUCHSIN-BISULFITE (SCHIFF'S REAGENT), 1% aq. soln. of fuchsin which has been decolorized with $NaHSO_3$ or SO_2. Bromine liberated by chromic acid soln. (25%) or chlorine produces a bluish color in the colorless reagt. Chlorides and iodides do not interfere and the test may be used for detc. or colmtc. estn. of bromides in iodides and chlorides; cf. *Feigl, p. 163; Snell, pp. 544–5;* Recomm. (*I. C.*). Dilute H_2SO_4 may be used as a solvent for fuchsin and the colored substance formed from the bromine extracted with isoamyl alcohol for colmtc. estn.; cf. *Snell, p. 546*.

α-NAPHTHOFLAVONE (7,8-BENZOFLAVONE; 2-PHENYL-1,4-α-NAPHTHOPYRONE), 0.5% soln. in alc., is a reagt. which gives an intense rust-brown color with bromide ion in a neutral or acid soln. and may be used as an indicator in bromometric titrations; the color is reversibly discharged with As (III), Sb (III), Sn (II); cf. E. Schulek, *Z. anal. Chem.* **102,** *111–13* (*1935*); cf. also *C. A.* **29,** *3934* (*1935*), and *C. A.* **29,** *6523* (*1935*); *Feigl, p. 164.* **DIPHENYLCARBAZIDE** may also be used as an indicator in titrating bromide solns. with 0.025 *N* mercuric nitrate soln.; H. R. McCleary, *Ind. Eng. Chem.*, (*Anal. Ed.*) **14,** *31* (*1942*).

CADMIUM

β-NAPHTHOQUINOLINE, 3% soln. in 0.5 *N* H_2SO_4, is a reagt. which gives with KI a quant. ppt. of Cd as $(C_{13}H_9NH)_2CdI_4$ and may be used for detn. of Cd in Zn ores and in spelter; Group II metals do not hinder the detn.; cf. Berg and Wurm, *Ber.* **60,** *1664–71* (*1927*). For less than 50 mg. of Zn a volmtc. method may be used; cf. Pass and Ward, *Analyst* 58, *667–72* (*1933*). Recomm. (*I. C.*).

DIPHENYLCARBAZIDE, satd. alc. soln., is used to impregnate paper used for a spot test. The test soln. is dropped on the paper which, after 1 or 2 minutes, is held over an open ammonia bottle to develop the blue-violet spot indicating Cd; by various means, interference by other Group II metals may be overcome; cf. *Feigl, p. 47*.

DINITRODIPHENYLCARBAZIDE, 0.1% alc. soln., gives with $Cd(OH)_2$ and other metallic hydroxides colored adsorption complexes; with KCN present, Cu does not intfr. with the Cd test which gives a greenish-blue color when test soln. is mixed on spot plate with NaOH, KCN and a little 40% formaldehyde; cf. *Feigl, p. 49.* Recomm. (*I. C.*).

DIPHENYLTHIOCARBAZONE (DITHIZONE), 30 mg. per liter of $CHCl_3$, may be used to detect minute amounts of Cd in a soln. made alk. with NaOH and contg. tartrate; the reagt. on shaking with the test soln. gives a red to violet color with Cd; Co and Ni give colorations under the same conditions; cf. H. Fischer, *Z. angew. Chem.* 47, *685–92* (*1934*). Recomm. (*I. C.*). For detn. of Cd in silicate rocks, cf. E. B. Sandell, *Ind. Eng. Chem.*, (*Anal. Ed.*) *11, 364* (*1939*).

NITROPHENOLARSINIC ACID, in 10% AcOH soln., is a specific qual. reagt. for Cd in AcOH soln.; 1 part of Cd in 200,000 parts of soln. will show a yellowish crystalline ppt. when warmed with the reagt.; cf. Pavelka and Kolmer, *Mikrochemie* **8,** *277–80* (*1930*). Recomm. (*I. C.*).

HEXAMETHYLENETETRAMINE ALLYLIODIDE (ALLYL IODOUROTROPINE), 10% aq. soln., quantitatively ppts. a complex Cd compound, containing 11.45% Cd, which may be dried at 105° C. for gravmtc. detn.; cf. Evrard, *Ann. chim. anal. chim. appl.*, **11,** *322–6* (*1929*). In the presence of Zn and some other metals the method is not satisfactory; cf. Hurd and Evans, *Ind. Eng. Chem.*, (*Anal. Ed.*) **5,** *16* (*1933*).

1-(2-QUINOLYL)-4-ALLYL-THIOSEMICARBAZIDE, satd. soln. in 50% alc., with KI in a neutral or slightly acid soln. gives a yellow ppt. with Cd; Cu does not intfr.; cf. Scott and Adams, *J. Am. Chem. Soc.* 57, *2541–2* (*1935*).

8-HYDROXYQUINOLINE (OXINE) quant. ppts. Cd from an AcOH soln. buffered with AcONa; Cu is also pptd. The ppt. is $Cd(C_9H_6ON)_2 \cdot 1.5H_2O$; cf. Burg and Wurm, *Z anal. Chem.* 71, *321* (*1927*); or, $Cd(C_9H_6ON)_2 \cdot 2H_2O$; cf. Wenger, Cimerman and Wyszewianska, *Mikrochemie* 18, *182* (*1935*).

4-NITRONAPHTHALENE-DIAZOAMINOBENZENE-4-AZOBENZENE (CADION 2B), 0.02 g. in 100 ml. of ethyl alc. contg. 1 ml. of 2 *N* KOH, is said to be specific,—in absence of Hg,—as a spot test for Cd. A drop of reagt. is placed on filter paper and a smaller drop of neutral or sl. acid (with AcOH) test soln. contg. tartrate is added. Finally a drop of 2 *N* KOH in 20% alc. is added. If as much as 0.002 mcg. Cd is present in the test drop, a pink spot surrounded by a blue circle will appear. F. P. Dwyer, *Australian Chem. Inst. J. & Proc.* **5,** *37–40* (*1938*); *C. A.* **32,** *2871.*

CALCIUM

AMMONIUM OXALATE is the most commonly useful reagt. for detc. and detn. of Ca in soln. contg. in addn. to Ca only Mg and alkali metals and no strong acids. The detn. may be made by gravmtc. or volmtc. methods, the latter being done by titration of oxalic acid liberated from the ppt. by action of strong acid; cf. Hillebrand and Lundell, *Applied Inorganic Analysis* (*Wiley*), *pp. 493–503* (*1929*) and other references. Recomm. (*I. C.*).

DIHYDROXYTARTARIC ACID OSAZONE (sodium salt) gives a yellow ppt. with Ca in even very low concn.; other alkaline earth metals behave similarly although Mg does not ppt. unless present in an amount greater than the Ca; alkali metals and ammonium do not intfr. Test is made by placing a small grain of the solid reagt. in depression of black spot plate and adding drop of neutral test soln.; the ppt. is formed slowly; cf. *Feigl, p. 140.* Recomm. (*I. C.*).

OLEIC, RICINOLEIC and **STEARIC ACIDS** are used in the estn. of Ca forming insoluble soaps which are determined by means of nephelometric or colorimetric measurements of the suspended soaps. In these methods it is usually necessary to make a preliminary sepn. of the Ca as CaC_2O_4 which is subsequently dissolved and detd. in the soln. freed from Mg and other interfering substances. The methods have been used in the detn. of Ca in urine, feces, blood, milk, and other organic materials. Samples used in the detn. should contain from 0.005 to 2.5 mg. Ca; cf. *Snell, pp. 449–53; Yoe I, pp. 143–7; Yoe II, pp. 119–25.* **SULFORICINOLEIC ACID** may be used in the same way and is said to have the advantage of not forming an insoluble Mg salt; for the method of use, cf. *Yoe II, 125–9; Snell, p. 453.*

ALIZARIN, 0.1% alc. soln., is used for the detn. of Ca which has been sepd. from Mg by pptn. as oxalate; the calcium oxalate is dissolved in dil. HCl, the reagt. and NH_4OH added, after several hours the blue-black crystalline ppt. of Ca alizarinate filtered off, washed, redissolved in oxalic acid, and the liberated alizarin estimated colmtcly.; 0.1 mg. Ca can be detd. to within 2 to 5%; cf. Laidlow and Payne, *Biochem. J.* **16,** *494–8* (*1922*); *Yoe I, pp. 139–43; Snell, p. 465.*

PICROLONIC ACID, aq. soln., has been used for the microscopic detc. of Ca. which forms spiny, yellow balls or needles; Mg, K, Na, NH_4 ions do not intfr.; Cu and Pb intfr.; cf. J. Kisser, *Mikrochemie* **1,** *25* (*1923*). The method has also been used for the colmtc. detn. of samples contg. between 0.02 and 0.15 mg. Ca; the Ca is pptd. as the picrolonate, filtered off, dissolved in hot water, xs. bromine water added, after warming a short time it is made alk. and the color compared with standards; cf. *Snell, p. 466.* In another method, Li picrolonate is used in xs. to ppt. the Ca salt and the xs. is detd. by titration with methylene blue; cf. A. Bollinger, *Australian J. Exptl. Med. Biol. Sci.* **13,** *75–8* (*1935*). The Ca salt may also be used for direct gravmtc. detn. of Ca; cf. F. Alten and associates, *Biochem. Z.* **265,** *85* (*1933*); Dvorzak and Reich-Rohrivig, *Z. anal. Chem.* **86,** *98* (*1931*).

ANTIPYRINE may be used for an indirect colmtc. detn. of Ca which is quant. ppt. as $K_2CaNi(NO_2)_6$, the nitrite ion of which is estimated colmtcly. by use of antipyrine; Ba and Sr react similarly but Cu, Mn, Al, Fe, Zn, and Mg do not ppt.; the error should be less than 4%; cf. *Snell, pp. 462–3.*

HYDROQUINONE with sodium bisulfite, **1,2,4-AMINONAPHTHOLSULFONIC ACID,** and other organic reducing agents are used for an indirect colmtc. detn. of Ca. The calcium is obtained as the phosphate, amm. molybdate is added to form the phosphomolybdate which is then reduced to the "molybdenum blue" for colmtc. estn.; As must be absent; the method is suitable for detn. of 0.02 to 0.2 mg. Ca; cf. *Snell, pp. 454–6;* Roe and Kahn, *J. Biol. Chem.* **81,** *1–8* (*1929*).

LORETIN (3-HYDROXY-7-IODOQUINOLINE-5-SULFONIC ACID) gives a bright orange-red ppt. with Ca salts in sl. acid solns. contg. between 5 ppm and 2% Ca. Mg, Na and K do not intfr. N. Schoorl, *Pharm. Weekblad* **76,** *620–5 (1939); C. A.* **33,** *5767.*

CARBON DIOXIDE, CARBONATE, CARBON MONOXIDE

PHENOLPHTHALEIN-sodium carbonate, 2.5 ml. 0.5% phenolphthalein, 1 ml. 0.1 *N* Na_2CO_3, and 10 ml. water, is a reagt. which is colored red but becomes colorless by absorption of CO_2; a drop may be held on a coiled platinum wire to test a mixture of gases, or the gas evolved on acidulation of a solid or liquid unknown substance; the test is not specific as any acid-forming gas will decolorize the reagt.; cf. *Feigl, p. 221;* Feigl and Krumholz, *Mikrochemie* **8,** *131 (1930).*

PHENOLSULFONEPHTHALEIN, BROMOTHYMOL BLUE and other indicators have been used for determining CO_2; cf. *Snell, pp. 117–24.*

HEMOGLOBIN with **PYROGALLIC** and **TANNIC ACIDS** has been used for the detn. of CO in blood and in gaseous mixtures; normal blood becomes gray when diluted with water and treated with tannic acid whereas in the presence of CO this color change does not occur and the color remains red; for details cf. Sayers, Yant and Jones, *Bur. Mines Repts. Investigations No. 2486 (1923); Snell, pp. 112–5.*

CERIUM

GALLIC ACID, 0.02% aq. soln., gives a blue-violet color with ceric ion in a soln. contg. in addition amm. hydroxide and Na_2SO_4; for colmtc. detn. a sample contg. 0.03 to 0.07 mg. Ce should be used and the test soln. covered with a protective layer of mineral oil or ether; Th, La, Ti ions intfr.; Fe, Al, Cr, Mn, Co, Ni, and uranyl ions do not intfr.; **PYROGALLOL** may be used for detc. instead of gallic acid; cf. F. M. Shemyakin, *Zavodskaya Lab.* **3,** *1090–1 (1934); C. A.* **29,** *2879; Snell, p. 366.* **TANNIN** may also be used; cf. *C. A.* **33,** *3289 (1939).*

BENZIDINE, in AcOH soln., will detect 0.0002 mg. Ce when a drop of the test soln. is placed on filter paper, then one drop of dil. NaOH followed by a drop of the reagt.; Ce (III) or Ce (IV) give a blue coloration; the test is specific in the rare earth metals, but ions of Mn, Co, Cu, Ag, Tl, CrO_4 intfr. by reacting similarly; in the presence of these interfering metals the Ce may be pptd. with HF and then tested; cf. *Feigl, p. 132;* cf. also E. Herzfeld, *C. A.* **33,** *3289 (1939).* The leuco base of **MALACHITE GREEN** is said to be slightly more sensitive to the Ce (IV) than is benzidine and the same ions intfr.; cf. L. M. Kul'berg, *J. Applied Chem. (U. S. S. R.)* **8,** *1452–6 (1935); C. A.* **30,** *5143 (1936);* **31,** *626 (1937).*

CESIUM

DIPICRYLAMINE (HEXANITRODIPHENYLAMINE) in soln. in Na_2CO_3 gives ppt. with Cs but reaction is not distinctive; cf. van Nieuwenburg and van der Hoek, *Mikrochemie* **18,** *175–8 (1935); C. A.* **30,** *43 (1936).*

CHLORINE, CHLORIDE, CHLORATE, PERCHLORATE

***o*-TOLIDINE,** 1 g. per liter of 10% HCl (prepared by mixing the solid tolidine with HCl and then adding more water and HCl) is stable for 6 months; it gives a yellow coloration with water contg. 0.01 to 1.0 ppm chlorine and is used in detg. free or chloramine chlorine in water. Permanent standards may be made from $CuSO_4$ and $K_2Cr_2O_7$, or K_2CrO_4 and $K_2Cr_2O_7$; cf. Dragt and Mellon, *Ind. Eng. Chem., (Anal. Ed.)* **10,** *256–8 (1938).* The color is allowed to develop 5 to 15 minutes in the dark before comparison is made. More than 0.3 ppm Fe (III), 0.01 ppm Mn (III), 0.3 ppm nitrite and other oxidizing agents intfr. by producing the same coloration as chlorine; cf. *A. P. H. A., pp. 20–5; ibid., pp. 228–31.* The reagt. has also been used for estn. of free chlorine in sewage and in air; cf. *Snell, pp. 538–41; Yoe I, pp. 157–9.* Recomm. *(I. C.).*

BENZIDINE has also been recommended for colmtc. detn. of free chlorine giving a green color which is more intense and better suited for colmtc. comparison than is *o*-tolidine; the color fades in 2 or 3 minutes and sulfates intfr. if present in a concentration sufficient to ppt. benzidine sulfate; cf. Stratton, Ficklen and Hough, *Ind. Eng. Chem.*, (*Anal. Ed.*) **4,** *2* (*1932*); *Snell, p. 541.*

DIMETHYL-*p*-PHENYLENEDIAMINE gives a red coloration with free chlorine which is suitable for colmtc. estn.; cf. Kolthoff, *Chem. Weekblad* **23,** *203–4* (*1926*); *Snell, p. 542.*

CHLOROPHENOL RED or **BROMOCRESOL GREEN,** 0.1 g. in 100 ml. 20% alc. soln., are adsorption indicators for titration of *chloride* with standard $HgNO_3$; cf. Zombary and Pollak, *Z. anorg. allgem. Chem.* **215,** *255–6* (*1933*); cf. also *J. Am. Chem. Soc.* **56,** *1891* (*1934*). **DIPHENYLCARBAZIDE** is also recommended as an indicator for titration with $Hg(NO_3)_2$; cf. I. Roberts, *Ind. Eng. Chem.*, (*Anal. Ed.*) **8,** *365–7* (*1936*). Diphenylcarbazide may also be used for detc. of chloride in a solid sample by volatilization therefrom of chromyl chloride the Cr of which affects the reagt. Recomm. (*I. C.*). *Feigl, 160.* **DICHLOROFLUORESCEIN,** 0.1% soln. in 50% alc. contg. a small amount of NaOH, as an indicator in titration of chloride with Ag ion, has some advantages over unsubstituted fluorescein; cf. Fajans and Wolf, *Z. anorg. allgem. Chem.* **137,** *221* (*1924*); Kolthoff and associates, *J. Am. Chem. Soc.* **51,** *3273–7* (*1929*). **TARTRAZINE** has also been used; cf. Fearon and Gillespie, *Biochem. J.* **28,** *1629* (*1934*).

NITROBENZENE has been added to the soln. in the Volhard method to enable titration of xs. $AgNO_3$ without removal of AgCl; cf. Caldwell and Moyer, *Ind. Eng. Chem.*, (*Anal. Ed.*) **7,** *38–9* (*1935*).

ANILINE HYDROCHLORIDE, in the absence of oxidizing agents, may be used for the detc. and colmtc. detn. of *chlorate;* reducing agents, other than the reagt., must be absent; cf. *Snell, p. 588; Yoe I, 163.* Chlorate may also be detc. by warming of unknown soln. with a mixture of 85% phosphoric acid and satd. manganous sulfate soln. On cooling, if chlorate is present, a violet color is obtained. Test can be made more sensitive by addn. of a drop of 1% alc. soln. of **DIPHENYLCARBAZIDE** which intensifies the color. Periodates and persulfates intrf. *Feigl, p. 190.* Recomm. (*I. C.*).

NITROSODIMETHYLANILINE, 0.1% soln. in dil. alc., gives a violet color with *perchlorate* and is recommended for detc. and colmtc. estn. of this ion in Chile saltpeter; iodides must be removed with silver oxide; cf. *Yoe I, p. 163; Snell, p. 592.*

METHYLENE BLUE, 1.6% aq. soln., may be used for pptn. or colmtc. detn. of *perchlorate. Snell, p. 590.* Recomm. (*I. C.*).

α-PHENYL-β-DIETHYLAMINOETHYL-*p*-NITROBENZOATE, 3 g. of the hydrochloride in 10 ml. water, may be used for detc. of *perchlorate* giving a turbidity or a white ppt. in neutral soln. with concns. of ClO_4 ion as low as 0.0025 *N;* nitrate ion also gives a ppt. in concns. of 0.01 *N;* iodide, oxalate, thiocyanate, and dichromate ions intfr.; cf. Marvel and du Vigneaud, *J. Am. Chem. Soc.* **46,** *2661–3* (*1924*).

CHROMIUM, CHROMATE

***s*-DIPHENYLCARBAZIDE,** satd. alc. soln., gives a violet coloration with chromate in a soln. acidified with AcOH; the color is suitable for estn. of Cr after oxidation to chromate by means of Na_2O_2 or other strong oxidizing agents; Fe does not intfr.; cf. A. Cazeneuve, *Analyst* **25,** *331* (*1900*). For the spot test, cf. *Feigl, pp. 98–102;* for colmtc. detn., cf. *Snell, p. 279* and *Yoe I, p. 166;* for application to qual. analysis scheme, cf. Stover, *J. Am. Chem. Soc.* **50,** *2363–6* (*1928*); for detn. of Cr in TiO_2, cf. Flatt and Vogt, *Bull. soc. chim.* (5) **2,** *1985–93* (*1935*). Recomm. (*I. C.*).

DISODIUM-1,8-DIHYDROXYNAPHTHALENE-3,6-DISULFONATE (CHROMOTROPIC ACID), 1% aq. soln., gives a pink to light red color with chromate and may be used for colmtc. detn. of Cr in steel and in plant ash; the reaction is carried out in strongly acid soln. contg. H_3PO_4. Cr is oxidized and removed from most of the iron by treatment with NaOH and Na_2O_2; steel contg. less than

0.6% Cr may be analyzed advantageously with this reagt., and 0.02 mg. Cr may be detd. with an average error of 1%; vanadium does not intfr. if present in amounts less than Cr; cf. F. Garratt, *Ind. Eng. Chem.* **5,** *298* (*1913*); *Snell, p. 278; Yoe I, p. 165.* Recomm. (*I. C.*).

BENZIDINE, 0.1% in 10% AcOH may be used for detc. of Cr by oxidn. to chromate through use of Na_2O_2, placing drop on filter paper, then drop of reagt. to get a blue ring. Mn and V intfr. by giving similar color. Cf. *Feigl, p. 102.* Recomm. (*I. C.*).

SERICHROME BLUE R may be used for estn. of chromate by first dyeing wool yarn or flock with the reagt. which produces a crimson color. The dyed samples are changed to blues of varying intensities by immersion in chromic acid of varying concentrations; cf. G. C. Spencer, *Ind. Eng. Chem.*, (*Anal. Ed.*) **4,** *245* (*1932*); *Snell, p. 281.*

DIPHENYLAMINE or **DIPHENYLCARBAZIDE** may be used as an internal indicator in titrations with dichromate; cf. Kolthoff, *J. Am. Chem. Soc.* **53,** *2902* (*1931*).

ORCINOL (*s*-**DIHYDROXYTOLUENE**) in alc. soln. gives a brown coloration as a spot test on paper; cf. G. Gutzeit, *Helv. Chim. Acta* **12,** *713* (*1929*).

COBALT

α-NITROSO-β-NAPHTHOL, 7 g. in 100 ml. glacial AcOH, is used for detg. Co in tungsten steels by adding to a slightly acid soln. of the steel 6 ml. of reagt. for every 10 mg. of expected Co, filtering, washing and igniting to Co_3O_4; with comparatively large amounts of Co the oxide is reduced to the metal with hydrogen; the ppt. may be contaminated with Ni if this metal predominates in the original soln.; cf. *Standards and Specifications for Metals and Metal Products; Misc. Publication No. 120 of the Bu. of Standards, issued March 11th, 1933;* cf. also Hillebrand and Lundell, *Applied Inorganic Analysis, p. 326.* For colmtc. methods of detg. Co in paints and other commercial products cf. *Snell, pp. 322–4;* E. G. Jones, *Analyst* **43,** *317* (*1918*); in these methods the reagt. is dissolved in dil. NaOH; cf. also *Yoe I, pp. 173–6.* As a spot test, giving a brown coloration, 0.05 mcg. Co may be detected; cf. *Feigl, pp. 83–6.* For detection and detn. of Co in soils cf. J. S. Hosking, *Australian Chem. Inst. J. and Proc.* **3,** *172–83* (*1936*). **β-NITROSO-α-NAPHTHOL** is said to be a more sensitive reagt. for Co; cf. I. Bellucci, *Gazz. Chim. Ital.* **49,** *11, 294–8* (*1919*). Yoe and Barton, *Ind. Eng. Chem.*, (*Anal. Ed.*) **12,** *405–9* (*1940*) discuss intfr. and colmtc. procedure using this reagt. Both reagts. recomm. (*I. C.*). **DINITROSORESORCINOL** has also been suggested for the gravmtc. detn. of Co, but results may be inaccurate; cf. Orndorf and Nichols, *J. Am. Chem. Soc.* **45,** *1439* (*1923*); Tomicek and Komarek, *Z. anal. Chem.* **91,** 90 (*1932*). **NITROSO-R-SALT** (**α-NITROSO-β-NAPHTHOL-3,6-DISODIUM DISULFONATE**), in 0.5% aq. soln., is a useful reagt. for detc. of Co. in a soln. strongly acid with HNO_3; cf. van Klooster, *J. Am. Chem. Soc.* **43,** *746* (*1921*).

RUBEANIC ACID (DITHIO-OXAMIDE), 1% alc. soln., gives a brown ppt. with ammoniacal Co soln. and may also be used for a spot test; Cu gives a black ppt., and Ni gives blue under the same conditions; cf. *Feigl, p. 86.* **POTASSIUM DITHIO-OXALATE** has also been used; cf. Gutzeit, *Helv. Chim. Acta* **12,** (*1929*).

FORMALDOXIME reagt. is made by boiling a mixture of 7 g. $NH_2OH \cdot HCl$, 15 ml. H_2O, and 3 g. trioxymethylene until clear, then cooling. For detc. of Co, add 1 drop reagt. and 2 drops of 10 *N* NaOH to 10 ml. of test soln. to get a pale yellow coloration or ppt. Mn (II), Ni, Fe (III) and Cu (II) intfr. Recomm. (*I. C.*). Cf. *C. A.* **27,** *927* (*1933*).

DIMETHYLGLYOXIME, in the absence of Cu and Fe, may be used for detc. or colmtc. detn. of Co; Ni, if present, is filtered off for observation of the soln, which will be brown in the presence of as much as 0.5 mcg. per ml.; the error in the estn. may be as high as 10%; cf. *Snell, p. 327*; Braley and Hobart, *J. Am. Chem. Soc.* 43, *482* (*1921*). The reaction is more sensitive if **BENZIDINE** or **TOLIDINE** is used along with the dimethylglyoxime reagt.; cf. Spacu and Macarovici, *Bul. soc. Stiinte Cluj* **8**, *245–56 (1935)*; *C. A.* **30**, *1684 (1936)*.

POTASSIUM XANTHATE gives a green ppt. with Co in a neutral or slightly acid soln.; Ni may ppt. but will dissolve in NH_4OH, making it possible to detect traces of Co in Ni; cf. Tougarinoff, *Ann. soc. sci. Bruxelles* **50B**, *168 and 235 (1930)*.

DIPHENYLTHIOCARBAZONE (DITHIZONE), in $CHCl_3$, has been used to detect traces of Co in Ni; cf. H. Fischer, *Wiss. Veroffentlich. Siemens-Konzern* **6**, *147–9 (1928)*; *C. A.* **23**, *1364 (1929)*.

PHENYLTHIOHYDANTOIC ACID has been used for the sepn. and gravmtc. detn. of Co in the presence of Al, Cr, V, W, U, Mo, As, Ti, Zn, Mn, Ca and Mg. The Ni ppt. is washed out with NH_4OH and the violet colored ppt. is ignited and weighed as Co_3O_4; cf. Willard and Hall, *J. Am. Chem. Soc.* **44**, *2219; ibid.*, **44**, *2226; ibid.*, **44**, *2253 (1922)*.

THIOGLYCOLIC ACID ANILIDE, 2% alc. soln., is a reagt. for detc. of Co in a soln. from which Ag and the Cu-Sn groups have been removed. The test soln., made ammoniacal, is boiled, the reagt. added, boiled, and then made acid with HCl; a ppt. remaining on acidification indicates Co; cf. T. Berzin, *Z. anal. Chem.* **85**, *428–33 (1931)*.

ANTHRANILIC ACID (*o*-AMINOBENZOIC ACID) quant. ppts. Co from a soln. free from Zn, Cd, Ni, Mn, and Cu, and buffered to a pH of 4.4 or above; cf. Funk and Ditt, *Z. anal. Chem.* **93**, *241–7 (1933)*; H. Goto, *J. Chem. Soc. Japan*, **55**, *1156–63 (1934)*.

For a critical report on about 150 reagts. for detc. of Co see Wenger, Duckert, and Basset, *Helv. Chim. Acta* **24**, *657–70 (1941)*; *C. A.* **35**, *6536 (1941)*.

COLUMBIUM

TANNIN with oxalic or tartaric acids has been used for the separation of Cb from Ta, and from Zr, Th, and Al; with Cb, tannin in the presence of oxalic acid gives a red ppt., whereas Ta gives a yellowish-brown; if Ta ppt. is contaminated with Cb, it is red. For details of quant. methods; cf. W. R. Schoeller, *The Analytical Chemistry of Tantalum and Niobium (1937), Nordemann Publishing Co. (New York).*

COPPER

α-BENZOINOXIME (CUPRON), 5% soln. in alc. gives a green ppt. with Cu from a hot ammoniacal soln. preferably free of NH_4 salts; tartrate prevents pptn. of Fe, Al, and other insol. hydroxides, thus permitting a sepn. of Cu from them; the ppt. may be dried at 100° C. for gravmtc. detn.; the reagt. may also be used for a spot test; cf. *Feigl. p. 38* and *Prodinger, pp. 63–66*. Recomm. (*I. C.*). For use in soil analysis, cf. J. S. Hosking, *Australian Chem. Inst. J. and Proc.* **3**, *172–83 (1936)*; *C. A.* **30**, *6488 (1936)*; in steel analysis, Kar, *Ind. Eng. Chem.*, (*Anal. Ed.*) **17**, *193 (1935)*, and in amperometric titration of Cu, A. Langer, *Ind. Eng. Chem.*, (*Anal. Ed.*) **14**, *283 (1942)*.

SALICYLALDOXIME reagt. is prepared by dissolving 1 g. in 5 ml. alc., pouring into 95 ml. water at 80°, allowing to stand a few minutes and then filtering, or it may be made without isolation of the oxime by dissolving 2.22 g. of salicylaldehyde in 8 ml. ethyl alc., adding to a soln. of 1.27 g. of $NH_2OH \cdot HCl$ in 2 ml. H_2O, diluting with 15 ml. alc. then stirring slowly into 225 ml. H_2O at 80°. Asten and Riley, *J. Chem. Soc.* (1933) 314. It is more nearly specific than benzoinoxime and only Au and Pd, in addition to Cu, ppt. in a soln. acid with AcOH. The yellow-green ppt. of Cu $(C_7H_6O_2N)_2$ may be used as a spot test for detc. or gravmtc. detn., or for the sepn. of Cu from Cd, Ni, Pb, and other metals. Recomm. (*I. C.*) cf. F. Ephraim, *Ber.* **63**, *1928 (1930)*; *ibid.*, **64**, *1210 (1931)*, *Feigl. p. 40*; Ishibashi and Kishi, *J. Chem. Soc. Japan* **55**, *1060–9 (1934)*; *C. A.* **29**, *702 (1936)*. For a nephelometric method using salicylaldoxime cf. Alten and associates, *Mikrochemie* **20**, *77 (1936)*. Cu may be sepd.

and quant. pptd. from Pb and Zn at pH 2.5 to 4.0; Biefeld and Ligett, *Ind. Eng. Chem., (Anal. Ed.)* **14**, *359–61 (1942)*. *p*-**HOMOSALICYLALDOXIME,** 1% aq. soln. with a little alc. is said to be easier to prepare than salicylaldoxime and is used in the same way; cf. Kao and Chen, *J. Chinese Chem. Soc.* **3**, *22–6 (1935) C. A.* **29**, *4691 (1935)*.

ANTHRANILIC ACID, 3% soln. of the sodium salt, gives a greenish crystalline ppt. $Cu(C_7H_6O_2N)_2$, which is formed in neutral or acidic (AcOH-AcONa) soln., and has been used for gravmtc. and volmtc. detn.; at pH 2.8 to 3.0 no other metals ppt.; cf. Funk and Ditt, *Z. anal. Chem.* **93**, *345–7 (1933)*; H. Goto, *J. Chem. Soc. Japan* **55**, *1156–63 (1934); C. A.* **29**, *1029 (1935); Prodinger, p. 37.*

α-**QUINALDINIC ACID,** about 5% soln. of the sodium salt, has been used for the gravmtc. detn. and for separation of Cu from Cd, P, As, Pb, Ni, Co, and Mn; a green ppt. is formed in sl. acid soln. (H_2SO_4) and is dried at 125° C. to $Cu(C_{10}H_6NO_2)_2 \cdot H_2O$; Zn and uranyl also ppt.; cf. Ray and Bose, *Z. anal. Chem.* **95**, *400–14 (1933)*; Lindsey and Shennan, *Analyst* **65**, *636 (1940); C. A.* **35**, *1340; Prodinger, p. 55.*

POTASSIUM ETHYL XANTHATE, 0.1% aq. soln. prepared fresh every day, is used for the colmtc. detn. of Cu in amounts less than 1 mg. and gives a yellow color in neutral or acid soln.; there is an error of 10–15% in detns. of 0.005 to 0.018 mg. of Cu; Fe, Pb, Ni, Co, Zn, and Mn in small amounts are said to be without interference but in plant ash it is best to separate out Cu first as CuS; *A. O. A. C., p. 130; Snell, pp. 152–5; Yoe I, p. 184.*

SODIUM DIETHYLDITHIOCARBAMATE, 0.1% aq. soln. is stable for several weeks if kept in a brown bottle and may be used for detc. of Cu in dilutions as low as 0.01 ppm and for colmtc. estn. of low concentrations as found in water which has been treated with $CuSO_4$ as an algaecide. The sample for detn. should not contain over 0.1 mg.; concentrations between 0.1 and 1.0 ppm are best for estn.; in this concentration a brown coloration is obtained and at higher concentrations a brown ppt. is formed; the reaction should be carried out in a slightly ammoniacal soln.; other metals in comparable amounts are not likely to intfr. although cyanide must be absent; cf. *A. P. H. A., pp. 25–6;* Callan and Henderson, *Analyst* **54**, *650 (1929)*. For a more general discussion cf. *Snell, pp. 164–6;* for Cu in milk cf. Conn and others, *Ind. Eng. Chem., (Anal. Ed.)* **7**, *15–23 (1935)*; for Cu in blood and other biological materials cf. S. L. Tompsett, *Biochem. J.* **29**, *480–6 (1915)*.

THIOGLYCOLIC *β*-**AMINONAPHTHALIDE (THIONALID),** alc. or AcOH soln. freshly prepared, ppts. Cu as a yellow compound from acid soln.; most of the metals which are pptd. by H_2S are likewise pptd.; in the absence of intfr. metals, the reagt. may be used for gravmtc., volmtc., colmtc., or nephelometric detn.; cf. Berg and Roebling, *Z. angew. Chem.* **48**, *430–2* and *597–601 (1935)*. It is claimed that Cu can be quant. sepd. from Tl, Fe, Ca, Ba, Mg, Zn, Cd, Mn, Co, Ni, Cr, Pb and Al; cf. *Prodinger, p. 88.*

RUBEANIC ACID (DITHIO-OXAMIDE), 0.5% alc. soln., gives a dark green to black ppt. with Cu, and as a spot test may be used for detc. of Cu in the presence of a large excess of Co, Ni, Fe, and Cd; cf. Ray, *Z. anal. Chem.* **79**, *94 (1930); Feigl, pp. 44–46.* Recomm. (*I. C.*).

MERCAPTOBENZOTHIAZOLE, alc. soln., gives a yellow ppt. with Cu and also forms ppts. with Au, Ag, Pb, and Hg but not with Ni, Co, Zn, Cd, Mg, Mn, Ca, Ba, and Sr; cf. Spacu and Kuras, *Z. anal. Chem.* **102**, *24* and *108 (1935)*. **DIMERCAPTOTHIODIAZOLE** is similar in its actions with metals; cf. Ray and Gupta, *J. Ind. Chem. Soc.* **12**, *308–17 (1935); C. A.* **29**, *7214 (1935); Prodinger, p. 112.*

DIPHENYLTHIOCARBAZONE (DITHIZONE), in $CHCl_3$ or CCl_4 soln., can be used for the colmtc. detc. and detn. of mcg. quantities of Cu; cf. Fischer and Leopoldi, *Z. angew. Chem.* **47**, *90–2 (1934)*; R. M. Mehurin, *J. Assoc. Official Agr. Chem.* **18**, *192–4 (1935); Feigl, p. 46.* For review of uses of this reagt., cf. Wichmann, *Ind. Eng. Chem., (Anal. Ed.)* **11**, *66–72 (1939)*.

PYRIDINE and thiocyanate may be used for pptn. of Cu as $Cu(CSN)_2 \cdot 2C_5H_5N$ which is dissolved in $CHCl_3$ for colmtc. detn.; or xs. KCNS may be titrated for volmtc.

detn.; cf. *Snell, pp. 159–62;* Hawk and Bergheim, *Practical Physiological Chemistry, 10th Ed., p. 468;* Tettamanzi, *Industria Chimica* **9**, *609–10 (1934); C. A.* **28**, *6653.* **BENZIDINE** or **TOLIDINE** may be used instead of pyridine; cf. *Z. anal. Chem.* **67**, *31 (1925).* Benzidine may be used with sodium salicylate for a rough colmtc. estn. of Cu; cf. *Snell, p. 162;* for other reactions of benzidine used in the detc. and detn. of Cu cf. *C. A.* **30**, *43 (1936);* **29**, *4498 (1935);* **29**, *6167 (1935);* **28**, *1951 (1934).*

The **AMMONIUM** salt of **NITROSOPHENYLHYDROXYLAMINE (CUPFERRON)**, 6% aq. soln. is a reagt. which is stable for weeks and gives a ppt. of Cu, in a neutral or slightly acid (AcOH) soln., which may be ignited to CuO for gravmtc. detn.; many other metals, such as Pb, Bi, Ag, Hg, Sn, and Fe, intfr. by pptg. also; Baudisch and King, *Ind. Eng. Chem.* 3, *629 (1911);* cf. also *C. A.* **29**, *3624 (1935); Prodinger, p. 72–75.*

5,7-DIBROMO-8-HYDROXYQUINOLINE, 0.5% soln. in 5 *N* HCl or satd. soln. (about 0.3%) in acetone, may be used for the gravmtc. detn. of Cu in micro quantities as in water; the ppt. is $C_{18}H_8O_2N_2Br_4Cu$; cf. Berg, *Z. anal. Chem.* **70**, *347 (1927);* L. W. Haase, *Z. anal. Chem.* 78, *113–24 (1929);* cf. also *Mikrochemie* **17**, *127 (1935)* and *C. A.* 30, *983 (1936).* Unsubstituted **8-HYDROXYQUINOLINE (OXINE)** may also be used; in AcOH soln., Cu may be detd. in presence of Be, Mg, Ca, Cd, Pb, As and Mn, cf. *Prodinger, p. 110.*

BENZOTRIAZOLE in 2% aq. soln. gives quant. pptn. of Cu as a blue-green compd., $(C_6H_4N_3)_2Cu$, at pH 7.0–8.5. Ni, Co, Ag, Cd, Zn intfr. J. A. Curtis, *Ind. Eng. Chem., (Anal. Ed.)* **13**, *349–51 (1941).*

CYANIDE

BENZIDINE, in AcOH soln., is oxidized to a blue compound by nascent oxygen from interaction of $Cu(OAc)_2$ and HCN; in the absence of other oxidizing and reducing agents, the reaction is specific for HCN. Paper may be impregnated with the reagt. and $Cu(OAc)_2$ solns. and, while moist, exposed to the gas suspected of contg. HCN; a distinct blue coloration indicates HCN; solids or solns. may be tested by acidification to liberate HCN. With controlled conditions, the test may be made roughly quant.; cf. *Feigl, p. 176.* Sieverts and Hermsdorf, *Z. angew. Chem.* **34**, *3 (1921);* cf. also *C. A.* 7, *3292.* **PHENOLPHTHALIN** will detect 0.2 ppm HCN which in the presence of dil. copper soln. yields the red phenolphthalein; Childs and Ball, *Analyst* **60**, *294–9 (1935).*

PICRIC ACID, alkaline soln., is a reagt. for impregnating paper and gives a red to brown spot with cyanide of low concn.; sulfide gives a similar color; cf. G. Gutzeit, *Helv. Chim. Acta* **12**, *713 (1929);* R. G. Smith, *J. Am. Chem. Soc.* **51**, *1171 (1929).*

FLUORIDE

SODIUM ALIZARINSULFONATE (ALIZARIN S) as a 0.05% aq. soln. is much used as an indicator in titration of fluoride solns. with standard thorium nitrate (0.05 to 1.0 *N*). The fluoride soln. should be adjusted to pH 3.0–3.2. The end point is shown by formation of pink color of thorium alizarin lake. Phosphate and certain other ions intfr. and are frequently eliminated from sample by distn. of the fluorine from sulfuric and perchloric acids. For detn. of F in soils cf. *A. O. A. C. p. 13;* in insecticides, *ibid. p. 51,* and in water, *same reference, p. 529.* In analysis for F in waters, however, distillation is usually unnecessary and detn. is made by colmtc. methods involving the use of the **ZIRCONIUM-ALIZARIN** lake which is changed from red-violet to yellow by an xs. of fluoride; the extent of the decoloration is a measure of amount of F. For details of detg. 0.1 ppm of F in presence of 500 ppm SO_4 cf. Lamar and Seegmiller, *Ind. Eng. Chem., (Anal. Ed.)* **13**, *901 (1941).* See also report of American Water Works Association Committee on methods of detg. fluorides, *J. Am. Water Works Assoc.* **33**, *1965–2017 (1941).* The color change of the Zr lake may be used as a spot test for F, *Feigl, p. 170.* Recomm. (*I. C.*).

p-**DIMETHYLAMINOAZOPHENYLARSONIC ACID** gives a brown insol. compound with zirconium salts which turns red with F ion due to liberation of the free dye; as with the alizarin reagt., other ions which remove Zr or form complexes with F intfr.; in all cases of intfr. the F may be separated out as HF or SiF_4; cf. *Feigl, p. 172.* Recomm. (*I. C.*).

After conversion to H_2SiF_6 and the treatment with ammonium molybdate, fluorine may be detc. by the oxidation of **BENZIDINE** to a blue compd. and simultaneous reduction of Mo to molybdenum blue; phosphates, arsenates, and silicates react similarly; cf. *Feigl, p. 173.* Cf. also Pertusi, *C. A.* **25,** *2076* (*1931*). Recomm. (*I. C.*).

TRIPHENYLTIN CHLORIDE has been suggested as a reagt. for the gravmtc. detn. of fluoride which ppts. as $(C_6H_5)_3SnF$. Allen and Furman, *J. Am. Chem. Soc.* **54,** *4625–31* (*1932*).

GALLIUM

QUINALIZARIN, 0.01% alc. soln., will detect and determine colorimetrically Ga in concns. from 0.02 mg. to 0.2 mg. per liter by formation of a pink to amethyst colored lake. The test soln. should be normal in NH_4OAc, 0.5 *N* in NH_4Cl, have a pH of about 5 and should contain 0.5 g. NaF per liter. Ga may be separated from most metals but the test sample should not contain more than 10 mg. Al or more than 1 mg. Fe; V and Mo must be absent; cf. Willard and Fogg, *J. Am. Chem. Soc.* **59,** *40–5* (*1937*). Recomm. (*I. C.*).

MORIN, satd. soln. in methyl alc., gives a green fluorescence in a soln. slightly acid with AcOH; Al gives the same test but its fluorescence is prevented by NaF; the Ga is also affected by the NaF but not as much as the Al; cf. G. Beck, *Mikrochemie* **20,** *194–7* (*1936*). Recomm. (*I. C.*).

8-HYDROXYQUINOLINE (OXINE), 0.1% in dil. AcOH, may be used to detect minute amts. of Ga. Test soln. at pH 2.6–3.0 is shaken with reagt. and $CHCl_3$. Chloroform layer shows yellowish fluorescence in ultraviolet light if Ga is present. Fe (III), Cu (II), vanadate, and molybdate must be removed; other elements do not intfr. E. B. Sandell, *Ind. Eng. Chem.*, (*Anal. Ed.*) **13,** *844* (*1941*).

GERMANIUM

BENZIDINE, 0.1% soln. in AcOH, may be used for a spot test; to a drop of the test soln. on a filter paper, is added a drop of amm. molybdate soln., a drop of HNO_3, then a drop of reagt., and the color developed with NH_3 fumes; as little as 0.25 mcg. of Ge gives a blue spot; the same reaction is given by Si, As, P_2O_5 and these must be absent; cf. Komarovskii and Poluektov, *Mikrochemie* **18,** *66–73* (*1935*). Recomm. (*I. C.*).

Germanic acid, H_2GeO_3, reacts towards reagts. listed under *boron* in a manner similar to that of boric acid; **QUINALIZARIN** is especially recommended; cf. N. S. Poluektov, *Mikrochemie* **18,** *48–9* (*1935*).

GOLD

Reducing agents such as *m*-**PHENYLENEDIAMINE, FORMALDEHYDE, PHENYLHYDRAZINE, BENZIDINE,** or **ACETYLENE** may be used for reduction of gold ion to colloidal gold which can be detc. or determined colmtcly.; cf. *Snell, pp. 402–8.* **BENZIDINE** may be used in a spot test with Au (III) giving the familiar blue spot; many other ions react similarly; cf. Malatesta and Di Nola, *Bull. Chim. Farm.* **52,** *461* (*1912*); *Feigl, p. 71.* For analysis of Au and sepn. from the platinum metals, cf. F. E. Beamish, et al., *Ind. Eng. Chem.*, (*Anal. Ed.*) **9,** *174–6* (*1937*).

DIMETHYLAMINOBENZALRHODANINE, satd. alc. soln., is used to impregnate paper for a spot test; Au in neutral or slightly acid soln. gives a reddish-violet ppt. or spot; Ag, Hg, and Pd react in a similar manner; *Feigl, p. 71;* cf. also *C. A.* **25,** *2380* (*1931*).

PYRIDINE, 1 vol. in 9 vol. 40% HBr, gives orange to maroon colored crystals with Au (III) in an acid soln. if the concn. of Au is above 0.01%; cf. M. N. Short, *Microscopic Determination of the Ore Minerals, Bull. 825 U. S. Geol. Survey, Pt. 4 Microchemical Methods (1931).*

HYDROGEN ION

See table on **ACID-BASE INDICATORS.**

INDIUM

MORIN as satd. soln. in alc. is said to give a distinctive green fluorescence with In in presence of dil. mineral acid. It may be recognized even in admixture with Al, Sc, and Ga; cf. G. Beck, *Mikrochim. Acta* **2,** *287–90 (1937); C. A.* **32,** *1606.*

A sensitive spot test for In may be made by the use of **ALIZARIN-** impregnated paper to which is added a drop of the prepared test soln. and which is then dipped in a satd. aq. soln. of H_3BO_3 to get a red spot if In is present; most elements of the $(NH_4)_2S$ group intfr., cf. Komarovskii and Poluektov, *Mikrochemie* **16,** *227–32 (1934).*

In may be detd. with **8-HYDROXYQUINOLINE** by pptn. from buffered AcOH soln. Cf. Geilmann and Wrigge, *Z. anorg. allgem. Chem.* **209,** *129 (1932).*

IODINE, IODIDE

The familiar **STARCH** test for free iodine has been used with some success for the colmtc. estn. of iodine; cf. *Snell, p. 569.*

***o*-TOLIDINE,** 0.6% soln. in alc., gives with iodine a blue-green color suitable for colmtc. detn. of amounts between 0.01 mg. and 0.10 mg.; iodides may be oxidized to free iodine with H_2O_2 an xs. of which does not intfr.; iodates may be reduced for detn.; the test is made in a neutral soln.; nitrites are oxidized with H_2O_2 and bicarbonate decomposed by boiling; under conditions of the test 1500 ppm of chloride or bromide have no effect; Fe, Cu, Hg, and other metals must be removed if present in a concn. high enough to cause pptn. with the reagt.; cf. Lange and Ward, *J. Am. Chem. Soc.* **47,** *1000–3 (1925).*

METHYLENE BLUE soln. is decolorized by sulfite in a soln. 2 *N* with HCl at an immeasurably slow rate in the absence of iodide; up to 4 mcg. iodide may be detd. with errors no greater than 5% by observing the rate of fading of the reagt. in the presence of iodide as catalyst; cf. H. P. Lundgren, *J. Am. Chem. Soc.* **59,** *413–6 (1937).*

DIPHENYLCARBAZIDE as a satd. soln. in alc. may be used as an indicator in titration of iodide by means of $Hg(NO_3)_2$ soln. The end point is rendered very distinct by the presence of 10 to 15% of purified dioxane; cf. H. R. McCleary, *Ind. Eng. Chem., (Anal. Ed.)* **14,** *31 (1942).*

DIOXANE (DIETHYLENE OXIDE) commonly contains peroxides which oxidize iodide to iodine which colors the soln. and permits detc. and colmtc. detn. of small amts. of I as in iodized salt. Saifer and Hughes, *J. Biol. Chem.* **118,** *241–5 (1937); ibid.* **121,** *801 (1937).*

IRIDIUM

MALACHITE GREEN, LEUCO BASE, 1% soln. in glacial AcOH, is oxidized to the green color by $(IrCl_6)^{--}$ in an acid soln. The test is given by Ir in dilutions of 0.14 ppm in water; 1 part Ir in the presence of 3,000 parts of Pt may be detected. The reaction is not affected by moderate amounts of Rh, Os, and divalent Pd; free Cl, Au (III), and $(PdCl_6)^{--}$ must be removed; cf. L. A. Chugaev, *Ann. inst. platine No. 7, 205–7 (1929); C. A.* **24,** *2689 (1930).* Recomm. (*I. C.*).

BENZIDINE has been used for the detc. of Ir in the presence of Pt and for its approximate detn.; a deep blue color is given by tetravalent iridium; other oxidizing agents must be absent; cf. V. G. Khlopin, *Ann. inst. platine* **1,** *324–30 (1926); Snell, p. 425.*

IRON

α,α′-**DIPYRIDYL,** 1–2% soln. in alc. or dil. HCl, has had much usage in detc. and detn. of Fe (II) ion. The test is carried out in slightly acid soln. and gives an intense, stable, red coloration; in dil. soln. and in the absence of Cu (I) the reaction is specific; cf. F. Blau, *Ber.* **21,** *1077 (1888); Snell, pp. 310–11; Feigl, p. 96; C. A.* **35,** *2439 (1941).* For detn. of Fe in soil, cf. Dyer and McFarlane, *Can. J. Research 16B No. 3, 91–6 (1938), C. A.* **32,** *4263;* in biological materials, cf. S. H. Jackson, *Ind. Eng. Chem., (Anal. Ed.)* **10,** *302–4 (1938).* This reagt. has also been used for detn. of Fe in cereal products; Andrews and Felt, *Cereal Chem.* **18,** *819–26 (1941), C. A.* **36,** *1393.* Reagt. recomm. (*I. C.*).

o–**PHENANTHROLINE** is similar to *α,α′*-dipyridyl in regard to reaction with Fe (II). Saywell and Cunningham have used it for detn. of Fe in fruit juices, *Ind. Eng. Chem., (Anal. Ed.)* **9,** *67–9 (1937).* Hummel and Willard report no intfr. from pyrophosphate, Pb, Zn, Al, Hg, As, F, I; *ibid.* **10,** *13–15 (1938);* cf. also Fortune and Mellon, *ibid.* **10,** *60.*

DIMETHYLGLYOXIME, 1% alc. soln., gives with Fe (II) in ammoniacal soln. a red, soluble compound useful for detc. and detn. with errors of 1 to 2% in detn. on concns. of 10 to 50 ppm; Ni intfr. is prevented by addn. of KCN; Cu and Co should be absent as well as large amounts of Al and Zn; Fe (III) is kept in soln. by the use of tartrate; cf. *Snell, p. 308; Yoe I, pp. 248–9; Feigl. p. 98.* Recomm. (*I. C.*).

7-IODO-8-HYDROXYQUINOLINE-5-SULFONIC ACID (FERRON) has been found satisfactory for detn. of Fe (III). The test soln. should be acidified to pH of about 3; the reagt., in a satd. aq. soln., gives a green, stable color with Fe (III); at concns. as low as 0.1 ppm the color is perceptibly different from the yellow of the reagt. soln.; fluoride ion prevents color development but otherwise the reagt. is unaffected by any other ion in concn. comparable to that of Fe (III); cf. J. H. Yoe, *J. Am. Chem. Soc.* **54,** *4139–43 (1932);* Yoe and Hall, *ibid.* **59,** *872 (1937);* Clark and Sieling, *Ind. Eng. Chem., (Anal. Ed.)* **8,** *256–7 (1936); Snell, p. 302.* Recomm. (*I. C.*).

THIOGLYCOLIC ACID (MERCAPTOACETIC ACID), 4 ml. dissolved in 8 ml. conc. NH_4OH in 50 ml. of water, gives with Fe (III), at a pH of 8.0 to 10.0, a blue to purple coloration which may be used for estn. of Fe in milk, blood or other materials. With Fe (II) a reddish color is given. The color may fade but is restored on shaking in air. The color is given in concns. of 0.1 ppm and the errors are no larger than 2%. The reagt. soln. should be made as needed; cf. *Snell, p. 298* for details and bibliography. Swank and Mellon found this reagt. to be superior to many others in regard to freedom from intfr. by many anions which are usually troublesome, e.g. phosphate, fluoride, tartrate; cf. *Ind. Eng. Chem., (Anal. Ed.)* **10,** *7–9 (1938).*

SALICYLIC ACID, 10% aq. soln. of the sodium salt, is a reagt. which gives an amethyst color with Fe (III) ion but no color with Fe (II) ion; strong acids decompose the colored compound and sunlight causes fairly rapid fading; phosphate, fluoride, and ions which form complexes with Fe (III) intfr. in detc. and detn. The test is made in a soln. slightly acid with AcOH and the sample should contain less than 0.2 mg. Fe (III); cf. J. P. Mehlig, *Ind. Eng. Chem., (Anal. Ed.)* **10,** *136–9 (1938)* and *Yoe I, pp. 243–5; Snell, p. 301.* Recomm. (*I.C.*). **SALICYLSULFONIC ACID** has been used for detn. of minute amounts of Fe in sputum; cf. *Snell, p. 302.* **THIOSALICYLIC ACID,** which gives a yellow coloration with minute amounts of Fe in ammoniacal soln., has been used for Fe detn. on 0.1 ml. of blood; cf. *Snell, p. 300;* cf. also *C. A.* **32,** *1207 (1938).*

CUPFERRON (AMMONIUM SALT OF NITROSOPHENYLHYDROXYLAMINE), 6% aq. soln., is widely used for sepg. iron (also V, Zr, Ti, Sn, Cb, Ta) from other elements such as Al, Be, P, Mn, Ni, and hexivalent U. The pptn. is carried out in an acid soln. and the pptd. Cu may be dissolved out of the ppt. with NH_4OH: cf. O. Baudisch, *Chem. Ztg.* **33,** *1298 (1909);* Baudisch and King, *Ind. Eng. Chem.* **3,** *629*

(1911); E. Benedetti, *Rev. facultad cienc. quim.* (*Univ. La Plata*) **9**, *59–68* (*1934*), *C. A.* **29**, *3624 (1935)*; cf. also Hillebrand and Lundell, *Applied Inorganic Analysis*, *pp. 109–14 (1929)*.

p-n-**BUTYLPHENYLARSONIC ACID,** 0.75% aq. soln., is useful as a precipitant for detg. or sepg. Fe; most of the metals commonly associated with Fe do not intfr., although Zr, Sn, Ti, Th, UO_2, Ce, and the anions of F, PO_4, tartrate, and citrate should be absent; pptn. is from a soln. approximately 0.4 *N* in a mineral acid and at a temperature of 80–90° C.; cf. Craig and Chandlee, *J. Am. Chem. Soc.* **56,** *1278–9* (*1934*).

In volmtc. methods of iron detn., titration of Fe (II) with oxidizing solns. may be made convenient by the use of internal indicators such as **DIPHENYLAMINE SULFONIC ACID;** cf. Sarver and Kolthoff, *J. Am. Chem. Soc.* **53,** *2902–6* (*1931*); *o*-**PHENANTHROLINE;** cf. Walden, Hammett, and Chapman, *J. Am. Chem. Soc.* **55,** *2649* (*1933*); *α,α'*-**DIPYRIDYL;** cf. Nieuwenburg and Blumendal, *Mikrochemie* **18,** *39* (*1935*); and **PHENYLANTHRANILIC ACID** (*o*-**DIPHENYLAMINE CARBOXYLIC ACID**); cf. Suirokomskii and Stepin, *J. Am. Chem. Soc.* **58,** *928–9* (*1936*).

DIISONITROSOACETONE, 1% aq. soln., gives an intensely blue color with Fe (II) even in very dil. solns.; Co and Ni intfr.; xs. Mn reduces sensitivity; cf. Dubsky and Kuras, *Chem. Listy* **23,** *496* (*1929*); *C. A.* **24,** *801* (*1930*). Recomm. (*I. C.*).

ACETYLACETONE, 0.5% freshly prepared alc. or aq. soln., gives with as little as 3 mcg. of Fe a distinctly red soln. which may be used for estn. of Fe; the sample should contain between 3 and 60 mcg. Fe; the color is stable for weeks and the reagt. may be used wherever thiocyanate is applicable; the test is made in slightly acid soln.; cf. A. Combes, *Compt. rend.* **105,** *868* (*1887*); H. V. Pulsifer, *J. Am. Chem. Soc.* **26,** *967* (*1904*); cf. also *Snell, p. 303* and *Yoe I, pp. 245–8*.

DINITROSORESORCINOL, aq. soln., gives green colors or ppts. with Fe (II) and Fe (III) in neutral soln.; Co and Cu also react; cf. Nichols and Cooper, *J. Am. Chem. Soc.* **47,** *1268* (*1925*); for use of this reagt. as a specific stain for iron in tissues, cf. A. A. Humphrey, *Arch. Path.* **20,** *256–8* (*1935*), *C. A.* **29,** *8035* (*1935*).

LANTHANUM

8-HYDROXYQUINOLINE (OXINE) when added to a dil. AcOH soln. contg. La ppts. $La(C_9H_6ON)_3$ upon addition of NH_3; the ppt. may be dried for gravmtc. detn. or dissolved for titration with $KBrO_3$-KBr; cf. Th. I. Pirtea, *Z. anal. Chem.* **107,** *191–3* (*1936*).

LEAD

DIPHENYLTHIOCARBAZONE (DITHIZONE), 1 to 10 mg. dissolved in 100 ml. CCl_4 or $CHCl_3$, is a soln. which may be preserved for 4 to 8 weeks when care is taken to prevent contamination, oxidation, and long exposure to sunlight. The reagt. is widely used for detc., sepn., colmtc. and titrimetc. detn. of minute amounts of Pb; in soln. contg. KCN, NH_3, and citric acid at pH of about 9.5, Pb leaves the aq. phase to form a chloroform-soluble, red, dithizonate; other metals, except Sn (II), Bi, and Tl, do not intfr. unless present in great xs.; cf. *A. O. A. C., pp. 394–409; A. P. H. A., pp. 241–5; Snell, pp. 202–4; Feigl, p. 31.* For survey of use of dithizone in analysis for Pb and other metals, cf. *Prodinger, pp. 117–141.* For Pb in sugar products, cf. T. D. Gray, *Ind. Eng. Chem.*, (*Anal. Ed.*) **14,** *110–4* (*1942*); in biological materials, K. Bambach, *ibid.* **11,** *401* (*1939*) and *C. A.* **33,** *73, 7234.* See also Biefeld and Patrick, *Ind. Eng. Chem.*, (*Anal. Ed.*) **14,** *275–8* (*1942*). Reagt. recomm. (*I. C.*).

s-**DIPHENYLCARBAZIDE** is used indirectly for detn. of Pb by pptn. as the chromate which is then dissolved for colmtc. estn. of the chromate, or xs. standard chromate may be used for pptn. and the xs. detd.; cf. under *chromium; Snell, pp.*

198–200; Yoe I, pp. 255–7. For use of this method in detg. Pb in blood, tissues, and excreta, cf. Letonoff and Reinhold, *Ind. Eng. Chem.*, (*Anal. Ed.*) **12,** *280–4* (*1940*), and Letonoff, *ibid.* **13,** *631* (*1941*).

TETRAMETHYLDIAMINODIPHENYLMETHANE, 1% soln. in glacial AcOH, forms a blue diphenylmethane dye with PbO_2; 5 mcg. Pb will produce the color and the intensity may be used for colmtc. estn.; other oxidizing agents give the same reaction; cf. *Snell, pp. 200–2.* Recomm. (*I. C.*). **BENZIDINE** may be used in a similar way and is likewise non-specific for PbO_2; cf. *Feigl, p. 29.*

CARMINIC ACID, 0.5% soln. in dil NH_4OH, is a reagt. for detc. of Pb by spot test. The test soln. is added to paper previously impregnated with the reagt., exposed to NH_3, and allowed to dry; a violet spot distinctly different from the red color of the reagt. denotes at least 1 mcg. of Pb in the drop used; Cu prevents test; intfr. of Ag, Bi, and Cd may be prevented; cf. F. Pavelka, *Mikrochemie* **7,** *301* (*1929*); *Feigl, p. 32.* Recomm. (*I. C.*).

With **GALLOCYANINE** (0.1% aq. soln.) and **PYRIDINE** (1% aq. soln.) a violet spot is obtained when a drop of the test soln. is put on paper, followed by pyridine soln., then by gallocyanine, and finally several more drops of pyridine soln. In the presence of Ag, Cu, Cd, and Bi, Pb may be pptd. in the paper as $PbSO_4$ and other ions removed by washing with several drops of water, after which pyridine and gallocyanine are added as directed above; cf. F. Pavelka, *Mikrochemie* **7,** *301* (*1929*); *Feigl, p. 32.* Pyridine with NH_4CNS may be used for rapid gravmtc. detn. of Pb; *Prodinger, p. 160.*

ANTHRANILIC ACID, 3% soln. in dil. NaOH soln., ppts. $Pb(C_7H_6O_2N)_2$ which may be dried and weighed or may be dissolved in NH_4OAc soln. and titrated with $KBrO_3$-KBr in an acid soln.; Zn, Cu, and Mn also ppt.; cf. Funk and Römer, *Z. anal. Chem.* **101,** *85–8* (*1935*); *Prodinger, p. 37.*

SALICYLALDOXIME as a 1% soln. in dil. alc. may be used for the quant. sepn. of Pb from Cu, Zn, Ag, Cd in strongly ammoniacal soln.; Biefeld and Ligett, *Ind. Eng. Chem.*, (*Anal. Ed.*) **14,** *359–61* (*1942*).

THIOUREA as the solid or as satd. soln. in N HNO_3 ppts. Pb and permits its sepn. from Ag, Hg, Cu, Bi, Zn, Ba, Cr, Mn, Al, Co, Ni, Fe, Sn, As, Sb, and Cd. Cf. *Prodinger, p. 154,* and Mahr and Ohle, *Z. anorg. Chem.* **234,** *224–8* (*1937*).

LITHIUM

AMMONIUM STEARATE, prepared by passing NH_3 into an ether soln. of stearic acid until all the ammonium stearate has pptd., is dried and redissolved in amyl alcohol; the reagt. must be made up fresh every day. Li stearate differs from all other alkali stearates in being much less soluble in amyl alcohol; for procedure in detn. of Li cf. E. R. Caley, *J. Am. Chem. Soc.* **52,** *2754–8* (*1930*); *Snell, p. 447.* **2-ETHYLHEXANOL** is said to be superior to amyl alc. as a solvent for the amm. stearate; Caley and Axilrod, *Ind. Eng. Chem.*, (*Anal. Ed.*) **14,** *242* (*1942*).

MAGNESIUM

8-HYDROXYQUINOLINE (OXINE), 2 to 5% alc. or AcOH soln., is a reagt. used extensively for macro- and micro-detn. and for the sepn. of Mg from metals of the alkali and alkaline earth groups. It gives a green-yellow ppt. from an ammoniacal soln. which may contain Ca, Ba, Sr, but must not contain Fe, Al, Mn, Cu, Zn, Ti, and phosphate. The ppt. when dried at 130–40° C. has the composition $Mg(C_9H_6ON)_2$; at lower temperatures it retains water of crystallization. By heating with oxalic acid, the ppt. may be ignited to the oxide for weighing. Many colmtc. methods are available for detn. of Mg in the presence of Ca as in urine, blood, etc.; for details and bibliography cf. *Snell, pp. 471–5;* Hillebrand and Lundell, *Applied Inorganic Analysis, pp. 114–5 (1929; Wiley, New York)*; cf. also *C. A. indexes.*

TITAN YELLOW (CLAYTON YELLOW, THIAZOLE YELLOW), 0.1 to 0.2% aq. soln., is a reagt. which is added to a neutral or acid soln. which is then made alkaline with NaOH and in the presence of Mg produces an orange to red color or ppt. The method is suitable for colmtc. estn. of 0.001 to 0.015 mg. Mg. Dialyzed agar may be used as an aid in the prevention of pptn.; the filtrate from pptn. with oxalate may be used. Ca has a slight intensifying effect on color; Al, Ni, Co, Mn, Sn, Zn, and a high concn. of NH_4 salts intfr. The method is recommended for Mg detn. in urine (0.1 ml. sample is sufficient), blood, serum, milk, meat, and soil extracts; cf. *Snell, p. 476;* recomm. (*I. C.*). Gillam reports this reagt. to be good for Mg in photoelectric colmty., *Ind. Eng. Chem.*, (*Anal. Ed.*) **13**, *499–50* (*1941*), and Otto and Otto, *ibid.*, *p. 65* (*1941*), find it good for detc. by test tube or spot plate methods after removal of most of metal ions.

Magnesium in pptd. $MgNH_4PO_4$ may be detd. colmtcly. by reduction of the phosphomolybdate to the usual blue color by means of reducing agents such as $SnCl_2$, **HYDROQUINONE,** or **AMINONAPHTHOLSULFONIC ACID;** the method is suitable for detn. of 0.015 mg. Mg; for details of the method and for bibliography cf. *Snell, pp. 468–9; Yoe I, pp. 264–6*, and biochemical laboratory manuals.

***p*-NITROBENZENEAZORESORCINOL (MAGNESON),** 0.5% soln. in 1% NaOH soln. (for low concns. of Mg dilute reagt. 5 to 10 times), is added to an acid soln. which is then made alkaline with NaOH to form a bright blue color or ppt. suitable for detc. of as little as 0.002 mg. Mg after removal of Ag, Cu-Sn, Fe, Co-Ni groups. Al and Ba, Sr, and Ca do not intfr; arsenate, chromate, and permanganate anions intfr. as does NH_4 when in concn. 70 times higher than Mg; cf. Newell, Pike, and Ficklen, *Z. anorg. allgem. Chem.* **225**, *284–4* (*1935*), and Mehlig and Johnson, *Ind. Eng. Chem.*, (*Anal. Ed.*) **12**, *30* (*1940*). Test papers may be made by soaking filter paper in 0.01% alc. soln. of reagt. and allowing to dry. For test, add a drop of unknown and then one of 1% NaOH; compare with a blank; cf. I. Stone, *Science* **72**, *322* (*1930*). ***p*-NITROBENZENEAZO-α-NAPHTHOL** is considerably more sensitive to Mg than the preceding reagt.; cf. *Feigl, p. 143*. Other similar compounds have been suggested; cf. *C. A.* **30**, *6302* (*1936*).

QUINALIZARIN, (1,2,5,8-TETRAHYDROXYANTHRAQUINONE), 10 to 20 mg. in 100 ml. alc., gives a blue color or ppt. with Mg when the reagt. soln. is added to a neutral or slightly acid test soln., then 2 *N* NaOH added in drops until alkaline. This reagt. is not as sensitive nor as specific as the reagts. previously listed. Alkaline earths, as well as metals of higher groups, must be removed by pptn. before making the test and a blank must be run; cf. Hahn, *Ber.* **57B**, *1394–6* (*1924*); *Feigl, p. 142*, cf. also *C. A.* **29,** *7214 and* **30,** *4116* (*1936*). Recomm. (*I. C.*).

CURCUMIN, 1% alc. soln., gives a yellow to orange color useful for colmtc. detn. of Mg in amounts approximating 0.05 mg; the color is formed when the reagt. is added to the test soln. and made alk. with NaOH; starch glycerite is used as a protective colloid. Phosphate in large amount does not intfr. if approximately equal amount is used in standards; borates in small amounts do not intfr.; Fe and other metals giving colored hydroxides intfr.; cf. I. M. Kolthoff, *J. Am. Chem. Soc.* **50,** *395* (*1928*); W. E. Thrun, *Ind. Eng. Chem.*, (*Anal. Ed.*) **4**, *426* (*1932*); *Snell, p. 477*.

OLEIC ACID, 2 g. and 0.5 g. KOH per liter 60% alc., is a reagt. for a nephelometric method suitable for detg. 0.02 to 0.1 mg. Mg; Ca must be absent; cf. *Snell, p. 478*.

MANGANESE

FORMALDOXIME (Deniges reagt.), prepd. by dissolving 20 g. trioxymethylene and 47 g. hydroxylamine sulfate in 100 ml. H_2O by boiling, gives a red coltn. to an alk. soln. of Mn (II). This color is suitable to the estn. of Mn in plant, soil, and biological materials. Colorations by Co, Cu, Fe, Cr, and Ni may be masked; cf. C. P. Sideris, *Ind. Eng. Chem.*, (*Anal. Ed.*) **9,** *445* (*1937*), and **12,** *307* (*1940*). Also see *C. A.* **32,** *77*. Recomm. (*I. C.*).

BENZIDINE, 2.3 g. dissolved in 100 ml. 5% HCl, may be used for detc. and detn. of Mn when the concn. of the element is too low for a satisfactory use of permanganate colorimetry. A blue-green color is given by manganate ion in concns. as low as 0.008 ppm; the color fades within 2 minutes and a color comparison is made with artificial standards of $CuSO_4$ and picric acid. Other oxidizing agents give a similar reaction and must be absent; the sample should contain 0.1 to 1.0 mcg. Mn; cf. *Snell, pp. 343–4;* cf. also N. A. Clark, *Ind. Eng. Chem.*, (*Anal. Ed.*) **5,** *241* (*1933*). As a spot test, conditions may be controlled to make the reagt. practically specific among common metallic ions; cf. *Feigl, pp. 106–8.* Recomm. (*I. C.*).

TETRAMETHYLDIAMINODIPHENYLMETHANE, dissolved in $CHCl_3$ or in dilute AcOH, is oxidized by Mn in its higher valences to form a blue color which is much more stable than that obtained with benzidine; the reaction is carried out in a soln. acid with AcOH; for the spot test, cf. *Feigl, p. 105.* Recomm. (*I. C.*). For the colmtc. detn., cf. R. G. Harry, *J. Soc. Chem. Ind.* **50,** *434–6T* (*1931*); *Snell, p. 342.*

o-**TOLIDINE** may, in the absence of free chlorine and other intfrnces., be used for colmtc. detc. and detn. of Mn as manganate; cf. *Snell, p. 341;* L. Forman, *J. Am. Water Works Assoc.* **21,** *1212–7* (*1929*).

STRYCHNINE, 1% soln. in conc. H_2SO_4, gives a blue-violet, changing to red, color with Mn which has been evaporated to dryness in the presence of NaOH. The test is specific in the absence of Co, chromate, and ferrocyanide; by the use of drop quantities, it is said to be sensitive to 0.2 mcg. Mn; cf. S. Augusti, *Ann. chim. applicata* **24,** *535–8* (*1934*).

ANTHRANILIC ACID may be used for the gravmtc. detn. of Mn in the absence of Zn, Cd, Ni, Co, and Cu which contaminate the ppt.; pptn. should be made at a pH above 5.2; cf. Funk and Demmel, *Z. anal. Chem.* **96,** *385–8* (*1934*); H. Goto, *J. Chem. Soc. Japan* **55,** *1156–63* (*1934*); *C. A.* **29,** *1029* (*1935*).

MERCURY

DIPHENYLTHIOCARBAZONE (DITHIZONE), 10 to 50 mg. per liter $CHCl_3$ or CCl_4, may be used for the detc., detn., and sepn. of small amounts of Hg which is extracted from acidic aq. phase by shaking with the reagt. soln. with consequent change in color from the original bluish-green to yellowish-orange; in soln. approximately pH 3, Cu is the only metal likely to intfr.; cf. Fischer and Leopoldi; *Z. anal. Chem.* **103,** *241* (*1935*); *Feigl, p. 23; A. O. A. C., pp. 409–412; Prodinger, p. 126.* Recomm. (*I. C.*). **DI-β-NAPHTHYLTHIOCARBAZONE** is similar to dithizone but is said to give a more distinctive color with Hg and to be superior for its colmtc. detn., D. M. Hubbard, *Ind. Eng. Chem.*, (*Anal. Ed.*) **12,** *768–71* (*1940*).

DIPHENYLCARBAZIDE (saturated soln. in alc.) and **DIPHENYLCARBAZONE** (saturated soln. in alc.) are also used in colmtc. detc. and detn. of Hg and as indicators in mercurimetric titration. Hg (II) gives a violet or blue color in neutral or slightly acid soln.; Zn, Fe, Co, Ni, Pb, Cu, Ag, chromate, cyanide, chloride, bromide, and iodide ions intfr.; cf. Stock and Zimmermann, *Z. angew. Chem.* **41,** *546–8* (*1928*); *Snell, p. 180,* and *Feigl, p. 22;* for adaptation to qual. scheme, cf. A. W. Scott, *J. Am. Chem. Soc.* **51,** *3351* (*1929*); for use as indicator, cf. Dubsky and Trtilek, *Chem. Listy* **27,** *385–8* (*1933*). If acidity and other conditions be controlled carefully, the carbazide may be used for colmtc. detn. of low concns. of Hg; cf. Laird and Smith, *Ind. Eng. Chem.*, (*Anal. Ed.*) **10,** *576* (*1938*). Recomm. (*I. C.*).

PROPYLENEDIAMINE with $CuSO_4$ gives with neutral or amm. soln. contg. about 0.1% Hg and xs. KI a ppt. of $HgI_4 \cdot Cu(Pn)_2$ which may be dried and weighed for detn.; Spacu and Spacu, *Z. anal. Chem.* **89,** *188* (*1932*). **ETHYLENEDIAMINE** may be used in a similar way; cf. Spacu and Sucui, *Z. anal. Chem.* **92,** *247* (*1933*).

For a determination using **PYRIDINE** with dichromate, cf. Spacu and Dick, *Z. anal. Chem.* **76,** *273* (*1929*); Furman and State, *Ind. Eng. Chem.*, (*Anal. Ed.*) **8,** *467* (*1936*), and *C. A.* **35,** *6892* (*1941*).

p-**DIMETHYLAMINOBENZALRHODANINE,** satd. alc. soln., may be used as a drop test for detc. of Hg (II) in nearly neutral soln. free of Ag; a red color is formed; cf. Heller and Krumholz, *Mikrochemie* **7,** *217* (*1929*); *Feigl, pp. 24–7;* Kolthoff, *J. Am. Chem. Soc.* **52,** *2222* (*1930*).

ANTHRANILIC ACID ppts. Hg (II) as a slightly soluble salt which may be weighed for detn. of the metal; cf. Funk and Romer, *Z. anal. Chem.* **101**, *88* (*1935*). **THIOGLYCOLIC ACID β-AMINONAPHTHALIDE (THIONALID)** is also useful as a quant. precipitant of Hg; cf. Berg and Roebling, *Z. angew. Chem.* **48**, *430*, *597* (*1935*). *Prodinger, pp. 38, 90.*

MOLYBDENUM, MOLYBDATE

POTASSIUM ETHYL XANTHATE (POTASSIUM XANTHATE) may be prepared as needed or the solid may be used as a reagt. giving a red colored complex soluble in $CHCl_3$. The reagt. is added to a neutral soln. contg. about 1 mcg. Mo per liter and the mixture is acidified to produce the color; for a colmtc. detn. the mixture is extracted with $CHCl_3$. The detn. is accurate to within about 8% and is specific fo Mo; it is used for detn. of small amounts of Mo in W; cf. D. Hall, *J. Am. Chem, Soc.* **44**, *1462* (*1922*); *Snell, p. 383; Feigl, p. 64.* For spot test to detect Mo in steel, cf. *C. A.* **31**, *2120* (*1937*).

α-BENZOINOXIME (CUPRON), 2% alc. soln., is used for the pptn. and detn. of Mo in steel; the sample should contain about 0.15 g. Mo in hexivalent state and pptn. is made in a cold, slightly acid soln. which must not contain W, Pb, chromate, pentavalent V, or Ta; cf. H. B. Knowles, *Bur. Standards J. Research* **9**, *1* (*1932*).

CINCHONINE, 12.5% soln. in 6 *N* HCl, may be used to increase the extent and rapidity of pptn. by means of KCNS and a reducing agent such as $SnCl_2$; cf. C. M. Johnson, *Iron Age* **132**, *No. 2, 16* (*1933*).

PHENYLHYDRAZINE, in soln. in AcOH or dil. H_2SO_4, gives a red to rose coloration when warmed with molybdate soln. which is highly sensitive and specific; the color is suitable for detn. as well as detc. Iodates give free iodine, vanadates a green color, and permanganates are decolorized; tungstate is without effect; cf. E. Montignie, *Bull. soc. chim.* (4) **47**, *128* (*1930*); *Snell, p. 389; Feigl, p. 65.*

TANNIC ACID, 0.5% aq. soln. freshly prepared, gives with a molybdate soln. contg. xs. AcOH a red, brown, or yellow color which is suitable for detn.; the sample should contain no more than 20 mg. Mo. W must have been sepd. previously; cf. G. Spurge, *Chem. Eng. Mining Rev.* **11**, *258* (*1919*); *Snell, p. 389; Yoe I, p. 284.*

NICKEL

DIMETHYLGLYOXIME, 1 to 1.5% soln. in alc., is widely used for detc., gravmtc., titrimetric, and colmtc. detn. and sepn. of Ni. For a quant. pptn., the reagt. is added to a slightly acid soln. contg. no more than 30 mg. Ni, then NH_4OH or NaOAc is added to raise the pH to approximately 7. Co gives a brown, soluble complex; Fe (II) and a few other metals may contaminate the ppt. if they are present in excessive amounts or if the soln. is made too basic; ordinarily, however, Pd is the only element likely to intfr.; cf. Chugaev, *Ber.* 38, *2520* (*1905*). For a discussion of the accuracy and limitation as a reagt., cf. E. G. Righellato, *Chem. Age* **28**, *574* (*1933*); for a summary of the use and precautions in pptn., cf. Hillebrand and Lundell, *Applied Inorganic Analysis, pp. 313–8* (*1929, Wiley, New York*); for spot tests by means of this reagt. with and without an accompanying oxidizing agent cf. *Feigl, pp. 88–92;* for detn. by colorimetry, cf. *Yoe I, p. 295,* and *Prodinger, 53;* for colorimetry in conjunction with an oxidizing agent (bromine water) which gives a red soluble complex making possible detn. of 0.015 to 0.5 mg. Ni without pptn., cf. *Snell, pp. 314–7;* for titrimetric method, cf. *C. A.* **29**, *1748* (*1935*); for detn. of Ni in soils, cf. *C. A.* **30**, *6488* (*1936*). Reagt. recomm. (*I.C.*).

A number of other reagts. have been suggested for Ni; for **α-BENZILDIOXIME (DIPHENYLGLYOXIME)**, cf. F. W. Atack, *Analyst* **38**, *316*, (*1913*); for **METHYLBENZOYLGLYOXIME**, cf. H. Holzer, *Z. anal. Chem.* **95**, *392* (*1933*); for **CYCLOHEXANEDIONEDIOXIME**, which is very similar to dimethylglyoxime but has the advantage of high water solubility, cf. O. Wallach, *Ann.* **437**, *148* (*1924*), *C. A.* **19**, *487* (*1925*); **α-FURILDIOXIME** is also soluble in water and has an added advantage in gravmtc. detn. of Ni in that Ni makes up only 11.81% of its compound with the reagt. whereas with dimethylglyoxime the percentage is 20.31; cf. Soule, *J. Am. Chem. Soc.* **47,** *981* (*1925*). For critical comparison of Ni reagts., cf. Wenger, et al., *Helv. Chim. Acta* **24,** *889–99* (*1941*), *C. A.* **36,** *2225*.

SALICYLALDOXIME, prepd. as described under *copper*, quant. ppts. Ni at pH 7; the ppt. may be contaminated by iron if this element is present in test soln.; cf. Biefeld and Howe, *Ind. Eng. Chem.*, (*Anal. Ed.*) **14,** *251–3* (*1942*).

DITHIOOXAMIDE (RUBEANIC ACID), 1% alc. soln., may be used as a sensitive spot reagt. and gives a blue-violet spot in ammoniacal soln.; Co, Fe, and Cu intfr.; cf. *Feigl, p. 92.* Recomm. (*I. C.*).

FORMALDOXIME, made as needed by boiling a mixture of 7 g. hydroxylamine hydrochloride, 15 ml. water, and 3 g. trioxymethylene, may be used for detc. and detn. of as low as 0.1% Ni in Co salts; it gives a brown color; cf. G. Deniges, *C. A.* **27,** *927* (*1933*). Recomm. (*I. C.*).

POTASSIUM DITHIOOXALATE, 0.1% aq. soln. made up fresh every few days, is said to be better for colorimetry than dimethylglyoxime. It gives a deep bluish-red color. The sample should contain about 1 mg. Ni; the color develops in a slightly acid soln. Co and Fe must be removed and most of the common metals intfr. if present in appreciable amounts; Mg, alkaline earths, Al, and phosphate do not intfr.; cf. *Snell, pp. 317–9, Yoe I, p. 298–303.*

ANTHRANILIC ACID ppts. a slightly soluble Ni salt from a slightly acid soln.; Cu, Mn, Zn, and Co intfr.; Funk and Ditt, *Z. anal. Chem.* **93,** *241–7* (*1933*).

ETHYLENEDIAMINE with thiosulfate may be used for a spot test for Ni and gives a violet ppt.; cf. G. Spacu and P. Spacu, *Z. anal. Chem.* **89,** *192* (*1932*).

NITRATE, NITRITE

Various reagts. are precipitants for nitrate. **NITRON,** 1 g. in 10 ml. 5% AcOH, is a reagt. which is unstable and must be prepared as needed; a formic acid soln. is said to be more stable. This reagt. forms a nitrate which is soluble only to the extent of 9.9 mg. per 100 ml. water; perchlorate and some other anions similarly give slightly soluble salts and intfr. in detn.; cf. Busch, *Ber.* **38,** *861* (*1905*); Cope and Barab, *J. Am. Chem. Soc.* **39,** *504–14* (*1917*). **DI-(α-NAPHTHYLMETHYL)-AMINE,** about 10% in 50% AcOH, is said to be a more effective precipitant than nitron but it is likewise non-specific; only its acetate, sulfate, and phosphate are soluble in water; cf. Rupe and Becherer, *Helv. Chim. Acta* **6,** *674* and *885* (*1923*); F. Konek, *Z. anal. Chem.* **97,** *416–8* (*1934*). For **α-PHENYL-β-DIETHYLAMINOETHYL-*p*-NITROBENZOATE** see under *chlorine* and *perchlorate*.

PHENOLDISULFONIC ACID, prepared by dissolving pure **PHENOL** in conc. H_2SO_4, gives a yellow color with minute amounts of nitrate in alk. soln.; for detn. in water of low chlorine content and samples contg. 0.05 mg. or less of nitrate, cf. *A. O. A. C., p. 527; A. P. H. A., pp. 48–9; Yoe I, pp. 313–6; Snell, pp. 629–35.* The color of **INDIGO CARMINE** is bleached by nitrate and this is used to detc. nitrate impurities in various salts; cf. *U. S. Pharmacopoeia XI, p. 493;* **DIPHENYLAMINE** or **DIPHENYLBENZIDINE** in sulfuric acid gives blue colors by reaction with nitrate in acid soln.; 0.5 to 5 mcg. may be detected and determined; for details and bibliography, cf. *Snell, pp. 637–41; Yoe I, p. 316; Feigl, p. 211;* for detc. of nitrate in milk, cf. *C. A.* **29,** *7510* (*1935*), and in wines, cf. *A. O. A. C., p. 170.*

BRUCINE, 0.02% soln. in H_2SO_4 for spot test, and 5% soln. in $CHCl_3$ for colmtc. detn. gives a red color with nitrate in acid soln. which changes to a stable yellow useful for colmtc. detn. The sample should contain 0.01 to 0.2 mg. nitrate nitrogen; nitrite reacts similarly if acid concn. is low; cf. *Feigl, p. 212; Snell, p. 635; Yoe I, p. 318.* **STRYCHNINE** also gives a very delicate test; cf. *Snell, p. 636, Yoe I, p. 320.*

For detn. of nitrate in nitrite the latter is destroyed by sodium azide then the nitrate reacted with **NITROBENZENE** to obtain dinitrobenzene which is detd. by means of acetone and alkali, cf. W. Seaman, et al., *Ind. Eng. Chem.*, (*Anal. Ed.*) **14,** *420–22* (*1942*).

AZORUBIN, 0.01% aq. soln., with H_2SO_4 is decolorized by nitrate or nitrite, and has the advantage over many of the other reagts. in that Fe (III) ion has no effect; cf. J. Skutil, *Chem. Listy* **30,** *74* (*1936*).

Nitrite is usually detc. or determined colmtcly. by its diazotization of amines which are then coupled with other amines or phenols to form colored azo compounds; **α-NAPHTHYLAMINE** and **SULFANILIC ACID** are widely used for this purpose; for nitrite in flour, cf. *A. O. A. C.*, p. *222;* for nitrite in water, cf. *A. O. A. C., p. 527; A. P. H. A., p. 46; Yoe I, p. 308; Snell, p. 644; Feigl, p. 215.* **DIMETHYL-α-NAPHTHYLAMINE** is said to be superior to the naphthylamine in the preceding reaction; cf. F. G. Germuth, *Ind. Eng. Chem.*, (*Anal. Ed.*) **1,** *28* (*1929*). **SULFANILAMIDE** with **N-(1-NAPHTHYL)-ETHYLENEDIAMINE DIHYDROCHLORIDE** have recently been found superior reagts. for nitrite; Martha B. Shinn, *Ind. Eng. Chem.*, (*Anal. Ed.*) **13,** *33* (*1941*). This procedure has been adapted to waterworks usage, cf. Kershaw and Chamberlin, *Ind. Eng. Chem.*, (*Anal. Ed.*) **14,** *312* (*1942*).

OSMIUM

THIOUREA when boiled with sodium chloroosmate and xs. HCl gives an intense red color when the concn. is above 10 ppm; cf. Chugaev, *Z. anorg. allgem. Chem.* **148,** *65* (*1925*); for complete procedure for Os, Ru, Pt, Pd, Rh, and Ir, cf. Gilchrist and Wichers, *J. Am. Chem. Soc.* **57,** *2565–73* (*1935*). For reaction with **NICKEL ACETATE,** see under *palladium.*

OXALATE

DIPHENYLAMINE, as the solid, may be mixed and heated with the unknown and the residue extracted with a little alc. to get a blue soln. if oxalate was present in the sample. Recomm. (*I. C.*). *Feigl, p. 336–8.*

INDIGO is not bleached by $K_2Cr_2O_7$ alone but in the presence of as little as 0.03 mg. oxalate, both oxalate and indigo are oxidized with consequent loss in color of the indigo; cf. Tavanaev and Budkevich, *Z. anal. Chem.* **103,** *353* (*1935*); *ibid.*, **104,** *413* (*1936*).

Oxalic acid may be reduced to glycolic acid by the use of Mg powder, and this glycolic acid may be detected by the use of **2,7-DIHYDROXYNAPHTHALENE** in H_2SO_4; cf. *Feigl, p. 335.*

OXYGEN

A mixture of $Mn(OH)_2$ and KI may be used for detc. or detn. of oxygen in a gaseous mixture; after absorption of oxygen, acid and **STARCH** are added and the detn. is made by comparison of the color of the starch-iodine complex; cf. *Snell, pp. 133–6; C. A.* **28,** *5778* and *6889* (*1934*).

PYROGALLOL, in alkaline soln. is in general use for removal of oxygen from other gases and is also used for the estn. of oxygen-supplying power of soil; cf. Hutchins and Livingston, *J. Agr. Research* **25,** *133* (*1923*).

For dissolved oxygen, the yellow leuco base of **INDIGO CARMINE** has been successfully used on 1 ml. samples of liquid; errors are low; extreme care must be taken to prevent contact of the reagt. soln. with air; for preparation of reagt. and details of procedure, cf. V. V. Efimov, *Biochem. Z.* **155,** *371–5* (*1925*) or *Snell, p. 137.* **ADUROL** has been used for approximate estn.; cf. *Snell, p. 136* or *Yoe I, p. 330.* **AMIDOL (2,4-DIAMINOPHENOL HYDROCHLORIDE)** has been used for a field method in determining oxygen in water and sewage; cf. *A. P. H. A., p. 237;* M. L. Isaacs, *Sewage Works J.* **7,** *435–43* (*1935*); F. W. Gilcreas, *J. Am. Water Works Assoc.* **27,** *1166* (*1935*).

PALLADIUM

DIMETHYLGLYOXIME gives a bright yellow ppt. from acid soln. of Pd and provides a method for separating Pd from Os, Ru, Pt, Rh, and Ir, and for its subsequent detn.; Au must be absent as it is pptd. as the metal; cf. Gilchrist and Wichers, *J. Am. Chem. Soc.* **57,** *2565–73* (*1935*). Recomm. (*I. C.*). *β*-**BENZILDIOXIME** may also be used and gives a ppt. with 3 mcg. Pd per ml.; cf. Dwyer and Mellor, *C. A.* **29,** *4690* (*1935*); other oximes which may be used are **BENZOYL-METHYLGLYOXIME,** cf. *Chem. News* **131,** *401* (*1925*) and **SALICYLALDOXIME,** cf. Holzer, *Z. anal. Chem.* **95,** *398* (*1933*). *β*-**FURFURALDOXIME** may be better than the dimethylglyoxime in detc. and detn. of Pd, cf. Hayes and Chandlee, *Ind. Eng. Chem.,* (*Anal. Ed.*) **14,** *491–3* (*1942*).

p-**DIMETHYLAMINOBENZALRHODANINE,** satd. alc. soln. gives a reddish-violet ppt. with Pd in neutral or sl. acid soln. contg. at least 0.1 ppm Pd; Pt, Au, Ag, and Hg also ppt.; cf. *Feigl, pp. 18–81.* **5-(4-SULFO-1-NAPHTHYLAZO)-8-HYDROXYQUINOLINE,** alc. soln., gives an orange color or red ppt. with as little as 2 mcg. Pd in dil HNO_3 soln. and is specific; cf. Gutzeit and Monnier, *Helv. Chim. Acta* **16,** *233* (*1933*); *Feigl, p. 81.* **6-NITROQUINOLINE** gives a yellow ppt. of $Pd(C_9H_6N \cdot NO_2)_2$ which may be dried for gravmtc. detn. and which is specific in the platinum group; cf. Ogburn and Riesmeyer, *J. Am. Chem. Soc.* **50,** *3018* (*1928*). *p*-**NITROSODIPHENYLAMINE** and related compounds have been found of merit in detc. and colmtc. detn. of Pd (II); cf. Yoe and Overholser, *J. Am. Chem. Soc.* **61,** *2058–63* (*1939*), and **63,** *3224* (*1941*).

The reduction of nickel in **NICKEL ACETATE** by sodium hypophosphite is catalyzed by Pd and this property may be used as a means of detecting Pd. The test is made in a clean test tube to which is added 1% soln. of $Ni(OAc)_2$, satd. NaH_2PO_2, and unknown. When warmed in boiling water, the Ni is deposited as a black powder or as a mirror within 2–30 min. A blank shows test only after a long time. Pt, Ru, and Os also give test but not as quickly; cf. *Feigl, p. 75.* Recomm. (*I. C.*).

PHOSPHORUS, PHOSPHATE

For amounts up to 1 or 2 mg. phosphate, detn. may generally be made most satisfactorily by formation of phosphomolybdate which is subsequently reduced by such reagts. as **1-AMINO-2-NAPHTHOL-4-SULFONIC ACID, HYDROQUINONE,** or **BENZIDINE** to produce colors suitable for colmtc. estn.; cf. *A. O. A. C., p. 133; A. P. H. A., pp. 109–11; Feigl, p. 216.* For a comprehensive review of colmtc. methods, cf. *Snell, pp. 480–516,* and for a comparison of various pptn., titrimetric, and colmtc. methods with bibliography, cf. Peters and Van Slyke, *Quantitative Clinical Chemistry, p. 857 ff (1932, Williams and Wilkins, Baltimore).* For the use of **STRYCHNINE MOLYBDATE** in nephelometry of phosphate, cf. *Yoe II, pp. 148–54.* The 1-amino-2-naphthol-4-sulfonic acid—ammonium molybdate reaction has been used for the detn. of phosphorus in soils; cf. Mildred S. Sherman, *Ind. Eng. Chem.,* (*Anal. Ed.*) **14,** *182* (*1942*).

PLATINUM

NICKEL ACETATE, see under *palladium.* Recomm. (*I. C.*). For analysis scheme for platinum metals, cf. Beamish and Scott, *Ind. Eng. Chem.,* (*Anal. Ed.*) **9,** *460–3* (*1937*).

POTASSIUM

p-**DIPICRYLAMINE (HEXANITRODIPHENYLAMINE** or **"AURANTIA"),** 0.2 g. in 20 ml. water contg. 2 ml. of *N* Na_2CO_3, gives an orange-red crystalline ppt. with K in sl. alk. sol.; as a spot test it will detect 3 mcg. K. NH_4 in large xs. must be removed but Li, Na, Mg, Ca, Sr, and Ba do not ppt.; cf. Poluektov, *Mikrochemie* **14,** *265–6* (*1934*); *Feigl, p. 149.* The Mg salt of the amine may be used instead of the Na salt as formed in Na_2CO_3 and has been satisfactorily used in gravmtc., volmtc., and colmtc. detn. of K in macro and micro amts.; cf. Kolthoff and Bendix, *Ind. Eng. Chem.*, (*Anal. Ed.*) **11,** *94–8* (*1939*). See also E. Amdur, *ibid.* **12,** *731–4* (*1940*). Recomm. (*I. C.*).

PICRIC ACID, saturated soln. in alc., ppts. K (as well as NH_4, Rb, and Cs) and the ppt. may be dissolved in water for colmtc. estn.; sulfates must be removed but Ca, Mg, Al, Fe, phosphates, and silicates do not intfr.; cf. E. R. Caley, *J. Am. Chem. Soc.* **53,** *539–45* (*1931*); *Snell, p. 437; C. A.* **29,** *1031* (*1935*); other nitrophenols have been tried, cf. Rosenthaler, *Mikrochemie* **2,** *29–32* (*1924*).

The familiar qual. reagt., sodium cobaltinitrite, may be used for sepn. of K and subsequent colmtc. detn. by reaction with many of the nitrite reagts.; cf. *Snell, pp. 432–7.* Washing of ppt. during sepn. should be done with 1% $Al_2(SO_4)_3$; W. E. Thrun, *Ind. Eng. Chem.*, (*Anal. Ed.*) **5,** *79* (*1933*). For indirect detn. of K in ppt. cf. C. P. Sideris, *ibid.* **9,** *145* (*1937*).

NAPHTHOL YELLOW S (2,4-DINITRO-1-NAPHTHOL-7-SULFONIC ACID), satd. aq. soln., gives a yellow ppt. with a soln. contg. as much as 400 ppm K; NH_4 and Na do not ppt.; cf. Clark and Willits, *Ind. Eng. Chem.*, (*Anal. Ed.*) **8,** *209* (*1936*).

SODIUM 5-NITRO-6-CHLOROTOLUENE-3-SULFONATE, satd. aq. soln., may be used for pptn. and detn. of K in the absence of NH_4 and Rb which are also pptd. by the reagt.; the K salt is 1/40 as sol. as the reagt.; cf. Davies and Davies, *J. Chem. Soc.* **123,** *2976–82* (*1923*).

"GARDINOL," "DREFT," or **"DRENE,"** 3% aq. soln., form K salts which are much less soluble than the corresponding Li, NH_4 Mg, Ca, Na, and Ca salts, and may therefore be used as tests for K; cf. E. A. Wildman, *C. A.* **30,** *407* (*1936*); B. Reichert, *C. A.* **29,** *3939* (*1935*).

The hydrogen **TARTRATE** ion is in common use as a precipitant for K. The reagt. soln. is prepared by mixing 50 ml. of 2 *N* tartaric acid, 25 ml. 0.5 *N* NaOH, 25 ml. 96% alc. and allowing the mixture to stand until clear; cf. *C. A.* **23,** *1588* (*1929*); Clarke and Davidson, *Ind. Eng. Chem.*, (*Anal. Ed.*) **3,** *258–9* and *324–5* (*1931*); for use in conjunction with sodium cobaltinitrite, cf. Wikul, *Z. anorg. allgem. Chem.* **151,** *338* (*1926*).

RUBIDIUM

For the use of **5-NITRO-6-CHLOROTOLUENE-3-SULFONATE** see under *potassium.*

RUTHENIUM

RUBEANIC ACID (DITHIOOXAMIDE), 2.5% soln. in glacial AcOH, gives a blue soln. with as little as 0.2 mcg. of Ru in aq. soln.; other Pt metals do not give permanent colorations; H_2PtCl_6 gives a red soln. which soon yields a brownish-red ppt.; cf. Wölbling and Steiger, *Mikrochemie* **15,** *295–301* (*1934*). For a complete analysis of the Pt group, cf. Gilchrist and Wichers, *J. Am. Chem. Soc.* **57,** *2565–73* (*1935*).

THIONALID (THIOGLYCOLIC β-AMINONAPHTHALIDE) has been used in detn. of Ru; cf. W. J. Rogers, et al., *Ind. Eng. Chem.*, (*Anal. Ed.*) **12,** *561–3* (*1940*).

SCANDIUM

MORIN with minute amts. of Sc gives a green fluorescence in ultraviolet light. For review of tests for Sc, cf. G. Beck, *Mikrochim. Acta* **2,** *9–12, 287–90* (*1937*); *C. A.* **32,** *452, 1606* (*1937*).

SELENIUM

THIOUREA in the absence of excess nitrate and Cu gives a red ppt. of free Se from HCl solns. contg. minute amounts; Se may be separated from Te by this reagt.

and may be detd. by weighing the pptd. Se; cf. P. Falciola, *Ann. chim. applicata* **17,** *357–8 (1927); Feigl, p. 231.* Recomm. (*I. C.*).

PYRROLE, 1% soln. in alc., added to a soln. of the unknown in syrupy phosphoric acid contg. a little $FeCl_3$ gives a deep blue color when the concn. of Se as H_2SeO_3 is over 0.1 ppm; the color is suitable for estn.; silicic acid acts similarly; selenic, tellurous and telluric acids do not intfr.; cf. Berg and Teitelbaum, *Mikrochemie, Emich Festschr. 23–6* (*1930*)*; Snell, p. 604; Feigl, p. 336.*

CODEINE PHOSPHATE, 4% aq. soln., has been used for detc. and colmtc. detn. of SeO_2 as an impurity in conc. H_2SO_4. When 0.1 ml. of the reagt. soln. is added to 10 ml. sample, a blue coloration is obtained when the concn. of SeO_2 is over 0.00005%; As_2O_5 gives no color in concn. below 1%; Fe (III) gives a blue color when concn. is above 0.0015%; cf. Tz. Raikhinstein, *C. A.* **23,** *2391* (*1929*).

For other methods, cf. Dudley and Byers, *Ind. Eng. Chem.*, (*Anal. Ed.*) **7,** *3* (*1935*)*;* Williams and Byers, *Ind. Eng. Chem.* **28,** *912* (*1936*).

SILICON, SILICATE

Ammonium molybdate with silicate in acid soln. gives the complex silicomolybdic acid which, after warming, gives with **BENZIDINE** a blue color in sl. ammoniacal soln.; phosphates and arsenates react similarly; cf. *Feigl, p. 219.* Recomm. (*I. C.*).

For use of **PYRROLE** see under *SELENIUM.*

SILVER

p-**DIMETHYLAMINOBENZALRHODANINE,** satd. soln. in acetone, when added to a soln. slightly acid with HNO_3 gives a reddish-violet color or ppt. if the concn. of Ag is above 0.4 ppm; other metals, Hg, Au, Pt, Pd, and Cu, also react; in the presence of KCN only Cu is likely to intfr.; cf. *Feigl, pp. 16–19; Z. anal. Chem.* **74,** *380–6* (*1928*)*; Mikrochemie* **3,** *165–73* (*1931*)*;* Kolthoff, *J. Am. Chem. Soc.* **52,** *2222–6* (*1930*). Recomm. (*I. C.*). For a spot test to detect Ag in galenites, cf. R. Jirkovsky, *Mikrochemie* **17,** *135–40* (*1935*)*;* for a colmtc. detn. of minute amounts of Ag, cf. *I. C.* Schoonover, *J. Research Natl. Bu. Standards* **15,** *377–84* (*1935*).

DIPHENYLTHIOCARBAZONE (DITHIZONE), in $CHCl_3$ soln., gives a violet color with 0.05 to 0.1 mcg. Ag in acid soln.; Cu and Hg give similar reactions; cf. Fischer, Leopoldi and von Uslar, *Z. anal. Chem.* **101,** *1–23* (*1935*)*; Feigl, p. 21.* Recomm. (*I. C.*).

2-THIO-5-KETO-4-CARBETHOXY-1,3-DIHYDROPYRIMIDINE, as a freshly made 0.01% soln. in acetone, may be superior to the dimethylaminobenzalrhodanine in detc. and detn. of Ag. The yellow soln. gives a purple coloration with Ag concns. over about 0.4 ppm. At pH 2.0, Hg (I) and Hg (II) intfr. and must be absent; Cu and Fe (III) in comparatively large amts. intfr. Yoe and Overholser, *Ind. Eng. Chem.,* (*Anal. Ed.*) **14,** *148* (*1942*).

With Ag in sl. alk. soln. many reducing agents, such as **DEXTRINE, GUM ARABIC, SUGAR, STARCH,** and **GLYCEROL,** reduce the silver ion to the element in colloidal form suitable for colmtc. estn.; cf. *Yoe I, p. 683.*

SODIUM

ZINC or **MAGNESIUM URANYL ACETATE,** see references for methods of preparing the reagt., may be used for the detc., gravmtc. and colmtc. detn. of Na; Ca, Mg, Sr, Ba, and Fe do not intfr.; K, unless present in an amount over 5 times that of the Na, does not ppt.; phosphate is pptd. by adding lime to prevent intfr.; proteins may be pptd. by $HgCl_2$; cf. Barber and Kolthoff, *J. Am. Chem. Soc.* **50,** *1625–31* (*1928*)*; ibid.,* **51,** *3233–7* (*1929*)*;* Caley and Foulk, *J. Am. Chem. Soc.* **51,** *1664–74* (*1929*)*;* also cf. *Snell, pp. 439–42, Feigl, p. 147;* Peters and Van Slyke, *Quantitative Clinical Chemistry, Vol. II, p. 732* (*1932, Williams and Wilkins, Baltimore*)*;* for **COBALT URANYL ACETATE,** cf. *U. S. Pharmacopoeia XI, p. 453.*

6,8-DICHLOROBENZOYLENEUREA (SHEIBLEY'S REAGENT) in soln. in dil. KOH may be used for detc. of Na in presence of other alkali metals, cf. F. E. Sheibley, *J. Org. Chem.* **3,** *414–23* (*1938*); *C. A.* **33,** *2895* (*1939*).

STRONTIUM

SODIUM RHODIZONATE, 5% aq. soln. made up when needed, gives a red-brown ppt. or red color in neutral soln. of Sr; the color disappears on acidulation; Ca does not intfr. and Ba interference is prevented by pptn. as chromate; cf. Feigl, *Mikrochemie* **2,** *187* (*1924*); *Feigl, p. 138;* G. Gutzeit, *Helv. Chim. Acta* **12,** *829* (*1929*).

SULFUR, SULFIDE, SULFATE

Free sulfur may be detected by heating the substance in a melting point tube for 5 minutes at 210° C. with **BENZYLIMIDO-DI (4-METHOXYPHENYL)-METHANE** which forms a blue color that may be extracted with benzene; cf. Schonberg and Urban, *Ber.* **67B,** *1999–2003* (*1935*).

For detn. of S in petroleum distillates, a reagt. freshly prepared from 10 vol. freshly distilled CS_2 and 1 vol. **PYRIDINE** is used. When heated with a sample contg. S it gives a pink color with an intensity varying with S content; cf. Thornton and Latta, *Ind. Eng. Chem.*, (*Anal. Ed.*) **4,** *441–2* (*1932*); *Snell. p. 600.*

***p*-AMINODIMETHYLANILINE,** dry or 1% soln., with a little 0.1 *N* $FeCl_3$ may be used to detect 1 mcg. or to determine 0.1 to 1 ppm sulfur as sulfide because of the formation of methylene blue; cf. *Feigl, p. 198; Yoe 1, pp. 373–7; Snell, pp. 593–6; C. A.* **29,** *1745* (*1935*). Recomm. (*I. C.*).

BENZIDINE, as the free base or as the hydrochloride dissolved in dil. HCl, is widely used for pptn. of sulfate as benzidine sulfate; the detn. may then be made by titration with standard NaOH to phenolphthalein end point, or may be made colmtcly. by various means; see references. Phosphate, if present, is removed with magnesium carbonate. For routine analysis of boiler waters, cf. *A. P. H. A., pp. 106–8;* Schroeder, *Ind. Eng. Chem.*, (*Anal. Ed.*) **5,** *6* and *403* (*1933*). See also Peters and Van Slyke, *Quantitative Clinical Chemistry, Vol. II, pp. 892–6* and *902* (*1932, Williams and Wilkins, Baltimore*); *Snell, pp. 621–4;* Marsden and Pollard, *J. Soc. Chem. Ind.* **56,** *464–8T* (*1937*).

BARIUM RHODIZONATE is not dissolved by acids; sulfuric acid or sulfate ion, however, bleach the red color of the insoluble barium salt by formation of $BaSO_4$. This may be used as a spot test for sulfate; cf. *Feigl, p. 204;* or, the reaction is the basis for use of sodium rhodizonate as an indicator for titration with $BaCl_2$; cf. Strebinger and Zombory, *Z. anal. Chem.* **105,** *346–50* (*1936*). **TETRAHYDROXYQUINONE** may be used in the same way to detect sulfate up to 30,000 ppm and has the advantage of being more stable; cf. Sheen and Kahler, *Ind. Eng. Chem.*, (*Anal. Ed.*) **8,** *127–30* (*1936*), and Peabody and Fisher, *ibid,* **10,** *651* (*1938*); *A. P. H. A., pp. 108–9;* **EOSIN** has been tried as an indicator for titration of sulfate with $Pb(NO_3)_2$; cf. J. E. Ricci, *Ind. Eng. Chem.*, (*Anal. Ed.*) **8,** *130–2* (*1936*).

Sulfite may be identified by its bleaching effect on such dyes as **MALACHITE GREEN, MELDOLA BLUE,** and **FUCHSIN;** cf. *Feigl, p. 201;* G. Gutzeit, *Helv. Chim. Acta* **12,** *736* (*1929*); V. E. Malinovskii, *C. A.* **25,** *2076* (*1931*). Sulfite in thiosulfate soln. may be detected by use of **FORMALDEHYDE** which releases alkali as shown by phenolphthalein; *Feigl, 202.* Recomm. (*I. C.*).

Thiosulfate may be detected by its formation of a ppt. in a neutral soln. with a reagt. made by adding **ETHYLENEDIAMINE** to a soln. of $Ni(NO_3)_2$ until a violet color develops; cf. G. Spacu and P. Spacu, *Z. anal. Chem.* **89,** *192–6* (*1932*).

TANTALUM

For tests and reagts. see under *columbium.*

TARTRATE

GALLIC ACID, 0.01 g. in 100 ml. concd. H_2SO_4, gives blue to yellow-green coloration with tartrate sepd. out as the Ca salt and heated to 120°–150° C. Formaldehyde, carbohydrates, glycolic acid and certain other acids intfr. by giving colorations but malic, cinnamic, salicylic, and the fatty acids do not. *Feigl, 338.* Recomm. (*I. C.*).

RESORCINOL, 2% aq. soln., gives a red color when heated with a sample contg. tartrate to which concn. H_2SO_4 is added; oxidizing agents intfr.; oxalate gives a blue color. For detc. of tartrate in cheese, cf. *A. O. A. C., p. 302.* If KBr be used with reagt. under controlled conditions of acidity and temperature, the reaction becomes specific except for chloral; cf. Ware, *Chemist and Druggist* **120,** *74–129* (*1934*); Pesez, *J. pharm. chim.* **21,** *542* (*1935*).

TELLURIUM

THIOUREA gives a yellow crystalline ppt. with acid or neutral solns. contg. Te in concns. of over 2–5 ppm. Se, Bi, and Sb may intfr. Cf. P. Falciola, *Ann. chim. applicata* **17,** *359–60* (*1927*); *C. A.* **21,** *3580* (*1927*). Recomm. (*I. C.*).

THALLIUM

DIPHENYLTHIOCARBAZONE (DITHIZONE), 0.01% soln. in $CHCl_3$ may be used for detn. of 0.005 to 0.2 mg. Tl in the presence of not over 100 mg. of Hg, Ni, or Zn, nor over 0.6 mg. Pb or Bi; Tl is extracted from an ammoniacal soln. by the reagt.; cf. L. A. Haddock, *Analyst* **60,** *394–9* (*1935*).

THIONALID (THIOGLYCOLIC ACID β-AMINONAPHTHALIDE), in alk. soln. contg. cyanide or tartrate, is practically specific for Tl and ppts. in concns. as low as 0.1 ppm; the ppt. is suitable for gravmtc., volmtc., or colmtc. methods; cf. Berg, and Roebling, *Z. angew. Chem.* **48,** *430* and *597* (*1935*).

For a summary of the action of many reagts. on Tl (I) and Tl (III), cf. Munch and Ward, *J. Am. Pharm. Assoc.* **24,** *351–8* (*1935*).

THORIUM

1-AMINO-4-HYDROXYANTHRAQUINONE as a 0.1% soln. in alc. gives with Th in weakly acid solns. a red fluorescence. Ga reacts similarly but is very much weaker in effect. Other metal ions do not intfr. unless they oxidize the reagt.; phosphate, fluoride, and sulfate intfr.; White and Lowe, *Ind. Eng. Chem.*, (*Anal. Ed.*) **13,** *809* (*1941*).

CUPFERRON (AMMONIUM NITROSOPHENYLHYDROXYLAMINE) gives a quant. pptn. of Th in acetic acid soln.; Ag, Pb, Hg, Sn, Bi, W, and Ce intfr.; cf. Baudisch, *Chem. Ztg.* **33,** *1298* (*1908*); W. M. Thornton, *Chem. News* **114,** *13* (*1916*).

PICROLONIC ACID, 2.6 g. per liter, gives a ppt. of Th salt which is less soluble than Ca and Pb salts; pptn. is from a soln. acid with AcOH. The reagt. does not serve to separate Th from other rare earths but in their absence is satisfactory for gravmtc. detn. of Th; cf. Hecht and Ehrmann, *Z. anal. Chem.* **100,** *87–8* (*1935*).

8-HYDROXYQUINOLINE (OXINE) gives a pptn. from AcOH soln. buffered with NH_4OAc which is said to provide a more convenient macro- and micro-detn. than that with picrolonic acid; cf. F. Hecht, *Z. anal. Chem.* **100,** *98–103* (*1935*).

PHENYLARSONIC ACID may be used to separate Th from Zr; the former gives a ppt. only in a soln. buffered with acetate; cf. Rice, Fogg, and James, *J. Am. Chem. Soc.* **48,** *895* (*1926*).

TIN

CACOTHELINE, satd. aq. soln., gives a violet color with Sn (II) which may be used as a spot test or for colmtc. detn. The reaction is most sensitive in the presence of HCl; thiosulfate, sulfite, Cu (I), and lower oxides of Mo and W give the same test; cf. G. Gutzeit, *Helv. Chim. Acta* **12,** *720* *(1929); Feigl, p. 59; Snell, p. 258;* Newell, Ficklen and Maxfield, *Ind. Eng. Chem.*, (*Anal. Ed.*) **7,** *40* *(1935)*; cf. also *C. A.* **30,** *4783* *(1936)*. Recomm. (*I. C.*).

DIMETHYLGLYOXIME with $FeCl_3$ added to an acid soln. of unknown and then made ammoniacal gives red Fe (II) dimethylglyoxime from reduction of Fe (III) by Sn (II) or any other strong reducing agent; tartrate is added before the ammonia to prevent pptn. of $Fe(OH)_3$; cf. *Feigl, p. 60.* Recomm. (*I. C.*).

CUPFERRON (AMMONIUM NITROSOPHENYLHYDROXYLAMINE) may be used for gravmtc. detn. of Sn and for its separation from As, Sb, Pb, Mn, Zn, Co, and Ni; cf. N. H. Furman, *Ind. Eng. Chem.* **15,** *1071* (*1923*); Pinkus and Claessens, *Bull. soc. chim. Belg.* **36,** *413* (*1927*)*; Prodinger, p. 82.*

4-CHLORO-1,2-DIMERCAPTOBENZENE (1-CHLOROBENZENE-3,4-DITHIOL) as 0.2% soln. in NaOH soln. gives a pink or red color with acid soln. contg. Sn (II). Sn (IV) slowly gives the test also. The test soln. may contain as much as 15% HCl. If xs. reagt. is used in test tube, only Cu, Bi and Ni intfr. Mills and Clark, *J. Chem. Soc.* **149,** *175* (*1936*); Clark, *Tech. Pub. Intern. Tin Research Development Council, Ser. A, No. 41* (*1936*). Recomm. (*I. C.*).

TITANIUM

CUPFERRON (AMMONIUM NITROSOPHENYLHYDROXYLAMINE), freshly prepared 6% aq. soln. ppts. the reddish-brown Ti compound from an acid soln. which may contain Al, Cr, Mn, and Ni without intfrnce.; Zr, Fe, V, W, and rare earths ppt. under the same conditions; cf. T. R. Cunningham, *Ind. Eng. Chem.*, (*Anal. Ed.*) **5,** *305* (*1933*).

For the use of **8-HYDROXYQUINOLINE (OXINE)** as a pptant. of Ti, cf. Berg and Teitelbaum, *Z. anal. Chem.* **81,** *1* (*1930*)*; Prodinger, p. 110.*

THYMOL, 5 g. dissolved in 5 ml. dil AcOH, then mixed with 95 ml. conc. H_2SO_4 and protected from sunlight, is a reagt. for colmtc. detn. of 0.2 to 2.5 mg. TiO_2. It gives a yellow to red color depending on the concn. and errors average 5%; only W is likely to intfr.; cf. Lehner and Crawford, *J. Am. Chem. Soc.* **35,** *138–41* (*1913*)*; Snell p. 363.*

DIHYDROXYMALEIC ACID prevents the formation of an orange color with V and H_2O_2, but does not affect the coloration arising from interaction of Ti and H_2O_2. Consequently Ti in admixture with V, in acid solns., may be detected by this reagt.; cf. Fenton, *J. Chem. Soc.* **93,** *1064* (*1908*)*; Snell, p. 365.*

GALLIC ACID, 1% aq. soln., may be used for colmtc. detn. of minute amounts of Ti in neutral solns. to which NaOAc soln. is added after addn. of the reagt.; yellow to red colors are produced and the reaction is 20 times more sensitive than H_2O_2 test; Fe, Mo, U, W, Cr, Ce, Al, Be, Th, Zr, Mn, Zn, Ni, Co, and Ca must be absent; cf. *C. A.* **29,** *7219* (*1935*).

PYROCATECHOL, 10% aq. soln. contg. a small amount of H_2SO_4 and freshly prepared, gives an orange coloration with Ti in concns. over 50 ppm; no intfrnce. is caused by Al, NH_4, Ba, Be, Cd, Ce, Cs, Co, La, Pb, Mn, Mo, K, Rb, Na, Sr, Te, W, Zn, chloride, nitrate, nitrite, sulfate or sulfite; Sb, As, Bi, Cr, Cu, Fe, Li, Mg, Hg, Ni, Ag, Sn, Tl, Th, U, V, Se, phosphate do intfr.; *Feigl, p. 122;* Pike, Ficklen, and Newell, *Ber.* **68B,** *1023–6* (*1935*).

CHROMOTROPIC ACID, 5% aq. soln., gives a brown-red color with HCl or H_2SO_4 solns. of titanic compounds; the test is interfered with by several metals; cf. *Feigl, p. 123.*

***p*-HYDROXYPHENYLARSONIC ACID,** 4% aq. soln., is useful in sepg. Ti from Fe (II), Fe (III), Al, Zn, Co, Ni, Be, Cr, Na, K, NH_4, PO_4, MoO_4 CrO_4, VO_4, uranyl. H_2O_2 must be absent; Zr and Sn intfr. Simpson and Chandlee, *Ind. Eng. Chem.*, (*Anal. Ed.*) **10,** *642* (*1938*); cf. also *C. A.* **35,** *4702* (*1941*).

TUNGSTEN, TUNGSTATE

CINCHONINE, 125 g. in 1 liter HCl soln. made from 500 ml. conc. HCl, 500 ml. water, is added in the digestion of an alloy or mineral of W with HCl or HNO_3 to increase the rapidity and completeness of pptn.; the ppt. is ignited to WO_3 for detn. and is a standard procedure; cf. Hillebrand and Lundell, *Applied Inorganic Analysis, pp. 548 ff (1929, Wiley, New York).* Simpson, Schumb, and Sieminski, *Ind. Eng. Chem.,* (*Anal. Ed.*) **10,** *243–5* (*1938*) have found that even small amts. of phosphate cause erratic results in the cinchonine method.

α-BENZOINOXIME (CUPRON), 5% alc. soln., may be used for the quant. sepn. of W (as tungstate) from Mo and V; cf. H. B. Knowles, *Bur. Standards J. Research* **9,** *1* (*1932*).

RHODAMINE B, 0.01% aq. soln., is changed in color from a yellowish-red to a bluish-red by W in dil. HCl soln. and this may be used for detc. and rough estn. Mo does not intfr. unless in great xs.; Sb (V) gives the same coloration; cf. E. Eegriwe, *Z. anal. Chem.* **70,** *400 (1927);* G. Heyne, *Z. angew. Chem.* **44,** *237–8* (*1931*). G. Heyne has also suggested the use of **HYDROQUINONE** in sulfuric acid which gives a red color with tungstate; Fe, Ti, Mo, nitrate, and chromate intfr.; the errors are not as large as with rhodamine B, but Mo intfrnce. is greater; cf. *Snell, p. 378.*

The tungstate ion catalyzes the reduction of **MALACHITE GREEN** by titanous chloride and this may be used as a means of detecting W; E. B. Sandell, *Ind. Eng. Chem.,* (*Anal. Ed.*) **10,** *667* (*1938*).

URANIUM

CUPFERRON (AMMONIUM NITROSOPHENYLHYDROXYLAMINE) does not ppt. hexavalent uranium (i.e. UO_2^{++}) and in H_2SO_4 acid soln. V, Fe, Ti, and Zr may be separated from U by pptn. with this reagt. When reduced to U^{4+}, however, it is pptd. and may in this manner be separated from Al, Cr, Mn, and P; cf. Hillebrand and Lundell, *Applied Inorganic Analysis, pp. 109–12 (1929, Wiley, New York).*

α-QUINALDINIC ACID, 5% aq. soln. of Na salt, may be used for the quant. pptn. of hexavalent U; cf. Ray and Bose, *Z. anal. Chem.* **95,** *400–14* (*1933*), *C. A.* **28,** *1625* (*1934*).

SALICYLIC ACID, 2% aq. soln. of the sodium salt, gives a red coloration with uranyl ion which may be used for estn.; errors may be as high as 7% and Fe must be absent; the reaction takes place in a neutral or sl. acid soln.; cf. Muller, *Chem. Ztg.* **43,** *739–40* (*1919*); *Snell, p. 394.*

VANADIUM, VANADATE

DIMETHYLGLYOXIME with $FeCl_3$ reacts with tetravalent V in the same manner as Sn (II); vanadate (pentavalent) may be reduced to vanadium (IV) by boiling with concd. HCl, then test may be made by adding $FeCl_3$ and reagt. and making alkaline with NH_4OH. *Feigl, 68.* Recomm. (*I. C.*).

CACOTHELINE, satd. aq. soln., gives violet coloration with V (III) in HCl soln. Vanadate may be reduced to V (III) by means of Zn in HCl. Molybdates and tungstates intfr. by giving colored reduction products; Fe (II) in presence of PO_4^{---} or F^- also intfrs. by reducing reagt. Sn must be absent. *Feigl, p. 69.* Recomm. (*I. C.*).

8-HYDROXYQUINOLINE (OXINE) may be used for detc. of vanadate; in AcOH soln. a yellow pptn. occurs which on warming becomes a deep blue colored soln.; Mo, W, Ti and Fe may be removed to prevent intfrnce.; cf. *Feigl, p. 69; C. A.* **28,** *3409* (*1934*).

AMMONIUM BENZOATE, satd. aq. soln., may be used for a gravmtc. detn. on a sample contg. 0.10 to 0.15 g. V_2O_5; the results are accurate to 0.001% and are not affected by the presence of Mg, Al, Cu, Mo, W, or Ti; Fe and Cr must be removed; for details, cf. F. M. Shemyakin, *C. A.* **29,** *2880* (*1935*).

CUPFERRON (AMMONIUM NITROSOPHENYLHYDROXYLAMINE), ppts. pentavalent V in cold, dil. H_2SO_4 soln. from Cr, As, P, Al, and uranyl; in the absence of appreciable amounts of Fe, Ti, and Zr this may be used for detn. of V; for references see under *uranium.*

ZINC

α-QUINALDINIC ACID, aq. soln. of the ammonium salt, ppts. Zn from a soln. alk. to methyl red-methylene blue indicator; Fe (III), Al, Cr. Be, Ti, and uranyl do not ppt. in the presence of tartrate and Zn may be detd. in their presence; the ppt. is dried at 125° C. and weighed as $Zn(C_{10}H_6O_2N)_2 \cdot H_2O$; cf. Ray and Majundar, *Z. anal. Chem.* **100,** *324–7 (1935);* also *Mikrochemie* **18,** *89 (1935).* and Shennan, *Analyst* **64,** *14* (*1939*); *Prodinger. p. 58.* For use of **5-NITROQUINALDINIC ACID** in colmtc. detn. of micro amts. of Zn see W. L. Lott, *Ind. Eng. Chem.*, (*Anal. Ed.*) **10,** *335–8* (*1938*).

8-HYDROXYQUINOLINE (OXINE), 2% alc. soln., gives a quant. pptn. of Zn; in acetate buffer solns. (pH 5–6) Zn may be sepd. from alkaline earths, Pb and Mn. In alk. soln. Zn is said to be separable from Al, Cr, Fe, Sb, As, Bi, Co, Ni, Mn; cf. Berg, *Z. anal. Chem.* **71,** *171* (*1927*)*:* Spacu and Dick, *ibid.* **73,** *356* (*1928*), and *Prodinger, p. 107.* For use in detn. of Zn in soils, cf. J. S. Hosking, *C. A.* **30,** *6488* (*1936*).

ANTHRANILIC ACID ppts. Zn from neutral or sl. acid soln.; the ppt. may be dried as $Zn(C_7H_6O_2N)_2$ for gravmtc. detn. or may be titrated with KBr–$KBrO_3$ soln.; cf. Funk and Ditt, *Z. anal. Chem.* **91,** *332–7* (*1933*)*;* Cimerman and Wenger, *Mikrochemie* **18,** *53* (*1935*)*; Prodinger, p. 31.* For use of reagt. in detn. of Zn in "white metal" alloys cf. C. W. Anderson, *Ind. Eng. Chem.*, (*Anal. Ed.*) **13,** *367* (*1941*)

DIPHENYLTHIOCARBAZONE (DITHIZONE) may be used for detc. and detn. of mcg. amounts of Zn. The Zn is extracted quant. by the reagt. in $CHCl_3$ soln. from the aq. soln. buffered to pH of about 5 and this results in changing the color of the reagt. soln. to red; cf. Fischer and Leopoldi, *Z. anal. Chem.* **97,** *385–95* (*1934*)*;* see also Fischer and Leopoldi for a method of preventing intfr. by any metal, *ibid.*, **107,** *241–69* (*1937*)*; C. A.* **31,** *969* (*1937*)*;* cf. also P. L. Hibbard, *Ind. Eng. Chem.*, (*Anal. Ed.*) **9,** *127–31* (*1937*)*; Snell, pp. 350–2.* For detn. of Zn in foods, in plant materials, and for a general discussion of specificity of the reagt. cf. Holland and Ritchie, *J. Assoc. Official Agr. Chem.* **22,** *333* (*1939*)*;* Cowling and Miller, *Ind. Eng. Chem.*, (*Anal. Ed.*) **13,** *145–9* (*1941*)*;* Wichmann, *ibid.* **11,** *66–72* (*1939*). For spot test, cf. *Feigl, p. 110.* Reagt. recomm. (*I. C.*).

Potassium ferricyanide may be used with a number of easily oxidized amines to ppt. zinc ferrocyanide by interaction of amine and ferricyanide; the oxidation product of the amine is simultaneously absorbed by the zinc ferrocyanide. **DIETHYLANILINE, DIPHENYLAMINE, DIPHENYLBENZIDINE, METANIL YELLOW, ORANGE IV (TROPAEOLIN OO)** have been used in detc. of Zn and as titrimetric indicators; cf. Cone and Cady, *J. Am. Chem. Soc.* **49,** *356* and *2214* (*1927*)*;* E. Eegriwe, *Z. anal. Chem.* **74,** *225–31* (*1928*)*; Feigl, p. 109.* For detn. of Zn in rubber compds., *p*-**ETHOXYCHRYSOIDINE** (*p*-**ETHOXYPHENYLAZO-*m*-PHENYLENEDIAMINE**) as a 0.2% soln. in about 60% H_2SO_4 has been found superior to the reagts. listed above as an indicator in titration with standard $K_4Fe(CN)_6$ soln., cf. W. P. Tyler, *Ind. Eng. Chem.*, (*Anal. Ed.*) **14,** *114–118* (*1942*).

ZIRCONIUM

PHENYLARSONIC ACID, 2.5% soln., has been used for pptn. and detn. of Zr; cf. P. Klinger, *Tech. Mitt. Krupp.* **3,** *1–4* (*1935*). *C. A.* **29,** *5039* (*1935*). **PROPYLARSONIC ACID** yields a white ppt. from $ZrCl_4$ in dil. HCl soln.; Th, Ti, Mn, Ni, Fe, Al, Ce, V, Cr, Cu, Mg, Zn, U, Mo, Co, Be, and Cd do not intfr.; Sb, Bi, and Sn do intfr.; cf. Arnold and Chandlee, *J. Am. Chem. Soc.* **57,** *8* and *591.* (*1935*). *p*-**DIMETHYLAMINOAZOPHENYLARSONIC ACID** has found use as a spot reagt.; cf. *Feigl, p. 126* and for a rapid colmtc. detn. of Zr in steel, cf. Hayes and Jones, *Ind. Eng. Chem.*, (*Anal. Ed.*) **13,** *603* (*1941*). Recomm. (*I. C.*). *p*-**HYDROXY-**

PHENYLARSONIC ACID is useful in detn. of Zr as it is for Ti (q.v.); intfr. by Ti is eliminated by addn. of H_2O_2; Sn and PO_4 ions intfr. Cf. reference under Ti.

β-NITROSO-α-NAPHTHOL, 1% alc. soln., is used for detc. in dil. HCl soln. contg. at least 0.1 mg. Zr per ml.; a red color is given; Fe, sulfates, xs. of Ti must be removed before making the test; Al, Th, Ce, and La do not intfr.; cf. Bellucci and Savoia, *C. A.* **18,** *3333* (*1924*); Oshman and Zerchaninova, *C. A.* **29,** *2881* (*1935*); *Feigl, p. 124.* Recomm. (*I. C.*).

SODIUM ALIZARIN SULFONATE (**ALIZARIN S**), in aq. soln., gives a violet-red color with Zr. The reagt. should be added to a neutral test soln. which is then boiled and acidified with a little dil. HCl. The colors given by Al, Th, Be, and Ti salts disappear under these conditions leaving only the Zr. F, PO_4, SO_4 ions intfr. Cf. de Boer, *Chem. Weekblad* **21,** *404* (*1924*); *Feigl, p. 125;* F. Pavelka, *Mikrochemie* **8,** *345–51* (*1930*). Recomm. (*I. C.*).

CUPFERRON (**AMMONIUM NITROSOPHENYLHYDROXYLAMINE**) may be used in H_2SO_4 medium for separating Zr from Al, Cr, uranyl, and B; in the absence of many other elements, such as Ti, Th, Ce, Fe, V, Cb, Ta, W, and Si, it may be used directly for gravmtc. detn.; cf. Lundell and Knowles, *Ind. Eng. Chem.* **12,** *344* (*1920*); *J. Am. Chem. Soc.* **42,** *1439* (*1920*).

CONCENTRATIONS OF LABORATORY REAGENTS

COMMONLY USED ACIDS AND AMMONIA*

Freshly opened bottles of these reagents are uniformly of the concentrations indicated below. This may not be true of bottles long opened and this is especially true of ammonia which rapidly loses its strength. In preparing volumetric solutions, it is well to be on the safe side and take a little more than the calculated volume of the concentrated reagent, since it is much easier to dilute a concentrated solution than to strengthen one that is too weak. The 5*N* solutions present obvious advantages over the usual indefinite dilutions for use as shelf reagents; however, it is not necessary that these shelf reagents be highly accurate.

	HCl	HNO_3	H_2SO_4	NH_4OH	$HC_2H_3O_2$
Mol. wt.	36.46	63.02	98.08	35.04	60.03
Average sp. gr. of conc. reagent	1.19	1.42	1.84	0.90	1.06
Average % present in conc. reagent	36.0	69.5	96.0	58.6	99.5
Grams active ingredient per ml.	0.426	0.985	1.76	0.527	1.055
Normality of conc. reagent	11.7	15.6	35.9	15.1	17.6
Ml. conc. reagent/liter *N* solution	85.5	64.0	28.4	66.5	56.9
Ml. to dilute to 500 cc. for use as shelf reagent (5*N*)	214	160	70	166	143

* Schollenberger, *Chemist Analyst* 18, No. 6, p. 8 (1929); reprinted by permission of J. T. Baker Chemical Co.

Routine Normal Solutions †

A concentrated C. P. acid usually comes to the laboratory in a bottle having a label which states: its molecular weight, M; its specific gravity, d; and its percentage assay, p. When such an acid is used in preparing an aqueous solution of desired normality, N, a convenient formula to employ is:

$$V = \frac{100\ MN}{bpd}$$

wherein b is the basicity of the acid and V is the number of milliliters of concentrated acid required for one liter of the dilute solution.

Example.—Acid Sulfuric is dibasic and has the molecular weight 98.08. If the concentrated acid assays 95.5% and has the specific gravity 1.84, the volume required for one liter of a 0.2 normal solution is:

$$V = \frac{100 \times 98.08 \times 0.2}{2 \times 95.5 \times 1.84} = 5.58 \text{ ml.}$$

Such a solution may often be used just as it stands. Where accuracy is required, it is most conveniently standardized by comparison with a high grade Potassium Biphthalate or other primary standard, *q.v.*

† Hague, *Chemist Analyst* 30, No. 1, p. 21 (1941); reprinted by permission of J. T. Baker Chemical Co.

LABORATORY SOLUTIONS

General Reagents and Special Solutions

Unless otherwise stated, the term *g per liter* signifies grams of the formula indicated dissolved in water and made up to a liter of solution. See also *Standard Volumetric Solutions*.

Acetic acid, $HC_2H_3O_2$—6 N: 350 cc glacial acetic acid per liter.

Alcohol, amyl, $C_5H_{11}OH$: use as purchased.

Alcohol, ethyl, C_2H_5OH; 95% alcohol, as purchased.

Aluminon (qualitative test for aluminum). The reagent consists of 0.1% solution of the ammonium salt of aurin tricarboxylic acid. A bright red precipitate, persisting in alkaline solution, indicates aluminum. See special table: *Organic Reagents for Inorganic Analysis.*

Aluminum chloride, $AlCl_3$—0.5 N: 22 g per liter.

Aluminum nitrate, $Al(NO_3)_3 \cdot 7.5H_2O$—0.5 N: 58 g per liter.

Aluminum sulfate, $Al_2(SO_4)_3 \cdot 18H_2O$—0.5 N: 55 g per liter.

Ammonium acetate, $NH_4C_2H_3O_2$—3 N: 231 g per liter.

Ammonium carbonate, $(NH_4)_2CO_3 \cdot H_2O$—3 N: 171 g per liter; for the anhydrous salt: 144 g per liter.

Ammonium chloride, NH_4Cl—3 N: 161 g per liter.

Ammonium hydroxide, NH_4OH—15 N: the concentrated solution which contains 28% NH_3; for 6 N: 400 cc per liter.

Ammonium molybdate, $(NH_4)_2MoO_4$—N: dissolve 88.3 g of solid $(NH_4)_6Mo_7O_{24} \cdot 4H_2O$ in 100 cc 6 N NH_4OH. Add 240 g of solid NH_4NO_3 and dilute to one liter. Another method is to take 72 g of MoO_3, and 130 cc of water and 75 cc of 15 N NH_4OH; stir mechanically until nearly all has dissolved, then add it to a solution of 240 cc concentrated HNO_3 and 500 cc of water; stir continuously while solutions are being mixed; allow to stand 3 days, filter, and use the clear filtrate.

Ammonium nitrate, NH_4NO_3—N: 80 g per liter.

Ammonium oxalate, $(NH_4)_2C_2O_4 \cdot H_2O$—0.5 N: 40 g per liter.

Ammonium polysulfide (yellow ammonium sulfide), $(NH_4)_2S_x$: allow the colorless $(NH_4)_2S$ to stand, or add sulfur.

Ammonium sulfate, $(NH_4)_2SO_4$—0.5 N: 33 g per liter; saturated: dissolve 780 g of $(NH_4)_2SO_4$ in water and make up to a liter.

Ammonium sulfide (colorless), $(NH_4)_2S$—saturated: pass H_2S through 200 cc of concentrated NH_4OH in the cold until no more gas is dissolved, add 200 cc NH_4OH and dilute with water to a liter; the addition of 15 g of sulfur is sufficient to make the polysulfide.

Ammonium thiocyanate: see *Volumetric Solutions.*

Antimony pentachloride, $SbCl_5$—0.5 N: 30 g per liter.

Antimony trichloride, $SbCl_3$—0.5 N: 38 g per liter.

Aqua regia: mix 3 parts of concentrated HCl and 1 part of concentrated HNO_3 just before ready to use.

Arsenic acid, $H_3AsO_4 \cdot 0.5H_2O$—0.5 N $(= \frac{1}{2}H_3AsO_4 \div 5)$: 15 g per liter.

Arsenous oxide, As_2O_3—0.25 N: 8 g per liter for saturation. See also *Volumetric Solutions.*

Aurichloric acid, $HAuCl_4 \cdot 3H_2O$: dissolve in ten parts of water.

Azolitmin solution (indicator): make up a 1% solution of azolitmin by boiling in water for 5 minutes; it may be necessary to add a small amount of NaOH to make the solution neutral.

Bang's reagent (for glucose estimation): dissolve 100 g of K_2CO_3, 66 g of KCl, and 160 g of $KHCO_3$ in the order given in about 700 cc of water at 30°C. Add 4.4 g of copper sulfate and dilute to 1000 cc after the CO_2 is evolved. This solution should be shaken only in such a manner as not to allow the entry of air. After 24 hours 300 cc are diluted to a liter with saturated KCl solution, shaken gently and used after 24 hours; 50 cc $\Bumpeq$ 10 mg glucose.

Barfoed's reagent (test for glucose):

dissolve 66 g of cupric acetate and 10 cc of glacial acetic acid in water and dilute to one liter.

Barium and Calcium chlorides: see *Precipitation reagent.*

Barium chloride, $BaCl_2 \cdot 2H_2O$—0.5 N: 61 g per liter.

Barium hydroxide, $Ba(OH)_2 \cdot 8H_2O$—0.2 N: 32 g per liter for saturation.

Barium nitrate, $Ba(NO_3)_2$—0.5 N: 65 g per liter.

Baudisch's reagent: see *Cupferron.*

Benedict's qualitative reagent (for glucose): dissolve 173 g of sodium citrate and 100 g of anhydrous sodium carbonate in about 600 cc of water, and dilute to 850 cc; dissolve 17.3 g of $CuSO_4 \cdot 5H_2O$ in 100 cc of water and dilute to 150 cc; this solution is added to the citrate-carbonate solution with constant stirring. See also the quantitative reagent below.

Benedict's quantitative reagent (sugar in urine): This solution contains 18 g copper sulfate, 100 g of anhydrous sodium carbonate, 200 g of potassium citrate, 125 g of potassium thiocyanate, and 0.25 g of potassium ferrocyanide per liter; 1 cc of this solution $\approx$ 0.002 g sugar.

Benzidine hydrochloride solution (for sulfate determination): mix 6.7 g of benzidine $[C_{12}H_8(NH_2)_2]$ or 8.0 g of the hydrochloride $[C_{12}H_8(NH_2)_2 \cdot 2HCl]$ into a paste with 20 cc of water; add 20 cc of HCl (sp. gr. 1.12) and dilute the mixture to one liter with water; each cc of this solution is equivalent to 0.00357 g H_2SO_4.

Bertrand's reagents (glucose estimation): (*a*) 40 g of copper sulfate diluted to one liter; (*b*) rochelle salt 200 g, NaOH 150 g and sufficient water to make one liter; (*c*) ferric sulfate 50 g, H_2SO_4 200 g and sufficient water to make one liter; (*d*) $KMnO_4$ 5 g and sufficient water to make one liter.

Bial's reagent (for pentoses): dissolve 1 g of orcinol in 500 cc of 30% HCl to which 30 drops of a 10% ferric chloride solution have been added.

Bismuth chloride, $BiCl_3$—0.5 N: 52 g per liter, using 1:5 HCl in place of water.

Bismuth nitrate, $Bi(NO_3)_3 \cdot 5H_2O$—0.25 N: 40 g per liter, using 1:5 HNO_3 in place of water.

Bismuth standard solution (quantitative color test for Bi): dissolve 1 g of bismuth in a mixture of 3 cc of concentrated HNO_3 and 2.8 cc of H_2O and make up to 100 cc with glycerol. Also dissolve 5 g of KI in 5 cc of water and make up to 100 cc with glycerol. The two solutions are used together in the colorimetric estimation of Bi.

Boutron-Boudet solution: see *Soap solution.*

Bromine water, saturated solution: to 400 cc of water add 20 cc of bromine; use a glass stopper coated with vaseline.

Brucke's reagent (protein precipitant): dissolve 50 g of KI in 500 cc of water, saturate with HgI_2 (about 120 g), and dilute to one liter.

Cadmium chloride, $CdCl_2$—0.5 N: 46 g per liter.

Cadmium nitrate, $Cd(NO_3)_2 \cdot 4H_2O$—0.5 N: 77 g per liter.

Cadmium sulfate, $CdSO_4 \cdot 4H_2O$—0.5 N: 70 g per liter.

Calcium chloride, $CaCl_2 \cdot 6H_2O$—0.5 N: 55 g per liter.

Calcium hydroxide, $Ca(OH)_2$—0.04 N: 10 g per liter for saturation.

Calcium nitrate, $Ca(NO_3)_2 \cdot 4H_2O$—0.5 N: 59 g per liter.

Calcium sulfate, $CaSO_4 \cdot 2H_2O$—0.03 N: mechanically stir 10 g in a liter of water for 3 hours; decant and use the clear liquid.

Carbon disulfide, (CS_2): commercial grade which is colorless.

Chloride reagent: dissolve 1.7 g of $AgNO_3$ and 25 g KNO_3 in water, add 17 cc of concentrated NH_4OH and make up to one liter with water.

Chlorine water, saturated solution: pass chlorine gas into small amounts of water as needed; solutions deteriorate on standing.

Chloroform, $CHCl_3$: commercial grade.

Chloroplatinic acid, $H_2PtCl_6 \cdot 6H_2O$—10% solution: dissolve 1 gram in 9 cc of

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water; keep in a dropping bottle.

Chromic chloride, $CrCl_3$—0.5 *N*: 26 g per liter.

Chromic nitrate, $Cr(NO_3)_3$—0.5 *N*: 40 g per liter.

Chromic sulfate, $Cr_2(SO_4)_3 \cdot 18H_2O$—0.5 *N*: 60 g per liter.

Cobaltous nitrate, $Co(NO_3)_2 \cdot 6H_2O$—0.5 *N*: 73 g per liter.

Cobaltous sulfate, $CoSO_4 \cdot 7H_2O$—0.5 *N*: 70 g per liter.

Cupferron (iron analysis): dissolve 6 g of ammonium nitrosophenyl-hydroxylamine (cupferron) in water and dilute to 100 cc. This solution is stable for about one week if protected from light. See special table: *Organic Reagents for Inorganic Analysis.*

Cupric chloride, $CuCl_2 \cdot 2H_2O$—0.5 *N*: 43 g per liter.

Cupric nitrate, $Cu(NO_3)_2 \cdot 6H_2O$—0.5 *N*: 74 g per liter.

Cupric sulfate, $CuSO_4 \cdot 5H_2O$—0.5 *N*: 62 g per liter.

Cuprous chloride, $CuCl$—0.5 *N*: 50 g per liter, using 1:5 HCl in place of water.

Cuprous chloride, acid (for gas analysis, absorption of CO): cover the bottom of a two-liter bottle with a layer of copper oxide ⅜ inch deep, and place a bundle of copper wire an inch thick in the bottle so that it extends from the top to the bottom. Fill the bottle with HCl (sp. gr. 1.10). The bottle is shaken occasionally, and when the solution is colorless or nearly so, it is poured into half-liter bottles containing copper wire. The large bottle may be filled with hydrochloric acid, and by adding the oxide or wire when either is exhausted, a constant supply of the reagent is available.

Cuprous chloride, ammoniacal: this solution is used for the same purpose, and is made in the same manner as the acid cuprous chloride above, except that the acid solution is treated with ammonia until a faint odor of ammonia is perceptible. Copper wire should be kept with the solution as in the acid reagent.

Dimethyl glyoxime, $(CH_3CNOH)_2$—0.01 *N*: 6 g in 500 cc of 95% alcohol. See special table: *Organic Reagents for Inorganic Analysis.*

Esbach's reagent (estimation of proteins): dissolve 10 g of picric acid and 20 g of citric acid in water and dilute to one liter.

Eschka's Mixture (sulfur in coal): mix 2 parts of porous calcined MgO with 1 part of anhydrous Na_2CO_3; not a solution but a dry mixture.

Ether, $(C_2H_5)_2O$—use commercial grade.

Fehling's solution (sugar detection and estimation): (*a*) Copper sulfate solution: dissolve 34.639 g of $CuSO_4 \cdot 5H_2O$ in water and dilute to 500 cc. (*b*) Alkaline tartrate solution: dissolve 173 g of rochelle salts ($KNaC_4H_4O_6 \cdot 4H_2O$) and 125 g of KOH in water and dilute to 500 cc. Equal volumes of the two solutions are mixed just prior to use. The Methods of the Assoc. of Official Agricultural Chemists give 50 g of NaOH in place of the 125 g KOH.

Ferric chloride, $FeCl_3$—0.5 *N*: 27 g per liter.

Ferric nitrate, $Fe(NO_3)_3 \cdot 9H_2O$—0.5 *N*: 67 g per liter.

Ferrous ammonium sulfate, Mohr's salt, $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$—0.5 *N*: 98 g per liter. See also *Volumetric Solutions.*

Ferrous sulfate, $FeSO_4 \cdot 7H_2O$—0.5 *N*: 80 g per liter; add a few drops of H_2SO_4.

Folin's mixture (for uric acid): dissolve 500 g of ammonium sulfate, 5 g of uranium acetate, and 6 cc of glacial acetic acid, in 650 cc of water. The volume is about a liter.

Formal or Formalin: use the commercial 40% solution of formaldehyde.

Froehde's reagent (gives characteristic colorations with certain alkaloids and glucosides): dissolve 0.01 g of sodium molybdate in 1 cc of concentrated H_2SO_4; use only a freshly prepared solution.

Glyoxylic acid solution (protein detection): cover 10 g of magnesium powder with water, and add slowly 250 cc of a saturated oxalic acid solution, keeping the mixture cool; filter off the magnesium oxalate, acidify the filtrate with acetic acid and make up to a liter with water.

Guaiacum tincture: dissolve 1 g of guaiacum in 100 cc of alcohol.

Gunzberg's reagent (detection of HCl in gastric juice): dissolve 4 g of phloroglucinol and 2 g of vanillin in 100 cc of absolute alcohol; use only a freshly prepared solution.

Hager's reagent (for alkaloids): this reagent is a saturated solution of picric acid in water.

Hanus solution (for determination of iodine number): dissolve 13.2 g of iodine in a liter of glacial acetic acid that will not reduce chromic acid; add sufficient bromine to double the halogen content determined by titration (3 cc is about the right amount). The iodine may be dissolved with the aid of heat, but the solution must be cold when the bromine is added.

Hydriodic acid, HI—0.5 *N*: 64 g per liter.

Hydrobromic acid, HBr—0.5 *N*: 40 g per liter.

Hydrochloric acid, HCl—5 *N*: 182 g per liter; sp. gr. 1.084. See also *Volumetric Solutions.*

Hydrofluoric acid, H_2F_2—48% solution: use as purchased, and keep in the special container.

Hydrogen peroxide, H_2O_2—3% solution: use as purchased.

Hydrogen sulfide, H_2S: prepare a saturated aqueous solution.

Iodic acid, HIO_3—0.5 *N* ($HIO_3/12$): 15 g per liter.

Iodine: see *Tincture of iodine*; see also *Volumetric Solutions.*

Litmus solution (indicator): powder the litmus and make up a 2% solution, boiling for 5 minutes.

Lead acetate, $Pb(C_2H_3O_2)_2 \cdot 3H_2O$—0.5 *N*: 95 g per liter.

Lead chloride, $PbCl_2$—saturated solution is 1/7 *N*.

Lead nitrate, $Pb(NO_3)_2$—0.5 *N*: 83 g per liter.

Lime water: see *calcium hydroxide.*

Magnesia mixture: 100 g of $MgSO_4$, 200 g of NH_4Cl, 400 cc of NH_4OH, 800 cc of water; each cc$\approx$0.01 g phosphorus (P).

Magnesium chloride, $MgCl_2 \cdot 6H_2O$—0.5 *N*: 50 g per liter.

Magnesium nitrate, $Mg(NO_3)_2 \cdot 6H_2O$—0.5 *N*: 64 g per liter.

Magnesium sulfate, epsom salts, $MgSO_4 \cdot 7H_2O$—0.5 *N*: 62 g per liter; saturated solution: dissolve 600 g of the salt in water and dilute to one liter.

Manganous chloride, $MnCl_2 \cdot 4H_2O$—0.5 *N*: 50 g per liter.

Manganous nitrate, $Mn(NO_3)_2 \cdot 6H_2O$—0.5 *N*: 72 g per liter.

Manganous sulfate, $MnSO_4 \cdot 7H_2O$—0.5 *N*: 69 g per liter.

Marme's reagent (gives yellowish-white precipitate with salts of alkaloids): saturate a boiling solution of 4 parts of KI in 12 parts of water with CdI_2; then add an equal volume of cold saturated KI solution.

Marquis reagent (gives a purple-red coloration, then violet, then blue with morphine, codeine, dionine, and heroine): mix 3 cc of concentrated H_2SO_4 with 3 drops of a 35% formaldehyde solution.

Mayer's reagent (gives white precipitate with most alkaloids in a slightly acid solution): dissolve 13.55 g of $HgCl_2$ and 50 g of KI in a liter of water.

Mercuric chloride, $HgCl_2$—0.5 *N*: 68 g per liter.

Mercuric nitrate, $Hg(NO_3)_2$—0.5 *N*: 81 g per liter.

Mercuric sulfate, $HgSO_4$—0.5 *N*: 74 g per liter.

Mercurous nitrate, $HgNO_3$: mix 1 part of $HgNO_3$, 20 parts of H_2O, and 1 part of HNO_3.

Methyl orange (indicator): dissolve 1 g of methyl orange in a liter of water.

Methyl red (indicator): dissolve 2 g of methyl red in a liter of alcohol. See also special section on *Acid-Base Indicators.*

Millon's reagent (gives a red precipitate with certain proteins and with

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various phenols): dissolve 1 part of mercury in 1 part of HNO_3 (sp. gr. 1.40) with gentle heating, then add 2 parts of water; a few crystals of KNO_3 help to maintain the strength of the reagent.

Mohr's salt: see ferrous ammonium sulfate.

α-Naphthol solution: dissolve 144 g of α-naphthol in enough alcohol to make a liter of solution.

Nessler's reagent (for free ammonia): dissolve 50 g of KI in the least possible amount of cold water; add a saturated solution of $HgCl_2$ until a very slight excess is indicated; add 400 cc of a 50% solution of KOH; allow to settle, make up to a liter with water, and decant.

Nickel chloride, $NiCl_2 \cdot 6H_2O$—0.5 *N*: 59 g per liter.

Nickel nitrate, $Ni(NO_3)_2 \cdot 6H_2O$—0.5 *N*: 73 g per liter.

Nickel sulfate, $NiSO_4 \cdot 6H_2O$—0.5 *N*: 66 g per liter.

Nitric acid, HNO_3—5 *N*: 315 g per liter; sp. gr. 1.165. See also *Volumetric Solutions.*

Nitrohydrochloric acid: see *aqua regia.*

Nitroso-β-naphthol, $HOC_{10}H_6NO$—saturated solution: saturate 100 cc of 50% acetic acid with the solid.

Nylander's solution (detection of glucose): dissolve 40 g of rochelle salt and 20 g of bismuth subnitrate in 1000 cc of an 8% NaOH solution.

Obermayer's reagent (detection of indoxyl in urine): dissolve 4 g of $FeCl_3$ in a liter of concentrated HCl.

Oxalic acid, $H_2C_2O_4 \cdot 2H_2O$: dissolve in ten parts of water. See also *Volumetric Solutions.*

Pavy's solution (estimation of glucose): mix 120 cc of Fehling's solution and 300 cc of ammonium hydroxide (sp. gr. 0.88), and dilute to a liter with water.

Perchloric acid, $HClO_4$—60%: use as purchased.

Phenol solution: dissolve 20 g of phenol (carbolic acid) in a liter of water.

Phenolphthalein solution (indicator): dissolve 1 g of phenolphthalein in 50 cc of alcohol and add 50 cc of water. See also special section on *Acid-Base Indicators.*

Phenol sulfonic acid (determination of nitrogen as nitrate; water analysis for nitrate): dissolve 25 grams of pure, white phenol in 150 cc of pure concentrated H_2SO_4, add 75 cc of fuming H_2SO_4 (15% SO_3), stir well and heat for two hours at 100°C.

Phosphoric acid, *ortho,* H_3PO_4—0.5 *N*: 16 g per liter.

Potassium acid antimonate, KH_2SbO_4—0.1 *N*: boil 23 g of the salt with 950 cc of water for 5 minutes, cool rapidly and add 35 cc of 6 *N* KOH; allow to stand for one day, filter, dilute filtrate to a liter.

Potassium arsenate, K_3AsO_4—0.5 *N* ($K_3AsO_4/10$): 26 g per liter.

Potassium arsenite, $KAsO_2$—0.5 *N* ($KAsO_2/6$): 24 g per liter.

Potassium bromate, $KBrO_3$—0.5 *N* ($KBrO_3/12$): 14 g per liter.

Potassium bromide, KBr—0.5 *N*: 60 g per liter.

Potassium carbonate, K_2CO_3—3 *N*: 207 g per liter.

Potassium chloride, KCl—0.5 *N*: 37 g per liter.

Potassium chromate, K_2CrO_4—0.5 *N*: 49 g per liter.

Potassium cyanide, KCN—0.5 *N*: 33 g per liter. See also *Volumetric Solutions.*

Potassium dichromate, $K_2Cr_2O_7$—0.5 *N* ($K_2Cr_2O_7/8$): 38 g per liter. See also *Volumetric Solutions.*

Potassium ferricyanide, $K_3Fe(CN)_6$—0.5 *N*: 55 g per liter.

Potassium ferrocyanide, $K_4Fe(CN)_6 \cdot 3H_2O$—0.5 *N*: 53 g per liter.

Potassium hydroxide, KOH—5 *N*: 312 g per liter. See also *Volumetric Solutions.*

Potassium iodate, KIO_3—0.5 *N* ($KIO_3/12$): 18 g per liter. See also *Volumetric Solutions.*

Potassium iodide, KI—0.5 *N*: 83 g per liter.

Potassium nitrate, KNO_3—0.5 N: 50 g per liter.

Potassium nitrite, KNO_2—6 N: 510 g per liter.

Potassium permanganate, $KMnO_4$—0.5 N ($KMnO_4/10$): 16 g per liter. See also *Volumetric Solutions.*

Potassium pyrogallate (oxygen in gas ananlysis): weigh out 5 g of pyrogallol (pyrogallic acid), and pour upon it 100 cc of a KOH solution. If the gas contains less than 28% of oxygen, the KOH solution should be 500 g KOH in a liter of water; if there is more than 28% of oxygen in the gas, the KOH solution should be 120 g of KOH in 100 cc of water.

Potassium sulfate, K_2SO_4—0.5 N: 44 g per liter.

Potassium thiocyanate, KCNS—0.5 N: 49 g per liter.

Precipitating reagent (for group II, anions): dissolve 61 g of $BaCl_2 \cdot 2H_2O$ and 52 g of $CaCl_2 \cdot 6H_2O$ in water and dilute to one liter. If the solution becomes turbid, filter and use filtrate.

Scheibler's reagent (precipitates alkaloids, albumoses and peptones): dissolve sodium tungstate in boiling water containing half its weight of phosphoric acid (sp. gr. 1.13); on evaporation of this solution, crystals of phosphotungstic acid are obtained. A 10% solution of phosphotungstic acid in water constitutes the reagent.

Schweitzer's reagent (dissolves cotton, linen, and silk, but not wool): add NH_4Cl and NaOH to a solution of copper sulfate. The blue precipitate is filtered off, washed, pressed, and dissolved in ammonia (sp. gr. 0.92).

Silver nitrate, $AgNO_3$—0.25 N: 43 g per liter. See also *Volumetric Solutions.*

Silver sulfate, Ag_2SO_4—$N/13$ (saturated solution): stir mechanically 10 g of the salt in a liter of water for 3 hours; decant and use the clear liquid.

Soap solution (for hardness in water): (*a*) *Clark's or A.P.H.A. Stand. Methods*—prepare stock solution of 100 g of pure powdered castile soap in a liter of 80% ethyl alcohol; allow to stand over night and decant. Titrate against $CaCl_2$ solution (0.5 g $CaCO_3$ dissolved in a concentrated HCl, neutralized with NH_4OH to slight alkalinity using litmus as the indicator, make up to 500 cc; 1 cc of this solution is equivalent to 1 mg $CaCO_3$) and dilute with 80% alcohol until 1 cc of the resulting solution is equivalent to 1 cc of the standard $CaCl_2$ making due allowance for the lather factor (the lather factor is that amount of standard soap solution required to produce a permanent lather in a 50 cc portion of distilled water). One cc of this solution after subtracting the lather factor is equivalent to 1 mg of $CaCO_3$. (*b*) *Boutron-Boudet*—dissolve 100 g of pure castile soap in about 2500 cc of 56% ethyl alcohol and adjust so that 2.4 cc will give a permanent lather with 40 cc of a solution containing 0.59 g $Ba(NO_3)_2$ per liter of water; 2.4 cc of this solution is equivalent to 22 French degrees or 220 parts per million of hardness (as $CaCO_3$) on a 40 cc sample of water.

Sodium acetate, $NaC_2H_3O_2 \cdot 3H_2O$: dissolve 1 part of the salt in 10 parts of water.

Sodium acetate, acid: dissolve 100 g of sodium acetate and 30 cc of glacial acetic acid in water and dilute to one liter.

Sodium bismuthate (oxidation of manganese): heat 20 parts of NaOH nearly to redness in an iron or nickel crucible, and add slowly 10 parts of basic bismuth nitrate which has been previously dried. Add 2 parts of sodium peroxide, and pour the brownish-yellow fused mass on an iron plate to cool. When cold break up in a mortar, extract with water, and collect on an asbestos filter.

Sodium carbonate, Na_2CO_3—3 N: 159 g per liter; one part Na_2CO_3, or 2.7 parts of the crystalline $Na_2CO_3 \cdot 10H_2O$ in 5 parts of water.

Sodium chloride, NaCl—0.5 N: 29 g per liter. See also *Volumetric Solutions.*

Sodium chloroplatinite, Na_2PtCl_4: dissolve 1 part of the salt in 12 parts of water.

Sodium cobaltinitrite, $Na_3Co(NO_2)_6$—0.3 N: dissolve 230 g of $NaNO_2$ in 500 cc of water, add 160 cc of 6 N acetic acid and 35 g of $Co(NO_3)_2 \cdot 6H_2O$. Allow to stand one day, filter, and dilute the filtrate to a liter.

Sodium hydrogen phosphate, $Na_2HPO_4 \cdot 12H_2O$—0.5 *N*: 60 g per liter.

Sodium hydroxide, NaOH—5 *N*: 220 g per liter. See also *Volumetric Solutions*.

Sodium hydroxide, alcoholic: dissolve 20 g of NaOH in alcohol and dilute to one liter with alcohol.

Sodium hypobromite: dissolve 100 g of NaOH in 250 cc of water and add 25 cc of bromine.

Sodium nitrate, $NaNO_3$—0.5 *N*: 43 g per liter.

Sodium nitroprusside (for sulfur detection): dissolve about one gram of sodium nitroprusside in 10 cc of water; as the solution deteriorates on standing, only freshly prepared solutions should be used. This compound is also called sodium nitroferricyanide and has the formula $Na_2Fe(NO)(CN)_6 \cdot 2H_2O$.

Sodium polysulfide, Na_2S_x: dissolve 480 g of $Na_2S \cdot 9H_2O$ in 500 cc of water, add 40 g of NaOH and 18 g of sulfur, stir mechanically and dilute to one liter with water.

Sodium sulfate, Na_2SO_4—0.5 *N*: 35 g per liter.

Sodium sulfide, Na_2S; saturate NaOH solution with H_2S, then add as much NaOH as was used in the original solution.

Sodium sulfite, $Na_2SO_3 \cdot 7H_2O$—0.5 *N*: 63 g per liter.

Sodium sulfite, acid (saturated): dissolve 600 g of $NaHSO_3$ in water and dilute to one liter; for the preparation of addition compounds with aldehydes and ketones: prepare a saturated solution of sodium carbonate in water and saturate with sulfur dioxide.

Sodium tartrate, acid, $NaHC_4H_4O_6$: dissolve 1 part of the salt in 10 parts of water.

Sodium thiosulfate, $Na_2S_2O_3 \cdot 5H_2O$: one part of the salt in 40 parts of water. See also *Volumetric Solutions.*

Sonnenschein's reagent (alkaloid detection): a nitric acid solution of ammonium molybdate is treated with phosphoric acid. The precipitate so produced is washed and boiled with aqua regia until the ammonium salt is decomposed. The solution is evaporated to dryness and the residue is dissolved in 10% HNO_3.

Stannic chloride, $SnCl_4$—0.5 *N*: 33 g per liter.

Stannous chloride, $SnCl_2 \cdot 2H_2O$—0.5 *N*: 56 g per liter. The water should be acid with HCl and some metallic tin should be kept in the bottle.

Starch solution (iodine indicator): dissolve 5 g of soluble starch in cold water, pour the solution into 2 liters of water and boil for a few minutes. Keep in a glass-stoppered bottle.

Starch solution (other than soluble): make a thin paste of the starch with cold water, then stir in 200 times its weight of boiling water, and boil for a few minutes. A few drops of chloroform added to the solution acts as a preservative.

Stoke's reagent: dissolve 30 g of ferrous sulfate and 20 g of tartaric acid in water and dilute to one liter. When required for use, add strong ammonia until the precipitate first formed is dissolved.

Strontium chloride, $SrCl_2 \cdot 6H_2O$—0.5 *N*: 67 g per liter.

Strontium nitrate, $Sr(NO_3)_2$—0.5 *N*: 53 g per liter.

Strontium sulfate, $SrSO_4$: prepare a saturated solution.

Sulfanilic acid (for detection of nitrites): dissolve 8 g of sulfanilic acid in one liter of acetic acid (sp. gr. 1.04).

Sulfuric acid, H_2SO_4—5 *N*: 245 g per liter, sp. gr. 1.153. See also *Volumetric Solutions.*

Sulfurous acid, H_2SO_3: saturate water with sulfur dioxide.

Tartaric acid, $H_2C_4H_4O_6$: dissolve one part of the acid in 3 parts of water; for a saturated solution dissolve 750 g of tartaric acid in water and dilute to one liter.

Tannic acid: dissolve one g of tannic acid in one cc of alcohol and make up to 10 cc with water.

Tincture of iodine (antiseptic): add 70 g of iodine and 50 g of KI to 50 cc of water; make up to one liter with alcohol.

o-Tolidine solution (for residual chlorine in water analysis): dissolve 1 g of pulverized *o*-tolidine, m.p. 129°C., in one liter of dilute hydrochloric acid (100 cc conc. HCl diluted to one liter).

Trichloroacetic acid: dissolve 100 g of the acid in water and dilute to one liter.

Turmeric paper (gives a rose-brown coloration with boric acid): wash the ground root of turmeric with water and discard the washings. Digest with alcohol and filter, using the clear filtrate to impregnate white, unsized paper, which is then dried.

Uffelmann's reagent (gives a yellow coloration in the presence of lactic acid): add a ferric chloride solution to a 2% phenol solution until the solution becomes violet in color.

Wagner's solution (phosphate rock analysis): dissolve 25 g of citric acid and one g of salicylic acid in water, and make up to one liter. Twenty-five to 50 cc of this reagent prevents precipitation of iron and aluminum.

Wijs solution (for iodine number): dissolve 13 g of resublimed iodine in one liter of glacial acetic acid (99.5%), and pass in washed and dried (over or through H_2SO_4) chlorine gas until the original thio titration of the solution is not quite doubled. There should be only a slight excess of iodine and no excess of chlorine. Preserve the solution in amber colored bottles sealed with paraffin. Do not use the solution after it has been prepared for more than 30 days.

Xylene cyanole-methyl orange indicator, Schoepfle modification (for partially color blind operators): dissolve 0.75 g of xylene cyanole FF (Eastman No. T 1579) and 1.50 g methyl orange in one liter of water.

Zinc chloride, $ZnCl_2$—0.5 *N*: 34 g per liter.

Zinc nitrate, $Zn(NO_3)_2 \cdot 6H_2O$—0.5 *N*: 74 g per liter.

Zinc sulfate, $ZnSO_4 \cdot 7H_2O$—0.5 *N*: 72 g per liter.

TRUE CAPACITY OF GLASS VESSELS

Based on the following coefficients of cubical expansion of glass, for:

Pyrex 774 $= 9.6 \times 10^{-6}$
Kimble N-51A $= 15 \times 10^{-6}$
Soda Lime $= 25 \times 10^{-6}$

The capacity of a glass vessel may be obtained by determining the weight of a contained liquid. The true capacity of glass vessels when their contents of water are weighed in air with brass weights can be found by means of the following equation:

$$V_t^\circ = W_t^\circ \times C_{\text{at } t^\circ c.}$$

where V_t° is the volume of the flask at t° C. when it contains W grams of water at t° C., and where C is read from the table below. Thus, if the contents of a glass flask filled with water weigh 100 grams at 15° C., then the true volume of the flask at 15° C. is 100×1.001935, or 100.1935 ml.

If it is desired to find the true volume of a glass flask at a temperature of T° C. when its contents are weighed at some other temperature of t° C., the following equation is used:

$$V_T^\circ = W_t^\circ \times C_{\text{at } t^\circ}(1 + C_{\text{at } T-t})$$

where V_T° is the true volume of the vessel at T°C. when it contains W grams of water at t° C., and $C_{\text{at } t^\circ}$ and $C_{\text{at } T-t}$ are values read from the table below. If $(T-t)$ is positive the constant $C_{\text{at } T-t}$ is positive; if $(T\text{-}t)$ is negative the constant $C_{\text{at } T-t}$ is negative. Thus, if the contents of a soda lime glass flask filled with water at 15° C. (t°) weigh 100 grams (W_t°), $C_{(\text{at } 25^\circ-15^\circ)}$ is 0.000250 and the true volume of the flask at 25° C. (V_T°) is 100×(1.001935+0.000250), or 100.2185 ml.

When mercury replaces water as the contained liquid of the vessel the value C for mercury is used.

	C When Filled With					
t°C.	Water	Mercury	T—t	Pyrex 774	Kimble N-51A	Soda Lime
0	1.001193	0.0735501	0	......	....	.....
1	1.001133	0.0735636	1	0.000010	0.000015	0.000025
2	1.001092	0.0735771	2	0.000019	0.000030	0.000050
3	1.001068	0.0735907	3	0.000029	0.000045	0.000075
4	1.001060	0.0736037	4	0.000038	0.000060	0.000100
5	1.001068	0.0736172	5	0.000048	0.000075	0.000125
6	1.001092	0.0736308	6	0.000058	0.000090	0.000150
7	1.001131	0.0736492	7	0.000067	0.000105	0.000175
8	1.001184	0.0736628	8	0.000077	0.000120	0.000200
9	1.001252	0.0736763	9	0.000086	0.000135	0.000225
10	1.001333	0.0736894	10	0.000096	0.000150	0.000250
11	1.001428	0.0736975	11	0.000106	0.000165	0.000275
12	1.001536	0.0737111	12	0.000115	0.000180	0.000300
13	1.001657	0.0737241	13	0.000125	0.000195	0.000325
14	1.001790	0.0737377	14	0.000134	0.000210	0.000350
15	1.001935	0.0737513	15	0.000144	0.000225	0.000375
16	1.002092	0.0737644	16	0.000154	0.000240	0.000400
17	1.002261	0.0737780	17	0.000163	0.000255	0.000425
18	1.002441	0.0737911	18	0.000173	0.000270	0.000450
19	1.002633	0.0738047	19	0.000182	0.000285	0.000475
20	1.002835	0.0738183	20	0.000192	0.000300	0.000500
21	1.003047	0.0738314	21	0.000202	0.000315	0.000525
22	1.003271	0.0738450	22	0.000211	0.000330	0.000550
23	1.003504	0.0738581	23	0.000221	0.000345	0.000575
24	1.003748	0.0738717	24	0.000230	0.000360	0.000600
25	1.004001	0.0738848	25	0.000240	0.000375	0.000625
26	1.004264	0.0738985	26	0.000250	0.000390	0.000650
27	1.004537	0.0739116	27	0.000259	0.000405	0.000675
28	1.004819	0.0739253	28	0.000269	0.000420	0.000700
29	1.005110	0.0739384	29	0.000278	0.000435	0.000725
30	1.005410	0.0739520	30	0.000288	0.000450	0.000750

DILUTION TABLE

% Before Dilution	% by Volume after Dilution																			% Before Dilution
	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	
10	200.00																			10
15	300.00	150.00																		15
20	400.00	200.00	133.33																	20
25	500.00	250.00	166.67	125.00																25
30	600.00	300.00	200.00	150.00	120.00															30
35	700.00	350.00	233.33	175.00	140.00	116.67														35
40	800.00	400.00	266.67	200.00	160.00	133.33	114.29													40
45	900.00	450.00	300.00	225.00	180.00	150.00	128.57	112.50												45
50	1000.00	500.00	333.33	250.00	200.00	166.67	142.86	125.00	111.11											50
55	1100.00	550.00	366.67	275.00	220.00	183.33	157.14	137.50	122.22	110.00										55
60	1200.00	600.00	400.00	300.00	240.00	200.00	171.43	150.00	133.33	120.00	109.09									60
65	1300.00	650.00	433.33	325.00	260.00	216.67	185.71	162.50	144.44	130.00	118.18	108.33								65
70	1400.00	700.00	466.67	350.00	280.00	233.33	200.00	175.00	155.56	140.00	127.27	116.67	107.69							70
75	1500.00	750.00	500.00	375.00	300.00	250.00	221.43	187.50	166.67	150.00	136.36	125.00	115.38	107.14						75
80	1600.00	800.00	533.33	400.00	320.00	266.67	228.57	200.00	177.78	160.00	145.45	133.33	123.08	114.29	106.67					80
85	1700.00	850.00	566.67	425.00	340.00	283.33	242.86	212.50	188.89	170.00	154.54	141.67	130.77	121.43	113.33	106.25				85
90	1800.00	900.00	600.00	450.00	360.00	300.00	257.14	225.00	200.00	180.00	163.64	150.00	138.46	128.57	120.00	112.50	105.88			90
95	1900.00	950.00	633.33	475.00	380.00	316.67	271.43	237.50	211.11	190.00	172.73	158.33	146.15	135.71	126.67	118.75	111.76	105.56		95
100	2000.00	1000.00	666.67	500.00	400.00	333.33	285.71	250.00	222.22	200.00	181.82	166.67	153.85	142.86	133.33	125.00	117.65	111.11	105.26	100

The table above shows the volume to which a more concentrated solution must be diluted to obtain the desired more dilute solution. Thus, 100 cc of a solution containing 15% of solute must be diluted to 300 cc to obtain a concentration of 5% and diluted to 150 cc to obtain a concentration of 10%. To prepare 1000 cc of a 5% solution by dilution of a 15% solution: (1000/300) × 100 or 333.33 cc of the 15% solution are diluted to 1000 cc.

STANDARD VOLUMETRIC (TITRIMETRIC) SOLUTIONS

Atomic Weights of 1948 *

Alkaline arsenite, 0.1 *N*. As^{3+} to As^{5+}. Dissolve 4.9455 g. of sublimed As_2O_3 in 40 ml. of 30% NaOH solution. Dilute with 200 ml. of water. Acidify the solution with 6 *N* HCl to the acid color of methyl red indicator. Add to this solution 40 g. of $NaHCO_3$ and dilute to one liter. This solution may be used as a standard for iodine solutions employing starch as the indicator for the titration and for ceric ion solutions using ortho-phenanthroline indicator. One ml. of the 0.1 *N* arsenite is equivalent to 0.012692 g. of iodine.

Ammonium thiocyanate, 0.1 *N*. Dissolve 7.6124 g. of NH_4CNS in water and dilute to a liter. Standardize against standard silver nitrate solution, using a ferric alum indicator.

Ceric sulfate, 0.1*N*. Ce^{4+} to Ce^{3+}. Dissolve 63.25 g. of ceric ammonium sulfate, $Ce(SO_4)_2 \cdot 2(NH_4)_2SO_4 \cdot 2H_2O$, in 500 ml. of 2 *N* sulfuric acid. Dilute the solution to a liter and standardize against the alkaline arsenite solution as follows: Measure, accurately, 30–40 ml. of arsenite solution into an Erlenmeyer flask and dilute to 150 ml. Add slowly, to prevent excessive frothing, 20 ml. of 4 *N* sulfuric acid, 2 drops of 0.01*M* osmium tetroxide solution and 4 drops of ortho-phenanthroline ferrous complex indicator. Titrate with the ceric sulfate solution to a faint blue end point. Compute the normality of the ceric solution from the normality of the arsenite solution.

Ferrous ammonium sulfate (Mohr's salt), 0.1 *N*. Fe^{2+} to Fe^{3+}. Dissolve 39.2158 g. of $FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$ in 500 ml. of 1 *N* H_2SO_4 and dilute to a liter. Standardize against standard permanganate or standard dichromate solution. The procedure for standardization with dichromate is described under potassium dichromate.

Hydrochloric acid, HCl. This acid may be standardized by the method of Hulett and Bonner as modified by Foulk and Hollingsworth (J. Am. Chem. Soc. 31, 390, (1909); *ibid.* 45, 1227 (1923)). For the preparation of a standard acid, HCl of approximately 1.10 density (as determined with a hydrometer) should be distilled at the rate of 3 to 4 ml. a minute. After three-fourths of the liquid has distilled the portion to be used as constant-boiling mixture should be collected. Distillation must, however, not be carried so far that less than 50 to 60 ml. of liquid remains in the flask. This acid is of constant composition, is not noticeably hygroscopic or volatile, and can be accurately weighed into a small flask, using a capillary pipette to obtain the exact weight desired. The preceding table by Foulk and Hollingsworth is based upon the atomic weights Ag = 107.88; Cl = 35.46; H = 1.008. Thus, to make 0.1*N* acid when the barometer reads 760 mm weigh out 18.0193 g. of distillate and dilute to a liter. For *N* acid use 180.193 g. A method of making approximately 1 *N* acid is to mix one volume of the concentrated acid with 11 volumes of water. This solution may be standardized by the precipitation of AgCl. For 0.1 *N* acid use a 1:110 mixture.

Barometer Pressure, mm of Hg	%HCl Vacuum weight basis	Grams (air-wt.) of const.-boiling distillate that contains 1 mole (vac.) of HCl
770	20.197	180.407
760	20.221	180.193
750	20.245	179.979
740	20.269	179.766
730	20.293	179.555

Iodine, 0.1 *N*. I^0 to I^{1-}. Dissolve 12.692 g. of resublimed iodine in 25 ml. of a solution containing 15 g. of KI which is free from iodate. Triturate the solution until all of the iodine has dissolved and then dilute to a liter. This solution can be used as a primary standard if the weighing is carefully done, or it can be checked against a standard thiosulfate solution or an alkaline arsenite solution, using starch as the indicator.

Nitric acid, 1 *N*. Normal acid contains 63.016 g. of HNO_3 per liter. Use a colorless acid, which can be made from the yellow acid by adding water and boiling. Dilution of 65 ml. of 1.42 sp. gr. acid to one liter gives approximately 1 *N* acid. Standardize by titration with a standard alkali.

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* *For the most recent atomic weights see inside of back cover.*

Oxalic acid, 1 *N*. Normal acid should contain 63.034 g. of $H_2C_2O_4 \cdot 2H_2O$ (or 45.018 g. of the anhydrous acid) per liter. Because of the uncertainty in the amount of water of crystallization oxalic acid solutions must be checked against a known alkali, using phenolphthalein indicator. This acid is not commonly used in titrimetric work as the weaker solutions are unstable, and the more concentrated solutions tend to give a precipitate if they are allowed to become too cold.

Potassium cyanide, for nickel titration, $0.1\,N = 0.4 \times KCN = 26.0456$ g. per liter. To make up this solution dissolve 26.0456 g. of KCN in water, add 10 g. of KOH to prevent hydrolysis, and dilute to one liter. For silver titration, $0.1\,N = 0.2 \times KCN$. In this case use 13.0228 g. of KCN and 5 g. of KOH.

Potassium dichromate, 0.1 *N*. Cr^{6+} to Cr^{3+}. Weigh out 4.9035 g. of $K_2Cr_2O_7$ that has been oven-dried and cooled in a desiccator, and dilute with water to one liter. This 0.1 *N* solution may be used in standardizing a sodium thiosulfate solution. Before using in an iron analysis the solution should be standardized against iron wire of known purity. Weigh out lengths of iron wire, previously cleaned, which approximate 0.2 g. in weight. Dissolve the sample of iron in 10 ml. of concentrated hydrochloric acid. Solution may be accelerated by warming. When the iron has dissolved add 0.5 *N* stannous chloride in a dropwise manner until the yellow color of the ferric ion disappears. Add 10 ml. of saturated mercuric chloride solution, and allow several minutes for precipitation of mercurous chloride. The ferrous ion solution is now diluted with 250 ml. of a solution containing 20 ml. of sulfuric acid and 5 ml. of 85% phosphoric acid. Add 10 drops of diphenylamine sulfonic acid indicator and titrate with the dichromate to the first permanent violet color. Calculate from the weight of iron sample and volume of dichromate, the normality of the solution.

Potassium hydroxide, 0.1 *N*. This solution should contain 5.6104 g. of KOH per liter, but it is best to dissolve about 7 g. in a half-liter of water, add enough $BaCl_2$ to precipitate any carbonate that may be present, allow the $BaCO_3$ to settle, filter into a liter flask and dilute to the mark with CO_2-free water. Standardize with potassium acid phthalate, succinic, sulfuric or hydrochloric acid, using a phenolphthalein or methyl orange indicator. The solution made up in this manner is slightly more than 0.1 *N* but it can easily be adjusted after an acid titration. Alkali solutions must be protected from air by having the solution siphoned from a bottle. The incoming air is filtered through a guard tube containing soda-lime or ASCARITE. To standardize, titrate accurately weighed portions of potassium acid phthalate of approximately 0.8 g. These are dissolved in 50 ml. of CO_2-free water and titrated using phenolphthalein indicator.

Potassium iodate, 0.1 *N*. I^{5+} to I^{1-}. Dry the KIO_3 in an oven at 120°C, cool in a desiccator, and weigh out exactly 3.567 g. of KIO_3 and about 15 g. of KI, dissolve in distilled water and dilute to one liter. This solution can be used as a standard if the iodate is pure, free from iodide, and is carefully weighed. The purity can be checked by dissolving a few crystals of the KIO_3 in 2 ml. of 2 *N* sulfuric acid to which is added starch indicator. Any blue coloration is evidence of iodide contamination.

Potassium permanganate, 0.1 *N*. Mn^{7+} to Mn^{2+}. A 0.1 *N* solution contains 3.1605 g. $KMnO_4$ per liter. Dissolve a little more than the calculated amount (about 3.3 g.) in a liter of distilled water. Allow this to stand for 2 or 3 days, then siphon it carefully through clean glass tubes, or filter it through a Gooch crucible, into the container in which it is to be kept, discarding the first 25 ml. and allowing the last inch of liquid to remain in the bottle. In this way any dust or reducing substance in the water is oxidized, and the MnO_2 so formed is removed from the final solution. Permanganate solutions should never be allowed to touch rubber, filter paper, or any other organic matter. To standardize the $KMnO_4$, weigh out several samples of about 0.3 g. of pure, dry sodium oxalate into Erlenmeyer flasks, add 150 ml. of distilled water and 4 ml. of concentrated H_2SO_4, and heat to 70°C. When all the sodium oxalate has been dissolved run in rapidly approximately three-fourths of the calculated volume of permanganate. Continue the addition of permanganate but add the last ml. drop by drop until a faint, permanent pink color is obtained. The temperature should be kept around 70°C throughout the titration. Each ml. of 0.1 N permanganate is equal to 0.00670 g. of sodium oxalate. The equation is: $2KMnO_4 + 5Na_2C_2O_4 + 8H_2SO_4 = K_2SO_4 + 2MnSO_4 + 5Na_2SO_4 + 10CO_2 + 8H_2O$.

Silver nitrate, 0.1 N. A 0.1 N solution contains 16.9888 g. of $AgNO_3$ per liter. Weigh out about 17.1 g. of $AgNO_3$ and dissolve in a liter of distilled water. Standardize against a standard NaCl solution by the method of Mohr, Volhard, or Fajans, or by precipitating and weighing AgCl. To standardize by the Fajans method, weigh out 0.2 g. samples of dried sodium chloride into Erlenmeyer flasks. Dissolve the samples in 50 ml. of water, add 0.1 g. of dextrin and 0.4 ml. dichlorofluorescein indicator. Titrate with silver nitrate in subdued light, until the precipitate of silver chloride becomes permanently pink.

Sodium chloride, 0.1 N. This solution contains 5.8454 g. of NaCl per liter. If the salt is dried, weighed, and diluted to a definite volume it may be used as a primary standard.

Sodium hydroxide, 0.1 N. This solution contains 4.0005 g. of NaOH per liter. It is prepared in the same manner as the potassium hydroxide solution, using about 6 g. for the 0.1 N solution, and about 42 g. for the normal solution. Standardize as directed for potassium hydroxide.

Sodium thiosulfate, 0.1 N. S^{4+} to S^{5+}. This solution contains 24.8206 g. of $Na_2S_2O_3 \cdot 5H_2O$ per liter. Weigh out 25 g. of $Na_2S_2O_3 \cdot 5H_2O$ and dilute to one liter. Add 0.5 g. of sodium carbonate, 0.5 ml. of chloroform, or 1% potassium furoate as a preservative. Standardize against resublimed iodine in the following manner: place approximately 5 ml. of a saturated solution of potassium iodide in a weighing bottle. Weigh the stoppered bottle with its contents accurately. Add 0.5 g. of pure iodine to the iodide solution, stopper the weighing bottle and reweigh. After the weighing transfer the stoppered bottle with its contents to a beaker containing 200 ml. of water. Remove the stopper of the weighing bottle with a glass rod and titrate the solution with the thiosulfate using starch indicator. From the weight of the iodine and the volume of titrant calculate the normality of the thiosulfate. Each ml. of 0.1 N thiosulfate is equivalent to 0.012692 g. of iodine.

Succinic acid, 0.1 N. This solution can be used as a primary standard if it is carefully weighed and diluted to a definite volume. Dry about 6 g. of $H_2C_4H_4O_4$ in an oven at 105°C and cool in a desiccator. Weigh out exactly 5.9044 g. and dilute to one liter. This solution is exactly 0.1 N.

Sulfuric acid, 1 N. This solution contains 49.038 g. of H_2SO_4 per liter. The 0.1 N solution contains 4.9038 g. per liter. Pour 30 ml. (3 ml. for the 0.1 N) of pure concentrated sulfuric acid of density 1.84 into 3 or 4 volumes of water. This must be done slowly and carefully. Cool the mixture and dilute to one liter. Standardize against a known KOH or NaOH solution using phenolphthalein, or against weighed portions of pure sodium carbonate using a methyl orange indicator.

See also the table: *Volumetric (Titrimetric) Primary Standards.*

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS

Name	At. or Mol. Wt.	Hydrogen Equivalent	Grams per cc of 1/10 normal solution
Acetic Acid	60.05	$HC_2H_3O_2$	0.006005
Ammonia	17.03	NH_3	0.001703
Ammonium	18.04	NH_4	0.001804
Ammonium Chloride	53.50	NH_4Cl	0.005350
Ammonium Hydroxide	35.05	NH_4OH	0.003505
Ammonium Nitrate	80.05	NH_4NO_3	0.008005
Ammonium Sulfate	132.14	$\frac{1}{2}(NH_4)_2SO_4$	0.006607
Ammonium Thiocyanate	76.12	NH_4CNS	0.007612
Barium	137.36	$\frac{1}{2}Ba$	0.006868
Barium Carbonate	197.37	$\frac{1}{2}BaCO_3$	0.009869
Barium Chloride	244.31	$\frac{1}{2}BaCl_2 \cdot 2H_2O$	0.012215
Barium Hydroxide	171.38	$\frac{1}{2}Ba(OH)_2$	0.008569
Barium Oxide	153.36	$\frac{1}{2}BaO$	0.007668
Boric Acid	61.84	$\frac{1}{3}H_3BO_3$	0.002061
Bromine	79.92	Br	0.007992
Calcium	40.08	$\frac{1}{2}Ca$	0.002004
Calcium Carbonate	100.09	$\frac{1}{2}CaCO_3$	0.005005
Calcium Chloride	110.99	$\frac{1}{2}CaCl_2$	0.005550
Calcium Chloride	219.09	$\frac{1}{2}CaCl_2 \cdot 6H_2O$	0.010955
Calcium Hydroxide	74.10	$\frac{1}{2}Ca(OH)_2$	0.003705
Calcium Oxide	56.08	$\frac{1}{2}CaO$	0.002804
Carbon Dioxide	44.01	$\frac{1}{2}CO_2$	0.002201
Chlorine	35.46	Cl	0.003546
Citric Acid	210.14	$\frac{1}{3}C_6H_8O_7 \cdot H_2O$	0.007005
Cobalt	58.94	$\frac{1}{2}Co$	0.002947
Copper	63.57	$\frac{1}{2}Cu$	0.003179
Copper Oxide	79.57	$\frac{1}{2}CuO$	0.003979
Copper Sulfate	249.71	$\frac{1}{2}CuSO_4 \cdot 5H_2O$	0.012486
Cyanogen	26.02	CN	0.002602
Hydrobromic Acid	80.92	HBr	0.008092
Hydrochloric Acid	36.47	HCl	0.003647
Hydrocyanic Acid	27.03	HCN	0.002703
Hydroiodic Acid	127.93	HI	0.012793
Iodine	126.92	I	0.012692
Lactic Acid	90.08	$C_3H_6O_3$	0.009008
Lead	207.21	$\frac{1}{2}Pb$	0.010361
Lead Carbonate	267.22	$\frac{1}{2}PbCO_3$	0.013361
Lead Oxide	223.21	$\frac{1}{2}PbO$	0.011161
Magnesium	24.32	$\frac{1}{2}Mg$	0.001216
Magnesium Carbonate	84.33	$\frac{1}{2}MgCO_3$	0.004217
Magnesium Chloride	95.23	$\frac{1}{2}MgCl_2$	0.004762
Magnesium Chloride	203.33	$\frac{1}{2}MgCl_2 \cdot 6H_2O$	0.010167
Magnesium Oxide	40.32	$\frac{1}{2}MgO$	0.002016
Malic Acid	134.09	$\frac{1}{2}C_4H_6O_5$	0.006704
Manganese	54.93	$\frac{1}{2}Mn$	0.002747
Manganese Sulfate	150.99	$\frac{1}{2}MnSO_4$	0.007550
Mercuric Chloride	271.52	$\frac{1}{2}HgCl_2$	0.013576
Nickel	58.69	$\frac{1}{2}Ni$	0.002935
Nitric Acid	63.02	HNO_3	0.006302
Nitrogen	14.01	N	0.001401
Nitrogen Pentoxide	108.02	$\frac{1}{2}N_2O_5$	0.005401
Nitrous Acid	47.02	HNO_2	0.004702
Oxalic Acid	90.04	$\frac{1}{2}H_2C_2O_4$	0.004502
Oxalic Acid	126.07	$\frac{1}{2}H_2C_2O_4 \cdot 2H_2O$	0.006303

DECI-NORMAL SOLUTIONS OF SALTS AND OTHER REAGENTS

Name	At. or Mol. Wt.	Hydrogen Equivalent	Grams per cc of 1/10 normal solution
Oxalic Anhydride	72.02	$\frac{1}{2}C_2O_3$	0.003601
Phosphoric Acid	98.00	$\frac{1}{3}H_3PO_4$	0.003267
Potassium	39.10	K	0.003910
Potassium Bicarbonate	100.11	$KHCO_3$	0.010011
Potassium Bitartrate	188.18	$KHC_4H_4O_6$	0.018818
Potassium Carbonate	138.20	$\frac{1}{2}K_2CO_3$	0.006910
Potassium Chloride	74.55	KCl	0.007455
Potassium Cyanide	65.11	KCN	0.006511
Potassium Dichromate	294.21	$\frac{1}{6}K_2Cr_2O_7$	0.004904
Potassium Hydroxide	56.10	KOH	0.005610
Potassium Oxide	94.19	$\frac{1}{2}K_2O$	0.004710
Potassium Permanganate for Co estimation	158.03	$\frac{1}{5}KMnO_4$	0.003161
Potassium Permanganate for Mn estimation	158.03	$\frac{1}{3}KMnO_4$	0.005268
Potassium Tartrate	226.26	$\frac{1}{2}K_2H_4C_4O_6$	0.011314
Potassium Tetroxalate	254.19	$\frac{1}{3}KH_3(C_2O_4)_2{\cdot}2H_2O$	0.008473
Silver	107.88	Ag	0.010788
Silver Nitrate	169.89	$AgNO_3$	0.016989
Sodium	23.00	Na	0.002300
Sodium Bicarbonate	84.02	$NaHCO_3$	0.008402
Sodium Carbonate	106.00	$\frac{1}{2}Na_2CO_3$	0.005300
Sodium Chloride	58.45	$NaCl$	0.005845
Sodium Hydroxide	40.01	$NaOH$	0.004001
Sodium Oxide	61.99	$\frac{1}{2}Na_2O$	0.003100
Sodium Phosphate (di)	141.98	$\frac{1}{2}Na_2HPO_4$	0.007099
Sodium Phosphate (tri)	163.97	$\frac{1}{3}Na_3PO_4$	0.005466
Sodium Sulfide	78.05	$\frac{1}{2}Na_2S$	0.003903
Sodium Tetraborate	201.27	$\frac{1}{2}Na_2B_4O_7$	0.010064
Sodium Tetraborate	381.44	$\frac{1}{2}Na_2B_4O_7{\cdot}10H_2O$	0.019072
Succinic Acid	118.09	$\frac{1}{2}H_2C_4H_4O_4$	0.005904
Sulfuric Acid	98.08	$\frac{1}{2}H_2SO_4$	0.004904
Sulfuric Trioxide	80.06	$\frac{1}{2}SO_3$	0.004003
Tartaric Acid	150.09	$\frac{1}{2}C_4H_6O_6$	0.007504
Zinc	65.38	$\frac{1}{2}Zn$	0.003269
Zinc Sulfate	287.55	$\frac{1}{2}ZnSO_4{\cdot}7H_2O$	0.014378

A METHOD FOR BALANCING EQUATIONS FOR OXIDATION-REDUCTION REACTIONS

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The rule for balancing equations in which oxidation and reduction takes place was originated by O. C. Johnson in 1880 (Chem. News 42, 51). It is an excellent and useful rule if a term such as "oxidation number" is substituted for the term "bond." The oxidation number of an element is often the same number as its valence; in many cases, however, the two numbers are entirely different. The oxidation number of an element is determined by the following simple rules:

(a) Hydrogen has an oxidation number of $+ 1$.

(b) Oxygen has an oxidation number of $- 2$, except in H_2O_2 and peroxides.

(c) Free elements have an oxidation number of 0.

(d) The sum of the oxidation numbers of the elements in a compound is 0.

Examples: (1) Find the oxidation number of P in H_3PO_4. Three of hydrogen have an oxidation number of $+ 3$, four of oxygen have an oxidation number of $- 8$, the atom of phosphorus must have an oxidation number of $+ 5$ in order that the sum shall be 0. The valence of phosphorus is also 5.

(2) Find the oxidation number of C in CH_2O. Two of hydrogen have an oxidation number of $+ 2$, one of oxygen has an oxidation number of $- 2$, therefore the oxidation number of the atom of carbon is 0. The valence of carbon is 4.

(3) Find the oxidation number of As in Ag_3AsO_3. This salt is derived from H_3AsO_3. The rules are applied to this acid.

The total gain in oxidation number for all of the atoms in one molecule of the reducing agent is the number of molecules of the oxidizing agent to be taken; the total loss in oxidation number for all of the atoms in one molecule of the oxidizing agent is the number of molecules of the reducing agent to be taken. After obtaining these two numbers the rest of the equation can be balanced by inspection.

Oxidation equations may be divided into three classes:

(a) in which the oxidizing agent and reducing agent simply oxidizes and reduces;

(b) in which part of the oxidizing agent or reducing agent also enters into combination without being oxidized or reduced;

(c) in which all of the elements oxidized and reduced are present in the same molecule.

Example of (a):

$3\,As_4+20\,HNO_3+8\,H_2O = 12\,H_3AsO_4 +20\,NO$. Four atoms of arsenic in metallic arsenic have an oxidation number of 0, in H_3AsO_4, the four atoms of arsenic have an oxidation number of +20; the total gain for the molecule (As_4) is 20, and therefore 20 of HNO_3 are taken. One atom of nitrogen in HNO_3 has an oxidation number of $+ 5$, in NO it has an oxidation number of +2; the total loss for the molecule (HNO_3) is 3, and therefore 3 of As_4 are taken.

Example of (b):

$3\,Cu + 8\,HNO_3 =3\,Cu(NO_3)_2+2\,NO +4\,H_2O$. One of Cu gains 2 and therefore 2 of HNO_3 are required to oxidize it. One of N loses 3 and therefore 3 of Cu are taken. This indicates that 3 of $Cu(NO_3)_2$ and 2 of NO are formed. Six of HNO_3 are evidently required to unite with the copper, and these are added to the two required to oxidize it.

Example of (c):

$3\,HClO_3 = HClO_4+2\,ClO_2+H_2O$. The $HClO_3$ should be written twice, considering the one part to be the oxidizer and the other the reducer. $2\,HClO_3$ (oxidizing) $+ HClO_3$ (reducing) $= HClO_4 + 2ClO_2 + H_2O$. The oxidizing $HClO_3$ changes to ClO_2, the reducing to $HClO_4$. On application of the rule, it is found that two molecules of the oxidizing $HClO_3$ are to be taken and this indicates that two molecules of ClO_2 are formed; since it is found that one molecule of the reducing $HClO_3$ is to be taken, one of $HClO_4$ is formed.

It should be kept in mind that more than one element in the same molecule may change in oxidation number.

EQUATIONS AND EQUIVALENTS FOR VOLUMETRIC (TITRIMETRIC) ANALYSIS

Aluminum

(1) $\mathrm{Al_2(SO_4)_3 + 6KOH = 2Al(OH)_3 + 3K_2SO_4}$

$$\mathrm{KOH} \Bumpeq \frac{\mathrm{Al}}{3} \Bumpeq \frac{\mathrm{Al_2O_3}}{6} \Bumpeq \frac{\mathrm{Al_2(SO_4)_3}}{6}$$

(2) $\mathrm{Al_2(SO_4)_3 + 5KI + KIO_3 + 3H_2O = 2Al(OH)_3 + 3K_2SO_4 + 3I_2}$

$$\mathrm{I} \Bumpeq \frac{\mathrm{Al}}{3} \Bumpeq \frac{\mathrm{Al_2(SO_4)_3}}{6}$$

Antimony

(3) $\mathrm{H_3SbO_4 + 2HI = H_3SbO_3 + H_2O + I_2}$

$$\mathrm{I} \Bumpeq \frac{\mathrm{Sb}}{2} \Bumpeq \frac{\mathrm{H_3SbO_4}}{2}$$

(4) $\mathrm{SbCl_5 + 2KI = SbCl_3 + 2KCl + I_2}$

$$\mathrm{I} \Bumpeq \frac{\mathrm{Sb}}{2} \Bumpeq \frac{\mathrm{Sb_2O_5}}{4}$$

(5) $\mathrm{Sb_2O_5 + 4HI = Sb_2O_3 + 2H_2O + 2I_2}$

$$\mathrm{I} \Bumpeq \frac{\mathrm{Sb}}{2} \Bumpeq \frac{\mathrm{Sb_2O_5}}{4}$$

(6) $\mathrm{Sb_2S_5 + 6HCl = 2SbCl_3 + 2S + 3H_2S}$

$$\mathrm{3H_2S + 3I_2 = 6HI + 3S}$$

$$\mathrm{I} \Bumpeq \frac{\mathrm{Sb}}{3} \Bumpeq \frac{\mathrm{Sb_2S_5}}{6}$$

(7) $\mathrm{2H_3SbO_3 + KIO_3 + 2HCl = 2H_3SbO_4 + KCl + ICl + H_2O}$

$$\frac{\mathrm{KIO_3}}{6} \Bumpeq \frac{\mathrm{Sb}}{3} \Bumpeq \frac{\mathrm{H_3SbO_3}}{3}$$

(8) $\mathrm{2NaSbO_3 + 4HI = 2NaSbO_2 + 2H_2O + 2I_2}$

$$\mathrm{I} \Bumpeq \frac{\mathrm{NaSbO_3}}{2}$$

(9) $\mathrm{H_3SbO_3 + I_2 + H_2O = H_3SbO_4 + 2HI}$

$$\mathrm{I} \Bumpeq \frac{\mathrm{Sb}}{2} \Bumpeq \frac{\mathrm{H_3SbO_3}}{2}$$

(10) $\mathrm{Sb_2O_3 + 2I_2 + 2H_2O = Sb_2O_5 + 4HI}$

$$\mathrm{I} \Bumpeq \frac{\mathrm{Sb}}{2} \Bumpeq \frac{\mathrm{Sb_2O_3}}{4}$$

(11) $SbCl_3 + I_2 + 2HCl = SbCl_5 + 2HI$

$$I \Bumpeq \frac{Sb}{2} \Bumpeq \frac{SbCl_3}{2}$$

(12) $Sb_2S_3 + 6HCl = 2SbCl_3 + 3H_2S$

$$3H_2S + 3I_2 = 6HI + 3S$$

$$I \Bumpeq \frac{Sb}{3} \Bumpeq \frac{Sb_2S_3}{6} \Bumpeq \frac{H_2S}{2}$$

(13) $5Sb_2(SO_4)_3 + 4KMnO_4 + 24H_2O = 10H_3SbO_4 + 2K_2SO_4 + 4MnSO_4 + 9H_2SO_4$

$$\frac{KMnO_4}{5} \Bumpeq \frac{Sb}{2} \Bumpeq \frac{Sb_2O_3}{4} \Bumpeq \frac{Sb_2(SO_4)_3}{4}$$

(14) $2NaSbO_2 + 2I_2 + 2H_2O = NaSbO_3 + 4HI$

$$I \Bumpeq \frac{NaSbO_2}{2}$$

(15) $NaSbO_2 + 2K_3Fe(CN)_6 + 2KOH = NaSbO_3 + 2K_4Fe(CN)_6 + H_2O$

$5K_4Fe(CN)_6 + KMnO_4 + 4H_2SO_4 = 5K_3Fe(CN)_6 + 3K_2SO_4 + MnSO_4 + 4H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{Sb}{2} \Bumpeq \frac{NaSbO_2}{2}$$

Arsenic

(16) $As_2O_3 + 2H_2O + 2I_2$ same as equation **10.**

(17) $AsCl_3 + I_2 + 2HCl$ same as equation **11.**

(18) $As_2S_3 + 6HCl$ same as equation **12.**

(19) $2Na_3AsO_4 \Bumpeq As_2O_5$

$$I \Bumpeq \frac{Na_3AsO_4}{2} \Bumpeq \frac{As_2O_5}{4}$$

(20) $2Na_2HAsO_4 \Bumpeq As_2O_5$

$$I \Bumpeq \frac{Na_2HAsO_4}{2} \Bumpeq \frac{As_2O_5}{4}$$

(21) $2NaH_2AsO_4 \Bumpeq As_2O_5$

$$I \Bumpeq \frac{NaH_2AsO_4}{2} \Bumpeq \frac{As_2O_5}{4}$$

(22) $2H_3AsO_3 + KIO_3 + 2HCl$ same as equation **7.**

(23) $H_3AsO_3 + I_2 + H_2O$ same as equation **9.**

(24) $2NaAsO_2 + 2I_2 + 2H_2O$ same as equation **14.**

(25) $2NaAsO_2 + 4K_3Fe(CN)_6 + 4KOH$ same as equation **15.**

(26) $2Na_3AsO_3 \Bumpeq As_2O_3$

$$I \Bumpeq \frac{Na_3AsO_3}{2} \Bumpeq \frac{As_2O_3}{4}$$

(27) $2Na_2HAsO_3 \Bumpeq As_2O_3$

$$I \Bumpeq \frac{Na_2HAsO_3}{2} \Bumpeq \frac{As_2O_3}{4}$$

(28) $2NaH_2AsO_3 \Bumpeq As_2O_3$

$$I \Bumpeq \frac{NaH_2AsO_3}{2} \Bumpeq \frac{As_2O_3}{4}$$

Boron

(29) $Na_2B_4O_7 + 2HCl + 5H_2O + (\text{Glycerol}) = 4H_3BO_3 + 2NaCl$

$$H_3BO_3 + NaOH = NaBO_2 + 2H_2O$$

$$NaOH \Bumpeq B \Bumpeq \frac{B_2O_3}{2} \Bumpeq H_3BO_3$$

(30) $6HBO_2 + KIO_3 + 5KI + (\text{Mannitol}) = 6KBO_2 + 3H_2O + 3I_2$

$$I \Bumpeq HBO_2 \Bumpeq H_3BO_3$$

Bromine

(31) $Br_2 + 2KI = 2KBr + I_2$

$$I \Bumpeq Br$$

(32) $KBrO_3 + 6KI + 6HBr = 7KBr + 3I_2 + 3H_2O$

$$I \Bumpeq \frac{KBrO_3}{6}$$

(33) $Ba(BrO_3)_2 + 6H_3AsO_3 = BaBr_2 + 6H_3AsO_4$

$$I \Bumpeq \frac{Ba(BrO_3)_2}{12} \Bumpeq \frac{H_3AsO_3}{2}$$

Cadmium

(34) $CdS + I_2 + 2HCl = CdCl_2 + 2HI + S$

$$I \Bumpeq \frac{Cd}{2} \Bumpeq \frac{CdS}{2} \Bumpeq \frac{S}{2}$$

Calcium

(35) $5CaC_2O_4 + 2KMnO_4 + 8H_2SO_4 = 5CaSO_4 + K_2SO_4 + 2MnSO_4 + 10CO_2 + 8H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{Ca}{2} \Bumpeq \frac{CaC_2O_4}{2} \Bumpeq \frac{CaCO_3}{2}$$

(36) $CaCO_3 + 2HCl = CaCl_2 + CO_2 + H_2O$

$$HCl \Bumpeq \frac{CaO}{2} \Bumpeq \frac{CaCO_3}{2}$$

Carbon

(37) $\mathrm{Na_2CO_3+2HCl=2NaCl+CO_2+H_2O}$

$$\mathrm{HCl} \Bumpeq \frac{\mathrm{Na_2CO_3}}{2}$$

(38) $\mathrm{Na_2CO_3+H_2SO_4=Na_2SO_4+CO_2+H_2O}$

$$\mathrm{H_2SO_4} \Bumpeq \mathrm{Na_2CO_3}$$

(39) $\mathrm{NaHCO_3+HCl=NaCl+CO_2+H_2O}$

$$\mathrm{HCl} \Bumpeq \mathrm{NaHCO_3}$$

(40) $\mathrm{2NaHCO_3+H_2SO_4=Na_2SO_4+2CO_2+2H_2O}$

$$\mathrm{H_2SO_4} \Bumpeq \mathrm{2NaHCO_3}$$

(41) $\mathrm{H_2C_2O_4{\cdot}2H_2O+2NaOH=Na_2C_2O_4+4H_2O}$

$$\mathrm{NaOH} \Bumpeq \frac{\mathrm{H_2C_2O_4{\cdot}2H_2O}}{2}$$

(42) $\mathrm{KHC_2O_4+KOH=K_2C_2O_4+H_2O}$

$$\mathrm{KOH} \Bumpeq \mathrm{KHC_2O_4}$$

(43) $\mathrm{5Na_2C_2O_4+2KMnO_4+8H_2SO_4=5Na_2SO_4+2MnSO_4+}$
$\mathrm{K_2SO_4+10CO_2+8H_2O}$

$$\frac{\mathrm{KMnO_4}}{5} \Bumpeq \frac{\mathrm{Na_2C_2O_4}}{2}$$

(44) $\mathrm{KCN+I_2=KI+CNI}$

$$\mathrm{I} \Bumpeq \frac{\mathrm{KCN}}{2}$$

(45) $\mathrm{5K_4Fe(CN)_6+KMnO_4+4H_2SO_4=5K_3Fe(CN)_6+MnSO_4+}$
$\mathrm{3K_2SO_4+4H_2O}$

$$\frac{\mathrm{KMnO_4}}{5} \Bumpeq \mathrm{K_4Fe(CN)_6}$$

(46) $\mathrm{2K_3Fe(CN)_6+2KI=2K_4Fe(CN)_6+I_2}$

$$\mathrm{I} \Bumpeq \mathrm{K_3Fe(CN)_6}$$

(47) $\mathrm{3KCNS+4Al+18HCl=3KCl+4AlCl_3+3NH_4Cl+3C+3H_2S}$

$$\mathrm{I} \Bumpeq \frac{\mathrm{KCNS}}{2} \Bumpeq \frac{\mathrm{H_2S}}{2}$$

(48) $\mathrm{5HCNS+6KMnO_4+4H_2SO_4=6MnSO_4+3K_2SO_4+5HCN+4H_2O}$

$$\frac{\mathrm{KMnO_4}}{5} \Bumpeq \frac{\mathrm{HCNS}}{6}$$

EQUATIONS AND EQUIVALENTS FOR VOLUMETRIC ANALYSIS

Cerium

(49) $2K_3Fe(CN)_6+Ce_2O_3+2KOH=2K_4Fe(CN)_6+2CeO_2+H_2O$

$$\frac{KMnO_4}{5} \asymp K_4Fe(CN)_6 \asymp Ce \asymp \frac{Ce_2O_3}{2}$$

(50) $2CeO_2+2KI+8HCl=2CeCl_3+2KCl+I_2+4H_2O$

$$I \asymp Ce \asymp CeO_2$$

Chlorine

(51) $Cl_2+2KI=2KCl+I_2$
$I_2+2Na_2S_2O_3=2NaI+Na_2S_4O_6$

$$I \asymp Cl$$

(52) $CaOCl_2+2HCl=CaCl_2+Cl_2+H_2O$

$$I \asymp Cl \asymp \frac{CaOCl_2}{2}$$

(53) $NaClO+2KI+H_2O=NaCl+2KOH+I_2$

$$I \asymp \frac{NaClO}{2}$$

(54) $NaCl+AgNO_3=AgCl+NaNO_3$

$$NaCl \asymp Cl$$

(55) $KClO_3+6FeSO_4+3H_2SO_4=KCl+3Fe_2(SO_4)_3+3H_2O$

$$\frac{KMnO_4}{5} \asymp \frac{KClO_3}{6}$$

(56) $KClO_3+6HI+H_2SO_4=KHSO_4+HCl+3I_2+3H_2O$

$$I \asymp \frac{KClO_3}{6}$$

(57) $KClO_4=KCl+2O_2$
$2O_2+8HI=4I_2+4H_2O$

$$I \asymp \frac{KClO_4}{8}$$

Chromium

(58) $Cr_2(SO_4)_3+5KI+KIO_3+3H_2O=2Cr(OH)_3+3K_2SO_4+3I_2$

$$I \asymp \frac{Cr}{3} \asymp \frac{Cr_2(SO_4)_3}{6}$$

(59) $K_2Cr_2O_7+6FeSO_4+8H_2SO_4=Cr_2(SO_4)_3+3Fe_2(SO_4)_3+$
$2KHSO_4+7H_2O$

$$\frac{KMnO_4}{5} \asymp \frac{K_2Cr_2O_7}{6} \asymp \frac{Cr}{3} \asymp \frac{Cr_2O_3}{6}$$

(60) $K_2Cr_2O_7 + 6FeCl_2 + 14HCl = 2CrCl_3 + 6FeCl_3 + 2KCl + 7H_2O$

$$Fe \approx \frac{K_2Cr_2O_7}{6} \approx \frac{Cr_2O_3}{6} \approx \frac{Cr}{3}$$

(61) $K_2Cr_2O_7 + 6KI + 7H_2SO_4 = Cr_2(SO_4)_3 + 4K_2SO_4 + 3I_2 + 7H_2O$

$$I \approx \frac{Cr}{3} \approx \frac{Cr_2O_3}{6} \approx \frac{K_2Cr_2O_7}{6}$$

(62) $K_2Cr_2O_7 + 2KOH = 2K_2CrO_4 + H_2O$

$$KOH \approx \frac{K_2Cr_2O_7}{2}$$

(63) $2K_2CrO_4 + 6KI + 16HCl = 2CrCl_3 + 10KCl + 3I_2 + 8H_2O$

$$I \approx \frac{Cr}{3} \approx \frac{CrO_3}{3} \approx \frac{K_2CrO_4}{3}$$

(64) $2BaCrO_4 + 6FeSO_4 + 8H_2SO_4 = 2BaSO_4 + Cr_2(SO_4)_3 + 3Fe_2(SO_4)_3 + 8H_2O$

$$\frac{KMnO_4}{5} \approx FeSO_4 \approx \frac{Cr}{3} \approx \frac{CrO_3}{3} \approx \frac{K_2CrO_4}{3} \approx \frac{BaCrO_4}{3}$$

Cobalt

(65) $3CoSO_4 + 5KI + KIO_3 + 3H_2O = 3Co(OH)_2 + 3K_2SO_4 + 3I_2$

$$I \approx \frac{Co}{2} \approx \frac{CoSO_4}{2}$$

(66) $6CoCl_2 + 5HgO + 2KMnO_4 + 10H_2O = 6Co(OH)_3 + 5HgCl_2 + 2MnO_2 + 2KCl + H_2O$

$$\frac{KMnO_4}{5} \approx \frac{3Co}{5} \approx \frac{3CoCl_2}{5}$$

Copper

(67) $2CuSO_4 + 4KI = 2CuI + K_2SO_4 + I_2$

$$I \approx Cu \approx CuSO_4$$

(68) $2Cu(C_2H_3O_2)_2 + 4KI = 2CuI + 4KC_2H_3O_2 + I_2$

$$I \approx Cu \approx Cu(C_2H_3O_2)_2$$

(69) $2CuSO_4 + 2KCNS + H_2SO_3 + H_2O = 2CuCNS + K_2SO_4 + 2H_2SO_4$
$CuCNS + KOH = KCNS + CuOH$
$5KCNS + 6KMnO_4 + 4H_2SO_4 = 3K_2SO_4 + 6MnSO_4 + 5KCN + 4H_2O$

$$\frac{KMnO_4}{5} \approx \frac{Cu}{6} \approx \frac{CuSO_4}{6} \approx \frac{KCNS}{6}$$

EQUATIONS AND EQUIVALENTS FOR TITRIMETRIC ANALYSIS

(70) $2CuSO_4 + NH_4OH = CuSO_4 \cdot Cu(OH)_2 + (NH_4)_2SO_4$
$CuSO_4 \cdot Cu(OH)_2 + 6NH_3 + (NH_4)_2SO_4 = 2Cu(NH_3)_4SO_4 \cdot H_2O$
$2Cu(NH_3)_4SO_4 \cdot H_2O + 7KCN = K_3NH_4Cu_2(CN)_6 + NH_4CNO + 6NH_3 + 2K_2SO_4 + H_2O$

$$\frac{KCN}{2} \Bumpeq \frac{Cu}{7} \Bumpeq \frac{CuSO_4}{7} \Bumpeq \frac{Cu(NH_3)_4SO_4 \cdot H_2O}{7}$$

Fluorine

(71) $6NaF + FeCl_3 = Na_3FeF_6 + 3NaCl$

$$FeCl_3 \Bumpeq 6NaF$$

Gold

(72) $AuCl_3 + 2KI = AuCl + 2KCl + I_2$

$$I \Bumpeq \frac{Au}{2} \Bumpeq \frac{AuCl_3}{2}$$

Iodine

(73) $I_2 + 2Na_2S_2O_3 = 2NaI + Na_2S_4O_6$

$$I \Bumpeq Na_2S_2O_3$$

(74) $10KI + 2KMnO_4 + 16HCl = 12KCl + 2MnCl_2 + 5I_2 + 8H_2O$

$$\frac{KMnO_4}{5} \Bumpeq I \Bumpeq KI$$

(75) $KIO_3 + 5KI + 6HCl = 6KCl + 3I_2 + 3H_2O$

$$I \Bumpeq \frac{KIO_3}{6} \Bumpeq \frac{5KI}{6}$$

(76) $Ca(IO_3)_2 + 10KI + 12HCl = CaCl_2 + 10KCl + 6I_2 + 6H_2O$

$$I \Bumpeq \frac{Ca(IO_3)_2}{12}$$

(77) $KIO_4 + 7KI + 8HCl = 8KCl + 4I_2 + 4H_2O$

$$I \Bumpeq \frac{KIO_4}{8}$$

Iron

(78) $6FeCl_2 + K_2Cr_2O_7 + 14HCl = 6FeCl_3 + 2CrCl_3 + 2KCl + 7H_2O$

$$\frac{K_2Cr_2O_7}{6} \Bumpeq Fe \Bumpeq FeCl_2 \Bumpeq \frac{Fe_2O_3}{2}$$

(79) $10FeSO_4 + 2KMnO_4 + 8H_2SO_4 = 5Fe_2(SO_4)_3 + 2MnSO_4 + K_2SO_4 + 8H_2O$

$$\frac{KMnO_4}{5} \Bumpeq Fe \Bumpeq FeSO_4 \Bumpeq \frac{Fe_2O_3}{2}$$

(80) $2FeCl_3+2KI=2KCl+2FeCl_2+I_2$

$$I \asymp Fe \asymp FeCl_3 \asymp \frac{Fe_2O_3}{2}$$

(81) $Fe_2(SO_4)_3+2KI=2FeSO_4+K_2SO_4+I_2$

$$I \asymp Fe \asymp \frac{Fe_2(SO_4)_3}{2} \asymp \frac{Fe_2O_3}{2}$$

(82) $2FeCl_3+SnCl_2=2FeCl_2+SnCl_4$
$SnCl_2+2HgCl_2=SnCl_4+2HgCl$
$2FeCl_2+I_2+2HCl=2FeCl_3+2HI$

$$I \asymp Fe \asymp FeCl_3 \asymp \frac{Fe_2O_3}{2}$$

Lead

(83) $2Pb(C_2H_3O_2)_2+K_2Cr_2O_7+H_2O=2PbCrO_4+2KC_2H_3O_2+$
$2HC_2H_3O_2$

$$Pb \asymp \frac{K_2Cr_2O_7}{2}$$

(83) $2Pb(C_2H_3O_2)_2+K_2Cr_2O_7+H_2O=2PbCrO_4+2KC_2H_3O_2+$
$2HC_2H_3O_2$
$2PbCrO_4+6KI+16HCl=2PbCl_2+2CrCl_3+6KCl+8H_2O+3I_2$

$$\frac{K_2Cr_2O_7}{6} \asymp \frac{Pb}{3} \asymp \frac{PbCrO_4}{3} \asymp I$$

(84) $PbO_2+4HI=PbI_2+I_2+2H_2O$

$$I \asymp \frac{Pb}{2} \asymp \frac{PbO_2}{2}$$

(85) $PbO_2+H_2C_2O_4=PbO+2CO_2+H_2O$
$5H_2C_2O_4+2KMnO_4+3H_2SO_4=10CO_2+2MnSO_4+K_2SO_4$
$+8H_2O$

$$\frac{KMnO_4}{5} \asymp \frac{H_2C_2O_4}{2} \asymp \frac{Pb}{2} \asymp \frac{PbO_2}{2}$$

(86) $PbO_2+H_2O_2+2HNO_3=Pb(NO_3)_2+2H_2O+O_2$
$5H_2O_2+2KMnO_4+6HNO_3=2Mn(NO_3)_2+2KNO_3+8H_2O$
$+5O_2$

$$\frac{KMnO_4}{5} \asymp \frac{H_2O_2}{2} \asymp \frac{Pb}{2} \asymp \frac{PbO_2}{2}$$

(87) $Pb_3O_4+4HC_2H_3O_2=PbO_2+2Pb(C_2H_3O_2)_2+2H_2O$
$PbO_2+4KI=PbI_2+2K_2O+I_2$

$$I \asymp \frac{Pb}{2} \asymp \frac{Pb_3O_4}{2} \asymp \frac{PbO_2}{2}$$

Magnesium

(88) $MgNH_4PO_4 + H_2SO_4 = MgSO_4 + NH_4H_2PO_4$

$$H_2SO_4 \Bumpeq MgNH_4PO_4$$

Manganese

(89) $MnO_2 + H_2C_2O_4 + H_2SO_4 = MnSO_4 + 2CO_2 + 2H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{H_2C_2O_4}{2} \Bumpeq \frac{Mn}{2} \Bumpeq \frac{MnO_2}{2}$$

(90) Bismuthate Method:

$$2Mn(NO_3)_2 + 5NaBiO_3 + 16HNO_3 = 2HMnO_4 + 5Bi(NO_3)_3 + 5NaNO_3 + 7H_2O$$

$$2HMnO_4 + 5Na_3AsO_3 + 4HNO_3 = 2Mn(NO_3)_2 + 5Na_3AsO_4 + 3H_2O$$

$$\frac{HMnO_4}{5} \Bumpeq \frac{Na_3AsO_3}{2} \Bumpeq \frac{Mn}{5}$$

(91) Ford Williams Method:

$$MnO_2 + 2FeSO_4 + 2H_2SO_4 = MnSO_4 + Fe_2(SO_4)_3 + 2H_2O$$

$$FeSO_4 \Bumpeq \frac{KMnO_4}{5} \Bumpeq \frac{MnO_2}{2} \Bumpeq \frac{Mn}{2}$$

(92) Lead Dioxide Method:

$$2MnSO_4 + 5PbO_2 + 6HNO_3 = 2HMnO_4 + 2PbSO_4 + 3Pb(NO_3)_2 + 2H_2O$$

$$2HMnO_4 + 5Na_3AsO_3 + 4HNO_3 = 2Mn(NO_3)_2 + 5Na_3AsO_4 + 3H_2O$$

$$\frac{Na_3AsO_3}{2} \Bumpeq \frac{KMnO_4}{5} \Bumpeq \frac{HMnO_4}{5} \Bumpeq \frac{Mn}{5}$$

(93) Persulfate Method:

$$2Mn(NO_3)_2 + 5(NH_4)_2S_2O_8 + 8H_2O = 2HMnO_4 + 5(NH_4)_2SO_4 + 5H_2SO_4 + 4HNO_3$$

$$2HMnO_4 + 10FeSO_4 + 7H_2SO_4 = 2MnSO_4 + 5Fe_2(SO_4)_3 + 8H_2O$$

$$FeSO_4 \Bumpeq \frac{KMnO_4}{5} \Bumpeq \frac{HMnO_4}{5} \Bumpeq \frac{Mn}{5}$$

(94) Volhard Method:

$$3MnSO_4 + 2KMnO_4 + 2H_2O = 5MnO_2 + K_2SO_4 + 2H_2SO_4$$

$$6MnSO_4 + 5ZnSO_4 + 4KMnO_4 + 14H_2O = 5[Zn(OH)_2 \cdot 2MnO_2] + 4KHSO_4 + 7H_2SO_4$$

$$\frac{KMnO_4}{5} \Bumpeq \frac{3MnSO_4}{10} \Bumpeq \frac{3Mn}{10}$$

(95) $2KMnO_4 + 5H_2C_2O_4 + 3H_2SO_4 = 2MnSO_4 + K_2SO_4 + 10CO_2 + 8H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{H_2C_2O_4}{2}$$

(96) $K_2MnO_4+2H_2C_2O_4+2H_2SO_4=MnSO_4+K_2SO_4+4CO_2+4H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{H_2C_2O_4}{2} \Bumpeq \frac{K_2MnO_4}{4}$$

Mercury

(97) $2HgCl+6KI+I_2=2K_2HgI_4+2KCl$

$$I \Bumpeq HgCl \Bumpeq Hg$$

(98) $3HgCl_2+2Na_2S_2O_3+2H_2O=HgCl_2\cdot 2HgS+2Na_2SO_4+4HCl$

$$I \Bumpeq Na_2S_2O_3 \Bumpeq \frac{3HgCl_2}{2} \Bumpeq \frac{3Hg}{2}$$

(99) $2HgCl_2+2FeCl_2=2HgCl+2FeCl_3$

$$\frac{KMnO_4}{5} \Bumpeq FeCl_2 \Bumpeq HgCl_2 \Bumpeq Hg$$

(100) $Hg(CN)_2+2I_2=HgI_2+2CNI$

$$I \Bumpeq \frac{Hg(CN)_2}{4} \Bumpeq \frac{Hg}{4}$$

Molybdenum

(101) $2MoO_3+3Zn+3H_2SO_4=Mo_2O_3+3ZnSO_4+3H_2O$
$5Mo_2O_3+6KMnO_4+9H_2SO_4=10MoO_3+6MnSO_4+$
$3K_2SO_4+9H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{Mo_2O_3}{6} \Bumpeq \frac{MoO_3}{3} \Bumpeq \frac{Mo}{3}$$

(102) $2MoO_3+4KI+4HCl=2MoO_2I+4KCl+I_2+2H_2O$

$$I \Bumpeq MoO_3 \Bumpeq Mo$$

Nickel

(103) $2NiSO_4+12NH_4OH=2Ni(NH_3)_6SO_4+12H_2O$
$Ni(NH_3)_6SO_4+4KCN=K_2Ni(CN)_4+K_2SO_4+6NH_3$

$$\frac{KCN}{2} \Bumpeq \frac{Ni(NH_3)_6SO_4}{8} \Bumpeq \frac{Ni}{8}$$

(104) $3NiSO_4+5KI+KIO_3+3H_2O=3Ni(OH)_2+3K_2SO_4+3I_2$

$$I \Bumpeq \frac{NiSO_4}{2} \Bumpeq \frac{Ni}{2}$$

Nitrogen

(105) $2HNO_3+6HI=2NO+3I_2+4H_2O$

$$I \Bumpeq \frac{HNO_3}{3} \Bumpeq \frac{N_2O_5}{6}$$

(106) $HNO_3+3HCl=NOCl+Cl_2+2H_2O$

$$I \Bumpeq Cl \Bumpeq \frac{HNO_3}{2} \Bumpeq \frac{N_2O_5}{4}$$

(107) $2HNO_3+3MnCl_2+6HCl=2NO+3MnCl_4+4H_2O$
$3MnCl_4=3MnCl_2+3Cl_2$

$$I \Bumpeq Cl \Bumpeq \frac{HNO_3}{3} \Bumpeq \frac{N_2O_5}{6}$$

(108) $4FeSO_4+2HNO_3+2H_2SO_4=2Fe_2(SO_4)_3+N_2O_3+3H_2O$

$$\frac{K_2Cr_2O_7}{6} \Bumpeq \frac{HNO_3}{2} \Bumpeq \frac{N_2O_5}{4}$$

(109) $6FeSO_4+2HNO_3+3H_2SO_4=3Fe_2(SO_4)_3+2NO+4H_2O$

$$\frac{K_2Cr_2O_7}{6} \Bumpeq \frac{HNO_3}{3} \Bumpeq \frac{N_2O_5}{6}$$

(110) $2HNO_2+2HI=2NO+I_2+2H_2O$

$$I \Bumpeq HNO_2 \Bumpeq \frac{N_2O_3}{2}$$

(111) $2HNO_2+MnCl_2+2HCl=2NO+MnCl_4+2H_2O$
$MnCl_4=MnCl_2+Cl_2$

$$I \Bumpeq Cl \Bumpeq HNO_2 \Bumpeq \frac{N_2O_3}{2}$$

(112) $2KMnO_4+5HNO_2+3H_2SO_4=2MnSO_4+5HNO_3+K_2SO_4+3H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{HNO_2}{2} \Bumpeq \frac{N_2O_3}{4}$$

Oxygen

(113) $O_3+2KI+H_2O=O_2+I_2+2KOH$

$$I \Bumpeq \frac{O_3}{2}$$

(114) $BaO_2+4HCl=BaCl_2+2H_2O+Cl_2$

$$I \Bumpeq Cl \Bumpeq \frac{BaO_2}{2}$$

(115) $2KI+H_2O_2=2KOH+I_2$

$$I \Bumpeq \frac{H_2O_2}{2}$$

(116) $5H_2O_2+2KMnO_4+4H_2SO_4=2MnSO_4+2KHSO_4+5O_2+8H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{H_2O_2}{2}$$

Phosphorus

(117) $H_3PO_4+12(NH_4)_2MoO_4+21HNO_3=(NH_4)_3PO_4\cdot 12MoO_3$
$+21NH_4NO_3+12H_2O$
$2(NH_4)_3PO_4\cdot 12MoO_3+46NaOH+H_2O=2(NH_4)_2HPO_4+$
$(NH_4)_2MoO_4+23Na_2MoO_4+23H_2O$

$$NaOH \Bumpeq \frac{(NH_4)_3PO_4\cdot 12MoO_3}{23} \Bumpeq \frac{P_2O_5}{46} \Bumpeq \frac{P}{23}$$

(118) $2(NH_4)_3PO_4\cdot 12MoO_3+46NH_4OH+H_2O=24(NH_4)_2MoO_4+$
$2(NH_4)_2HPO_4+23H_2O$
$(NH_4)_2MoO_4+H_2SO_4=(NH_4)_2SO_4+H_2MoO_4$
$2MoO_3+3Zn+3H_2SO_4=Mo_2O_3+3ZnSO_4+3H_2O$
$5Mo_2O_3+6KMnO_4+9H_2SO_4=10MoO_3+6MnSO_4+3K_2SO_4$
$+9H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{(NH_4)_3PO_4\cdot 12MoO_3}{36} \Bumpeq \frac{Mo_2O_3}{6} \Bumpeq \frac{P_2O_5}{72} \Bumpeq \frac{P}{36}$$

(119) Ferric alum absent:
First three equations as in 118
$12Mo_2O_3+O=Mo_{24}O_{37}$
$Mo_{24}O_{37}+14KMnO_4+21H_2SO_4=24MoO_3+14MnSO_4+$
$7K_2SO_4+21H_2O$

$$\frac{14KMnO_4}{70} \Bumpeq \frac{Mo_{24}O_{37}}{70} \Bumpeq \frac{(NH_4)_3PO_4\cdot 12MoO_3}{35} \Bumpeq \frac{P_2O_5}{70} \Bumpeq \frac{P}{35}$$

(120) With methyl orange:
$Na_2HPO_4+HCl=NaH_2PO_4+NaCl$

$$HCl \Bumpeq Na_2HPO_4$$

(121) With methyl orange:
$H_3PO_4+NaOH=NaH_2PO_4+H_2O$

$$NaOH \Bumpeq H_3PO_4$$

(122) With phenolphthalein:
$NaH_2PO_4+NaOH=Na_2HPO_4+H_2O$

$$NaOH \Bumpeq NaH_2PO_4$$

(123) With phenolphthalein:
$H_3PO_4+2NaOH=Na_2HPO_4+2H_2O$

$$NaOH \Bumpeq \frac{H_3PO_4}{2}$$

Potassium

(124) $10K_2NaCo(NO_2)_6+22KMnO_4+58H_2SO_4=21K_2SO_4$
$+5Na_2SO_4+10CoSO_4+22MnSO_4+60HNO_3+28H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{K_2O}{11}$$

EQUATIONS AND EQUIVALENTS FOR TITRIMETRIC ANALYSIS

Selenium

(125) $K_2SeO_4+4HCl=2KCl+H_2SeO_3+Cl_2+H_2O$

$$I \Bumpeq Cl \Bumpeq \frac{K_2SeO_4}{2} \Bumpeq \frac{Se}{2} \Bumpeq \frac{SeO_3}{2}$$

(126) $K_2SeO_3+4KI+6HCl=6KCl+Se+2I_2+3H_2O$

$$I \Bumpeq \frac{K_2SeO_3}{4} \Bumpeq \frac{Se}{4} \Bumpeq \frac{SeO_2}{4}$$

Silicon

(127) $H_2SiF_6+6NaOH=6NaF+Si(OH)_4+2H_2O$

$$NaOH \Bumpeq \frac{H_2SiF_6}{6}$$

Sulfur

(128) $H_2S+I_2=2HI+S$

$$I \Bumpeq \frac{H_2S}{2} \Bumpeq \frac{S}{2}$$

(129) $Na_2SO_3+I_2+H_2O=Na_2SO_4+2HI$

$$I \Bumpeq \frac{Na_2SO_3}{2} \Bumpeq \frac{SO_2}{2} \Bumpeq \frac{S}{2}$$

(130) $2H_2SO_3+KIO_3+2HCl=2H_2SO_4+KCl+ICl+H_2O$

$$\frac{KIO_3}{6} \Bumpeq \frac{H_2SO_3}{3} \Bumpeq \frac{SO_2}{3}$$

(131) $2Na_2S_2O_3+I_2=Na_2S_4O_6+2NaI$

$$I \Bumpeq Na_2S_2O_3$$

(132) $Na_2S_2O_3+2KIO_3+2HCl=Na_2SO_4+K_2SO_4+2ICl+H_2O$

$$\frac{KIO_3}{6} \Bumpeq \frac{Na_2S_2O_3}{12}$$

(133) $K_2S_2O_8+H_2C_2O_4=K_2SO_4+H_2SO_4+2CO_2$

$$\frac{KMnO_4}{5} \Bumpeq \frac{H_2C_2O_4}{2} \Bumpeq \frac{K_2S_2O_8}{2}$$

(134) $K_2S_2O_8+2FeSO_4=Fe_2(SO_4)_3+K_2SO_4$

$$\frac{KMnO_4}{5} \Bumpeq FeSO_4 \Bumpeq \frac{K_2S_2O_8}{2}$$

(135) $3Na_2S_2O_3+8KMnO_4+H_2O=3Na_2SO_4+3K_2SO_4+8MnO_2$
$+2KOH$

$$\frac{KMnO_4}{5} \Bumpeq \frac{3Na_2S_2O_3}{40}$$

(136) $2BaS_2O_3+I_2=BaI_2+BaS_4O_6$

$$I \approx BaS_2O_3$$

(137) $2Na_2S_2O_3+I_2=2NaI+Na_2S_4O_6$

$$I \approx Na_2S_2O_3$$

(138) With phenolphthalein:
$H_2SO_3+2NaOH=Na_2SO_3+2H_2O$

$$NaOH \approx \frac{H_2SO_3}{2} \approx \frac{SO_2}{2}$$

(139) With methyl orange:
$H_2SO_3+NaOH=NaHSO_3+H_2O$

$$NaOH \approx H_2SO_3 \approx SO_2$$

Tellurium

(140) $Na_2TeO_3+4NaI+6HCl=6NaCl+Te+3H_2O+2I_2$

$$I \approx \frac{Na_2TeO_3}{4} = \frac{TeO_2}{4} \approx \frac{Te}{4}$$

(141) $Na_2TeO_4+4HCl=H_2TeO_3+2NaCl+Cl_2+H_2O$

$$I \approx Cl \approx \frac{Na_2TeO_4}{2} \approx \frac{TeO_3}{2} \approx \frac{Te}{2}$$

Tin

(142) $SnCl_2+I_2+2HCl=SnCl_4+2HI$

$$I \approx \frac{SnCl_2}{2} \approx \frac{Sn}{2}$$

(143) $SnCl_2+2K_3Fe(CN)_6+2KCl=SnCl_4+2K_4Fe(CN)_6$

$$\frac{KMnO_4}{5} \approx K_4Fe(CN)_6 \approx \frac{SnCl_2}{2} \approx \frac{Sn}{2}$$

(144) $SnCl_2+2FeCl_3=SnCl_4+2FeCl_2$

$$\frac{KMnO_4}{5} \approx \frac{SnCl_2}{2} \approx \frac{Sn}{2}$$

Titanium

(145) $Ti_2(SO_4)_3+Fe_2(SO_4)_3=2Ti(SO_4)_2+2FeSO_4$

$$\frac{KMnO_4}{5} \approx FeSO_4 \approx \frac{Ti_2(SO_4)_3}{2} \approx Ti$$

Tungsten

(146) $WO_3+2NaOH=Na_2WO_4+H_2O$

$$NaOH \approx \frac{W}{2} \approx \frac{WO_3}{2}$$

Uranium

(147) $U_3O_8+4H_2SO_4=2(UO_2)SO_4+U(SO_4)_2+4H_2O$

$5U(SO_4)_2+2KMnO_4+2H_2O=2KHSO_4+2MnSO_4$

$\qquad\qquad +5(UO_2)SO_4+2MnSO_4$

$$\frac{KMnO_4}{5} \Bumpeq \frac{U}{2} \Bumpeq \frac{UO_2}{2} \Bumpeq \frac{U(SO_4)_2}{2}$$

$$U_3O_8 \Bumpeq 2UO_3+UO_2$$

$$\frac{KMnO_4}{5} \Bumpeq \frac{3U}{2} \Bumpeq \frac{U_3O_8}{2}$$

(148) $3UO_2(NO_3)_2+5KI+KIO_3+3H_2O=3UO_2(OH)_2+6KNO_3$

$\qquad\qquad +3I_2$

$$I \Bumpeq \frac{U}{2} \Bumpeq \frac{UO_2}{2} \Bumpeq \frac{UO_2(NO_3)_2}{2}$$

Vanadium

(149) $V_2O_5+2KI+2HCl=V_2O_4+2KCl+I_2+H_2O$

$$I \Bumpeq \frac{V_2O_5}{2} \Bumpeq V$$

(150) $V_2O_5+H_2C_2O_4=V_2O_4+2CO_2+H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{H_2C_2O_4}{2} \Bumpeq \frac{V_2O_5}{2} \Bumpeq V$$

(151) $V_2O_5+3Zn(+H_3PO_4)+3H_2SO_4=V_2O_5+3ZnSO_4+3H_2O$

$5V_2O_2+6KMnO_4+9H_2SO_4=5V_2O_5+6MnSO_4+3K_2SO_4$

$\qquad\qquad +9H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{V_2O_5}{6} \Bumpeq \frac{V_2O_2}{6} \Bumpeq \frac{V}{3}$$

(152) $V_2O_5+SO_2=V_2O_4+SO_3$

$5V_2O_4+2KMnO_4+3H_2SO_4=5V_2O_5+2MnSO_4+K_2SO_4+3H_2O$

$$\frac{KMnO_4}{5} \Bumpeq \frac{V_2O_5}{2} \Bumpeq \frac{V_2O_4}{2} \Bumpeq V$$

$V_2O_4+2HI=V_2O_3+I_2+H_2O$

$$I \Bumpeq \frac{V_2O_4}{2} \Bumpeq V$$

$V_2O_4+I_2+H_2O=V_2O_5+2HI$

$$I \Bumpeq \frac{V_2O_4}{2} \Bumpeq V$$

$V_2O_4+2K_3Fe(CN)_6+2KOH=V_2O_5+2K_4Fe(CN)_6+H_2O$

$$\frac{KMnO_4}{5} \Bumpeq K_4Fe(CN)_6 \Bumpeq \frac{V_2O_4}{2} \Bumpeq V$$

(153) $2H_3VO_4+2FeSO_4+3H_2SO_4=V_2O_2(SO_4)_2+Fe_2(SO_4)_3+6H_2O$
$2FeSO_4+MnO_2+2H_2SO_4=Fe_2(SO_4)_3+MnSO_4+2H_2O$
$5V_2O_2(SO_4)_2+2KMnO_4+22H_2O=10H_3VO_4+2MnSO_4+$
$K_2SO_4+7H_2SO_4$

$$\frac{KMnO_4}{5} \approx \frac{V_2O_2(SO_4)_2}{2} \approx \frac{V_2O_5}{2} \approx V$$

Zinc

(154) $Zn+Fe_2(SO_4)_3=ZnSO_4+2FeSO_4$

$$\frac{KMnO_4}{5} \approx FeSO_4 \approx \frac{Zn}{2}$$

(155) $15Zn+30NaOH=15Na_2ZnO_2+15H_2$
$5KIO_3+15H_2=5KI+15H_2O$
$5KI+KIO_3+3H_2SO_4=3K_2SO_4+I_2+3H_2O$

$$\frac{KIO_3}{6} \approx I \approx \frac{15Zn}{6}$$

(156) $3Zn+K_2Cr_2O_7+7H_2SO_4=3ZnSO_4+Cr_2(SO_4)_3+K_2SO_4+7H_2O$
$K_2Cr_2O_7+6FeSO_4+8H_2SO_4=Cr_2(SO_4)_3+3Fe_2(SO_4)_3$
$+2KHSO_4+7H_2O$

$$\frac{K_2Cr_2O_7}{6} \approx \frac{Zn}{2}$$

(157) $3ZnCl_2+2K_4Fe(CN)_6=K_2Zn_3[Fe(CN)_6]_2+6KCl$

$$K_4Fe(CN)_6 \approx \frac{3Zn}{2} \approx \frac{3ZnCl_2}{2}$$

(158) $15ZnSO_4+20KI+4KIO_3+12H_2O=3Zn_5(OH)_8SO_4+$
$12K_2SO_4+12I_2$

$$I \approx \frac{15ZnSO_4}{24} \approx \frac{15Zn}{24}$$

(159) $Na_2ZnO_2+4HCl=ZnCl_2+2NaCl+2H_2O$

$$HCl \approx \frac{Na_2ZnO_2}{4}$$

TITRIMETRIC FACTORS AND THEIR LOGARITHMS

ACIDS*

The following factors are the equivalent of one milliliter of *normal acid*. Where the normality of the solution which is being used is other than normal multiply the factors given in the table below by the normality of the solution employed.

The equivalents of the esters are based on the results of saponification.

The indicators methyl orange and phenolphthalein are indicated by the abbreviations MO and PH respectively.

Substance	Formula	Grams	Logarithm
			—10
Ammonia	NH_3	0.017032	8.23127
Ammonium	NH_4	0.018040	8.25624
Ammonium chloride	NH_4Cl	0.053497	8.72833
Ammonium hydroxide	NH_4OH	0.035048	8.54467
Ammonium oleate	$C_{17}H_{33}CO_2NH_4$	0.29948	9.47637
Ammonium oxide	$(NH_4)_2O$	0.026040	8.41564
Amyl acetate	$CH_3CO_2C_5H_{11}$	0.13018	9.11454
Barium carbonate (MO)	$BaCO_3$	0.09869	8.99423
Barium hydroxide	$Ba(OH)_2$	0.085688	8.93292
Barium oxide	BaO	0.07668	8.88468
Bornyl acetate	$CH_3CO_2C_{10}H_{17}$	0.19628	9.29288
Calcium carbonate (MO)	$CaCO_3$	0.05005	8.69940
Calcium hydroxide	$Ca(OH)_2$	0.037048	8.56877
Calcium oleate	$(C_{17}H_{33}CO_2)_2Ca$	0.30148	9.47926
Calcium oxide	CaO	0.02804	8.44778
Calcium stearate	$(C_{17}H_{35}CO_2)_2Ca$	0.30350	9.48216
Casein (N 6.38)	....	0.089371	8.95120
Ethyl acetate	$CH_3CO_2C_2H_5$	0.088104	8.94500
Glue (N 5.60)	....	0.078445	8.89457
Hydrochloric acid	HCl	0.036465	8.56188
Magnesium carbonate (MO)	$MgCO_3$	0.04217	8.62500
Magnesium oxide	MgO	0.02016	8.30449
Menthyl acetate	$CH_3CO_2C_{10}H_{19}$	0.19830	9.29732
Methyl acetate	$CH_3CO_2CH_3$	0.074079	8.86970
Nicotine	$C_{10}H_{14}N_2$	0.16223	9.21013
Nitrogen	N	0.014008	8.14638
Potassium carbonate (MO)	K_2CO_3	0.06910	8.83948
Potassium carbonate, acid (MO)	$KHCO_3$	0.10011	9.00048
Potassium nitrate	KNO_3	0.10111	9.00479
Potassium oleate	$C_{17}H_{33}CO_2K$	0.32054	9.50588
Potassium oxide	K_2O	0.04710	8.67302
Potassium stearate	$C_{17}H_{35}CO_2K$	0.32256	9.50861
Protein (N 5.70)	....	0.079846	8.90225
Protein (N 6.25)	....	0.087550	8.94226
Sodium acetate	CH_3CO_2Na	0.082041	8.91403
Sodium acetate	$CH_3CO_2Na \cdot 3H_2O$	0.13609	9.13383
Sodium borate, tetra- (MO)	$Na_2B_4O_7$	0.10064	9.00277
Sodium borate, tetra- (MO)	$Na_2B_4O_7 \cdot 10H_2O$	0.19072	9.28040
Sodium carbonate (MO)	Na_2CO_3	0.053002	8.72429
Sodium carbonate (MO)	$Na_2CO_3 \cdot H_2O$	0.062010	8.79246
Sodium carbonate (MO)	$Na_2CO_3 \cdot 10H_2O$	0.14308	9.15558
Sodium carbonate, acid (MO)	$NaHCO_3$	0.084015	8.92436
Sodium hydroxide	$NaOH$	0.040005	8.60211
Sodium oleate	$C_{17}H_{33}CO_2Na$	0.30444	9.48350
Sodium oxalate	$Na_2C_2O_4$	0.067007	8.82612
Sodium oxide	Na_2O	0.030997	8.49132
Sodium phosphate (MO)	Na_2HPO_4	0.14198	9.15223

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*Based on the 1941 International Atomic Weights.

VOLUMETRIC FACTORS AND THEIR LOGARITHMS

ACIDS (Continued)

Substance	Formula	Grams	Logarithm
			—10
Sodium phosphate (MO)	$Na_2HPO_4 \cdot 12H_2O$	0.35817	9.55409
Sodium phosphate (MO)	Na_3PO_4	0.081986	8.91374
Sodium phosphate (PH)	Na_3PO_4	0.16397	9.21476
Sodium silicate	$Na_2Si_4O_9$	0.15112	9.17932
Sodium stearate	$C_{17}H_{35}CO_2Na$	0.30646	9.48637
Sodium sulfide (MO)	Na_2S	0.039027	8.59137

ALKALI

The following factors are the equivalent of one milliliter of *normal alkali*. Where the normality of the solution which is being used is other than normal multiply the factors given in the table below by the normality of the solution employed.

The equivalents of the esters are based on the results of saponification.

The indicators methyl orange and phenolphthalein are indicated by the abbreviations MO and PH respectively.

Substance	Formula	Grams	Logarithm
			—10
Abietic acid (PH)	$HC_{20}H_{29}O_2$	0.30244	9.48064
Acetic acid (PH)	CH_3CO_2H	0.06005	8.77853
Acetic anhydride (PH)	$(CH_3CO)_2O$	0.051044	8.70794
Aluminum sulfate	$Al_2(SO_4)_3$	0.05702	8.75603
Amyl acetate	$CH_3CO_2C_5H_{11}$	0.13018	9.11454
Benzoic acid (PH)	$C_6H_5CO_2H$	0.12212	9.08679
Borate tetra- (PH)	B_4O_7	0.03882	8.58906
Boric acid (PH)	H_3BO_3	0.061844	8.79130
Boric anhydride (PH)	B_2O_3	0.03482	8.54183
Bornyl acetate	$CH_3CO_2C_{10}H_{17}$	0.19628	9.29288
Butyric acid (PH)	$C_3H_7CO_2H$	0.088104	8.94500
Calcium acetate	$(CH_3CO_2)_2Ca$	0.079084	8.89809
Calcium oleate	$(C_{17}H_{33}CO_2)_2Ca$	0.30148	9.47926
Calcium stearate	$(C_{17}H_{35}CO_2)_2Ca$	0.30350	9.48216
Carbon dioxide (PH)	CO_2	0.022005	8.34252
Chlorine	Cl	0.035457	8.54970
Citric acid (PH)	$H_3C_6H_5O_7 \cdot H_2O$	0.070047	8.84539
Ethyl acetate	$CH_3CO_2C_2H_5$	0.088104	8.94500
Formaldehyde	$HCHO$	0.030026	8.47750
Formic acid (PH)	HCO_2H	0.046026	8.66300
Glycerol (sap. of acetyl)	$C_3H_5(OH)_3$	0.030698	8.48711
Hydriodic acid	HI	0.12793	9.10697
Hydrobromic acid	HBr	0.080924	8.90808
Hydrochloric acid	HCl	0.036465	8.56188
Lactic acid (PH)	$HC_3H_5O_3$	0.090078	8.95462
Lead acetate	$(CH_3CO_2)_2Pb \cdot 3H_2O$	0.18967	9.27800
Maleic acid (PH)	$(CHCO_2H)_2$	0.058036	8.76370
Malic acid (PH)	$H_2C_4H_4O_5$	0.067044	8.82636
Menthol (sap. of acetyl)	$C_{10}H_{19}OH$	0.15626	9.19385
Menthyl acetate	$CH_3CO_2C_{10}H_{19}$	0.19830	9.29732
Methyl acetate	$CH_3CO_2CH_3$	0.074078	8.86969
Nitrate	NO_3	0.062008	8.79245
Nitric acid	HNO_3	0.063016	8.79945
Nitrogen	N	0.014008	8.14638
Nitrogen pentoxide	N_2O_5	0.054008	8.73246
Oleic acid (PH)	$C_{17}H_{33}CO_2H$	0.28245	9.45094

TITRIMETRIC FACTORS AND THEIR LOGARITHMS

ALKALI (Continued)

Substance	Formula	Grams	Logarithm
			−10
Oxalic acid (PH)	$(CO_2H)_2$	0.045018	8.65339
Oxalic acid (PH)	$(CO_2H)_2{\cdot}2H_2O$	0.063034	8.79957
Phosphoric acid (MO)	H_3PO_4	0.098004	8.99124
Phosphoric acid (PH)	H_3PO_4	0.049002	8.69021
Potassium carbonate, acid (MO)	$KHCO_3$	0.10011	9.00048
Potassium oleate	$C_{17}H_{33}CO_2K$	0.32054	9.50588
Potassium oxalate, acid (PH)	KHC_2O_4	0.12812	9.10762
Potassium phthalate, acid (PH)	$HC_8H_4O_4K$	0.20422	9.31010
Potassium stearate	$C_{17}H_{35}CO_2K$	0.32256	9.50861
Sodium benzoate	$C_6H_5CO_2Na$	0.14411	9.15869
Sodium borate, tetra- (PH)	$Na_2B_4O_7$	0.050319	8.70173
Sodium borate, tetra- (PH)	$Na_2B_4O_7{\cdot}10H_2O$	0.095359	8.97936
Sodium carbonate, acid (MO)	$NaHCO_3$	0.084015	8.92436
Sodium oleate	$C_{17}H_{33}CO_2Na$	0.30444	9.48350
Sodium salicylate	$C_6H_5OCO_2Na$	0.16011	9.20442
Stearic acid (PH)	$C_{17}H_{35}CO_2H$	0.28447	9.45404
Succinic acid (PH)	$(CH_2CO_2H)_2$	0.059044	8.77118
Sulfate	SO_4	0.04803	8.68151
Sulfur dioxide (PH)	SO_2	0.03203	8.50556
Sulfur trioxide	SO_3	0.04003	8.60239
Sulfuric acid	H_2SO_4	0.049038	8.69053
Sulfurous acid (PH)	H_2SO_3	0.041038	8.61319
Tartaric acid (PH)	$H_2C_4H_4O_6$	0.075044	8.87532
Tartaric acid (PH)	$H_2C_4H_4O_6{\cdot}H_2O$	0.084052	8.92455

IODINE

The following factors are the equivalent of one milliliter of *normal iodine*. Where the normality of the solution which is being used is other than normal multiply the factors given in the table below by the normality of the solution employed.

Substance	Formula	Grams	Logarithm
			−10
Acetone	$(CH_3)_2CO$	0.0096798	7.98587
Ammonium chromate	$(NH_4)_2CrO_4$	0.050697	8.70498
Antimony	Sb	0.06088	8.78448
Antimony trioxide	Sb_2O_3	0.07288	8.86261
Arsenic	As	0.037455	8.57351
Arsenic pentoxide	As_2O_5	0.057455	8.75933
Arsenic trioxide	As_2O_3	0.049455	8.69421
Arsenite	AsO_3	0.061455	8.78856
Bleaching powder	$CaOCl_2$	0.063497	8.80275
Bromine	Br	0.079916	8.90264
Chlorine	Cl	0.035457	8.54970
Chromic oxide	Cr_2O_3	0.02534	8.40381
Chromium trioxide	CrO_3	0.033337	8.52293
Copper	Cu	0.06357	8.80325
Copper oxide	CuO	0.07957	8.90075
Copper sulfate	$CuSO_4$	0.15963	9.20312
Copper sulfate	$CuSO_4{\cdot}5H_2O$	0.24971	9.39744
Ferric iron	Fe^{+++}	0.05585	8.74702
Ferric oxide	Fe_2O_3	0.07985	8.90227
Hydrosulfuric acid	H_2S	0.017038	8.23142
Iodine	I	0.126920	9.10353

IODINE (Continued)

Substance	Formula	Grams	Logarithm
			−10
Lead chromate	$PbCrO_4$	0.10774	9.03238
Lead dioxide	PbO_2	0.11961	9.07777
Nitrous acid	HNO_2	0.023508	8.37122
Oxygen	O	0.0080000	7.90309
Potassium chlorate	$KClO_3$	0.020426	8.31018
Potassium chromate	K_2CrO_4	0.064734	8.81113
Potassium dichromate	$K_2Cr_2O_7$	0.049035	8.69051
Potassium nitrite	KNO_2	0.042552	8.62892
Potassium permanganate	$KMnO_4$	0.031605	8.49976
Red lead	Pb_3O_4	0.34282	9.53507
Sodium chromate	Na_2CrO_4	0.054001	8.73240
Sodium dichromate	$Na_2Cr_2O_7$	0.043669	8.64017
Sodium dichromate	$Na_2Cr_2O_7{\cdot}2H_2O$	0.049675	8.69614
Sodium nitrite	$NaNO_2$	0.034503	8.53786
Sodium sulfide	Na_2S	0.039027	8.59137
Sodium sulfide	$Na_2S{\cdot}9H_2O$	0.12009	9.07951
Sodium sulfite	Na_2SO_3	0.063027	8.79953
Sodium sulfite	$Na_2SO_3{\cdot}7H_2O$	0.12608	9.10065
Sodium thiosulfate	$Na_2S_2O_3$	0.15811	9.19896
Sulfur	S	0.01603	8.20493
Sulfur dioxide	SO_2	0.03203	8.50556
Sulfurous acid	H_2SO_3	0.041038	8.61319
Tin	Sn	0.05935	8.77342

POTASSIUM DICHROMATE

The following factors are the equivalent of one milliliter of *normal potassium dichromate*. Where the normality of the solution which is being used is other than normal multiply the factors given in the table below by the normality of the solution employed.

Substance	Formula	Grams	Logarithm
			—10
Chromic oxide	Cr_2O_3	0.025337	8.40375
Chromium trioxide	CrO_3	0.03334	8.52297
Ferrous iron	Fe^{++}	0.05585	8.74702
Ferrous oxide	FeO	0.07185	8.85643
Ferroso-ferric oxide	Fe_3O_4	0.077183	8.88752
Ferrous sulfate	$FeSO_4$	0.15191	9.18159
Ferrous sulfate	$FeSO_4{\cdot}7H_2O$	0.27802	9.44408
Glycerol	$C_3H_5(OH)_3$	0.0065782	7.81811
Lead chromate	$PbCrO_4$	0.10774	9.03238
Zinc	Zn	0.03269	8.51442

POTASSIUM PERMANGANATE

The following factors are the equivalent of one milliliter of *normal potassium permanganate*. Where the normality of the solution which is being used is other than normal multiply the factors given in the table below by the normality of the solution employed.

Substance	Formula	Grams	Logarithm
			—10
Ammonium oxalate	$(NH_4)_2C_2O_4$	0.062050	8.79274
Ammonium oxalate	$(NH_4)_2C_2O_4{\cdot}H_2O$	0.071058	8.85161
Ammonium persulfate	$(NH_4)_2S_2O_8$	0.11410	9.05729

TITRIMETRIC FACTORS AND THEIR LOGARITHMS

POTASSIUM PERMANGANATE (Continued)

Substance	Formula	Grams	Logarithm −10
Antimony	Sb	0.06088	8.78448
Barium peroxide	BaO_2	0.08468	8.92778
Barium peroxide	$BaO_2 \cdot 8H_2O$	0.15674	9.19518
Calcium carbonate	$CaCO_3$	0.050045	8.69936
Calcium oxide	CaO	0.02804	8.44778
Calcium peroxide	CaO_2	0.03604	8.55679
Calcium sulfate	$CaSO_4$	0.06807	8.83296
Calcium sulfate	$CaSO_4 \cdot 2H_2O$	0.086086	8.93493
Ferric oxide	Fe_2O_3	0.07985	8.90227
Ferroso-ferric oxide	Fe_3O_4	0.077183	8.88756
Ferrous ammonium sulfate	$Fe(NH_4)_2(SO_4)_2 \cdot 6H_2O$	0.39215	9.59342
Ferrous oxide	FeO	0.07185	8.85643
Ferrous sulfate	$FeSO_4$	0.15191	9.18159
Ferrous sulfate	$FeSO_4 \cdot 7H_2O$	0.27802	9.44408
Formic acid	HCO_2H	0.023013	8.36197
Hydrogen peroxide	H_2O_2	0.017008	8.23065
Iodine	I	0.126920	9.10353
Iron	Fe	0.05585	8.74702
Manganese	Mn	0.010986	8.04084
Manganese dioxide	MnO_2	0.043465	8.63814
Manganous oxide (Volhard)	MnO	0.035465	8.54980
Molybdenum trioxide titration from yellow ppt. after reduction	MoO_3	0.047983	8.68109
Oxalic acid	$(CO_2H)_2$	0.045018	8.65339
Oxalic acid	$(CO_2H)_2 \cdot 2H_2O$	0.063034	8.79957
Phosphorous titration from yellow ppt. after reduction	P	0.0008606	6.93480
Phosphorous pentoxide titration from yellow ppt. after reduction	P_2O_5	0.001971	7.29469
Potassium dichromate	$K_2Cr_2O_7$	0.049035	8.69051
Potassium nitrite	KNO_2	0.042552	8.62892
Potassium persulfate	$K_2S_2O_8$	0.13516	9.13085
Sodium nitrite	$NaNO_2$	0.034503	8.53786
Sodium oxalate	$Na_2C_2O_4$	0.066997	8.82606
Sodium persulfate	$Na_2S_2O_8$	0.11906	9.07577
Tin	Sn	0.05935	8.77342

SILVER NITRATE

The following factors are the equivalent of one milliliter of *normal silver nitrate*. Where the normality of the solution which is being used is other than normal multiply the factors given in the table below by the normality of the solution employed.

Substance	Formula	Grams	Logarithm −10
Ammonium bromide	NH_4Br	0.097956	8.99103
Ammonium chloride	NH_4Cl	0.053497	8.72833
Ammonium iodide	NH_4I	0.14496	9.16125
Ammonium thiocyanate	NH_4CNS	0.076118	8.88149
Barium chloride	$BaCl_2$	0.10414	9.01762
Barium chloride	$BaCl_2 \cdot 2H_2O$	0.12216	9.08693
Bromine	Br	0.079916	8.90263
Cadmium chloride	$CdCl_2$	0.091662	8.96219
Cadmium iodide	CdI_2	0.18313	9.26276

VOLUMETRIC FACTORS AND THEIR LOGARITHMS

SILVER NITRATE (Continued)

Substance	Formula	Grams	Logarithm
			−10
Calcium chloride	$CaCl_2$	0.055497	8.74427
Chlorine	Cl	0.035457	8.54970
Ferric chloride	$FeCl_3$	0.05407	8.73296
Ferrous chloride	$FeCl_2$	0.063382	8.80197
Hydriodic acid	HI	0.12793	9.10697
Hydrobromic acid	HBr	0.080924	8.90808
Hydrochloric acid	HCl	0.036465	8.56188
Iodine	I	0.126920	9.10353
Lithium chloride	$LiCl$	0.042397	8.62734
Lead chloride	$PbCl_2$	0.13906	9.14320
Magnesium chloride	$MgCl_2$	0.047617	8.67776
Magnesium chloride	$MgCl_2 \cdot 6H_2O$	0.10167	9.00719
Potassium bromide	KBr	0.11901	9.07558
Potassium chloride	KCl	0.074553	8.87247
Potassium iodide	KI	0.16602	9.22016
Potassium oxide	K_2O	0.047096	8.67298
Potassium thiocyanate	$KCNS$	0.097174	8.98755
Silver	Ag	0.10788	9.03294
Silver iodide	AgI	0.23480	9.37070
Silver nitrate	$AgNO_3$	0.16989	9.23016
Sodium bromide	$NaBr$	0.10291	9.01246
Sodium bromide	$NaBr \cdot 2H_2O$	0.13895	9.14286
Sodium chloride	$NaCl$	0.058454	8.76681
Sodium iodide	NaI	0.14992	9.17586
Sodium iodide	$NaI \cdot 2H_2O$	0.18595	9.26940
Sodium oxide	Na_2O	0.030997	8.49132
Strontium chloride	$SrCl_2$	0.079272	8.89912
Strontium chloride	$SrCl_2 \cdot 6H_2O$	0.13332	9.12490
Zinc chloride	$ZnCl_2$	0.068147	8.83345

SODIUM THIOSULFATE

The following factors are the equivalent of one milliliter of *normal sodium thiosulfate*. Where the normality of the solution which is being used is other than normal multiply the factors given in the table below by the normality of the solution employed.

Substance	Formula	Grams	Logarithm
			−10
Acetone	$(CH_3)_2CO$	0.0096797	7.98586
Ammonium chromate	$(NH_4)_2CrO_4$	0.050697	8.70498
Antimony	Sb	0.06088	8.78448
Antimony trioxide	Sb_2O_3	0.07288	8.86261
Bleaching powder	$CaOCl_2$	0.063497	8.80275
Bromine	Br	0.079916	8.90264
Chlorine	Cl	0.035457	8.54970
Chromic oxide	Cr_2O_3	0.02534	8.40381
Chromium trioxide	CrO_3	0.033337	8.52293
Copper	Cu	0.06357	8.80325
Copper oxide	CuO	0.07957	8.90075
Copper sulfate	$CuSO_4$	0.15963	9.20312
Copper sulfate	$CuSO_4 \cdot 5H_2O$	0.24971	9.39744
Iodine	I	0.12692	9.10353
Lead chromate	$PbCrO_4$	0.10774	9.03238
Lead dioxide	PbO_2	0.11961	9.07777

TITRIMETRIC FACTORS AND THEIR LOGARITHMS

SODIUM THIOSULFATE (Continued)

Substance	Formula	Grams	Logarithm −10
Nitrous acid	HNO_2	0.023508	8.37122
Potassium chromate	K_2CrO_4	0.064734	8.8113
Potassium dichromate	$K_2Cr_2O_7$	0.049035	8.69051
Red lead	Pb_3O_4	0.34282	9.53507
Sodium chromate	Na_2CrO_4	0.054001	8.73240
Sodium dichromate	$Na_2Cr_2O_7$	0.043669	8.64017
Sodium dichromate	$Na_2Cr_2O_7 \cdot 2H_2O$	0.049674	8.69613
Sodium nitrite	$NaNO_2$	0.034503	8.53786
Sodium thiosulfate	$Na_2S_2O_3$	0.15811	9.19896
Sodium thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$	0.24819	9.39478
Sulfur	S	0.01603	8.20493
Sulfur dioxide	SO_2	0.03203	8.50556
Tin	Sn	0.05935	8.77342

VOLUMETRIC (TITRIMETRIC) PRIMARY STANDARDS

Based on the 1941 International Atomic Weights.**

Name	Formula	Formula Weight	Equivalent Weight					
			Al.	Ac	O	I	CNS	Ag
Benzoic acid	$HC_7H_5O_2$	122.118	1	...	...	...	...	...
Copper	Cu	63.57	...	...	...	1	...	...
Cyanogen iodide	CNI	76.469	...	...	...	½	...	...
s-Diphenylguanidine†	$C_{13}H_{13}N_3$	211.258	...	1	...	...	...	...
Hydrazine sulfate	$N_2H_4 \cdot H_2SO_4$	130.124	½	...	...	¼	...	...
Hydrochloric acid*	HCl	36.465	1	...	...	...	...	...
Iodine	I	126.92	...	...	...	1	...	...
Maleic acid	$H_2C_4H_2O_4$	116.072	½	...	...	...	...	...
Mercury	Hg	200.61	...	...	...	...	½	...
Mercury oxide (ic)	HgO	216.61	...	½	...	...	½	...
Potassium acid carbonate	$HKCO_3$	100.114	...	1	...	...	...	...
Potassium acid oxalate	HKC_2O_4	128.124	1	...	...	...	...	...
Potassium acid phthalate	$HKC_8H_4O_4$	204.216	1	...	...	...	...	...
Potassium acid tartrate	$HKC_4H_4O_6$	188.176	1	...	...	...	...	...
Potassium bromate	$KBrO_3$	167.016	...	...	...	⅙	...	...
Potassium bromide	KBr	119.016	...	...	...	...	...	1
Potassium chloride	KCl	74.557	...	...	...	...	...	1
Potassium dichromate	$K_2Cr_2O_7$	294.22	...	...	...	⅙	...	...
Potassium ferricyanide	$K_3Fe(CN)_6$	329.246	...	...	...	1	...	...
Potassium ferrocyanide	$K_4Fe(CN)_6 \cdot 3H_2O$	422.390	...	...	1	...	...	...
Potassium iodate	KIO_3	214.02	...	⅙	...	⅙	...	...
Potassium tetroxalate	$H_3K(C_2O_4)_2 \cdot 2H_2O$	254.192	⅓	...	...	...	...	...
Silver	Ag	107.88	...	...	1	...	1	...
Silver nitrate	$AgNO_3$	169.888	...	...	...	...	1	...
Sodium carbonate	Na_2CO_3	105.994	...	½	...	...	...	...
Sodium chloride	NaCl	58.454	...	...	...	...	...	1
Sodium oxalate	$Na_2C_2O_4$	133.994	...	...	½	...	...	...
Sodium thiosulfate	$Na_2S_2O_3 \cdot 5H_2O$	248.194	...	...	...	1	...	...
Succinic acid	$H_2C_4H_4O_4$	118.088	½	...	...	...	...	...

*See section on: Standard Volumetric (Titrimetric) Solutions.

**For the most recent atomic weights see inside of back cover.

†In alcoholic soln., using methyl red or bromothymol blue as the indicator.

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Based on the 1941 International Atomic Weights.*

In the table below the elements are arranged in alphabetical order.

Example:—To convert a given weight of Al_2O_3 to its equivalent of Al multiply by the factor at the right, 0.52914; similarly to convert Al to Al_2O_3, multiply by the factor at the left, 1.8899. For convenience in computation, the corresponding logarithms are given in each case.

Log. of factor −10	Factor	**ALUMINUM** $Al = 26.97$	Factor	Log. of factor −10
9.87485	0.74964	$Al \leftrightarrow Al_4C_3$	1.3340	10.12515
9.81833	0.65816	$Al \leftrightarrow AlN$	1.5194	10.18167
10.27643	1.8899	$Al_2O_3 \leftrightarrow Al$	0.52914	9.72357
10.15129	1.4167	$Al_2O_3 \leftrightarrow Al_4C_3$	0.70585	9.84871
9.58235	0.38225	$Al_2O_3 \leftrightarrow AlCl_3$	2.6161	10.41765
9.62099	0.41782	$Al_2O_3 \leftrightarrow AlPO_4$	2.3934	10.37901
9.47417	0.29797	$Al_2O_3 \leftrightarrow Al_2(SO_4)_3$	3.3561	10.52583
9.18460	0.15297	$Al_2O_3 \leftrightarrow Al_2(SO_4)_3 \cdot 18H_2O$	6.5373	10.81540
9.03119	0.10745	$Al_2O_3 \leftrightarrow K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	9.3071	10.96881
9.05090	0.11244	$Al_2O_3 \leftrightarrow (NH_4)_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	8.8939	10.94910
10.65530	4.5217	$AlPO_4 \leftrightarrow Al$	0.22116	9.34470
10.14451	1.3948	$CaF_2 \leftrightarrow AlF_3$	0.71696	9.85549
9.76495	0.58204	$P_2O_5 \leftrightarrow AlPO_4$	1.7181	10.23505
		AMMONIUM $NH_4 = 18.040$		
10.04191	1.1013	$Ag \leftrightarrow NH_4Br$	0.90801	9.95809
10.30461	2.0165	$Ag \leftrightarrow NH_4Cl$	0.49590	9.69539
9.87169	0.74420	$Ag \leftrightarrow NH_4I$	1.3437	10.12831
10.28265	1.9171	$AgBr \leftrightarrow NH_4Br$	0.52161	9.71735
10.42803	2.6793	$AgCl \leftrightarrow NH_4Cl$	0.37323	9.57197
10.20945	1.6198	$AgI \leftrightarrow NH_4I$	0.61738	9.79055
10.24710	1.7665	$BaSO_4 \leftrightarrow (NH_4)_2SO_4$	0.56610	9.75290
9.91160	0.81583	$Br \leftrightarrow NH_4Br$	1.2257	10.08840
10.29347	1.9655	$Cl \leftrightarrow NH_4$	0.50879	9.70655
9.82137	0.66278	$Cl \leftrightarrow NH_4Cl$	1.5088	10.17863
9.83355	0.68163	$HCl \leftrightarrow NH_4Cl$	1.4671	10.16645
9.94228	0.87555	$I \leftrightarrow NH_4I$	1.1421	10.05772
11.15867	14.410	$MgNH_4PO_4 \cdot 6H_2O \leftrightarrow NH_3$	0.069396	8.84133
11.13370	13.605	$MgNH_4PO_4 \cdot 6H_2O \leftrightarrow NH_4$	0.073502	8.86630
10.97430	9.4253	$MgNH_4PO_4 \cdot 6H_2O \leftrightarrow (NH_4)_2O$	0.10610	9.02570
9.91511	0.82247	$N \leftrightarrow NH_3$	1.2159	10.08489
9.89014	0.77650	$N \leftrightarrow NH_4$	1.2878	10.10986
9.41804	0.26184	$N \leftrightarrow NH_4Cl$	3.8191	10.58196
9.24303	0.17500	$N \leftrightarrow NH_4NO_3$	5.7145	10.75697
9.73074	0.53794	$N \leftrightarrow (NH_4)_2O$	1.8589	10.26926
9.32637	0.21202	$N \leftrightarrow (NH_4)_2SO_4$	4.7166	10.67363
9.97503	0.94412	$NH_3 \leftrightarrow NH_4$	1.0592	10.02497
9.54962	0.35451	$NH_3 \leftrightarrow (NH_4)_2CO_3$	2.8208	10.45038
9.33332	0.21544	$NH_3 \leftrightarrow NH_4HCO_3$	4.6417	10.66668
9.32792	0.21278	$NH_3 \leftrightarrow NH_4NO_3$	4.6998	10.67208
9.81562	0.65407	$NH_3 \leftrightarrow (NH_4)_2O$	1.5289	10.18438
9.68660	0.48596	$NH_3 \leftrightarrow NH_4OH$	2.0578	10.31340
9.41126	0.25779	$NH_3 \leftrightarrow (NH_4)_2SO_4$	3.8792	10.58874
10.49706	3.1409	$NH_4Cl \leftrightarrow NH_3$	0.31838	9.50294
10.47209	2.9655	$NH_4Cl \leftrightarrow NH_4$	0.33722	9.52791
10.31269	2.0544	$NH_4Cl \leftrightarrow (NH_4)_2O$	0.48676	9.68731
10.18367	1.5264	$NH_4Cl \leftrightarrow NH_4OH$	0.65514	9.81633

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* For the most recent atomic weights see inside of back cover.

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**AMMONIUM (Continued)** **NH_4 = 18.040**	Factor	Log. of factor −10
10.39829	2.5020	$NH_4OH \leftrightarrow N$	0.39968	9.60171
10.28843	1.9428	$NH_4OH \leftrightarrow NH_4$	0.51472	9.71157
11.11514	13.036	$(NH_4)_2PtCl_6 \leftrightarrow NH_3$	0.076712	8.88486
11.09017	12.307	$(NH_4)_2PtCl_6 \leftrightarrow NH_4$	0.081252	8.90983
10.61807	4.1502	$(NH_4)_2PtCl_6 \leftrightarrow NH_4Cl$	0.24095	9.38193
10.44305	2.7737	$(NH_4)_2PtCl_6 \leftrightarrow NH_4NO_3$	0.36054	9.55695
10.93076	8.5262	$(NH_4)_2PtCl_6 \leftrightarrow (NH_4)_2O$	0.11729	9.06924
10.80174	6.3349	$(NH_4)_2PtCl_6 \leftrightarrow NH_4OH$	0.15785	9.19826
10.52640	3.3605	$(NH_4)_2PtCl_6 \leftrightarrow (NH_4)_2SO_4$	0.29758	9.47360
10.12947	1.3473	$(NH_4)_2SO_4 \leftrightarrow H_2SO_4$	0.74221	9.87053
10.50119	3.1710	$N_2O_5 \leftrightarrow NH_3$	0.31536	9.49881
9.82911	0.67469	$N_2O_5 \leftrightarrow NH_4NO_3$	1.4822	10.17089
10.31682	2.0740	$N_2O_5 \leftrightarrow (NH_4)_2O$	0.48215	9.68318
10.75825	5.7313	$Pt \leftrightarrow NH_3$	0.17448	9.24175
10.73328	5.4110	$Pt \leftrightarrow NH_4$	0.18481	9.26672
10.26119	1.8247	$Pt \leftrightarrow NH_4Cl$	0.54804	9.73881
10.08617	1.2195	$Pt \leftrightarrow NH_4NO_3$	0.82004	9.91383
10.57388	3.7487	$Pt \leftrightarrow (NH_4)_2O$	0.26676	9.42612
10.44485	2.7852	$Pt \leftrightarrow NH_4OH$	0.35904	9.55515
10.16951	1.4774	$Pt \leftrightarrow (NH_4)_2SO_4$	0.67685	9.83049
10.37112	2.3503	$SO_3 \leftrightarrow NH_3$	0.42548	9.62888
9.78238	0.60587	$SO_3 \leftrightarrow (NH_4)_2SO_4$	1.6505	10.21762
		ANTIMONY **Sb = 121.76**		
9.56184	0.36462	$Sb \leftrightarrow KSbO \cdot C_4H_4O_6 \cdot \frac{1}{2}H_2O$	2.7426	10.43816
9.92187	0.83535	$Sb \leftrightarrow Sb_2O_3$	1.1971	10.07813
9.87663	0.75272	$Sb \leftrightarrow Sb_2O_5$	1.3285	10.12337
9.63997	0.43649	$Sb_2O_3 \leftrightarrow KSbO \cdot C_4H_4O_6 \cdot \frac{1}{2}H_2O$	2.2910	10.36003
9.95477	0.90109	$Sb_2O_3 \leftrightarrow Sb_2O_5$	1.1098	10.04523
9.85848	0.72191	$Sb_2O_3 \leftrightarrow Sb_2S_5$	1.3852	10.14152
9.66318	0.46045	$Sb_2O_4 \leftrightarrow KSbO \cdot C_4H_4O_6 \cdot \frac{1}{2}H_2O$	2.1718	10 33682
10.10134	1.2628	$Sb_2O_4 \leftrightarrow Sb$	0.79188	9.89866
10.02321	1.0549	$Sb_2O_4 \leftrightarrow Sb_2O_3$	0.94797	9.97679
9.97797	0.95054	$Sb_2O_4 \leftrightarrow Sb_2O_5$	1.0520	10.02203
9.95678	0.90527	$Sb_2O_4 \leftrightarrow Sb_2S_3$	1.1046	10.04322
9.88169	0.76153	$Sb_2O_4 \leftrightarrow Sb_2S_5$	1.3132	10.11831
9.90371	0.80115	$Sb_2O_5 \leftrightarrow Sb_2S_5$	1.2482	10.09629
9.70640	0.50863	$Sb_2S_3 \leftrightarrow KSbO \cdot C_4H_4O_6 \cdot \frac{1}{2}H_2O$	1.9661	10.29360
10.14456	1.3950	$Sb_2S_3 \leftrightarrow Sb$	0.71687	9.85544
10.06643	1.1653	$Sb_2S_3 \leftrightarrow Sb_2O_3$	0.85817	9.93357
10.02119	1.0500	$Sb_2S_3 \leftrightarrow Sb_2O_5$	0.95237	9.97881
10.21965	1.6583	$Sb_2S_5 \leftrightarrow Sb$	0.60304	9.78035
		ARSENIC **As = 74.91**		
10.12069	1.3204	$As_2O_3 \leftrightarrow As$	0.75735	9.87931
9.93488	0.86076	$As_2O_3 \leftrightarrow As_2O_5$	1.1618	10.06512
10.18582	1.5340	$As_2O_5 \leftrightarrow As$	0.65190	9.81418
10.21537	1.6420	$As_2S_3 \leftrightarrow As$	0.60902	9.78463
10.09468	1.2436	$As_2S_3 \leftrightarrow As_2O_3$	0.80415	9.90532
10.02954	1.0704	$As_2S_3 \leftrightarrow As_2O_5$	0.93423	9.97046
9.89940	0.79324	$As_2S_3 \leftrightarrow As_2S_5$	1.2607	10.10060
10.31597	2.0700	$As_2S_5 \leftrightarrow As$	0.48310	9.68403
10.19526	1.5677	$As_2S_5 \leftrightarrow As_2O_3$	0.63788	9.80474
10.13014	1.3494	$As_2S_5 \leftrightarrow As_2O_5$	0.74106	9.86986

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**ARSENIC (Continued)** **As = 74.91**	Factor	Log. of factor −10
10.66969	4.6740	$BaSO_4 \leftrightarrow As$	0.21395	9.33031
10.54898	3.5399	$BaSO_4 \leftrightarrow As_2O_3$	0.28250	9.45102
10.48387	3.0470	$BaSO_4 \leftrightarrow As_2O_5$	0.32819	9.51613
10.45464	2.8487	$BaSO_4 \leftrightarrow AsO_3$	0.35104	9.54536
10.40150	2.5206	$BaSO_4 \leftrightarrow AsO_4$	0.39674	9.59850
10.31644	2.0722	$Mg_2As_2O_7 \leftrightarrow As$	0.48257	9.68356
10.19573	1.5694	$Mg_2As_2O_7 \leftrightarrow As_2O_3$	0.63718	9.80427
10.13062	1.3509	$Mg_2As_2O_7 \leftrightarrow As_2O_5$	0.74026	9.86938
10.10139	1.2630	$Mg_2As_2O_7 \leftrightarrow AsO_3$	0.79179	9.89861
10.04824	1.1175	$Mg_2As_2O_7 \leftrightarrow AsO_4$	0.89487	9.95176
10.10108	1.2620	$Mg_2As_2O_7 \leftrightarrow As_2S_3$	0.79236	9.89892
10.40485	2.5401	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O \leftrightarrow As$	0.39369	9.59515
10.28415	1.9238	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O \leftrightarrow As_2O_3$	0.51982	9.71585
10.21903	1.6559	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O \leftrightarrow As_2O_5$	0.60390	9.78097
10.18980	1.5481	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O \leftrightarrow AsO_3$	0.64595	9.81020
10.13666	1.3698	$MgNH_4AsO_4 \cdot \frac{1}{2}H_2O \leftrightarrow AsO_4$	0.73004	9.86334
		BARIUM **Ba = 137.36**		
10.15742	1.4369	$BaCO_3 \leftrightarrow Ba$	0.69595	9.84258
9.97665	0.94765	$BaCO_3 \leftrightarrow BaCl_2$	1.0552	10.02335
9.88132	0.76088	$BaCO_3 \leftrightarrow Ba(HCO_3)_2$	1.3143	10.11868
10.10957	1.2870	$BaCO_3 \leftrightarrow BaO$	0.77702	9.89043
10.26589	1.8446	$BaCrO_4 \leftrightarrow Ba$	0.54213	9.73411
10.08512	1.2165	$BaCrO_4 \leftrightarrow BaCl_2$	0.82201	9.91488
10.10847	1.2838	$BaCrO_4 \leftrightarrow BaCO_3$	0.77898	9.89153
10.21804	1.6521	$BaCrO_4 \leftrightarrow BaO$	0.60528	9.78196
10.30840	2.0342	$BaSiF_6 \leftrightarrow Ba$	0.49159	9.69160
10.20233	1.5934	$BaSiF_6 \leftrightarrow BaF_2$	0.62759	9.79767
10.26055	1.8220	$BaSiF_6 \leftrightarrow BaO$	0.54885	9.73945
10.23028	1.6993	$BaSO_4 \leftrightarrow Ba$	0.58847	9.76972
10.04950	1.1207	$BaSO_4 \leftrightarrow BaCl_2$	0.89227	9.95050
9.98020	0.95544	$BaSO_4 \leftrightarrow BaCl_2 \cdot 2H_2O$	1.0466	10.01980
10.07286	1.1827	$BaSO_4 \leftrightarrow BaCO_3$	0.84556	9.92714
9.95087	0.89304	$BaSO_4 \leftrightarrow Ba(NO_3)_2$	1.1198	10.04913
10.18243	1.5220	$BaSO_4 \leftrightarrow BaO$	0.65701	9.81757
10.13933	1.3783	$BaSO_4 \leftrightarrow BaO_2$	0.72556	9.86067
10.13917	1.3778	$BaSO_4 \leftrightarrow BaS$	0.72582	9.86083
9.45784	0.28697	$CO_2 \leftrightarrow BaO$	3.4847	10.54216
9.34827	0.22299	$CO_2 \leftrightarrow BaCO_3$	4.4847	10.65173
		BERYLLIUM **Be = 9.02**		
10.94753	8.8619	$BeCl_2 \leftrightarrow Be$	0.11284	9.05247
10.44308	2.7738	$BeO \leftrightarrow Be$	0.36051	9.55692
9.49556	0.31301	$BeO \leftrightarrow BeCl_2$	3.1948	10.50444
9.14996	0.14124	$BeO \leftrightarrow BeSO_4 \cdot 4H_2O$	7.0801	10.85004
		BISMUTH **Bi = 209.00**		
9.95279	0.89700	$Bi \leftrightarrow Bi_2O_3$	1.1148	10.04721
10.22132	1.6647	$BiAsO_4 \leftrightarrow Bi$	0.60073	9.77868
10.17411	1.4932	$BiAsO_4 \leftrightarrow Bi_2O_3$	0.66971	9.82589
9.68152	0.48031	$Bi_2O_3 \leftrightarrow Bi(NO_3)_3 \cdot 5H_2O$	2.0820	10.31848
9.90946	0.81182	$Bi_2O_3 \leftrightarrow BiONO_3$	1.2318	10.09054
10.09559	1.2462	$BiOCl \leftrightarrow Bi$	0.80244	9.90441

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**BISMUTH (Continued)** **Bi = 209.00**	Factor	Log. of factor −10
9.72990	0.53691	$BiOCl \leftrightarrow Bi(NO_3)_3{\cdot}5H_2O$	1.8625	10.27010
10.04838	1.1178	$BiOCl \leftrightarrow Bi_2O_3$	0.89458	9.95162
9.95784	0.90749	$BiOCl \leftrightarrow BiONO_3$	1.1019	10.04216
10.08994	1.2301	$Bi_2S_3 \leftrightarrow Bi$	0.81295	9.91006
10.04273	1.1034	$Bi_2S_3 \leftrightarrow Bi_2O_3$	0.90630	9.95727
		BORON **B = 10.82**		
10.50760	3.2181	$B_2O_3 \leftrightarrow B$	0.31074	9.49240
9.91018	0.81317	$B_2O_3 \leftrightarrow BO_2$	1.2298	10.08982
9.77230	0.59198	$B_2O_3 \leftrightarrow BO_3$	1.6893	10.22770
9.95277	0.89696	$B_2O_3 \leftrightarrow B_4O_7$	1.1149	10.04723
9.75053	0.56302•	$B_2O_3 \leftrightarrow H_3BO_3$	1.7761	10.24947
9.56247	0.36515	$B_2O_3 \leftrightarrow Na_2B_4O_7{\cdot}10H_2O$	2.7386	10.43753
11.06585	11.637	$KBF_4 \leftrightarrow B$	0.085930	8.93415
10.55825	3.6162	$KBF_4 \leftrightarrow B_2O_3$	0.27653	9.44175
10.30878	2.0360	$KBF_4 \leftrightarrow H_3BO_3$	0.49116	9.69122
10.12072	1.3204	$KBF_4 \leftrightarrow Na_2B_4O_7{\cdot}10H_2O$	0.75732	9.87928
		BROMINE **Br = 79.916**		
10.13031	1.3499	$Ag \leftrightarrow Br$	0.74079	9.86969
9.92602	0.84337	$Ag \leftrightarrow BrO_3$	1.1857	10.07398
10.12486	1.3331	$Ag \leftrightarrow HBr$	0.75013	9.87514
10.37105	2.3499	$AgBr \leftrightarrow Br$	0.42555	9.62895
10.16676	1.4681	$AgBr \leftrightarrow BrO_3$	0.68114	9.83324
10.36561	2.3206	$AgBr \leftrightarrow HBr$	0.43091	9.63439
9.74628	0.55754	$Br \leftrightarrow AgCl$	1.7936	10.25372
10.99954	9.9895	$Br \leftrightarrow O$	0.10011	9.00046
10.07398	1.1857	$BrO_3 \leftrightarrow Ag$	0.84337	9.92602
		CADMIUM **Cd = 112.41**		
9.78759	0.61318	$Cd \leftrightarrow CdCl_2$	1.6309	10.21241
9.67711	0.47546	$Cd \leftrightarrow Cd(NO_3)_2$	2.1032	10.32289
10.05779	1.1423	$CdO \leftrightarrow Cd$	0.87540	9.94221
9.84538	0.70045	$CdO \leftrightarrow CdCl_2$	1.4276	10.15462
9.73490	0.54313	$CdO \leftrightarrow Cd(NO_3)_2$	1.8412	10.26510
10.10897	1.2852	$CdS \leftrightarrow Cd$	0.77809	9.89103
9.89656	0.78806	$CdS \leftrightarrow CdCl_2$	1.2689	10.10344
9.78608	0.61106	$CdS \leftrightarrow Cd(NO_3)_2$	1.6365	10.21392
10.05118	1.1251	$CdS \leftrightarrow CdO$	0.88884	9.94882
9.84073	0.69300	$CdS \leftrightarrow CdSO_4$	1.4430	10.15927
10.26824	1.8546	$CdSO_4 \leftrightarrow Cd$	0.53921	9.73176
10.05582	1.1372	$CdSO_4 \leftrightarrow CdCl_2$	0.87938	9.94418
9.94535	0.88176	$CdSO_4 \leftrightarrow Cd(NO_3)_2$	1.1341	10.05465
10.21044	1.6235	$CdSO_4 \leftrightarrow CdO$	0.61596	9.78956
		CALCIUM **Ca = 40.08**		
10.50996	3.2357	$BaSO_4 \leftrightarrow CaS$	0.30906	9.49004
10.23415	1.7146	$BaSO_4 \leftrightarrow CaSO_4$	0.58324	9.76585
10.13217	1.3557	$BaSO_4 \leftrightarrow CaSO_4{\cdot}2H_2O$	0.73761	9.86783
9.55763	0.36110	$Ca \leftrightarrow CaCl_2$	2.7693	10.44237
9.71039	0.51332	$Ca \leftrightarrow CaF_2$	1.9481	10.28961

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**CALCIUM** (**Continued**) **Ca = 40.08**	Factor	Log. of factor −10
9.85412	0.71469	$Ca \leftrightarrow CaO$	1.3992	10.14588
10.39746	2.4973	$CaCO_3 \leftrightarrow Ca$	0.40048	9.60254
9.95509	0.90176	$CaCO_3 \leftrightarrow CaCl_2$	1.1089	10.04491
9.79056	0.61740	$CaCO_3 \leftrightarrow Ca(HCO_3)_2$	1.6197	10.20944
10.25158	1.7849	$CaCO_3 \leftrightarrow CaO$	0.56029	9.74842
9.86640	0.73520	$CaCO_3 \leftrightarrow CaSO_4$	1.3602	10.13360
9.76443	0.58134	$CaCO_3 \leftrightarrow CaSO_4 \cdot 2H_2O$	1.7202	10.23557
10.13748	1.3724	$CaCO_3 \leftrightarrow HCl$	0.72865	9.86252
10.14588	1.3992	$CaO \leftrightarrow Ca$	0.71469	9.85412
9.70351	0.50525	$CaO \leftrightarrow CaCl_2$	1.9792	10.29649
9.74842	0.56030	$CaO \leftrightarrow CaCO_3$	1.7848	10.25158
9.85627	0.71824	$CaO \leftrightarrow CaF_2$	1.3923	10.14373
9.53898	0.34593	$CaO \leftrightarrow Ca(HCO_3)_2$	2.8908	10.46102
9.87901	0.75686	$CaO \leftrightarrow Ca(OH)_2$	1.3213	10.12099
9.61482	0.41193	$CaO \leftrightarrow CaSO_4$	2.4276	10.38518
9.51284	0.32572	$CaO \leftrightarrow CaSO_4 \cdot 2H_2O$	3.0701	10.48716
10.26571	1.8438	$Ca_3(PO_4)_2 \leftrightarrow CaO$	0.54236	9.73429
9.88053	0.75951	$Ca_3(PO_4)_2 \leftrightarrow CaSO_4$	1.3166	10.11947
10.53106	3.3967	$CaSO_4 \leftrightarrow Ca$	0.29440	9.46894
10.08869	1.2266	$CaSO_4 \leftrightarrow CaCl_2$	0.81529	9.91131
10.13360	1.3602	$CaSO_4 \leftrightarrow CaCO_3$	0.73520	9.86640
10.24145	1.74360	$CaSO_4 \leftrightarrow CaF_2$	0.57353	9.75855
10.38518	2.4276	$CaSO_4 \leftrightarrow CaO$	0.41193	9.61482
10.24780	1.7693	$Cl \leftrightarrow Ca$	0.56519	9.75220
9.80543	0.63890	$Cl \leftrightarrow CaCl_2$	1.5652	10.19457
10.10192	1.2645	$Cl \leftrightarrow CaO$	0.79082	9.89808
9.89474	0.78477	$CO_2 \leftrightarrow CaO$	1.2743	10.10526
9.64316	0.43970	$CO_2 \leftrightarrow CaCO_3$	2.2743	10.35684
9.89206	0.77993	$Mg_2As_2O_7 \leftrightarrow Ca_3(AsO_4)_2$	1.2822	10.10794
9.85671	0.71897	$MgO \leftrightarrow CaO$	1.3909	10.14329
9.85588	0.71760	$Mg_2P_2O_7 \leftrightarrow Ca_3(PO_4)_2$	1.3935	10.14412
11.08274	12.099	$(NH_4)_3PO_4 \cdot 12MoO_3 \leftrightarrow Ca_3(PO_4)_2$	0.082652	8.91726
9.81839	0.65825	$N_2O_5 \leftrightarrow Ca(NO_3)_2$	1.5192	10.18161
9.66052	0.45764	$P_2O_5 \leftrightarrow Ca_3(PO_4)_2$	2.1851	10.33948
10.15461	1.4276	$SO_3 \leftrightarrow CaO$	0.70047	9.84539
9.76943	0.58807	$SO_3 \leftrightarrow CaSO_4$	1.7005	10.23057
9.66745	0.46500	$SO_3 \leftrightarrow CaSO_4 \cdot 2H_2O$	2.1505	10.33255
9.90595	0.80528	$WO_3 \leftrightarrow CaWO_4$	1.2418	10.09405
		CARBON **C = 12.01**		
10.60116	3.9917	$Ag \leftrightarrow HCN$	0.25051	9.39883
10.21927	1.6568	$Ag \leftrightarrow KCN$	0.60358	9.78073
10.69499	4.9544	$AgCN \leftrightarrow HCN$	0.20184	9.30500
10.31310	2.0564	$AgCN \leftrightarrow KCN$	0.48630	9.68690
10.21574	16.434	$BaCO_3 \leftrightarrow C$	0.060850	8.78426
10.65173	4.4848	$BaCO_3 \leftrightarrow CO_2$	0.22298	9.34827
10.51706	3.2890	$BaCO_3 \leftrightarrow CO_3$	0.30405	9.48294
10.54216	3.4847	$BaO \leftrightarrow CO_2$	0.28697	9.45784
10.24113	1.7423	$BaO \leftrightarrow CO_2$, bicarbonate	0.57394	9.75887
9.28850	0.19431	$CN \leftrightarrow AgCN$	5.1464	10.71150
9.38233	0.24118	$CN \leftrightarrow Ag$	4.1464	10.61767
9.54391	0.34987	$CNS \leftrightarrow AgCNS$	2.8582	10.45609
9.67891	0.47743	$CNS \leftrightarrow CuCNS$	2.0946	10.32109
9.39587	0.24881	$CNS \leftrightarrow BaSO_4$	4.0191	10.60413
10.10526	1.2743	$CaO \leftrightarrow CO_2$	0.78477	9.89474
9.80423	0.63713	$CaO \leftrightarrow$ Bicarbonate CO_2	1.5695	10.19577

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**CARBON** (Continued) **C = 12.01**	Factor	Log. of factor −10
9.53062	0.33933	$CO_2 \leftrightarrow Ba(HCO_3)_2$	2.9470	10.46938
10.56401	3.6644	$CO_2 \leftrightarrow C$	0.27289	9.43599
9.64316	0.43970	$CO_2 \leftrightarrow CaCO_3$	2.2743	10.35684
9.73476	0.54295	$CO_2 \leftrightarrow Ca(HCO_3)_2$	1.8418	10.26524
9.86533	0.73338	$CO_2 \leftrightarrow CO_3$	1.3636	10.13467
9.13056	0.13507	$CO_2 \leftrightarrow Cs_2CO_3$	7.4035	10.86944
9.35591	0.22694	$CO_2 \leftrightarrow CsHCO_3$	4.4064	10.64409
9.57962	0.37986	$CO_2 \leftrightarrow FeCO_3$	2.6326	10.42038
9.69444	0.49481	$CO_2 \leftrightarrow Fe(HCO_3)_2$	2.0210	10.30556
9.50304	0.31845	$CO_2 \leftrightarrow K_2CO_3$	3.1402	10.49696
9.64306	0.43960	$CO_2 \leftrightarrow KHCO_3$	2.2748	10.35694
9.66954	0.46724	$CO_2 \leftrightarrow K_2O$	2.1402	10.33046
9.77497	0.59562	$CO_2 \leftrightarrow Li_2CO_3$	1.6789	10.22503
9.81131	0.64761	$CO_2 \leftrightarrow LiHCO_3$	1.5441	10.18869
10.16817	1.4695	$CO_2 \leftrightarrow Li_2O$	0.67894	9.83183
9.71757	0.52188	$CO_2 \leftrightarrow MgCO_3$	1.9162	10.28243
9.77917	0.60141	$CO_2 \leftrightarrow Mg(HCO_3)_2$	1.6628	10.22083
10.03803	1.0915	$CO_2 \leftrightarrow MgO$	0.91616	9.96197
9.53308	0.38290	$CO_2 \leftrightarrow MnCO_3$	2.6117	10.41692
9.69669	0.49738	$CO_2 \leftrightarrow Mn(HCO_3)_2$	2.0105	10.30331
9.79272	0.62047	$CO_2 \leftrightarrow MnO$	1.6117	10.20728
9.61823	0.41517	$CO_2 \leftrightarrow Na_2CO_3$	2.4086	10.38177
9.71919	0.52383	$CO_2 \leftrightarrow NaHCO_3$	1.9090	10.28081
9.85120	0.70991	$CO_2 \leftrightarrow Na_2O$	1.4086	10.14880
9.66087	0.45801	$CO_2 \leftrightarrow (NH_4)_2CO_3$	2.1834	10.33913
9.74560	0.55668	$CO_2 \leftrightarrow NH_4HCO_3$	1.7964	10.25440
9.21668	0.16470	$CO_2 \leftrightarrow PbCO_3$	6.0718	10.78332
9.28000	0.19054	$CO_2 \leftrightarrow Rb_2CO_3$	5.2481	10.72000
9.47772	0.30041	$CO_2 \leftrightarrow RbHCO_3$	3.3287	10.52228
9.37180	0.23540	$CO_2 \leftrightarrow Rb_2O$	4.2481	10.62820
9.47435	0.29809	$CO_2 \leftrightarrow SrCO_3$	3.3547	10.52565
9.62305	0.41981	$CO_2 \leftrightarrow Sr(HCO_3)_2$	2.3820	10.37695
9.62807	0.42468	$CO_2 \leftrightarrow SrO$	2.3547	10.37193
		CERIUM		
		Ce = 140.13		
9.55752	0.36101	$Ce \leftrightarrow Ce(NO_3)_4$	2.7700	10.44248
9.39350	0.24746	$Ce \leftrightarrow Ce(NO_3)_4{\cdot}2NH_4NO_3{\cdot}H_2O$	4.0412	10.60650
9.91067	0.81409	$Ce \leftrightarrow CeO_2$	1.2284	10.08933
9.93134	0.85377	$Ce \leftrightarrow Ce_2O_3$	1.1713	10.06866
9.69288	0.49303	$Ce \leftrightarrow Ce_2(SO_4)_3$	2.0283	10.30712
10.02228	1.0526	$Ce_2(C_2O_4)_3{\cdot}3H_2O \leftrightarrow Ce_2(SO_4)_3$	0.94998	9.97772
10.32941	2.1350	$Ce_2(C_2O_4)_3{\cdot}3H_2O \leftrightarrow Ce$	0.46837	9.67059
9.64684	0.44345	$CeO_2 \leftrightarrow Ce(NO_3)_4$	2.2551	10.35316
9.48283	0.30397	$CeO_2 \leftrightarrow Ce(NO_3)_4{\cdot}2NH_4NO_3{\cdot}H_2O$	3.2898	10.51717
9.62617	0.42284	$Ce_2O_3 \leftrightarrow Ce(NO_3)_4$	2.3650	10.37383
9.46216	0.28984	$Ce_2O_3 \leftrightarrow Ce(NO_3)_4{\cdot}2NH_4NO_3{\cdot}H_2O$	3.4502	10.53784
9.97933	0.95352	$Ce_2O_3 \leftrightarrow CeO_2$	1.0487	10.02067
9.76153	0.57748	$Ce_2O_3 \leftrightarrow Ce_2(SO_4)_3$	1.7317	10.23847
		CESIUM		
		Cs = 132.91		
9.93010	0.85134	$AgCl \leftrightarrow CsCl$	1.1746	10.06990
9.42614	0.26677	$Cl \leftrightarrow Cs$	3.7485	10.57386

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**CESIUM (Continued)** Cs = 132.91	Factor	Log. of factor −10
9.32345	0.21059	$Cl \leftrightarrow CsCl$	4.7485	10.67655
9.89730	0.78941	$Cs \leftrightarrow CsCl$	1.2668	10.10270
9.91160	0.81582	$Cs \leftrightarrow Cs_2CO_3$	1.2258	10.08840
9.97462	0.94323	$Cs \leftrightarrow Cs_2O$	1.0602	10.02538
9.92268	0.83692	$Cs_2O \leftrightarrow CsCl$	1.1949	10.07732
9.89141	0.77877	$Cs_2O \leftrightarrow Cs_2SO_4$	1.2841	10.10859
10.40394	2.5348	$Cs_2PtCl_6 \leftrightarrow Cs$	0.39451	9.59606
10.30124	2.0010	$Cs_2PtCl_6 \leftrightarrow CsCl$	0.49976	9.69876
10.31553	2.0679	$Cs_2PtCl_6 \leftrightarrow Cs_2CO_3$	0.48469	9.68447
10.37855	2.3909	$Cs_2PtCl_6 \leftrightarrow Cs_2O$	0.41826	9.62145
10.13398	1.3614	$Cs_2SO_4 \leftrightarrow Cs$	0.73455	9.86602
10.03128	1.0747	$Cs_2SO_4 \leftrightarrow CsCl$	0.93051	9.96872
10.04557	1.1106	$Cs_2SO_4 \leftrightarrow Cs_2CO_3$	0.90038	9.95443
9.45344	0.28408	$SO_3 \leftrightarrow Cs_2O$	3.5201	10.54656
		CHLORINE Cl = 35.457		
10.48324	3.0426	$Ag \leftrightarrow Cl$	0.32867	9.51676
10.47106	2.9584	$Ag \leftrightarrow HCl$	0.33802	9.52894
10.60666	4.0426	$AgCl \leftrightarrow Cl$	0.24737	9.39334
10.59448	3.9308	$AgCl \leftrightarrow HCl$	0.25440	9.40552
10.55302	3.5729	$BaCrO_4 \leftrightarrow Cl$	0.27988	9.44698
9.75220	0.56519	$Ca \leftrightarrow Cl$	1.7693	10.24780
9.98782	0.97235	$Cl \leftrightarrow HCl$	1.0284	10.01218
9.76510	0.58224	$ClO_3 \leftrightarrow AgCl$	1.7175	10.23490
10.04897	1.1194	$ClO_3 \leftrightarrow KCl$	0.89336	9.95103
10.15465	1.4277	$ClO_3 \leftrightarrow NaCl$	0.70041	9.84535
9.84128	0.69387	$ClO_4 \leftrightarrow AgCl$	1.4412	10.15872
10.12515	1.3340	$ClO_4 \leftrightarrow KCl$	0.74964	9.87485
10.23082	1.7015	$ClO_4 \leftrightarrow NaCl$	0.58773	9.76918
10.04243	1.1026	$K \leftrightarrow Cl$	0.90692	9.95757
10.32276	2.1026	$KCl \leftrightarrow Cl$	0.47559	9.67724
9.29166	0.19573	$Li \leftrightarrow Cl$	5.1091	0.70834
9.53523	0.34295	$Mg \leftrightarrow Cl$	2.9159	10.46477
10.12806	1.3430	$MgCl_2 \leftrightarrow Cl$	0.74463	9.87194
10.08844	1.2259	$MnO_2 \leftrightarrow Cl$	0.81576	9.91156
9.81197	0.64859	$Na \leftrightarrow Cl$	1.5418	10.18803
10.21711	1.6486	$NaCl \leftrightarrow Cl$	0.60658	9.78289
9.70654	0.50879	$NH_4 \leftrightarrow Cl$	1.9655	10.29346
10.16646	1.4671	$NH_4Cl \leftrightarrow HCl$	0.68162	9.83354
10.25813	1.8119	$(NH_4)_2SO_4 \leftrightarrow HCl$	0.55192	9.74187
10.65877	4.5579	$PbCrO_4 \leftrightarrow Cl$	0.21940	9.34123
		CHROMIUM Cr = 52.01		
10.68767	4.8716	$BaCrO_4 \leftrightarrow Cr$	0.20527	9.31233
10.52288	3.3340	$BaCrO_4 \leftrightarrow Cr_2O_3$	0.30000	9.47712
10.40371	2.5334	$BaCrO_4 \leftrightarrow CrO_3$	0.39472	9.59629
10.33926	2.1840	$BaCrO_4 \leftrightarrow CrO_4$	0.45787	9.66074
9.84957	0.70725	$BaCrO_4 \leftrightarrow Cr_2(SO_4)_3 \cdot 18H_2O$	1.4139	10.15043
10.28396	1.9229	$CrO_3 \leftrightarrow Cr$	0.52005	9.71604
10.16478	1.4614	$Cr_2O_3 \leftrightarrow Cr$	0.68425	9.83522
9.88083	0.76002	$Cr_2O_3 \leftrightarrow CrO_3$	1.3157	10.11917
9.81638	0.65522	$Cr_2O_3 \leftrightarrow CrO_4$	1.5262	10.18362
10.57217	3.7339	$K_2CrO_4 \leftrightarrow Cr$	0.26781	9.42783
10.28821	1.9418	$K_2CrO_4 \leftrightarrow CrO_3$	0.51498	9.71179
10.16759	1.4709	$K_2Cr_2O_7 \leftrightarrow CrO_3$	0.67985	9.83241

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**CHROMIUM (Continued)** **Cr = 52.01**	Factor	Log. of factor −10
10.79341	6.2146	$PbCrO_4 \leftrightarrow Cr$	0.16091	9.20659
10.62863	4.2523	$PbCrO_4 \leftrightarrow Cr_2O_3$	0.23516	9.37137
10.50945	3.2319	$PbCrO_4 \leftrightarrow CrO_3$	0.30942	9.49055
10.44500	2.7861	$PbCrO_4 \leftrightarrow CrO_4$	0.35892	9.55500
9.95532	0.90223	$PbCrO_4 \leftrightarrow Cr_2(SO_4)_3 \cdot 18H_2O$	1.1084	10.04468
10.22124	1.6643	$PbCrO_4 \leftrightarrow K_2CrO_4$	0.60084	9.77876
10.34187	2.1972	$PbCrO_4 \leftrightarrow K_2Cr_2O_7$	0.45513	9.65813
		COBALT **Co = 58.94**		
9.30644	0.20251	$Co \leftrightarrow Co(NO_3)_2 \cdot 6H_2O$	4.9381	10.69356
9.89570	0.78650	$Co \leftrightarrow CoO$	1.2715	10.10430
9.32153	0.20967	$Co \leftrightarrow CoSO_4 \cdot 7H_2O$	4.7695	10.67847
10.88499	7.6735	$Co(NO_2)_3 \cdot (KNO_2)_3 \leftrightarrow Co$	0.13032	9.11501
10.78069	6.0352	$Co(NO_2)_3 \cdot (KNO_2)_3 \leftrightarrow CoO$	0.16570	9.21931
10.13416	1.3620	$Co_3O_4 \leftrightarrow Co$	0.73424	9.86584
10.02986	1.0712	$Co_3O_4 \leftrightarrow CoO$	0.93356	9.97014
10.41992	2.6298	$CoSO_4 \leftrightarrow Co$	0.38026	9.58008
10.31562	2.0683	$CoSO_4 \leftrightarrow CoO$	0.48348	9.68438
10.57417	3.7512	$CoSO_4 \cdot 7H_2O \leftrightarrow CoO$	0.26658	9.42583
10.84908	7.0644	$(CoSO_4)_2 \cdot (K_2SO_4)_3 \leftrightarrow Co$	0.14155	9.15092
10.74477	5.5562	$(CoSO_4)_2 \cdot (K_2SO_4)_3 \leftrightarrow CoO$	0.17998	9.25523
		COLUMBIUM **Cb = 92.91**		
10.15550	1.4305	$Cb_2O_5 \leftrightarrow Cb$	0.69904	9.84450
		COPPER **Cu = 63.57**		
9.39935	0.25081	$Cu \leftrightarrow Cu_2C_2H_3O_2 \cdot (AsO_2)_3$	3.9870	10.60065
9.90250	0.79892	$Cu \leftrightarrow CuO$	1.2517	10.09750
9.40581	0.25457	$Cu \leftrightarrow CuSO_4 \cdot 5H_2O$	3.9281	10.59419
10.28185	1.9136	$CuCNS \leftrightarrow Cu$	0.52257	9.71815
10.18436	1.5288	$CuCNS \leftrightarrow CuO$	0.65410	9.81564
10.09750	1.2517	$CuO \leftrightarrow Cu$	0.79892	9.90250
9.50331	0.31865	$CuO \leftrightarrow CuSO_4 \cdot 5H_2O$	3.1383	10.49669
10.05148	1.1258	$Cu_2O \leftrightarrow Cu$	0.88822	9.94852
10.09766	1.2522	$Cu_2S \leftrightarrow Cu$	0.79862	9.90234
10.00016	1.0004	$Cu_2S \leftrightarrow CuO$	0.99962	9.99984
10.04618	1.1122	$Cu_2S \leftrightarrow Cu_2O$	0.89912	9.95382
9.50348	0.31877	$Cu_2S \leftrightarrow CuSO_4 \cdot 5H_2O$	3.1371	10.49652
9.96316	0.91868	$Mg_2As_2O_7 \leftrightarrow Cu_2C_2H_3O_2 \cdot (AsO_2)_3$	1.0885	10.03684
		ERBIUM **Er = 167.2**		
10.05939	1.1465	$Er_2O_3 \leftrightarrow Er$	0.87220	9.94061
		FLUORINE **F = 19.00**		
10.20233	1.5934	$BaSiF_6 \leftrightarrow BaF_2$	0.62759	9.79767
10.38935	2.4511	$BaSiF_6 \leftrightarrow F$	0.40799	9.61065
10.36690	2.3276	$BaSiF_6 \leftrightarrow 6HF$	0.42963	9.63310
10.28767	1.9394	$BaSiF_6 \leftrightarrow H_2SiF_6$	0.51563	9.71233
10.42897	2.6852	$BaSiF_6 \leftrightarrow SiF_4$	0.37241	9.57103
10.29379	1.9669	$BaSiF_6 \leftrightarrow SiF_6$	0.50841	9.70621
10.21107	1.6258	$CaF_2 \leftrightarrow H_2SiF_6$	0.61508	9.78893

Log. of factor −10	Factor	**FLUORINE** (**Continued**) **F =19.00**	Factor	Log. of factor −10
10.21719	1.6489	CaF_2 ↔ SiF_6	0.60647	9.78281
10.55420	3.5826	$CaSO_4$ ↔ F	0.27912	9.44580
10.53175	3.4021	$CaSO_4$ ↔ HF	0.29393	9.46825
9.68724	0.48668	F ↔ CaF_2	2.0547	10.31276
9.70970	0.51250	HF ↔ CaF_2	1.9512	10.29030
10.10169	1.2638	H_2SiF_6 ↔ F	0.79125	9.89831
10.55636	3.6004	H_2SiF_6 ↔ 2HF	0.27774	9.44364
10.07924	1.2001	H_2SiF_6 ↔ 6HF	0.83323	9.92076
10.14131	1.3845	H_2SiF_6 ↔ SiF_4	0.72226	9.85869
10.00612	1.0142	H_2SiF_6 ↔ SiF_6	0.98601	9.99388
10.28603	1.9321	K_2SiF_6 ↔ F	0.51757	9.71397
10.26356	1.8347	K_2SiF_6 ↔ HF	0.54505	9.73644
10.18433	1.5287	K_2SiF_6 ↔ H_2SiF_6	0.65124	9.81567
10.27776	1.8956	K_2SiF_6 ↔ KF	0.52753	9.72224
10.19046	1.5505	K_2SiF_6 ↔ SiF_6	0.64497	9.80954
		GALLIUM **Ga =69.72**		
10.12847	1.3442	Ga_2O_3 ↔ Ga	0.74392	9.87153
10.22782	1.6898	Ga_2S_3 ↔ Ga	0.59180	9.77218
		GERMANIUM **Ge =72.60**		
10.15860	1.4408	GeO_2 ↔ Ge	0.69407	9.84140
10.56197	3.6473	K_2GeF_6 ↔ Ge	0.27418	9.43803
		GOLD **Au =197.2**		
9.81265	0.64960	Au ↔ $AuCl_3$	1.5394	10.18735
9.67990	0.47852	Au ↔ $HAuCl_4 \cdot 4H_2O$	2.0898	10.32010
9.74056	0.55025	Au ↔ $KAu(CN)_4 \cdot H_2O$	1.8174	10.25944
		HYDROGEN **H =1.0080**		
10.95117	8.9365	H_2O ↔ H	0.11190	9.04883
10.89964	7.9367	O ↔ H	0.12600	9.10036
9.55149	0.35603	HCNS ↔ AgCNS	2.8087	10.44851
9.68638	0.48571	HCNS ↔ CuCNS	2.0588	10.31362
9.40335	0.25313	HCNS ↔ $BaSO_4$	3.9505	10.59665
		INDIUM **In =114.76**		
10.08247	1.2091	In_2O_3 ↔ In	0.82704	9.91753
10.15200	1.4190	In_2S_3 ↔ In	0.70470	9.84800
		IODINE **I =126.92**		
9.92597	0.84329	Ag ↔ HI	1.1858	10.07403
9.92941	0.84998	Ag ↔ I	1.1765	10.07059
10.05283	1.1293	AgCl ↔ I	0.88547	9.94717
10.26373	1.8354	AgI ↔ HI	0.54484	9.73627
10.26717	1.8500	AgI ↔ I	0.54055	9.73283
10.12786	1.3423	AgI ↔ IO_3	0.74497	9.87214
10.08985	1.2298	AgI ↔ IO_4	0.81312	9.91015
10.14819	1.4067	AgI ↔ I_2O_5	0.71090	9.85181
10.10844	1.2836	AgI ↔ I_2O_7	0.77905	9.89156

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**IODINE (Continued)** **I = 126.92**	Factor	Log. of factor −10
9.62017	0.41703	$Pd \leftrightarrow HI$	2.3979	10.37983
9.62360	0.42034	$Pd \leftrightarrow I$	2.3790	10.37640
10.14896	1.4092	$PdI_2 \leftrightarrow HI$	0.70965	9.85104
10.15239	1.4203	$PdI_2 \leftrightarrow I$	0.70406	9.84761
10.01308	1.0306	$PdI_2 \leftrightarrow IO_3$	0.97032	9.98692
9.97507	0.94422	$PdI_2 \leftrightarrow IO_4$	1.0591	10.02493
10.03342	1.0800	$PdI_2 \leftrightarrow I_2O_5$	0.92594	9.96658
9.99366	0.98551	$PdI_2 \leftrightarrow I_2O_7$	1.0147	10.00634
10.41327	2.5898	$TlI \leftrightarrow HI$	0.38613	9.58673
10.41670	2.6104	$TlI \leftrightarrow I$	0.38308	9.58330
10.27740	1.8941	$TlI \leftrightarrow IO_3$	0.52796	9.72260
10.23938	1.7353	$TlI \leftrightarrow IO_4$	0.57626	9.76062
10.29773	1.9848	$TlI \leftrightarrow I_2O_5$	0.50382	9.70227
10.25797	1.8112	$TlI \leftrightarrow I_2O_7$	0.55211	9.74203
		IRON **Fe = 55.85**		
10.35408	2.2599	$Ag \leftrightarrow Fe_7(CN)_{18}$ (Prussian blue)	0.44251	9.64592
9.73641	0.54502	$CN \leftrightarrow Fe_7(CN)_{18}$	1.8348	10.26359
9.78712	0.61253	$CO_2 \leftrightarrow FeO$	1.6326	10.21288
9.57962	0.37986	$CO_2 \leftrightarrow FeCO_3$	2.6326	10.42038
9.69444	0.49481	$CO_2 \leftrightarrow Fe(HCO_3)_2$	2.0210	10.30556
9.49688	0.31397	$Fe \leftrightarrow Fe(HCO_3)_2$	3.1851	10.50312
9.64403	0.44058	$Fe \leftrightarrow FeCl_2$	2.2697	10.35597
9.89060	0.77731	$Fe \leftrightarrow FeO$	1.2865	10.10940
9.84475	0.69944	$Fe \leftrightarrow Fe_2O_3$	1.4297	10.15525
9.56544	0.36765	$Fe \leftrightarrow FeSO_4$	2.7200	10.43456
9.30294	0.20088	$Fe \leftrightarrow FeSO_4 \cdot 7H_2O$	4.9780	10.69706
9.15358	0.14242	$Fe \leftrightarrow FeSO_4\ (NH_4)_2SO_4 \cdot 6H_2O$	7.0214	10.84642
9.79249	0.62014	$FeO \leftrightarrow FeCO_3$	1.6125	10.20751
9.60629	0.40391	$FeO \leftrightarrow Fe(HCO_3)_2$	2.4758	10.39371
9.95415	0.89980	$FeO \leftrightarrow Fe_2O_3$	1.1114	10.04585
9.69219	0.49226	$Fe_2O_3 \leftrightarrow FeCl_3$	2.0314	10.30781
9.83834	0.68919	$Fe_2O_3 \leftrightarrow FeCO_3$	1.4510	10.16166
9.65213	0.44888	$Fe_2O_3 \leftrightarrow Fe(HCO_3)_2$	2.2278	10.34787
9.52405	0.33424	$Fe_2O_3 \leftrightarrow Fe(HCO_3)_3$	2.9919	10.47595
10.04585	1.1114	$Fe_2O_3 \leftrightarrow FeO$	0.89980	9.95415
10.01475	1.0346	$Fe_2O_3 \leftrightarrow Fe_3O_4$	0.96660	9.98525
9.72379	0.52940	$Fe_2O_3 \leftrightarrow FePO_4$	1.8889	10.27621
9.72069	0.52564	$Fe_2O_3 \leftrightarrow FeSO_4$	1.9024	10.27931
9.45820	0.28721	$Fe_2O_3 \leftrightarrow FeSO_4 \cdot 7H_2O$	3.4818	10.54180
9.30883	0.20362	$Fe_2O_3 \leftrightarrow FeSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	4.9110	10.69117
9.60138	0.39937	$Fe_2O_3 \leftrightarrow Fe_2(SO_4)_3$	2.5039	10.39862
10.43146	2.7006	$FePO_4 \leftrightarrow Fe$	0.37028	9.56854
10.32206	2.0992	$FePO_4 \leftrightarrow FeO$	0.47636	9.67794
10.19702	1.5740	$FeS \leftrightarrow Fe$	0.63531	9.80298
10.08761	1.2235	$FeS \leftrightarrow FeO$	0.81731	9.91239
10.04176	1.1009	$FeS \leftrightarrow Fe_2O_3$	0.90832	9.95824
9.90148	0.79703	$Mg_2As_2O_7 \leftrightarrow FeAsO_4$	1.2547	10.09852
10.04699	1.1143	$SO_3 \leftrightarrow FeO$	0.89745	9.95301
9.72183	0.52702	$SO_3 \leftrightarrow FeSO_4$	1.8975	10.27817
		LANTHANUM **La = 138.92**		
10.06921	1.1728	$La_2O_3 \leftrightarrow La$	0.85269	9.93079

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**LEAD** **Pb** = **207.21**	Factor	Log. of factor −10
9.88954	0.77543	$Pb \leftrightarrow PbCO_3$	1.2896	10.11046
9.90386	0.80141	$Pb \leftrightarrow (PbCO_3)_2 \cdot Pb(OH)_2$	1.2478	10.09614
9.93399	0.85899	$Pb \leftrightarrow Pb(OH)_2$	1.1642	10.06601
9.96770	0.92832	$Pb \leftrightarrow PbO$	1.0772	10.03230
10.12783	1.3422	$PbCl_2 \leftrightarrow Pb$	0.74502	9.87217
10.09553	1.2460	$PbCl_2 \leftrightarrow PbO$	0.80255	9.90447
10.19309	1.5599	$PbCrO_4 \leftrightarrow Pb$	0.64108	9.80691
9.93046	0.85204	$PbCrO_4 \leftrightarrow Pb(C_2H_3O_2)_2 \cdot 3H_2O$	1.1737	10.06954
10.09694	1.2501	$PbCrO_4 \leftrightarrow (PbCO_3)_2 \cdot Pb(OH)_2$	0.79994	9.90306
10.16078	1.4481	$PbCrO_4 \leftrightarrow PbO$	0.69058	9.83922
10.15053	1.4143	$PbCrO_4 \leftrightarrow Pb_3O_4$	0.70708	9.84947
10.02767	1.0658	$PbCrO_4 \leftrightarrow PbSO_4$	0.93828	9.97233
9.92184	0.83530	$PbO \leftrightarrow PbCO_3$	1.1972	10.07816
9.82859	0.67389	$PbO \leftrightarrow Pb(NO_3)_2$	1.4839	10.17141
9.96993	0.93311	$PbO \leftrightarrow PbO_2$	1.0717	10.03007
10.06237	1.1544	$PbO_2 \leftrightarrow Pb$	0.86623	9.93752
9.85865	0.72220	$PbO_2 \leftrightarrow Pb(NO_3)_2$	1.3847	10.14135
10.06248	1.1547	$PbS \leftrightarrow Pb$	0.86601	9.93752
10.03017	1.0720	$PbS \leftrightarrow PbO$	0.93288	9.96983
9.89706	0.78897	$PbS \leftrightarrow PbSO_4$	1.2675	10.10294
10.11369	1.2992	$PbSO_4 \leftrightarrow BaSO_4$	0.76968	9.88631
10.16542	1.4636	$PbSO_4 \leftrightarrow Pb$	0.68325	9.83458
9.90279	0.79945	$PbSO_4 \leftrightarrow Pb(C_2H_3O_2)_2 \cdot 3H_2O$	1.2509	10.09721
10.05496	1.1349	$PbSO_4 \leftrightarrow PbCO_3$	0.88113	9.94504
10.06928	1.1729	$PbSO_4 \leftrightarrow (PbCO_3)_2 \cdot Pb(OH)_2$	0.85256	9.93072
9.96171	0.91560	$PbSO_4 \leftrightarrow Pb(NO_3)_2$	1.0922	10.03829
10.13312	1.3587	$PbSO_4 \leftrightarrow PbO$	0.73601	9.86688
10.10305	1.2678	$PbSO_4 \leftrightarrow PbO_2$	0.78877	9.89695
10.12286	1.3270	$PbSO_4 \leftrightarrow Pb_3O_4$	0.75360	9.87714
		LITHIUM **Li** = 6.940		
9.77497	0.59562	$CO_2 \leftrightarrow Li_2CO_3$	1.6789	10.22503
9.81131	0.64761	$CO_2 \leftrightarrow LiHCO_3$	1.5442	10.18869
10.16817	1.4729	$CO_2 \leftrightarrow Li_2O$	0.67894	9.83183
10.78598	6.1091	$LiCl \leftrightarrow Li$	0.16369	9.21402
10.45298	2.8378	$LiCl \leftrightarrow Li_2O$	0.35238	9.54702
10.72620	5.3235	$Li_2CO_3 \leftrightarrow Li$	0.18785	9.27380
9.94022	0.87141	$Li_2CO_3 \leftrightarrow LiCl$	1.1476	10.05978
9.73531	0.54364	$Li_2CO_3 \leftrightarrow LiHCO_3$	1.8394	10.26469
10.39321	2.4729	$Li_2CO_3 \leftrightarrow Li_2O$	0.40438	9.60679
10.65789	4.5487	$LiHCO_3 \leftrightarrow Li_2O$	0.21984	9.34211
10.33299	2.1527	$Li_2O \leftrightarrow Li$	0.46452	9.66701
9.43422	0.27178	$Li_2O \leftrightarrow Li_2SO_4$	3.6794	10.56578
10.74523	5.5620	$Li_3PO_4 \leftrightarrow Li$	0.17979	9.25477
9.95925	0.91044	$Li_3PO_4 \leftrightarrow LiCl$	1.0984	10.04075
10.01903	1.0448	$Li_3PO_4 \leftrightarrow Li_2CO_3$	0.95712	9.98097
9.75435	0.56800	$Li_3PO_4 \leftrightarrow LiHCO_3$	1.7606	10.24565
10.41224	2.5837	$Li_3PO_4 \leftrightarrow Li_2O$	0.38705	9.58776
9.84646	0.70220	$Li_3PO_4 \leftrightarrow Li_2SO_4$	1.4240	10.15354
9.78056	0.60333	$Li_3PO_4 \leftrightarrow Li_2SO_4 \cdot H_2O$	1.6575	10.21944
10.89877	7.9207	$Li_2SO_4 \leftrightarrow Li$	0.12625	9.10123
10.11279	1.2966	$Li_2SO_4 \leftrightarrow LiCl$	0.77128	9.88721
10.42804	2.6794	$SO_3 \leftrightarrow Li_2O$	0.37322	9.57196
9.86226	0.72822	$SO_3 \leftrightarrow Li_2SO_4$	1.3732	10.13774

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor		Factor	Log. of factor −10
		MAGNESIUM **Mg** = 24.32		
10.28758	1.9390	$BaSO_4 \leftrightarrow MgSO_4$	0.51572	9.71242
9.97633	0.94696	$BaSO_4 \leftrightarrow MgSO_4{\cdot}7H_2O$	1.0560	10.02367
10.81770	6.5720	$Br \leftrightarrow Mg$	0.15216	9.18230
9.93849	0.86794	$Br \leftrightarrow MgBr_2$	1.1522	10.06151
9.73791	0.54690	$Br \leftrightarrow MgBr_2{\cdot}6H_2O$	1.8284	10.26209
10.46477	2.9159	$Cl \leftrightarrow Mg$	0.34295	9.53523
9.87194	0.74463	$Cl \leftrightarrow MgCl_2$	1.3430	10.12806
9.54253	0.34876	$Cl \leftrightarrow MgCl_2{\cdot}6H_2O$	2.8673	10.45747
9.71757	0.52188	$CO_2 \leftrightarrow MgCO_3$	1.9162	10.28243
10.03803	1.0915	$CO_2 \leftrightarrow MgO$	0.91616	9.96197
11.01860	10.438	$I \leftrightarrow Mg$	0.09584	8.98140
9.96027	0.91257	$I \leftrightarrow MgI_2$	1.0958	10.03973
9.40717	0.25537	$Mg \leftrightarrow MgCl_2$	3.9159	10.59283
9.45998	0.28839	$Mg \leftrightarrow MgCO_3$	3.4675	10.54002
9.76057	0.57620	$MgCO_3 \leftrightarrow Mg(HCO_3)_2$	1.7355	10.23943
11.00398	10.092	$MgNH_4PO_4{\cdot}6H_2O \leftrightarrow Mg$	0.099088	8.99602
10.78442	6.0872	$MgNH_4PO_4{\cdot}6H_2O \leftrightarrow MgO$	0.16428	9.21558
10.21956	1.6579	$MgO \leftrightarrow Mg$	0.60318	9.78044
9.67954	0.47812	$MgO \leftrightarrow MgCO_3$	2.0915	10.32046
9.44012	0.27550	$MgO \leftrightarrow Mg(HCO_3)_2$	3.6298	10.55988
9.52497	0.33494	$MgO \leftrightarrow MgSO_4$	2.9856	10.47503
10.66053	4.5765	$Mg_2P_2O_7 \leftrightarrow Mg$	0.21851	9.33947
10.06770	1.1687	$Mg_2P_2O_7 \leftrightarrow MgCl_2$	0.85565	9.93230
9.73829	0.54738	$Mg_2P_2O_7 \leftrightarrow MgCl_2{\cdot}6H_2O$	1.8269	10.26171
9.60263	0.40053	$Mg_2P_2O_7 \leftrightarrow MgCl_2{\cdot}KCl{\cdot}6H_2O$	2.4967	10.39737
10.12051	1.3198	$Mg_2P_2O_7 \leftrightarrow MgCO_3$	0.75768	9.87949
9.88108	0.76047	$Mg_2P_2O_7 \leftrightarrow Mg(HCO_3)_2$	1.3150	10.11892
10.44097	2.7604	$Mg_2P_2O_7 \leftrightarrow MgO$	0.36226	9.55903
9.96594	0.92457	$Mg_2P_2O_7 \leftrightarrow MgSO_4$	1.0816	10.03406
9.65469	0.45153	$Mg_2P_2O_7 \leftrightarrow MgSO_4{\cdot}7H_2O$	2.2147	10.34531
10.69459	4.9498	$MgSO_4 \leftrightarrow Mg$	0.20203	9.30541
10.29790	1.9856	$SO_3 \leftrightarrow MgO$	0.50362	9.70210
9.82286	0.66506	$SO_3 \leftrightarrow MgSO_4$	1.5036	10.17714
9.51161	0.32480	$SO_3 \leftrightarrow MgSO_4{\cdot}7H_2O$	3.0789	10.48839
		MANGANESE **Mn** = 54.93		
10.18919	1.5459	$BaSO_4 \leftrightarrow MnSO_4$	0.64686	9.81081
9.58308	0.38290	$CO_2 \leftrightarrow MnCO_3$	2.6127	10.41692
9.79272	0.62047	$CO_2 \leftrightarrow MnO$	1.6117	10.20728
9.67934	0.47790	$Mn \leftrightarrow MnCO_3$	2.0925	10.32066
9.88898	0.77443	$Mn \leftrightarrow MnO$	1.2913	10.11102
9.80064	0.63189	$Mn \leftrightarrow MnO_2$	1.5826	10.19936
9.84257	0.69593	$Mn \leftrightarrow Mn_2O_3$	1.4369	10.15743
9.88152	0.76124	$MnCO_3 \leftrightarrow MnSO_4$	1.3136	10.11848
10.18742	1.5396	$Mn(HCO_3)_2 \leftrightarrow MnCO_3$	0.64951	9.81258
9.79036	0.61710	$MnO \leftrightarrow MnCO_3$	1.6205	10.20964
9.60294	0.40081	$MnO \leftrightarrow Mn(HCO_3)_2$	2.4949	10.39706
9.95359	0.89864	$MnO \leftrightarrow Mn_2O_3$	1.1128	10.04641
9.67188	0.46977	$MnO \leftrightarrow MnSO_4$	2.1287	10.32812
10.14251	1.3884	$Mn_3O_4 \leftrightarrow Mn$	0.72027	9.85749
9.82184	0.66351	$Mn_3O_4 \leftrightarrow MnCO_3$	1.5071	10.17816
9.63443	0.43095	$Mn_3O_4 \leftrightarrow Mn(HCO_3)_2$	2.3205	10.36557
10.03149	1.0752	$Mn_3O_4 \leftrightarrow MnO$	0.93007	9.96851

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**MANGANESE**(**Continued**) **Mn = 54.93**	Factor	Log. of factor −10
9.98507	0.96621	Mn_3O_4 ↔ Mn_2O_3	1.0350	10.01493
9.94315	0.87730	Mn_3O_4 ↔ MnO_2	1.1399	10.05685
9.70337	0.50509	Mn_3O_4 ↔ $MnSO_4$	1.9799	10.29663
10.41220	2.5835	$Mn_2P_2O_7$ ↔ Mn	0.38708	9.58780
10.09154	1.2346	$Mn_2P_2O_7$ ↔ $MnCO_3$	0.80995	9.90846
10.30118	2.0007	$Mn_2P_2O_7$ ↔ MnO	0.49982	9.69882
10.21284	1.6325	$Mn_2P_2O_7$ ↔ MnO_2	0.61257	9.78716
9.97306	0.93986	$Mn_2P_2O_7$ ↔ $MnSO_4$	1.0640	10.02694
10.19966	1.5837	MnS ↔ Mn	0.63145	9.80034
9.87900	0.75683	MnS ↔ $MnCO_3$	1.3213	10.12100
10.08864	1.2264	MnS ↔ MnO	0.81538	9.91136
9.76052	0.57613	MnS ↔ $MnSO_4$	1.7357	10.23948
10.43914	2.7488	$MnSO_4$ ↔ Mn	0.36380	9.56086
10.05259	1.1287	SO_3 ↔ MnO	0.88596	9.94741
9.72447	0.53023	SO_3 ↔ $MnSO_4$	1.8860	10.27253
		MERCURY **Hg = 200.61**		
9.86854	0.73883	Hg ↔ $HgCl_2$	1.3535	10.13146
9.96667	0.92613	Hg ↔ HgO	1.0798	10.03333
9.93561	0.86221	Hg ↔ HgS	1.1598	10.06439
10.07068	1.1767	HgCl ↔ Hg	0.84980	9.92932
9.93923	0.86942	HgCl ↔ $HgCl_2$	1.1502	10.06077
9.95371	0.89890	HgCl ↔ $HgNO_3$	1.1125	10.04629
10.05370	1.1316	HgCl ↔ Hg_2O	0.88369	9.94630
10.03736	1.0898	HgCl ↔ HgO	0.91758	9.96264
10.00629	1.0146	HgCl ↔ HgS	0.98561	9.99371
9.99371	0.98561	HgS ↔ HgCl	1.0146	10.00629
9.93293	0.85690	HgS ↔ $HgCl_2$	1.1670	10.06707
9.96423	0.92093	HgS ↔ $Hg(CN)_2$	1.0859	10.03577
9.94742	0.88596	HgS ↔ $HgNO_3$	1.1287	10.05258
9.85536	0.71673	HgS ↔ $Hg(NO_3)_2$	1.3952	10.14464
9.83190	0.67905	HgS ↔ $Hg(NO_3)_2 \cdot H_2O$	1.4727	10.16810
10.04741	1.1153	HgS ↔ Hg_2O	0.89659	9.95259
10.03106	1.0741	HgS ↔ HgO	0.93098	9.96894
9.89447	0.78427	HgS ↔ $HgSO_4$	1.2751	10.10553
		MOLYBDENUM **Mo = 95.95**		
10.17617	1.5003	MoO_3 ↔ Mo	0.66655	9.82383
9.86589	0.73432	MoO_3 ↔ $(NH_4)_2MoO_4$	1.3618	10.13441
10.30155	2.0024	MoS_3 ↔ Mo	0.50055	9.69845
10.12538	1.3347	MoS_3 ↔ MoO_3	0.74923	9.87462
9.99127	0.98010	MoS_3 ↔ $(NH_4)_2MoO_4$	1.0203	10.00873
10.03596	1.0863	$(NH_4)_3PO_4 \cdot 12MoO_3$ ↔ MoO_3	0.92054	9.96404
9.90184	0.79771	$(NH_4)_3PO_4 \cdot 12MoO_3$ ↔ $(NH_4)_2MoO_4$	1.2536	10.09816
10.58281	3.8266	$PbMoO_4$ ↔ Mo	0.26133	9.41719
10.40664	2.5506	$PbMoO_4$ ↔ MoO_3	0.39206	9.59336
10.27253	1.8730	$PbMoO_4$ ↔ $(NH_4)_2MoO_4$	0.53391	9.72747
		NEODYMIUM **Nd = 144.27**		
10.06683	1.1664	Nd_2O_3 ↔ Nd	0.85737	9.93317
		NICKEL **Ni = 58.69**		
9.30792	0.20320	Ni ↔ Ni-glyoxime	4.9213	10.69208
9.30496	0.20182	Ni ↔ $Ni(NO_3)_2 \cdot 6H_2O$	4.9549	10.69504

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**NICKEL (Continued)** **Ni = 58.69**	Factor	Log. of factor −10
9.89530	0.78578	Ni ↔ NiO	1.2726	10.10470
9.32007	0.20896	Ni ↔ $NiSO_4 \cdot 7H_2O$	4.7856	10.67993
10.58738	3.8671	Ni-glyoxime ↔ NiO	0.25859	9.41262
9.40966	0.25684	NiO ↔ $Ni(NO_3)_2 \cdot 6H_2O$	3.8934	10.59034
9.42477	0.26593	NiO ↔ $NiSO_4 \cdot 7H_2O$	3.7604	10.57523
10.42107	2.6367	$NiSO_4$ ↔ Ni	0.37926	9.57893
9.72603	0.53215	$NiSO_4$ ↔ $Ni(NO_3)_2 \cdot 6H_2O$	1.8792	10.27397
10.31637	2.0719	$NiSO_4$ ↔ NiO	0.48265	9.68363
9.74114	0.55098	$NiSO_4$ ↔ $NiSO_4 \cdot 7H_2O$	1.8149	10.25886
		NITROGEN **N = 14.008**		
10.51496	3.2731	$AgNO_2$ ↔ HNO_2	0.30552	9.48504
10.60733	4.0488	$AgNO_2$ ↔ N_2O_3	0.24698	9.39267
10.27231	1.8720	KNO_3 ↔ N_2O_5	0.53418	9.72769
9.34693	0.22230	N ↔ HNO_3	4.4985	10.65307
9.48354	0.30447	N ↔ NO_2	3.2844	10.51646
9.56650	0.36855	N ↔ N_2O_3	2.7133	10.43350
9.35393	0.22591	N ↔ NO_3	4.4266	10.64607
9.41392	0.25937	N ↔ N_2O_5	3.8555	10.58608
10.78307	6.0683	$NaNO_3$ ↔ N	0.16479	9.21693
10.19699	1.5739	$NaNO_3$ ↔ N_2O_5	0.63535	9.80301
9.67779	0.47620	NO ↔ HNO_3	2.0999	10.32221
9.81440	0.65223	NO ↔ NO_2	1.5332	10.18560
9.89736	0.78952	NO ↔ N_2O_3	1.2666	10.10264
9.68479	0.48394	NO ↔ NO_3	2.0664	10.31521
9.74478	0.55562	NO ↔ N_2O_5	1.7998	10.25522
9.43181	0.27028	NH_3 ↔ HNO_3	3.6999	10.56819
10.08489	1.2159	NH_3 ↔ N	0.82245	9.91511
9.49881	0.31536	NH_3 ↔ N_2O_5	3.1710	10.50119
9.43882	0.27467	NH_3 ↔ NO_3	3.6407	10.56118
9.92888	0.84894	NH_4Cl ↔ HNO_3	1.1779	10.07112
9.93588	0.86275	NH_4Cl ↔ NO_3	1.1591	10.06412
9.99587	0.99055	NH_4Cl ↔ N_2O_5	1.0095	10.00413
10.58195	3.8190	NH_4Cl ↔ N	0.26185	9.41805
10.54695	3.5233	$(NH_4)_2PtCl_6$ ↔ HNO_3	0.28382	9.45305
11.20003	15.850	$(NH_4)_2PtCl_6$ ↔ N	0.063092	8.79997
10.61395	4.1110	$(NH_4)_2PtCl_6$ ↔ N_2O_5	0.24325	9.38605
10.55396	3.5807	$(NH_4)_2PtCl_6$ ↔ NO_3	0.27928	9.44604
10.67363	4.7166	$(NH_4)_2SO_4$ ↔ N	0.21202	9.32637
10.08755	1.2233	$(NH_4)_2SO_4$ ↔ N_2O_5	0.81743	9.91245
10.19007	1.5491	Pt ↔ HNO_3	0.64555	9.80993
10.84314	6.9685	Pt ↔ N	0.14350	9.15686
10.19707	1.5742	Pt ↔ NO_3	0.63523	9.80293
10.25706	1.8074	Pt ↔ N_2O_5	0.55328	9.74294
9.80294	0.63524	SO_3 ↔ HNO_3	1.5742	10.19706
10.45601	2.8577	SO_3 ↔ N	0.34994	9.54399
9.86993	0.74119	SO_3 ↔ N_2O_5	1.3492	10.13007
		OSMIUM **Os = 190.2**		
10.12597	1.3365	OsO_4 ↔ Os	0.74823	9.87403
		PALLADIUM **Pd = 106.7**		
9.69847	0.49942	Pd ↔ $PdCl_2 \cdot 2H_2O$	2.0023	10.30153
9.66509	0.46247	Pd ↔ $Pd(NO_3)_2$	2.1623	10.33491

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**PALLADIUM** (**Continued**) **Pd = 106.7**	Factor	Log. of factor −10
10.52879	3.3790	$PdI_2 \leftrightarrow Pd$	0.29594	9.47121
10.57132	3.7267	$K_2PdCl_6 \leftrightarrow Pd$	0.26834	9.42868
10.26979	1.8612	$K_2PdCl_6 \leftrightarrow PdCl_2 \cdot 2H_2O$	0.53729	9.73021
		PHOSPHORUS **P = 30.98**		
11.13074	13.513	$Ag_3PO_4 \leftrightarrow P$	0.074005	8.86926
10.64419	4.4075	$Ag_3PO_4 \leftrightarrow PO_4$	0.22689	9.35581
10.77068	5.8977	$Ag_3PO_4 \leftrightarrow P_2O_5$	0.16956	9.22932
10.98999	9.7721	$Ag_4P_2O_7 \leftrightarrow P$	0.10233	9.01001
10.50344	3.1874	$Ag_4P_2O_7 \leftrightarrow PO_4$	0.31373	9.49656
10.62993	4.2651	$Ag_4P_2O_7 \leftrightarrow P_2O_5$	0.23446	9.37007
9.85618	0.71809	$Al_2O_3 \leftrightarrow P_2O_5$	1.3926	10.14382
10.10855	1.2840	$AlPO_4 \leftrightarrow PO_4$	0.77884	9.89145
10.23505	1.7181	$AlPO_4 \leftrightarrow P_2O_5$	0.58204	9.76495
10.33948	2.1851	$Ca_3(PO_4)_2 \leftrightarrow P_2O_5$	0.45764	9.66052
10.20086	1.5880	$FePO_4 \leftrightarrow PO_4$	0.62972	9.79914
10.32735	2.1250	$FePO_4 \leftrightarrow P_2O_5$	0.47060	9.67265
9.89426	0.78396	$Mg_2P_2O_7 \leftrightarrow Na_2HPO_4$	1.2757	10.10574
9.49240	0.31074	$Mg_2P_2O_7 \leftrightarrow Na_2HPO_4 \cdot 12H_2O$	3.2181	10.50760
9.72616	0.53231	$Mg_2P_2O_7 \leftrightarrow NaNH_4HPO_4 \cdot 4H_2O$	1.8786	10.27384
10.55541	3.5926	$Mg_2P_2O_7 \leftrightarrow P$	0.27835	9.44459
10.06886	1.1718	$Mg_2P_2O_7 \leftrightarrow PO_4$	0.85337	9.93114
10.19536	1.5680	$Mg_2P_2O_7 \leftrightarrow P_2O_5$	0.63774	9.80464
11.78227	60.572	$(NH_4)_3PO_4 \cdot 12MoO_3 \leftrightarrow P$	0.016509	8.21773
11.29572	19.757	$(NH_4)_3PO_4 \cdot 12MoO_3 \leftrightarrow PO_4$	0.050616	8.70428
11.42221	26.437	$(NH_4)_3PO_4 \cdot 12MoO_3 \leftrightarrow P_2O_5$	0.037826	8.57779
9.80464	0.63774	$P_2O_5 \leftrightarrow Mg_2P_2O_7$	1.5680	10.19536
9.69890	0.49992	$P_2O_5 \leftrightarrow Na_2HPO_4$	2.0003	10.30110
9.29704	0.19817	$P_2O_5 \leftrightarrow Na_2HPO_4 \cdot 12H_2O$	5.0462	10.70296
9.53080	0.33947	$P_2O_5 \leftrightarrow NaNH_4HPO_4 \cdot 4H_2O$	2.9458	10.46920
10.36005	2.2912	$P_2O_5 \leftrightarrow P$	0.43646	9.63995
11.76380	58.050	$P_2O_5 \cdot 24MoO_3 \leftrightarrow P$	0.017227	8.23620
11.27725	18.978	$P_2O_5\ 24MoO_3 \leftrightarrow PO_4$	0.052814	8.72275
11.40375	25.336	$P_2O_5 \cdot 24MoO_3 \leftrightarrow P_2O_5$	0.039469	8.59625
11.06165	11.525	$U_2P_2O_{11} \leftrightarrow P$	0.086767	8.93835
10.57510	3.7592	$U_2P_2O_{11} \leftrightarrow PO_4$	0.26601	9.42490
10.70159	5.0303	$U_2P_2O_{11} \leftrightarrow P_2O_5$	0.19880	9.29841
		PLATINUM **Pt = 195.23**		
9.97238	0.93839	$K_2PtCl_6 \leftrightarrow H_2PtCl_6 \cdot 6H_2O$	1.0657	10.02762
10.39624	2.4902	$K_2PtCl_6 \leftrightarrow Pt$	0.40157	9.60376
10.15908	1.4424	$K_2PtCl_6 \leftrightarrow PtCl_4$	0.69330	9.84092
10.05621	1.1382	$K_2PtCl_6 \leftrightarrow PtCl_4 \cdot 5H_2O$	0.87859	9.94379
10.35689	2.2745	$(NH_4)_2PtCl_6 \leftrightarrow Pt$	0.43966	9.64311
10.11973	1.3174	$(NH_4)_2PtCl_6 \leftrightarrow PtCl_4$	0.75905	9.88027
10.03680	1.0884	$(NH_4)_2PtCl_6 \leftrightarrow PtCl_6$	0.91875	9.96320
9.57615	0.37683	$Pt \leftrightarrow H_2PtCl_6 \cdot 6H_2O$	2.6537	10.42385
9.76284	0.57922	$Pt \leftrightarrow PtCl_4$	1.7265	10.23716
9.65998	0.45707	$Pt \leftrightarrow PtCl_4 \cdot 5H_2O$	2.1879	10.34002
		POTASSIUM **K = 39.096**		
9.95735	0.90646	$Ag \leftrightarrow KBr$	1.1032	10.04265
10.16048	1.4470	$Ag \leftrightarrow KCl$	0.69107	9.83952
9.94462	0.88027	$Ag \leftrightarrow KClO_3$	1.1360	10.05538

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log of factor −10	Factor	**POTASSIUM (Continued)** K = 39.096	Factor	Log. of factor −10
9.89133	0.77862	Ag ↔ $KClO_4$	1.2843	10.10867
10.21927	1.6568	Ag ↔ KCN	0.60358	9.78073
9.81279	0.64982	Ag ↔ KI	1.5389	10.18721
10.19810	1.5780	AgBr ↔ KBr	0.63373	9.80190
10.05094	1.1244	AgBr ↔ $KBrO_3$	0.88933	9.94906
10.28389	1.9226	AgCl ↔ KCl	0.52012	9.71611
10.06803	1.1696	AgCl ↔ $KClO_3$	0.85500	9.93197
10.01474	1.0345	AgCl ↔ $KClO_4$	0.96662	9.98526
10.31310	2.0564	AgCN ↔ KCN	0.48630	9.68690
10.15055	1.4143	AgI ↔ KI	0.70705	9.84945
10.04025	1.0971	AgI ↔ KIO_3	0.91148	9.95975
10.11550	1.3047	$BaCrO_4$ ↔ K_2CrO_4	0.76648	9.88450
10.23612	1.7224	$BaCrO_4$ ↔ $K_2Cr_4O_7$	0.58060	9.76388
10.23408	1.7143	$BaSO_4$ ↔ $KHSO_4$	0.58334	9.76592
10.32575	2.1171	$BaSO_4$ ↔ K_2S	0.47233	9.67425
10.12696	1.3396	$BaSO_4$ ↔ K_2SO_4	0.74652	9.87304
10.31050	2.0441	Br ↔ K	0.48921	9.68950
9.82704	0.67150	Br ↔ KBr	1.4892	10.17296
9.61779	0.41475	CaF_2 ↔ $KF \cdot 2H_2O$	2.4111	10.38221
9.85924	0.72316	$CaSO_4$ ↔ $KF \cdot 2H_2O$	1.3828	10.14076
9.95757	0.90692	Cl ↔ K	1.1026	10.04243
9.67724	0.47559	Cl ↔ KCl	2.1026	10.32276
9.46138	0.28932	Cl ↔ $KClO_3$	3.4564	10.53862
9.40809	0.25591	Cl ↔ $KClO_4$	3.9076	10.59191
9.87672	0.75287	Cl ↔ K_2O	1.3283	10.12328
9.66954	0.46724	CO_2 ↔ K_2O	2.1402	10.33046
9.50307	0.31847	CO_2 ↔ K_2CO_3	3.1400	10.49693
9.88338	0.76450	I ↔ KI	1.3080	10.11662
9.77308	0.59304	I ↔ KIO_3	1.6862	10.22692
9.50381	0.31901	K ↔ $KClO_3$	3.1347	10.49619
9.91915	0.83013	K ↔ K_2O	1.2046	10.08085
9.58736	0.38669	K ↔ KNO_3	2.5860	10.41264
10.48346	3.0441	KBr ↔ K	0.32850	9.51654
10.40261	2.5270	KBr ↔ K_2O	0.39572	9.59739
10.28033	1.9069	KCl ↔ K	0.52441	9.71967
10.03301	1.0790	KCl ↔ K_2CO_3	0.92680	9.96699
9.70483	0.50680	KCl ↔ $K_2Cr_2O_7$	1.9732	10.29517
9.87197	0.74468	KCl ↔ $KHCO_3$	1.3429	10.12803
9.86770	0.73739	KCl ↔ KNO_3	1.3561	10.13230
10.19948	1.5830	KCl ↔ K_2O	0.63171	9.80052
9.93232	0.85569	KCl ↔ K_2SO_4	1.1686	10.06768
10.21586	1.6438	$KClO_3$ ↔ KCl	0.60833	9.78414
10.54948	3.5439	$KClO_4$ ↔ K	0.28217	9.45052
10.26915	1.8584	$KClO_4$ ↔ KCl	0.53808	9.73085
10.46863	2.9419	$KClO_4$ ↔ K_2O	0.33991	9.53137
10.62802	4.2464	KI ↔ K	0.23550	9.37198
10.54717	3.5251	KI ↔ K_2O	0.28368	9.45283
9.58466	0.38429	K_2O ↔ $KClO_3$	2.6022	10.41534
9.83353	0.68160	K_2O ↔ K_2CO_3	1.4671	10.16647
9.50535	0.32015	K_2O ↔ $K_2Cr_2O_7$	3.1235	10.49465
9.67249	0.47042	K_2O ↔ $KHCO_3$	2.1257	10.32751
9.66822	0.46582	K_2O ↔ KNO_3	2.1468	10.33178
9.90951	0.81191	KOH ↔ K_2CO_3	1.2317	10.09049
10.07601	1.1913	KOH ↔ K_2O	0.83944	9.92399
10.79362	6.2176	K_2PtCl_6 ↔ K	0.16083	9.20638

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**POTASSIUM (Continued)** **K = 39.096**	Factor	Log. of factor −10
10.54630	3.5180	$K_2PtCl_6 \leftrightarrow K_2CO_3$	0.28425	9.45370
10.51329	3.2605	$K_2PtCl_6 \leftrightarrow KCl$	0.30670	9.48671
10.38526	2.4281	$K_2PtCl_6 \leftrightarrow KHCO_3$	0.41185	9.61474
10.38098	2.4043	$K_2PtCl_6 \leftrightarrow KNO_3$	0.41593	9.61902
10.71277	5.1614	$K_2PtCl_6 \leftrightarrow K_2O$	0.19375	9.28723
10.44561	2.7900	$K_2PtCl_6 \leftrightarrow K_2SO_4$	0.35842	9.55439
9.70963	0.51242	$K_2PtCl_6 \leftrightarrow K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	1.9515	10.29037
9.68729	0.48673	$K_2PtCl_6 \leftrightarrow K_2SO_4 \cdot Cr_2(SO_4)_3 \cdot 24H_2O$	2.0545	10.31271
10.10069	1.2609	$K_2SO_4 \leftrightarrow K_2CO_3$	0.79306	9.89931
9.93965	0.87027	$K_2SO_4 \leftrightarrow KHCO_3$	1.1491	10.06035
9.80609	0.63986	$K_2SO_4 \leftrightarrow KHSO_4$	1.5628	10.19391
10.01020	1.0237	$K_2SO_4 \leftrightarrow KNO_2$	0.97679	9.98980
9.93538	0.86175	$K_2SO_4 \leftrightarrow KNO_3$	1.1604	10.06462
10.34802	2.2285	$K_2SO_4 \leftrightarrow K$	0.44874	9.65198
10.26716	1.8500	$K_2SO_4 \leftrightarrow K_2O$	0.54055	9.73284
10.19879	1.5805	$K_2SO_4 \leftrightarrow K_2S$	0.63272	9.80121
9.78240	0.60590	$Mg_2As_2O_7 \leftrightarrow K_3AsO_4$	1.6504	10.21760
9.85230	0.71171	$Mg_2As_2O_7 \leftrightarrow K_2HAsO_4$	1.4051	10.14770
9.60251	0.40041	$Mn_2O_3 \leftrightarrow K_2MnO_4$	2.4974	10.39749
9.69851	0.49947	$Mn_2O_3 \leftrightarrow KMnO_4$	2.0021	10.30149
9.64473	0.44130	$MnS \leftrightarrow K_2MnO_4$	2.2660	10.35527
9.74074	0.55048	$MnS \leftrightarrow KMnO_4$	1.8166	10.25926
9.14161	0.13855	$N \leftrightarrow KNO_3$	7.2176	10.85839
9.22650	0.16846	$NH_3 \leftrightarrow KNO_3$	5.9361	10.77350
9.47247	0.29680	$NO \leftrightarrow KNO_3$	3.3692	10.52753
9.64992	0.44661	$N_2O_3 \leftrightarrow KNO_2$	2.2391	10.35008
10.05947	1.1468	$N_2O_5 \leftrightarrow K_2O$	0.87202	9.94053
9.72769	0.53418	$N_2O_5 \leftrightarrow KNO_3$	1.8720	10.27231
10.39738	2.4968	$Pt \leftrightarrow K$	0.40051	9.60262
10.11705	1.3093	$Pt \leftrightarrow KCl$	0.76375	9.88295
10.31653	2.0727	$Pt \leftrightarrow K_2O$	0.48247	9.68347
9.59035	0.38936	$SiO_2 \leftrightarrow K_2SiO_3$	2.5683	10.40965
9.66224	0.45945	$SO_3 \leftrightarrow K_2SO_4$	2.1765	10.33776
		PRASEODYMIUM **Pr = 140.92**		
10.06830	1.1703	$Pr_2O_3 \leftrightarrow Pr$	0.85448	9.93170
		RHODIUM **Rh = 102.91**		
9.42740	0.26755	$Rh \leftrightarrow Na_3RhCl_6$	3.7377	10.57260
9.69173	0.49173	$Rh \leftrightarrow RhCl_3$	2.0336	10.30827
		RUBIDIUM **Rb = 85.48**		
10.22449	1.6768	$AgCl \leftrightarrow Rb$	0.59636	9.77551
10.07381	1.1853	$AgCl \leftrightarrow RbCl$	0.84370	9.92619
9.61784	0.41480	$Cl \leftrightarrow Rb$	2.4108	10.38216
9.46716	0.29320	$Cl \leftrightarrow RbCl$	3.4107	10.53284
9.84932	0.70684	$Rb \leftrightarrow RbCl$	1.4148	10.15068
9.86934	0.74018	$Rb \leftrightarrow Rb_2CO_3$	1.3510	10.13066
9.96115	0.91442	$Rb \leftrightarrow Rb_2O$	1.0936	10.03885
9.80635	0.64025	$Rb \leftrightarrow Rb_2SO_4$	1.5619	10.19365
10.02002	1.0472	$RbCl \leftrightarrow Rb_2CO_3$	0.95495	9.97998
9.95703	0.90580	$RbCl \leftrightarrow Rb_2SO_4$	1.1040	10.04297

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**RUBIDIUM** (Continued) **Rb = 85.48**	Factor	Log. of factor −10
9.89669	0.78831	$Rb_2CO_3 \leftrightarrow RbHCO_3$	1.2685	10.10331
9.88817	0.77299	$Rb_2O \leftrightarrow RbCl$	1.2937	10.11183
9.84520	0.70017	$Rb_2O \leftrightarrow Rb_2SO_4$	1.4282	10.15480
10.52973	3.3864	$Rb_2PtCl_6 \leftrightarrow Rb$	0.29530	9.47027
10.37905	2.3936	$Rb_2PtCl_6 \leftrightarrow RbCl$	0.41778	9.62095
10.39907	2.5065	$Rb_2PtCl_6 \leftrightarrow Rb_2CO_3$	0.39896	9.60093
10.29577	1.9759	$Rb_2PtCl_6 \leftrightarrow RbHCO_3$	0.50610	9.70423
10.49088	3.0966	$Rb_2PtCl_6 \leftrightarrow Rb_2O$	0.32294	9.50912
10.06299	1.1561	$Rb_2SO_4 \leftrightarrow Rb_2CO_3$	0.86499	9.93701
9.95968	0.91134	$Rb_2SO_4 \leftrightarrow RbHCO_3$	1.0973	10.04032
		SELENIUM **Se = 78.96**		
9.78690	0.61221	$Se \leftrightarrow H_2SeO_3$	1.6334	10.21310
9.73611	0.54464	$Se \leftrightarrow H_2SeO_4$	1.8361	10.26389
9.85224	0.71161	$Se \leftrightarrow SeO_2$	1.4053	10.14776
9.79374	0.62193	$Se \leftrightarrow SeO_3$	1.6079	10.20626
		SILICON **Si = 28.06**		
10.42897	2.6852	$BaSiF_6 \leftrightarrow SiF_4$	0.37241	9.57103
10.66767	4.6523	$BaSiF_6 \leftrightarrow SiO_2$	0.21495	9.33233
10.32564	2.1166	$K_2SiF_6 \leftrightarrow SiF_4$	0.47246	9.67436
10.56433	3.6672	$K_2SiF_6 \leftrightarrow SiO_2$	0.27269	9.43567
9.88607	0.76925	$SiO_2 \leftrightarrow H_2SiO_3$	1.3000	10.11393
10.33050	2.1404	$SiO_2 \leftrightarrow Si$	0.46720	9.66950
9.76130	0.57717	$SiO_2 \leftrightarrow SiF_4$	1.7326	10.23870
9.89743	0.78964	$SiO_2 \leftrightarrow SiO_3$	1.2664	10.10257
9.81451	0.65240	$SiO_2 \leftrightarrow SiO_4$	1.5328	10.18549
10.22156	1.6656	$SiO_2 \leftrightarrow Si_2O$	0.60040	9.77844
9.79590	0.62503	$SiO_2 \leftrightarrow Si(OH)_4$	1.5999	10.20410
		SILVER **Ag = 107.880**		
9.80278	0.63501	$Ag \leftrightarrow AgNO_3$	1.5748	10.19722
9.96893	0.93096	$Ag \leftrightarrow Ag_2O$	1.0742	10.03107
10.24075	1.7408	$AgBr \leftrightarrow Ag$	0.57445	9.75925
10.12342	1.3287	$AgCl \leftrightarrow Ag$	0.75263	9.87658
9.92620	0.84371	$AgCl \leftrightarrow AgNO_3$	1.1852	10.07380
10.09235	1.2369	$AgCl \leftrightarrow Ag_2O$	0.80844	9.90765
10.25372	1.7936	$AgCl \leftrightarrow Br$	0.55754	9.74628
10.09383	1.2412	$AgCN \leftrightarrow Ag$	0.80569	9.90617
10.33776	2.1765	$AgI \leftrightarrow Ag$	0.45945	9.66224
10.11176	1.2935	$Ag_3PO_4 \leftrightarrow Ag$	0.77311	9.88824
10.14710	1.4031	$Ag_4P_2O_7 \leftrightarrow Ag$	0.71269	9.85290
9.86969	0.74079	$Br \leftrightarrow Ag$	1.3499	10.13031
9.62895	0.42555	$Br \leftrightarrow AgBr$	2.3499	10.37105
9.51676	0.32867	$Cl \leftrightarrow Ag$	3.0426	10.48324
9.39334	0.24737	$Cl \leftrightarrow AgCl$	4.0426	10.60666
10.07059	1.1765	$I \leftrightarrow Ag$	0.84998	9.92941
9.73283	0.54055	$I \leftrightarrow AgI$	1.8500	10.26717
		SODIUM **Na = 22.997**		
10.02047	1.0483	$Ag \leftrightarrow NaBr$	0.95396	9.97953
10.26613	1.8456	$Ag \leftrightarrow NaCl$	0.54184	9.73387
9.85709	0.71956	$Ag \leftrightarrow NaI$	1.3897	10.14291

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**SODIUM** (Continued) **Na = 22.997**	Factor	Log. of factor −10
10.26122	1.8248	$AgBr \leftrightarrow NaBr$	0.54800	9.73878
10.38954	2.4521	$AgCl \leftrightarrow NaCl$	0.40781	9.61046
10.19485	1.5662	$AgI \leftrightarrow NaI$	0.63849	9.80515
10.28872	1.9441	$BaSO_4 \leftrightarrow NaHSO_4$	0.51437	9.71128
10.22800	1.6905	$BaSO_4 \leftrightarrow NaHSO_4 \cdot H_2O$	0.59156	9.77200
10.47574	2.9905	$BaSO_4 \leftrightarrow Na_2S$	0.33439	9.52426
10.26758	1.8517	$BaSO_4 \leftrightarrow Na_2SO_3$	0.54003	9.73242
9.96645	0.92565	$BaSO_4 \leftrightarrow Na_2SO_3 \cdot 7H_2O$	1.0803	10.03355
10.21568	1.6432	$BaSO_4 \leftrightarrow Na_2SO_4$	0.60858	9.78432
9.86000	0.72443	$BaSO_4 \leftrightarrow Na_2SO_4 \cdot 10H_2O$	1.3804	10.14000
9.84010	0.69199	$B_2O_3 \leftrightarrow Na_2B_4O_7$	1.4451	10.15990
9.56247	0.36515	$B_2O_3 \leftrightarrow Na_2B_4O_7 \cdot 10H_2O$	2.7386	10.43753
10.54096	3.4751	$Br \leftrightarrow Na$	0.28776	9.45904
9.89016	0.77654	$Br \leftrightarrow NaBr$	1.2878	10.10984
10.41131	2.5782	$Br \leftrightarrow Na_2O$	0.38787	9.58869
9.97746	0.94940	$CaCl_2 \leftrightarrow NaCl$	1.0533	10.02254
9.97507	0.94421	$CaCO_3 \leftrightarrow Na_2CO_3$	1.0591	10.02493
9.96829	0.92959	$CaF_2 \leftrightarrow NaF$	1.0757	10.03171
9.72349	0.52904	$CaO \leftrightarrow Na_2CO_3$	1.8902	10.27651
10.10866	1.2843	$CaSO_4 \leftrightarrow Na_2CO_3$	0.77864	9.89134
10.18803	1.5418	$Cl \leftrightarrow Na$	0.64859	9.81197
9.78289	0.60658	$Cl \leftrightarrow NaCl$	1.6486	10.21711
10.05838	1.1439	$Cl \leftrightarrow Na_2O$	0.87422	9.94162
9.61823	0.41517	$CO_2 \leftrightarrow Na_2CO_3$	2.4086	10.38177
9.85120	0.70991	$CO_2 \leftrightarrow Na_2O$	1.4086	10.14880
10.08957	1.2291	$H_3BO_3 \leftarrow Na_2B_4O_7$	0.81362	9.91043
9.81194	0.64855	$H_3BO_3 \leftrightarrow Na_2B_4O_7 \cdot 10H_2O$	1.5419	10.18806
10.74186	5.5190	$I \leftrightarrow Na$	0.18119	9.25814
9.92768	0.84660	$I \leftrightarrow NaI$	1.1812	10.07232
10.61225	4.0950	$I \leftrightarrow Na_2O$	0.24420	9.38775
10.39835	2.5024	$KBF_4 \leftrightarrow Na_2B_4O_7$	0.39962	9.60165
10.12072	1.3204	$KBF_4 \leftrightarrow Na_2B_4O_7 \cdot 10H_2O$	0.75732	9.87928
9.96075	0.91359	$Mg_2As_2O_7 \leftrightarrow Na_2HAsO_3$	1.0946	10.03925
9.92167	0.83490	$Mg_2As_2O_7 \leftrightarrow Na_2HAsO_4$	1.1977	10.07833
9.91095	0.81459	$MgCl_2 \leftrightarrow NaCl$	1.2276	10.08905
9.83173	0.67878	$Mg_2P_2O_7 \leftrightarrow Na_3PO_4$	1.4732	10.16827
9.89426	0.78390	$Mg_2P_2O_7 \leftrightarrow Na_2HPO_4$	1.2757	10.10574
9.49240	0.31074	$Mg_2P_2O_7 \leftrightarrow Na_2HPO_4 \cdot 12H_2O$	3.2181	10.50760
9.72616	0.53231	$Mg_2P_2O_7 \leftrightarrow NaNH_4HPO_4 \cdot 4H_2O$	1.8786	10.27384
9.69808	0.49898	$Mg_2P_2O_7 \leftrightarrow Na_4P_2O_7 \cdot 10H_2O$	2.0041	10.30192
10.65080	4.4751	$NaBr \leftrightarrow Na$	0.22346	9.34920
10.52115	3.3201	$NaBr \leftrightarrow Na_2O$	0.30120	9.47885
10.40514	2.5418	$NaCl \leftrightarrow Na$	0.39342	9.59486
10.04252	1.1029	$NaCl \leftrightarrow Na_2CO_3$	0.90673	9.95748
9.84246	0.69576	$NaCl \leftrightarrow NaHCO_3$	1.4373	10.15754
9.91561	0.82340	$NaCl \leftrightarrow Na_2HPO_4$	1.2148	10.08451
10.27549	1.8858	$NaCl \leftrightarrow Na_2O$	0.53028	9.72451
9.91539	0.82298	$NaCl \leftrightarrow Na_2SO_4$	1.2145	10.08439
9.87080	0.74268	$NaClO_3 \leftrightarrow AgCl$	1.3465	10.12920
10.26035	1.8212	$NaClO_3 \leftrightarrow NaCl$	0.54910	9.73965
9.93161	0.85431	$NaClO_4 \leftrightarrow AgCl$	1.1705	10.06839
10.32116	2.0949	$NaClO_4 \leftrightarrow NaCl$	0.47735	9.67884
10.36262	2.3047	$Na_2CO_3 \leftrightarrow Na$	0.43389	9.63738
9.79993	0.63086	$Na_2CO_3 \leftrightarrow NaHCO_3$	1.5851	10.20007
10.23297	1.7099	$Na_2CO_3 \leftrightarrow Na_2O$	0.58483	9.76703
10.12218	1.3249	$Na_2CO_3 \leftrightarrow NaOH$	0.75478	9.87782

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**SODIUM (Continued)** **Na = 22.997**	Factor	Log. of factor −10
10.56269	3.6533	$NaHCO_3 \leftrightarrow Na$	0.27372	9.43731
10.43304	2.7104	$NaHCO_3 \leftrightarrow Na_2O$	0.36895	9.56696
10.81418	6.5190	$NaI \leftrightarrow Na$	0.15340	9.18582
10.68453	4.8365	$NaI \leftrightarrow Na_2O$	0.20676	9.31547
10.43812	2.7424	$NaNO_3 \leftrightarrow Na_2O$	0.36465	9.56188
10.12965	1.3479	$Na_2O \leftrightarrow Na$	0.74191	9.87035
9.64012	0.43663	$Na_2O \leftrightarrow Na_2HPO_4$	2.2903	10.35988
9.56188	0.36465	$Na_2O \leftrightarrow NaNO_3$	2.7424	10.43812
9.88920	0.77483	$Na_2O \leftrightarrow NaOH$	1.2906	10.11080
9.97153	0.93655	$Na_4P_2O_7 \leftrightarrow Na_2HPO_4$	1.0677	10.02847
9.56967	0.37125	$Na_4P_2O_7 \leftrightarrow Na_2HPO_4{\cdot}12H_2O$	2.6963	10.43033
10.48975	3.0885	$Na_2SO_4 \leftrightarrow Na$	0.32378	9.51025
10.12713	1.3401	$Na_2SO_4 \leftrightarrow Na_2CO_3$	0.74622	9.87287
9.69584	0.49641	$Na_2SO_4 \leftrightarrow Na_2CO_3{\cdot}10H_2O$	2.0144	10.30416
10.36010	2.2914	$Na_2SO_4 \leftrightarrow Na_2O$	0.43641	9.63990
9.21693	0.16479	$N \leftrightarrow NaNO_3$	6.0683	10.78307
9.30183	0.20037	$NH_3 \leftrightarrow NaNO_3$	4.9908	10.69817
8.91094	0.081459	$NH_3 \leftrightarrow NaNH_4HPO_4{\cdot}4H_2O$	12.276	11.08906
9.54779	0.35301	$NO \leftrightarrow NaNO_3$	2.8327	10.45221
9.80301	0.63535	$N_2O_5 \leftrightarrow NaNO_3$	1.5739	10.19699
10.24114	1.7424	$N_2O_5 \leftrightarrow Na_2O$	0.57393	9.75886
9.69890	0.49992	$P_2O_5 \leftrightarrow Na_2HPO_4$	2.0003	10.30110
9.29704	0.19817	$P_2O_5 \leftrightarrow Na_2HPO_4{\cdot}12H_2O$	5.0462	10.70296
9.53080	0.33947	$P_2O_5 \leftrightarrow NaNH_4HPO_4{\cdot}4H_2O$	2.9458	10.46920
9.78928	0.61558	$SO_2 \leftrightarrow NaHSO_3$	1.6245	10.21072
9.70603	0.50820	$SO_2 \leftrightarrow Na_2SO_3$	1.9677	10.29397
9.40491	0.25404	$SO_2 \leftrightarrow Na_2SO_3{\cdot}7H_2O$	3.9364	10.59509
10.11107	1.2914	$SO_3 \leftrightarrow Na_2O$	0.77434	9.88893
9.75096	0.56359	$SO_3 \leftrightarrow Na_2SO_4$	1.7743	10.24904
		STRONTIUM **Sr = 87.63**		
9.47435	0.29809	$CO_2 \leftrightarrow SrCO_3$	3.3547	10.52565
9.88793	0.77256	$SO_3 \leftrightarrow SrO$	1.2944	10.11207
9.63933	0.43584	$SO_3 \leftrightarrow SrSO_4$	2.2944	10.36067
9.61704	0.41404	$Sr \leftrightarrow Sr(NO_3)_2$	2.4152	10.38296
10.22655	1.6848	$SrCO_3 \leftrightarrow Sr$	0.59354	9.77345
9.96905	0.93122	$SrCO_3 \leftrightarrow SrCl_2$	1.0739	10.03095
9.84768	0.70417	$SrCO_3 \leftrightarrow Sr(HCO_3)_2$	1.4201	10.15232
9.84359	0.69758	$SrCO_3 \leftrightarrow Sr(NO_3)_2$	1.4335	10.15641
10.07283	1.1826	$SrO \leftrightarrow Sr$	0.84560	9.92717
9.81534	0.65364	$SrO \leftrightarrow SrCl_2$	1.5299	10.18466
9.84628	0.70191	$SrO \leftrightarrow SrCO_3$	1.4247	10.15372
9.69396	0.49426	$SrO \leftrightarrow Sr(HCO_3)_2$	2.0232	10.30604
9.68988	0.48964	$SrO \leftrightarrow Sr(NO_3)_2$	2.0423	10.31012
10.32143	2.0962	$SrSO_4 \leftrightarrow Sr$	0.47705	9.67857
10.06394	1.1586	$SrSO_4 \leftrightarrow SrCl_2$	0.86311	9.93606
10.09488	1.2442	$SrSO_4 \leftrightarrow SrCO_3$	0.80375	9.90512
9.93848	0.86791	$SrSO_4 \leftrightarrow Sr(NO_3)_2$	1.1522	10.06152
10.24860	1.7726	$SrSO_4 \leftrightarrow SrO$	0.56416	9.75140
		SULFUR **S = 32.06**		
10.38136	2.4064	$As_2S_3 \leftrightarrow H_2S$	0.41556	9.61864
10.40785	2.5577	$As_2S_3 \leftrightarrow S$	0.39098	9.59215
10.59010	3.8913	$BaSO_4 \leftrightarrow FeS_2$	0.25698	9.40990
10.83569	6.8499	$BaSO_4 \leftrightarrow H_2S$	0.14599	9.16431

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**SULFUR** (Continued) **S = 32.06**	Factor	Log. of factor −10
10.45392	2.8439	$BaSO_4 \leftrightarrow H_2SO_3$	0.35162	9.54608
10.37658	2.3800	$BaSO_4 \leftrightarrow H_2SO_4$	0.42017	9.62342
10.86217	7.2807	$BaSO_4 \leftrightarrow S$	0.13735	9.13783
10.56155	3.6438	$BaSO_4 \leftrightarrow SO_2$	0.27444	9.43845
10.46472	2.9156	$BaSO_4 \leftrightarrow SO_3$	0.34299	9.53528
10.38560	2.4299	$BaSO_4 \leftrightarrow SO_4$	0.41153	9.61440
10.62733	4.2397	$CdS \leftrightarrow H_2S$	0.23587	9.37267
10.65381	4.5062	$CdS \leftrightarrow S$	0.22191	9.34619
10.08815	1.2250	$H_2SO_4 \leftrightarrow SO_3$	0.81631	9.91185
10.21762	1.6505	$(NH_4)_2SO_4 \leftrightarrow SO_3$	0.60587	9.78238
10.12947	1.3473	$(NH_4)_2SO_4 \leftrightarrow H_2SO_4$	0.74221	9.87053
10.37096	2.3494	$SO_3 \leftrightarrow H_2S$	0.42563	9.62904
		TANTALUM **Ta = 180.88**		
9.91323	0.81891	$Ta \leftrightarrow Ta_2O_5$	1.2211	10.08677
9.70331	0.50502	$Ta \leftrightarrow TaCl_5$	1.9801	10.29669
9.79007	0.61670	$Ta_2O_5 \leftrightarrow TaCl_5$	1.6215	10.20993
10.01602	1.0376	$Ta_2O_5 \leftrightarrow Ta_2O_4$	0.96378	9.98398
		TELLURIUM **Te = 127.61**		
9.81892	0.65905	$Te \leftrightarrow H_2TeO_4$	1.5173	10.18108
9.74480	0.55565	$Te \leftrightarrow H_2TeO_4 \cdot 2H_2O$	1.7997	10.25520
9.90282	0.79951	$Te \leftrightarrow TeO_2$	1.2508	10.09718
9.86134	0.72667	$Te \leftrightarrow TeO_3$	1.3761	10.13866
10.19436	1.5645	$(TeO_2)_2SO_3 \leftrightarrow Te$	0.63920	9.80564
		THALLIUM **Tl = 204.39**		
9.94051	0.87199	$Tl \leftrightarrow Tl_2CO_3$	1.1468	10.05949
9.93053	0.85217	$Tl \leftrightarrow TlCl$	1.1735	10.06947
9.79023	0.61692	$Tl \leftrightarrow TlI$	1.6210	10.20977
9.88493	0.76724	$Tl \leftrightarrow TlNO_3$	1.3034	10.11507
9.98333	0.96233	$Tl \leftrightarrow Tl_2O$	1.0391	10.01667
10.10850	1.2838	$Tl_2CrO_4 \leftrightarrow Tl$	0.77894	9.89150
10.16877	1.4749	$TlHSO_4 \leftrightarrow Tl$	0.67801	9.83123
10.30060	1.9980	$Tl_2PtCl_6 \leftrightarrow Tl$	5.0049	9.69940
10.23113	1.7027	$Tl_2PtCl_6 \leftrightarrow TlCl$	0.58732	9.76887
10.24111	1.7423	$Tl_2PtCl_6 \leftrightarrow Tl_2CO_3$	0.57397	9.75889
10.09083	1.2326	$Tl_2PtCl_6 \leftrightarrow TlI$	0.81129	9.90917
10.18553	1.5330	$Tl_2PtCl_6 \leftrightarrow TlNO_3$	0.65234	9.81447
10.28393	1.9228	$Tl_2PtCl_6 \leftrightarrow Tl_2O$	0.52008	9.71607
10.20894	1.6178	$Tl_2PtCl_6 \leftrightarrow Tl_2SO_4$	0.61811	9.79106
10.09166	1.2350	$Tl_2SO_4 \leftrightarrow Tl$	0.80972	9.90834
		THORIUM **Th = 232.12**		
10.05609	1.1379	$ThO_2 \leftrightarrow Th$	0.87884	9.94391
9.84899	0.70630	$ThO_2 \leftrightarrow ThCl_4$	1.4158	10.15101
9.65224	0.44900	$ThO_2 \leftrightarrow Th(NO_3)_4 \cdot 6H_2O$	2.2272	10.34776
		TIN **Sn = 118.70**		
9.79658	0.62601	$Sn \leftrightarrow SnCl_2$	1.5974	10.20342

GRAVIMETRIC FACTORS AND THEIR LOGARITHMS

Log. of factor −10	Factor	**TIN (Continued)** **Sn = 118.70**	Factor	Log. of factor −10
9.72102	0.52605	$Sn \leftrightarrow SnCl_2 \cdot 2H_2O$	1.9010	10.27898
9.65860	0.45561	$Sn \leftrightarrow SnCl_4$	2.1948	10.34140
9.50917	0.32298	$Sn \leftrightarrow SnCl_4 \cdot (NH_4Cl)_2$	3.0962	10.49083
9.94508	0.88122	$Sn \leftrightarrow SnO$	1.1348	10.05492
9.89634	0.78766	$Sn \leftrightarrow SnO_2$	1.2696	10.10366
9.90024	0.79477	$SnO_2 \leftrightarrow SnCl_2$	1.2582	10.09976
9.82469	0.66786	$SnO_2 \leftrightarrow SnCl_2 \cdot 2H_2O$	1.4973	10.17531
9.76226	0.57844	$SnO_2 \leftrightarrow SnCl_4$	1.7288	10.23774
9.61283	0.41005	$SnO_2 \leftrightarrow SnCl_4 \cdot (NH_4Cl)_2$	2.4388	10.38717
10.04875	1.1188	$SnO_2 \leftrightarrow SnO$	0.89383	9.95125
		TITANIUM **Ti = 47.90**		
10.22221	1.6681	$TiO_2 \leftrightarrow Ti$	0.59950	9.77779
		TUNGSTEN **W = 183.92**		
10.06966	1.1740	$WO_2 \leftrightarrow W$	0.85180	9.93034
10.10071	1.2610	$WO_3 \leftrightarrow W$	0.79303	9.89929
		URANIUM **U = 238.07**		
10.05477	1.1344	$UO_2 \leftrightarrow U$	0.88151	9.94523
10.07159	1.1792	$U_3O_8 \leftrightarrow U$	0.84802	9.92841
10.01682	1.0395	$U_3O_8 \leftrightarrow UO_2$	0.96200	9.98318
9.74744	0.55903	$U_3O_8 \leftrightarrow UO_2(NO_3)_2 \cdot 6H_2O$	1.7888	10.25256
10.17605	1.4999	$U_2P_2O_{11} \leftrightarrow U$	0.66673	9.82395
10.12128	1.3221	$U_2P_2O_{11} \leftrightarrow UO_2$	0.75635	9.87872
		VANADIUM **V = 50.95**		
10.25166	1.7851	$V_2O_5 \leftrightarrow V$	0.56020	9.74834
9.89829	0.79121	$V_2O_5 \leftrightarrow VO_4$	1.2639	10.10171
		YTTERBIUM **Yb = 173.04**		
10.05641	1.1387	$Yb_2O_3 \leftrightarrow Yb$	0.87820	9.94359
		ZINC **Zn = 65.38**		
10.37940	2.3955	$BaSO_4 \leftrightarrow ZnS$	0.41744	9.62060
9.90942	0.81175	$BaSO_4 \leftrightarrow ZnSO_4 \cdot 7H_2O$	1.2319	10.09058
9.90493	0.80339	$Zn \leftrightarrow ZnO$	1.2447	10.09507
10.43595	2.7287	$ZnNH_4PO_4 \leftrightarrow Zn$	0.36648	9.56405
10.34088	2 1922	$ZnNH_4PO_4 \leftrightarrow ZnO$	0.45616	9.65912
9.77604	0.59709	$ZnO \leftrightarrow ZnCl_2$	1.6748	10.22396
9.81229	0.64907	$ZnO \leftrightarrow ZnCO_3$	1.5407	10.18771
9.45180	0.28301	$ZnO \leftrightarrow ZnSO_4 \cdot 7H_2O$	3.5335	10.54820
10.36743	2.3304	$Zn_2P_2O_7 \leftrightarrow Zn$	0.42912	9.63257
10.27235	1.8722	$Zn_2P_2O_7 \leftrightarrow ZnO$	0.53413	9.72765
10.17329	1.4904	$ZnS \leftrightarrow Zn$	0.67098	9.82671
10.07822	1.1973	$ZnS \leftrightarrow ZnO$	0.83518	9.92178
9.53002	0.33886	$ZnS \leftrightarrow ZnSO_4 \cdot 7H_2O$	2.9511	10.46998
		ZIRCONIUM **Zr = 91.22**		
10.13059	1.3508	$ZrO_2 \leftrightarrow Zr$	0.74030	9.86941
9.66714	0.46467	$ZrO_2 \leftrightarrow ZrP_2O_7$	2.1521	10.33286

CUPROUS OXIDE AND COPPER EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE *

Method of Munson and Walker, *Jour. Amer. Chem. Soc.* 28, 663, (1906).

Twenty five ml. (25 ml.) of Fehling Solution A and 25 ml. of Fehling Solution B as modified by the Assoc. of Official Agricultural Chemists (for preparation of these solutions see under *Special Reagents and Solutions*) are added to 50 ml. of the sugar solution in a 400 ml. beaker (when a smaller volume of sugar solution must be used, sufficient water must be added to make the final volume of solution 100 ml.) and the mixture heated at such a rate that a boiling temperature is obtained in four minutes and the boiling continued for exactly two minutes longer, keeping the beaker covered with a watch glass throughout the entire time of heating; the mixture is immediately filtered with suction through a Gooch crucible, washing the precipitated cuprous oxide first with water at 60°C., then with 10 ml. of alcohol and finally with 100 ml. of ether; after drying for 30 minutes at 100°C. and cooling in a desiccator it is weighed as cuprous oxide.

(Values in the Table Expressed in Milligrams)

Cuprous Oxide (Cu_2O)	Copper (Cu)	Dextrose (*d*-Glucose)	Invert Sugar	Lactose $C_{12}H_{22}O_{11}+H_2O$	Maltose $C_{12}H_{22}O_{11}+H_2O$
10	8.9	4.0	4.5	6.3	6.2
11	9.8	4.5	5.0	6.9	7.0
12	10.7	4.9	5.4	7.5	7.9
13	11.5	5.3	5.8	8.2	8.7
14	12.4	5.7	6.3	8.8	9.5
15	13.3	6.2	6.7	9.4	10.4
16	14.2	6.6	7.2	10.0	11.2
17	15.1	7.0	7.6	10.7	12.0
18	16.0	7.5	8.1	11.3	12.9
19	16.9	7.9	8.5	11.9	13.7
20	17.8	8.3	8.9	12.5	14.6
21	18.7	8.7	9.4	13.2	15.4
22	19.5	9.2	9.8	13.8	16.2
23	20.4	9.6	10.3	14.4	17.1
24	21.3	10.0	10.7	15.0	17.9
25	22.2	10.5	11.2	15.7	18.7
26	23.1	10.9	11.6	16.3	19.6
27	24.0	11.3	12.0	16.9	20.4
28	24.9	11.8	12.5	17.6	21.2
29	25.8	12.2	12.9	18.2	22.1
30	26.6	12.6	13.4	18.8	22.9
31	27.5	13.1	13.8	19.4	23.7
32	28.4	13.5	14.3	20.1	24.6
33	29.3	13.9	14.7	20.7	25.4
34	30.2	14.3	15.2	21.4	26.2
35	31.1	14.8	15.6	22.1	27.1
36	32.0	15.2	16.1	22.8	27.9
37	32.9	15.6	16.5	23.5	28.7
38	33.8	16.1	16.9	24.2	29.6
39	34.6	16.5	17.4	24.8	30.4
40	35.5	16.9	17.8	25.5	31.3
41	36.4	17.4	18.3	26.2	32.1
42	37.3	17.8	18.7	26.9	32.9
43	38.2	18.2	19.2	27.6	33.8
44	39.1	18.7	19.6	28.3	34.6
45	40.0	19.1	20.1	28.9	35.4
46	40.9	19.6	20.5	29.6	36.3
47	41.7	20.0	21.0	30.3	37.1
48	42.6	20.4	21.4	31.0	37.9
49	43.5	20.9	21.9	31.7	38.8
50	44.4	21.3	22.3	32.3	39.6
51	45.3	21.7	22.8	33.0	40.4
52	46.2	22.2	23.2	33.7	41.3
53	47.1	22.6	23.7	34.4	42.1
54	48.0	23.0	24.1	35.1	42.9

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* For better values see following table of values by Hammond.

CUPROUS OXIDE AND COPPER EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE

Cuprous Oxide (Cu_2O)	Copper (Cu)	Dextrose (*d*-Glucose)	Invert Sugar	Lactose $C_{12}H_{22}O_{11}+H_2O$	Maltose $C_{12}H_{22}O_{11}+H_2O$
55	48.9	23.5	24.6	35.8	43.8
56	49.7	23.9	25.0	36.4	44.6
57	50.6	24.3	25.5	37.1	45.4
58	51.5	24.8	25.9	37.8	46.3
59	52.4	25.2	26.4	38.5	47.1
60	53.3	25.6	26.8	39.2	48.0
61	54.2	26.1	27.3	39.9	48.8
62	55.1	26.5	27.7	40.5	49.6
63	56.0	27.0	28.2	41.2	50.5
64	56.8	27.4	28.6	41.9	51.3
65	57.7	27.8	29.1	42.6	52.1
66	58.6	28.3	29.5	43.3	53.0
67	59.5	28.7	30.0	44.0	53.8
68	60.4	29.2	30.4	44.7	54.6
69	61.3	29.6	30.9	45.3	55.5
70	62.2	30.0	31.3	46.0	56.3
71	63.1	30.5	31.8	46.7	57.1
72	64.0	30.9	32.3	47.4	58.0
73	64.8	31.4	32.7	48.1	58.8
74	65.7	31.8	33.2	48.8	59.6
75	66.6	32.2	33.6	49.4	60.5
76	67.5	32.7	34.1	50.1	61.3
77	68.4	33.1	34.5	50.8	62.1
78	69.3	33.6	35.0	51.5	63.0
79	70.2	34.0	35.4	52.2	63.8
80	71.1	34.4	35.9	52.9	64.6
81	71.9	34.9	36.3	53.6	65.5
82	72.8	35.3	36.8	54.2	66.3
83	73.7	35.8	37.3	54.9	67.1
84	74.6	36.2	37.7	55.6	68.0
85	75.5	36.7	38.2	56.3	68.8
86	76.4	37.1	38.6	57.0	69.7
87	77.3	37.5	39.1	57.7	70.5
88	78.2	38.0	39.5	58.4	71.3
89	79.1	38.4	40.0	59.0	72.2
90	79.9	38.9	40.4	59.7	73.0
91	80.8	39.3	40.9	60.4	73.8
92	81.7	39.8	41.4	61.1	74.7
93	82.6	40.2	41.8	61.8	75.5
94	83.5	40.6	42.3	62.5	76.3
95	84.4	41.1	42.7	63.2	77.2
96	85.3	41.5	43.2	63.8	78.0
97	86.2	42.0	43.7	64.5	78.8
98	87.1	42.4	44.1	65.2	79.7
99	87.9	42.9	44.6	65.9	80.5
100	88.8	43.3	45.0	66.6	81.3
101	89.7	43.8	45.5	67.3	82.2
102	90.6	44.2	46.0	68.0	83.0
103	91.5	44.7	46.4	68.7	83.8
104	92.4	45.1	46.9	69.3	84.7
105	93.3	45.5	47.3	70.0	85.5
106	94.2	46.0	47.8	70.7	86.3
107	95.0	46.4	48.3	71.4	87.2
108	95.9	46.9	48.7	72.1	88.0
109	96.8	47.3	49.2	72.8	88.8
110	97.7	47.8	49.6	73.5	89.7
111	98.6	48.2	50.1	74.2	90.5
112	99.5	48.7	50.6	74.8	91.3
113	100.4	49.1	51.1	75.5	92.2
114	101.3	49.6	51.5	76.2	93.0
115	102.2	50.0	51.9	76.9	93.9
116	103.0	50.5	52.4	77.6	94.7

CUPROUS OXIDE AND COPPER EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE

Cuprous Oxide (Cu_2O)	Copper (Cu)	Dextrose (*d*-Glucose)	Invert Sugar	Lactose $C_{12}H_{22}O_{11} + H_2O$	Maltose $C_{12}H_{22}O_{11} + H_2O$
117	103.9	50.9	52.9	78.3	95.5
118	104.8	51.4	53.3	79.0	96.4
119	105.7	51.8	53.8	79.6	97.2
120	106.6	52.3	54.3	80.3	98.0
121	107.5	52.7	54.7	81.0	98.9
122	108.4	53.2	55.2	81.7	99.7
123	109.3	53.6	55.7	82.4	100.5
124	110.1	54.1	56.1	83.1	101.4
125	111.0	54.5	56.6	83.8	102.2
126	111.9	55.0	57.0	84.5	103.0
127	112.8	55.4	57.5	85.1	103.9
128	113.7	55.9	58.0	85.8	104.7
129	114.6	56.3	58.4	86.5	105.5
130	115.5	56.8	58.9	87.2	106.4
131	116.4	57.2	59.4	87.9	107.2
132	117.3	57.7	59.8	88.6	108.0
133	118.1	58.1	60.3	89.3	108.9
134	119.0	58.6	60.8	90.0	109.7
135	119.9	59.0	61.2	90.6	110.5
136	120.8	59.5	61.7	91.3	111.4
137	121.7	60.0	62.2	92.0	112.2
138	122.6	60.4	62.6	92.7	113.0
139	123.5	60.9	63.1	93.4	113.9
140	124.4	61.3	63.6	94.1	114.7
141	125.2	61.8	64.0	94.8	115.5
142	126.1	62.2	64.5	95.5	116.4
143	127.0	62.7	65.0	96.1	117.2
144	127.9	63.1	65.4	96.8	118.0
145	128.8	63.6	65.9	97.5	118.9
146	129.7	64.0	66.4	98.2	119.7
147	130.6	64.5	66.9	98.9	120.5
148	131.5	65.0	67.3	99.6	121.4
149	132.4	65.4	67.8	100.3	122.2
150	133.2	65.9	68.3	101.0	123.0
151	134.1	66.3	68.7	101.6	123.9
152	135.0	66.8	69.2	102.3	124.7
153	135.9	67.2	69.7	103.0	125.5
154	136.8	67.7	70.1	103.7	126.4
155	137.7	68.2	70.6	104.4	127.2
156	138.6	68.6	71.1	105.1	128.0
157	139.5	69.1	71.6	105.8	128.9
158	140.3	69.5	72.0	106.5	129.7
159	141.2	70.0	72.5	107.2	130.5
160	142.1	70.4	73.0	107.9	131.4
161	143.0	70.9	73.4	108.5	132.2
162	143.9	71.4	73.9	109.2	133.0
163	144.8	71.8	74.4	109.9	133.9
164	145.7	72.3	74.9	110.6	134.7
165	146.6	72.8	75.3	111.3	135.5
166	147.5	73.2	75.8	112.0	136.4
167	148.3	73.7	76.3	112.7	137.2
168	149.2	74.1	76.8	113.4	138.0
169	150.1	74.6	77.2	114.1	138.9
170	151.0	75.1	77.7	114.8	139.7
171	151.9	75.5	78.2	115.4	140.5
172	152.8	76.0	78.7	116.1	141.4
173	153.7	76.4	79.1	116.8	142.2
174	154.6	76.9	79.6	117.5	143.0
175	155.5	77.4	80.1	118.2	143.9
176	156.3	77.8	80.6	118.9	144.7
177	157.2	78.3	81.0	119.6	145.5
178	158.1	78.8	81.5	120.3	146.4

CUPROUS OXIDE AND COPPER EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE

Cuprous Oxide (Cu_2O)	Copper (Cu)	Dextrose (*d*-Glucose)	Invert Sugar	Lactose $C_{12}H_{22}O_{11}+H_2O$	Maltose $C_{12}H_{22}O_{11}+H_2O$
179	159.0	79.2	82.0	121.0	147.2
180	159.9	79.7	82.5	121.6	148.0
181	160.8	80.1	82.9	122.3	148.9
182	161.7	80.6	83.4	123.1	149.7
183	162.6	81.1	83.9	123.7	150.5
184	163.4	81.5	84.4	124.3	151.4
185	164.3	82.0	84.9	125.1	152.2
186	165.2	82.5	85.3	125.8	153.0
187	166.1	82.9	85.8	126.5	153.9
188	167.0	83.4	86.3	127.2	154.7
189	167.9	83.9	86.8	127.9	155.5
190	168.8	84.3	87.2	128.5	156.4
191	169.7	84.8	87.7	129.2	157.2
192	170.5	85.3	88.2	129.9	158.0
193	171.4	85.7	88.7	130.6	158.9
194	172.3	86.2	89.2	131.3	159.7
195	173.2	86.7	89.6	132.0	160.5
196	174.1	87.1	90.1	132.7	161.4
197	175.0	87.6	90.6	133.4	162.2
198	175.9	88.1	91.1	134.1	163.0
199	176.8	88.5	91.6	134.8	163.9
200	177.7	89.0	92.0	135.4	164.7
201	178.5	89.5	92.5	136.1	165.5
202	179.4	89.9	93.0	136.8	166.4
203	180.3	90.4	93.5	137.5	167.2
204	181.2	90.9	94.0	138.2	168.0
205	182.1	91.4	94.5	138.9	168.9
206	183.0	91.8	94.9	139.6	169.7
207	183.9	92.3	95.4	140.3	170.5
208	184.8	92.8	95.9	141.0	171.4
209	185.6	93.2	96.4	141.7	172.2
210	186.5	93.7	96.9	142.3	173.0
211	187.4	94.2	97.4	143.0	173.8
212	188.3	94.6	97.8	143.7	174.7
213	189.2	95.1	98.3	144.4	175.5
214	190.1	95.6	98.8	145.1	176.4
215	191.0	96.1	99.3	145.8	177.2
216	191.9	96.5	99.8	146.5	178.0
217	192.8	97.0	100.3	147.2	178.9
218	193.6	97.5	100.8	147.9	179.7
219	194.5	98.0	101.2	148.6	180.5
220	195.4	98.4	101.7	149.3	181.4
221	196.3	98.9	102.2	150.0	182.2
222	197.2	99.4	102.7	150.7	183.0
223	198.1	99.9	103.2	151.3	183.9
224	199.0	100.3	103.7	152.0	184.7
225	199.9	100.8	104.2	152.7	185.5
226	200.7	101.3	104.6	153.4	186.4
227	201.6	101.8	105.1	154.1	187.2
228	202.5	102.2	105.6	154.8	188.0
229	203.4	102.7	106.1	155.5	188.8
230	204.3	103.2	106.6	156.2	189.7
231	205.2	103.7	107.1	156.9	190.5
232	206.1	104.1	107.6	157.6	191.3
233	207.0	104.6	108.1	158.3	192.2
234	207.9	105.1	108.6	159.0	193.0
235	208.7	105.6	109.1	159.6	193.8
236	209.6	106.0	109.5	160.3	194.7
237	210.5	106.5	110.0	161.0	195.5
238	211.4	107.0	110.5	161.7	196.3
239	212.3	107.5	111.0	162.4	197.2
240	213.2	108.0	111.5	163.1	198.0

CUPROUS OXIDE AND COPPER EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE

Cuprous Oxide (Cu_2O)	Copper (Cu)	Dextrose (*d*-Glucose)	Invert Sugar	Lactose $C_{12}H_{22}O_{11}+H_2O$	Maltose $C_{12}H_{22}O_{11}+H_2O$
241	214.1	108.4	112.0	163.8	198.8
242	215.0	108.9	112.5	164.5	199.7
243	215.8	109.4	113.0	165.2	200.5
244	216.7	109.9	113.5	165.9	201.3
245	217.6	110.4	114.0	166.6	202.2
246	218.5	110.8	114.5	167.3	203.0
247	219.4	111.3	115.0	168.0	203.8
248	220.3	111.8	115.4	168.7	204.7
249	221.2	112.3	115.9	169.4	205.5
250	222.1	112.8	116.4	170.1	206.3
251	223.0	113.2	116.9	170.8	207.2
252	223.8	113.7	117.4	171.5	208.0
253	224.7	114.2	117.9	172.1	208.8
254	225.6	114.7	118.4	172.8	209.7
255	226.5	115.2	118.9	173.5	210.5
256	227.4	115.7	119.4	174.2	211.3
257	228.3	116.1	119.9	174.9	212.2
258	229.2	116.6	120.4	175.6	213.0
259	230.1	117.1	120.9	176.3	213.8
260	231.0	117.6	121.4	177.0	214.7
261	231.8	118.1	121.9	177.7	215.5
262	232.7	118.6	122.4	178.4	216.3
263	233.6	119.0	122.9	179.1	217.2
264	234.5	119.5	123.4	179.8	218.0
265	235.4	120.0	123.9	180.5	218.8
266	236.3	120.5	124.4	181.2	219.7
267	237.2	121.0	124.9	181.9	220.5
268	238.1	121.5	125.4	182.6	221.3
269	238.9	122.0	125.9	183.3	222.1
270	239.8	122.5	126.4	184.0	223.0
271	240.7	122.9	126.9	184.6	223.8
272	241.6	123.4	127.4	185.3	224.6
273	242.5	123.9	127.9	186.0	225.5
274	243.4	124.4	128.4	186.7	226.3
275	244.3	124.9	128.9	187.4	227.1
276	245.2	125.4	129.4	188.1	228.0
277	246.1	125.9	129.9	188.8	228.8
278	246.9	126.4	130.4	189.5	229.6
279	247.8	126.9	130.9	190.2	230.5
280	248.7	127.3	131.4	190.9	231.3
281	249.6	127.8	131.9	191.6	232.1
282	250.5	128.3	132.4	192.3	233.0
283	251.4	128.8	132.9	193.0	233.8
284	252.3	129.3	133.4	193.7	234.6
285	253.2	129.8	133.9	194.4	235.5
286	254.0	130.3	134.4	195.1	236.3
287	254.9	130.8	134.9	195.8	237.1
288	255.8	131.3	135.4	196.5	238.0
289	256.7	131.8	135.9	197.1	238.8
290	257.6	132.3	136.4	197.8	239.6
291	258.5	132.7	136.9	198.5	240.5
292	259.4	133.2	137.4	199.2	241.3
293	260.3	133.7	137.9	199.9	242.1
294	261.2	134.2	138.4	200.6	242.9
295	262.0	134.7	138.9	201.3	243.8
296	262.9	135.2	139.4	202.0	244.6
297	263.8	135.7	140.0	202.7	245.4
298	264.7	136.2	140.5	203.4	246.3
299	265.6	136.7	141.0	204.1	247.1
300	266.5	137.2	141.5	204.8	247.9
301	267.4	137.7	142.0	205.5	248.8
302	268.3	138.2	142.5	206.2	249.6

CUPROUS OXIDE AND COPPER EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE

Cuprous Oxide (Cu_2O)	Copper (Cu)	Dextrose (*d*-Glucose)	Invert Sugar	Lactose $C_{12}H_{22}O_{11} + H_2O$	Maltose $C_{12}H_{22}O_{11} + H_2O$
303	269.1	138.7	143.0	206.9	250.4
304	270.0	139.2	143.5	207.6	251.3
305	270.9	139.7	144.0	208.3	252.1
306	271.8	140.2	144.5	209.0	252.9
307	272.7	140.7	145.0	209.7	253.8
308	273.6	141.2	145.5	210.4	254.6
309	274.5	141.7	146.1	211.1	255.4
310	275.4	142.2	146.6	211.8	256.3
311	276.3	142.7	147.1	212.5	257.1
312	277.1	143.2	147.6	213.2	257.9
313	278.0	143.7	148.1	213.9	258.8
314	278.9	144.2	148.6	214.6	259.6
315	279.8	144.7	149.1	215.3	260.4
316	280.7	145.2	149.6	216.0	261.2
317	281.6	145.7	150.1	216.6	262.1
318	282.5	146.2	150.7	217.3	262.9
319	283.4	146.7	151.2	218.0	263.7
320	284.2	147.2	151.7	218.7	264.6
321	285.1	147.7	152.2	219.4	265.4
322	286.0	148.2	152.7	220.1	266.2
323	286.9	148.7	153.2	220.8	267.1
324	287.8	149.2	153.7	221.5	267.9
325	288.7	149.7	154.3	222.2	268.7
326	289.6	150.2	154.8	222.9	269.6
327	290.5	150.7	155.3	223.6	270.4
328	291.4	151.2	155.8	224.3	271.2
329	292.2	151.7	156.3	225.0	272.1
330	293.1	152.2	156.8	225.7	272.9
331	294.0	152.7	157.3	226.4	273.7
332	294.9	153.2	157.9	227.1	274.6
333	295.8	153.7	158.4	227.8	275.4
334	296.7	154.2	158.9	228.5	276.2
335	297.6	154.7	159.4	229.2	277.0
336	298.5	155.2	159.9	229.9	277.9
337	299.3	155.8	160.5	230.6	278.7
338	300.2	156.3	161.0	231.3	279.5
339	301.1	156.8	161.5	232.0	280.4
340	302.0	157.3	162.0	232.7	281.2
341	302.9	157.8	162.5	233.4	282.0
342	303.8	158.3	163.1	234.1	282.9
343	304.7	158.8	163.6	234.8	283.7
344	305.6	159.3	164.1	235.5	284.5
345	306.5	159.8	164.6	236.2	285.4
346	307.3	160.3	165.1	236.9	286.2
347	308.2	160.8	165.7	237.6	287.0
348	309.1	161.4	166.2	238.3	287.9
349	310.0	161.9	166.7	239.0	288.7
350	310.9	162.4	167.2	239.7	289.5
351	311.8	162.9	167.7	240.1	290.4
352	312.7	163.4	168.3	241.1	291.2
353	313.6	163.9	168.8	241.8	292.0
354	314.4	164.4	169.3	242.5	292.8
355	315.3	164.9	169.8	243.2	293.7
356	316.2	165.4	170.4	243.9	294.5
357	317.1	166.0	170.9	244.6	295.3
358	318.0	166.5	171.4	245.3	296.2
359	318.9	167.0	171.9	246.0	297.0
360	319.8	167.5	172.5	246.7	297.8
361	320.7	168.0	173.0	247.4	298.7
362	321.6	168.5	173.5	248.1	299.5
363	322.4	169.0	174.0	248.8	300.3
364	323.3	169.6	174.6	249.5	301.2

CUPROUS OXIDE AND COPPER EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE

Cuprous Oxide (Cu_2O)	Copper (Cu)	Dextrose (*d*-Glucose)	Invert Sugar	Lactose $C_{12}H_{22}O_{11} + H_2O$	Maltose $C_{12}H_{22}O_{11} + H_2O$
365	324.2	170.1	175.1	250.2	302.0
366	325.1	170.6	175.6	250.9	302.8
367	326.0	171.1	176.1	251.6	303.6
368	326.9	171.6	176.7	252.3	304.5
369	327.8	172.1	177.2	253.0	305.3
370	328.7	172.7	177.7	253.7	306.1
371	329.5	173.2	178.3	254.4	307.0
372	330.4	173.7	178.8	255.1	307.8
373	331.3	174.2	179.3	255.8	308.6
374	332.2	174.7	179.8	256.5	309.5
375	333.1	175.3	180.4	257.2	310.3
376	334.0	175.8	180.9	257.9	311.1
377	334.9	176.3	181.4	258.6	312.0
378	335.8	176.8	182.0	259.3	312.8
379	336.7	177.3	182.5	260.0	313.6
380	337.5	177.9	183.0	260.7	314.5
381	338.4	178.4	183.6	261.4	315.3
382	339.3	178.9	184.1	262.1	316.1
383	340.2	179.4	184.6	262.8	316.9
384	341.1	180.0	185.2	263.5	317.8
385	342.0	180.5	185.7	264.2	318.6
386	342.9	181.0	186.2	264.9	319.4
387	343.8	181.5	186.8	265.6	320.3
388	344.6	182.0	187.3	266.3	321.1
389	345.5	182.6	187.8	267.0	321.9
390	346.4	183.1	188.4	267.7	322.8
391	347.3	183.6	188.9	268.4	323.6
392	348.2	184.1	189.4	269.1	324.4
393	349.1	184.7	190.0	269.8	325.2
394	350.0	185.2	190.5	270.5	326.1
395	350.9	185.7	191.0	271.2	326.9
396	351.8	186.2	191.6	271.9	327.7
397	352.6	186.8	192.1	272.6	328.6
398	353.5	187.3	192.7	273.3	329.4
399	354.4	187.8	193.2	274.0	330.2
400	355.3	188.4	193.7	274.7	331.1
401	356.2	188.9	194.3	275.4	331.9
402	357.1	189.4	194.8	276.1	332.7
403	358.0	189.9	195.4	276.8	333.6
404	358.9	190.5	195.9	277.5	334.4
405	359.7	191.0	196.4	278.2	335.2
406	360.6	191.5	197.0	278.9	336.0
407	361.5	192.1	197.5	279.6	336.9
408	362.4	192.6	198.1	280.3	337.7
409	363.3	193.1	198.6	281.0	338.5
410	364.2	193.7	199.1	281.7	339.4
411	365.1	194.2	199.7	282.4	340.2
412	366.0	194.7	200.2	283.2	341.0
413	366.9	195.2	200.8	283.9	341.9
414	367.7	195.8	201.3	284.6	342.7
415	368.6	196.3	201.8	285.3	343.5
416	369.5	196.8	202.4	286.0	344.4
417	370.4	197.4	202.9	286.7	345.2
418	371.3	197.9	203.5	287.4	346.0
419	372.2	198.4	204.0	288.1	346.8
420	373.1	199.0	204.6	288.8	347.7
421	374.0	199.5	205.1	289.5	348.5
422	374.8	200.1	205.7	290.2	349.3
423	375.7	200.6	206.2	290.9	350.2
424	376.6	201.1	206.7	291.6	351.0
425	377.5	201.7	207.3	292.3	351.8
426	378.4	202.2	207.8	293.0	352.7

CUPROUS OXIDE AND COPPER EQUIVALENT OF DEXTROSE, INVERT SUGAR, LACTOSE AND MALTOSE

Cuprous Oxide (Cu_2O)	Copper (Cu)	Dextrose (*d*-Glucose)	Invert Sugar	Lactose $C_{12}H_{22}O_{11}+H_2O$	Maltose $C_{12}H_{22}O_{11}+H_2O$
427	379.3	202.8	208.4	293.7	353.5
428	380.2	203.3	208.9	294.4	354.3
429	381 1	203.8	209.5	295.1	355.1
430	382.0	204.4	210.0	295.8	356.0
431	382.8	204.9	210.6	296.5	356.8
432	383.7	205.5	211.1	297.2	357.6
433	384.6	206.0	211.7	297.9	358.5
434	385.5	206.5	212.2	298.6	359.3
435	386.4	207.1	212.8	299.3	360.1
436	387.3	207.6	213.3	300.0	361.0
437	388.2	208.2	213.9	300.7	361.8
438	389.1	208.7	214.4	301.4	362.6
439	390.0	209.2	215.0	302.1	363.4
440	390.8	209.8	215.5	302.8	364.3
441	391.7	210.3	216.1	303.5	365.1
442	392.6	210.9	216.6	304.2	365.9
443	393.5	211.4	217.2	304.9	366.8
444	394.4	212.0	217.8	305.6	367.6
445	395.3	212.5	218.3	306.3	368.4
446	396.2	213.1	218.9	307.0	369.3
447	397.1	213.6	219.4	307.7	370.1
448	397.9	214.1	220.0	308.4	370.9
449	398.8	214.7	220.5	309.1	371.7
450	399.7	215.2	221.1	309.9	372.6
451	400.6	215.8	221.6	310.6	373.4
452	401.5	216.3	222.2	311.3	374.2
453	402.4	216.9	222.8	312.0	375.1
454	403.3	217.4	223.3	312.7	375.9
455	404.2	218.0	223.9	313.4	376.7
456	405.1	218.5	224.4	314.1	377.6
457	405.9	219.1	225.0	314.8	378.4
458	406.8	219.6	225.5	315.5	379.2
459	407.7	220.2	226.1	316.2	380.0
460	408.6	220.7	226.7	316.9	380.9
461	409.5	221.3	227.3	317.6	381.7
462	410.4	221.8	227.8	318.3	382.5
463	411.3	222.4	228.3	319.0	383.4
464	412.2	222.9	228.9	319.7	384.2
465	413.0	223.5	229.5	320.4	385.0
466	413.9	224.0	230.0	321.1	385.9
467	414.8	224.6	230.6	321.8	386.7
468	415.7	225.1	231.1	322.5	387.5
469	416.6	225.7	231.7	323.2	388.3
470	417.5	226.2	232.3	323.9	389.2
471	418.4	226.8	232.8	324.6	390.0
472	419.3	227.4	233.4	325.3	390.8
473	420.2	227.9	234.0	326.0	391.7
474	421.0	228.3	234.5	326.8	392.5
475	421.9	229.0	235.1	327.5	393.3
476	422.8	229.6	235.7	328.2	394.2
477	423.7	230.1	236.2	328.9	395.0
478	424.6	230.7	236.8	329.6	395.8
479	425.5	231.3	237.4	330.3	396.6
480	426.4	231.8	237.9	331.0	397.5
481	427.3	232.4	238.5	331.7	398.3
482	428.1	232.9	239.1	332.4	399.1
483	429.0	233.5	239.6	333.1	400.0
484	429.9	234.1	240.2	333.8	400.8
485	430.8	234.6	240.8	334.5	401.6
486	431.7	235.2	241.4	335.2	402.4
487	432.6	235.7	241.9	335.9	403.3
488	433.5	236.3	242.5	336.6	404.1
489	434.4	236.9	243.1	337.3	404.9
490	435.3	237.4	243.6	338.0	405.8

MUNSON-WALKER REDUCING-SUGAR VALUES

Cf. Lester D. Hammond, *Jour. Res. Natl. Bu. Stand. 24, 579 (1940).*

Sugars of higher purity than those originally used in making up the Munson-Walker determinations having become available, a redetermination of the earlier work has been made by Hammond. To this have been added the values for levulose, as well as the values for an additional sugar mixture containing 0.3 g. of total sugar. This latter mixture extends the adaptability of the method to include such products as simulated molasses, which contain such high percentages of invert sugar in the total sugar present that neither column of sugar-mixture values in the original Munson-Walker table was directly applicable. The invert sugar used in the determination of the values given in the following table were prepared by taking equal weights of crystalline dextrose and levulose. The conditions of the Munson-Walker method [1] were followed, except that the copper was determined electrolytically and the solution was heated by electricity.

The 400 ml. beaker is placed in an electric heater such that the 100 ml. of solution it contains is entirely surrounded by a nest of the resistance wire. The electric current is adjusted so that the solution can be brought to boiling in the 4-minute interval used in the method to within ±5 seconds.

The cuprous oxide is transferred to a Gooch crucible, washed, and then dissolved by the slow dropwise addition of 5 ml. of 1:1 nitric acid. The copper nitrate is received in a 250 ml. beaker, and 10 ml. of 1:1 nitric acid added, as well as about 5 g. of ammonium sulfate. Enough water to cover the cylindrical platinum-gauze electrodes is added, making the total volume of electrolyte about 180 ml. The electrolysis is conducted for about 36 hours [2] at a current density of approximately 0.10 amp./sq. dm.; and upon completion, as indicated by the ferrocyanide test, the electrolyte is displaced with distilled water before breaking the current. The copper deposit is washed with alcohol, dried for 15 minutes at 100°C., cooled in a desiccator, and weighed.[3]

(Values in the Table Expressed in Milligrams) [4]

Copper (Cu)	Cuprous Oxide (Cu_2O)	Dextrose (*d*-Glucose)	Invert Sugar	Invert Sugar and Sucrose			Levulose
				Weight of Total Sugar			
				0.3 g.	0.4 g.	2.0 g.	
10	11.3	4.6	5.2	3.2	2.9	....	5.1
11	12.4	5.1	5.7	3.7	3.4	....	5.6
12	13.5	5.6	6.2	4.2	3.9	....	6.1
13	14.6	6.0	6.7	4.8	4.4	....	6.7
14	15.8	6.5	7.2	5.3	4.9	....	7.2
15	16.9	7.0	7.7	5.8	5.4	....	7.7
16	18.0	7.5	8.2	6.3	5.9	....	8.3
17	19.1	8.0	8.7	6.8	6.4	....	8.8
18	20.3	8.5	9.2	7.3	6.9	....	9.3
19	21.4	8.9	9.7	7.8	7.4	....	9.9
20	22.5	9.4	10.2	8.3	7.9	1.9	10.4
21	23.6	9.9	10.7	8.8	8.4	2.4	10.9
22	24.8	10.4	11.2	9.3	8.9	2.9	11.5
23	25.9	10.9	11.7	9.9	9.5	3.4	12.0
24	27.0	11.4	12.3	10.4	10.0	3.9	12.5
25	28.1	11.9	12.8	10.9	10.5	4.4	13.1
26	29.3	12.3	13.3	11.4	11.0	4.9	13.6
27	30.4	12.8	13.8	11.9	11.5	5.5	14.2
28	31.5	13.3	14.3	12.4	12.0	6.0	14.7
29	32.6	13.8	14.8	12.9	12.5	6.5	15.2
30	33.8	14.3	15.3	13.4	13.0	7.0	15.8
31	34.9	14.8	15.8	14.0	13.5	7.5	16.3
32	36.0	15.3	16.3	14.5	14.1	8.0	16.8
33	37.2	15.7	16.8	15.0	14.6	8.5	17.4
34	38.3	16.2	17.3	15.5	15.1	9.0	17.9

[1] See preceding table.

[2] The electrolysis can be completed overnight by using a larger current. Cf. Sherrer, Bell, and Mogerman, *Jour. Res. Natl. Bu. Stand. 22, 697 (1939).*

[3] In the routine analysis of sugar products, any method of determining copper which is suitable to the products may be used.

[4] The values in the table for concentrations of reducing sugar less than 20 mg are extrapolated and should be used with caution and only for approximate determinations.

MUNSON-WALKER-HAMMOND REDUCING-SUGAR VALUES

Copper (Cu)	Cuprous Oxide (Cu_2O)	Dextrose (*d*-Glucose)	Invert Sugar	Invert Sugar and Sucrose Weight of Total Sugar			Levulose
				0.3 g.	0.4 g.	2.0 g.	
35	39.4	16.7	17.8	16.0	15.6	9.5	18.4
36	40.5	17.2	18.3	16.5	16.1	10.1	19.0
37	41.7	17.7	18.9	17.0	16.6	10.6	19.5
38	42.8	18.2	19.4	17.6	17.1	11.1	20.1
39	43.9	18.7	19.9	18.1	17.6	11.6	20.6
40	45.0	19.2	20.4	18.6	18.2	12.1	21.1
41	46.2	19.7	20.9	19.1	18.7	12.6	21.7
42	47.3	20.1	21.4	19.6	19.2	13.1	22.2
43	48.4	20.6	21.9	20.1	19.7	13.7	22.8
44	49.5	21.1	22.4	20.7	20.2	14.2	23.3
45	50.7	21.6	22.9	21.2	20.7	14.7	23.8
46	51.8	22.1	23.5	21.7	21.3	15.2	24.4
47	52.9	22.6	24.0	22.2	21.8	15.7	24.9
48	54.0	23.1	24.5	22.7	22.3	16.2	25.4
49	55.2	23.6	25.0	23.2	22.8	16.8	26.0
50	56.3	24.1	25.5	23.8	23.3	17.3	26.5
51	57.4	24.6	26.0	24.3	23.8	17.8	27.1
52	58.5	25.1	26.5	24.8	24.3	18.3	27.6
53	59.7	25.6	27.0	25.3	24.9	18.8	28.2
54	60.8	26.1	27.6	25.8	25.4	19.3	28.7
55	61.9	26.5	28.1	26.3	25.9	19.9	29.2
56	63.0	27.0	28.6	26.9	26.4	20.4	29.8
57	64.2	27.5	29.1	27.4	26.9	20.9	30.3
58	65.3	28.0	29.6	27.9	27.5	21.4	30.9
59	66.4	28.5	30.1	28.4	28.0	21.9	31.4
60	67.6	29.0	30.6	28.9	28.5	22.5	31.9
61	68.7	29.5	31.2	29.5	29.0	23.0	32.5
62	69.8	30.0	31.7	30.0	29.5	23.5	33.0
63	70.9	30.5	32.2	30.5	30.1	24.0	33.6
64	72.1	31.0	32.7	31.0	30.6	24.5	34.1
65	73.2	31.5	33.2	31.6	31.1	25.1	34.7
66	74.3	32.0	33.7	32.1	31.6	25.6	35.2
67	75.4	32.5	34.3	32.6	32.1	26.1	35.8
68	76.6	33.0	34.8	33.1	32.7	26.6	36.3
69	77.7	33.5	35.3	33.6	33.2	27.1	36.8
70	78.8	34.0	35.8	34.2	33.7	27.7	37.4
71	79.9	34.5	36.3	34.7	34.2	28.2	37.9
72	81.1	35.0	36.8	35.2	34.7	28.7	38.5
73	82.2	35.5	37.4	35.7	35.3	29.2	39.0
74	83.3	36.0	37.9	36.3	35.8	29.8	39.6
75	84.4	36.5	38.4	36.8	36.3	30.3	40.1
76	85.6	37.0	38.9	37.3	36.8	30.8	40.7
77	86.7	37.5	39.4	37.8	37.4	31.3	41.2
78	87.8	38.0	40.0	38.4	37.9	31.9	41.7
79	88.9	38.5	40.5	38.9	38.4	32.4	42.3
80	90.1	39.0	41.0	39.4	38.9	32.9	42.8
81	91.2	39.5	41.5	39.9	39.5	33.4	43.4
82	92.3	40.0	42.0	40.5	40.0	34.0	43.9
83	93.4	40.5	42.6	41.0	40.5	34.5	44.5
84	94.6	41.0	43.1	41.5	41.0	35.0	45.0
85	95.7	41.5	43.6	42.0	41.6	35.5	45.6
86	96.8	42.0	44.1	42.6	42.1	36.1	46.1
87	97.9	42.5	44.7	43.1	42.6	36.6	46.7
88	99.1	43.0	45.2	43.6	43.1	37.1	47.2
89	100.2	43.5	45.7	44.1	43.7	37.6	47.8
90	101.3	44.0	46.2	44.7	44.2	38.2	48.3
91	102.5	44.5	46.7	45.2	44.7	38.7	48.9
92	103.6	45.0	47.3	45.7	45.2	39.2	49.4
93	104.7	45.5	47.8	46.3	45.8	39.8	50.0
94	105.8	46.0	48.3	46.8	46.3	40.3	50.5

MUNSON-WALKER-HAMMOND REDUCING-SUGAR VALUES

Copper (Cu)	Cuprous Oxide (Cu_2O)	Dextrose (*d*-Glucose)	Invert Sugar	Invert Sugar and Sucrose Weight of Total Sugar			Levulose
				0.3 g.	0.4 g.	2.0 g.	
95	107.0	46.5	48.8	47.3	46.8	40.8	51.1
96	108.1	47.0	49.4	47.8	47.4	41.3	51.6
97	109.2	47.5	49.9	48.4	47.9	41.9	52.2
98	110.3	48.0	50.4	48.9	48.4	42.4	52.7
99	111.5	48.5	50.9	49.4	48.9	42.9	53.3
100	112.6	49.0	51.5	50.0	49.5	43.5	53.8
101	113.7	49.5	52.0	50.5	50.0	44.0	54.4
102	114.8	50.0	52.5	51.0	50.5	44.5	54.9
103	116.0	50.6	53.0	51.6	51.1	45.1	55.5
104	117.1	51.1	53.6	52.1	51.6	45.6	56.0
105	118.2	51.6	54.1	52.6	52.1	46.1	56.6
106	119.3	52.1	54.6	53.1	52.7	46.7	57.1
107	120.5	52.6	55.2	53.7	53.2	47.2	57.7
108	121.6	53.1	55.7	54.2	53.7	47.7	58.2
109	122.7	53.6	56.2	54.7	54.2	48.3	58.8
110	123.8	54.1	56.7	55.3	54.8	48.8	59.3
111	125.0	54.6	57.3	55.8	55.3	49.3	59.9
112	126.1	55.1	57.8	56.3	55.8	49.9	60.4
113	127.2	55.6	58.3	56.9	56.4	50.4	61.0
114	128.3	56.1	58.9	57.4	56.9	50.9	61.6
115	129.5	56.7	59.4	57.9	57.4	51.5	62.1
116	130.6	57.2	59.9	58.5	58.0	52.0	62.7
117	131.7	57.7	60.4	59.0	58.5	52.5	63.2
118	132.8	58.2	61.0	59.5	59.0	53.1	63.8
119	134.0	58.7	61.5	60.1	59.6	53.6	64.3
120	135.1	59.2	62.0	60.6	60.1	54.1	64.9
121	136.2	59.7	62.6	61.2	60.7	54.7	65.4
122	137.4	60.2	63.1	61.7	61.2	55.2	66.0
123	138.5	60.7	63.6	62.2	61.7	55.8	66.5
124	139.6	61.3	64.2	62.8	62.3	56.3	67.1
125	140.7	61.8	64.7	63.3	62.8	56.8	67.7
126	141.9	62.3	65.2	63.8	63.3	57.4	68.2
127	143.0	62.8	65.8	64.4	63.9	57.9	68.8
128	144.1	63.3	66.3	64.9	64.4	58.4	69.3
129	145.2	63.8	66.8	65.4	64.9	59.0	69.9
130	146.4	64.3	67.4	66.0	65.5	59.5	70.4
131	147.5	64.9	67.9	66.5	66.0	60.1	71.0
132	148.6	65.4	68.4	67.1	66.6	60.6	71.6
133	149.7	65.9	69.0	67.6	67.1	61.1	72.1
134	150.9	66.4	69.5	68.1	67.6	61.7	72.7
135	152.0	66.9	70.0	68.7	68.2	62.2	73.2
136	153.1	67.4	70.6	69.2	68.7	62.8	73.8
137	154.2	68.0	71.1	69.8	69.3	63.3	74.3
138	155.4	68.5	71.6	70.3	69.8	63.9	74.9
139	156.5	69.0	72.2	70.8	70.3	64.4	75.5
140	157.6	69.5	72.7	71.4	70.9	64.9	76.0
141	158.7	70.0	73.2	71.9	71.4	65.5	76.6
142	159.9	70.5	73.8	72.5	72.0	66.0	77.1
143	161.0	71.1	74.3	73.0	72.5	66.6	77.7
144	162.1	71.6	74.9	73.5	73.0	67.1	78.3
145	163.2	72.1	75.4	74.1	73.6	67.7	78.8
146	164.4	72.6	75.9	74.6	74.1	68.2	79.4
147	165.5	73.1	76.5	75.2	74.7	68.7	80.0
148	166.6	73.7	77.0	75.7	75.2	69.3	80.5
149	167.8	74.2	77.6	76.3	75.7	69.8	81.1
150	168.9	74.7	78.1	76.8	76.3	70.4	81.6
151	170.0	75.2	78.6	77.3	76.8	70.9	82.2
152	171.1	75.7	79.2	77.9	77.4	71.5	82.8
153	172.3	76.3	79.7	78.4	77.9	72.0	83.3
154	173.4	76.8	80.3	79.0	78.5	72.6	83.9

MUNSON-WALKER-HAMMOND REDUCING-SUGAR VALUES

Copper (Cu)	Cuprous Oxide (Cu_2O)	Dextrose (*d*-Glucose)	Invert Sugar	Invert Sugar and Sucrose			Levulose
				Weight of Total Sugar			
				0.3 g.	0.4 g.	2.0 g.	
155	174.5	77.3	80.8	79.5	79.0	73.1	84.4
156	175.6	77.8	81.3	80.1	79.6	73.7	85.0
157	176.8	78.3	81.9	80.6	80.1	74.2	85.6
158	177.9	78.9	82.4	81.2	80.6	74.8	86.1
159	179.0	79.4	83.0	81.7	81.2	75.3	86.7
160	180.1	79.9	83.5	82.2	81.7	75.9	87.3
161	181.3	80.4	84.0	82.8	82.3	76.4	87.8
162	182.4	81.0	84.6	83.3	82.8	77.0	88.4
163	183.5	81.5	85.1	83.9	83.4	77.5	89.0
164	184.6	82.0	85.7	84.4	83.9	78.1	89.5
165	185.8	82.5	86.2	85.0	84.5	78.6	90.1
166	186.9	83.1	86.8	85.5	85.0	79.2	90.6
167	188.0	83.6	87.3	86.1	85.6	79.7	91.2
168	189.1	84.1	87.8	86.6	86.1	80.3	91.8
169	190.3	84.6	88.4	87.2	86.7	80.8	92.3
170	191.4	85.2	88.9	87.7	87.2	81.4	92.9
171	192.5	85.7	89.5	88.3	87.8	81.9	93.5
172	193.6	86.2	90.0	88.8	88.3	82.5	94.0
173	194.8	86.7	90.6	89.4	88.9	83.0	94.6
174	195.9	87.3	91.1	89.9	89.4	83.6	95.2
175	197.0	87.8	91.7	90.5	90.0	84.1	95.7
176	198.1	88.3	92.2	91.0	90.5	84.7	96.3
177	199.3	88.9	92.8	91.6	91.1	85.2	96.9
178	200.4	89.4	93.3	92.1	91.6	85.8	97.4
179	201.5	89.9	93.8	92.7	92.2	86.3	98.0
180	202.7	90.4	94.4	93.2	92.7	86.9	98.6
181	203.8	91.0	94.9	93.8	93.3	87.4	99.2
182	204.9	91.5	95.5	94.3	93.8	88.0	99.7
183	206.0	92.0	96.0	94.9	94.4	88.6	100.3
184	207.2	92.6	96.6	95.4	94.9	89.1	100.9
185	208.3	93.1	97.1	96.0	95.5	89.7	101.4
186	209.4	93.6	97.7	96.5	96.0	90.2	102.0
187	210.5	94.2	98.2	97.1	96.6	90.8	102.6
188	211.7	94.7	98.8	97.6	97.1	91.3	103.1
189	212.8	95.2	99.3	98.2	97.7	91.9	103.7
190	213.9	95.7	99.9	98.7	98.2	92.4	104.3
191	215.0	96.3	100.4	99.3	98.8	93.0	104.8
192	216.2	96.8	101.0	99.9	99.4	93.6	105.4
193	217.3	97.3	101.5	100.4	99.9	94.1	106.0
194	218.4	97.9	102.1	101.0	100.5	94.7	106.6
195	219.5	98.4	102.6	101.5	101.0	95.2	107.1
196	220.7	98.9	103.2	102.1	101.6	95.8	107.7
197	221.8	99.5	103.7	102.6	102.1	96.4	108.3
198	222.9	100.0	104.3	103.2	102.7	96.9	108.8
199	224.0	100.5	104.8	103.7	103.2	97.5	109.4
200	225.2	101.1	105.4	104.3	103.8	98.0	110.0
201	226.3	101.6	106.0	104.9	104.4	98.6	110.6
202	227.4	102.2	106.5	105.4	104.9	99.2	111.1
203	228.5	102.7	107.1	106.0	105.5	99.7	111.7
204	229.7	103.2	107.6	106.5	106.0	100.3	112.3
205	230.8	103.8	108.2	107.1	106.6	100.9	112.9
206	231.9	104.3	108.7	107.6	107.2	101.4	113.4
207	233.1	104.8	109.3	108.2	107.7	102.0	114.0
208	234.2	105.4	109.8	108.8	108.3	102.5	114.6
209	235.3	105.9	110.4	109.3	108.8	103.1	115.2
210	236.4	106.5	110.9	109.9	109.4	103.7	115.7
211	237.6	107.0	111.5	110.4	110.0	104.2	116.3
212	238.7	107.5	112.1	111.0	110.5	104.8	116.9
213	239.8	108.1	112.6	111.6	111.1	105.4	117.5
214	240.9	108.6	113.2	112.1	111.6	105.9	118.0

MUNSON-WALKER-HAMMOND REDUCING-SUGAR VALUES

Copper (Cu)	Cuprous Oxide (Cu_2O)	Dextrose (*d*-Glucose)	Invert Sugar	Invert Sugar and Sucrose			Levulose
				Weight of Total Sugar			
				0.3 g.	0.4 g.	2.0 g.	
215	242.1	109.2	113.7	112.7	112.2	106.5	118.6
216	243.1	109.7	114.3	113.2	112.8	107.1	119.2
217	244.3	110.2	114.9	113.8	113.3	107.6	119.8
218	245.4	110.8	115.4	114.4	113.9	108.2	120.3
219	246.6	111.3	116.0	114.9	114.4	108.8	120.9
220	247.7	111.9	116.5	115.5	115.0	109.3	121.5
221	248.8	112.4	117.1	116.1	115.6	109.9	122.1
222	249.9	112.9	117.6	116.6	116.1	110.5	122.6
223	251.1	113.5	118.2	117.2	116.7	111.0	123.2
224	252.2	114.0	118.8	117.7	117.3	111.6	123.8
225	253.3	114.6	119.3	118.3	117.8	112.2	124.4
226	254.4	115.1	119.9	118.9	118.4	112.7	125.0
227	255.6	115.7	120.4	119.4	119.0	113.3	125.5
228	256.7	116.2	121.0	120.0	119.5	113.9	126.1
229	257.8	116.7	121.6	120.6	120.1	114.4	126.7
230	258.9	117.3	122.1	121.1	120.7	115.0	127.3
231	260.1	117.8	122.7	121.7	121.2	115.6	127.9
232	261.2	118.4	123.3	122.3	121.8	116.2	128.4
233	262.3	118.9	123.8	122.8	122.4	116.7	129.0
234	263.4	119.5	124.4	123.4	122.9	117.3	129.6
235	264.6	120.0	124.9	124.0	123.5	117.9	130.2
236	265.7	120.6	125.5	124.5	124.1	118.4	130.8
237	266.8	121.1	126.1	125.1	124.6	119.0	131.3
238	268.0	121.7	126.6	125.7	125.2	119.6	131.9
239	269.1	122.2	127.2	126.2	125.8	120.2	132.5
240	270.2	122.7	127.8	126.8	126.3	120.7	133.1
241	271.3	123.3	128.3	127.4	126.9	121.3	133.7
242	272.5	123.8	128.9	127.9	127.5	121.9	134.2
243	273.6	124.4	129.5	128.5	128.0	122.5	134.8
244	274.7	124.9	130.0	129.1	128.6	123.0	135.4
245	275.8	125.5	130.6	129.6	129.2	123.6	136.0
246	277.0	126.0	131.2	130.2	129.8	124.2	136.6
247	278.1	126.6	131.7	130.8	130.3	124.8	137.2
248	279.2	127.1	132.3	131.3	130.9	125.3	137.7
249	280.3	127.7	132.9	131.9	131.5	125.9	138.3
250	281.5	128.2	133.4	132.5	132.0	126.5	138.9
251	282.6	128.8	134.0	133.1	132.6	127.1	139.5
252	283.7	129.3	134.6	133.6	133.2	127.6	140.1
253	284.8	129.9	135.1	134.2	133.8	128.2	140.7
254	286.0	130.4	135.7	134.8	134.3	128.8	141.3
255	287.1	131.0	136.3	135.3	134.9	129.4	141.8
256	288.2	131.6	136.8	135.9	135.5	130.0	142.4
257	289.3	132.1	137.4	136.5	136.0	130.5	143.0
258	290.5	132.7	138.0	137.1	136.6	131.1	143.6
259	291.6	133.2	138.6	137.6	137.2	131.7	144.2
260	292.7	133.8	139.1	138.2	137.8	132.3	144.8
261	293.8	134.3	139.7	138.8	138.3	132.9	145.4
262	295.0	134.9	140.3	139.4	138.9	133.4	145.9
263	296.1	135.4	140.8	139.9	139.5	134.0	146.5
264	297.2	136.0	141.4	140.5	140.1	134.6	147.1
265	298.3	136.5	142.0	141.1	140.7	135.2	147.7
266	299.5	137.1	142.6	141.7	141.2	135.8	148.3
267	300.6	137.7	143.1	142.2	141.8	136.3	148.9
268	301.7	138.2	143.7	142.8	142.4	136.9	149.5
269	302.9	138.8	144.3	143.4	143.0	137.5	150.1
270	304.0	139.3	144.8	144.0	143.5	138.1	150.6
271	305.1	139.9	145.4	144.5	144.1	138.7	151.2
272	306.2	140.4	146.0	145.1	144.7	139.3	151.8
273	307.4	141.0	146.6	145.7	145.3	139.8	152.4
274	308.5	141.6	147.1	146.3	145.9	140.4	153.0

MUNSON-WALKER-HAMMOND REDUCING-SUGAR VALUES

Copper (Cu)	Cuprous Oxide (Cu_2O)	Dextrose (*d*-Glucose)	Invert Sugar	Invert Sugar and Sucrose			Levulose
				Weight of Total Sugar			
				0.3 g.	0.4 g.	2.0 g.	
275	309.6	142.1	147.7	146.8	146.4	141.0	153.6
276	310.7	142.7	148.3	147.4	147.0	141.6	154.2
277	311.9	143.2	148.9	148.0	147.6	142.2	154.8
278	313.0	143.8	149.4	148.6	148.2	142.8	155.4
279	314.1	144.4	150.0	149.2	148.8	143.4	156.0
280	315.2	144.9	150.6	149.7	149.3	143.9	156.5
281	316.4	145.5	151.2	150.3	149.9	144.5	157.1
282	317.5	146.0	151.8	150.9	150.5	145.1	157.7
283	318.6	146.6	152.3	151.5	151.1	145.7	158.3
284	319.7	147.2	152.9	152.1	151.7	146.3	158.9
285	320.9	147.7	153.5	152.6	152.2	146.9	159.5
286	322.0	148.3	154.1	153.2	152.8	147.5	160.1
287	323.1	148.8	154.6	153.8	153.4	148.1	160.7
288	324.2	149.4	155.2	154.4	154.0	148.6	161.3
289	325.4	150.0	155.8	155.0	154.6	149.2	161.9
290	326.5	150.5	156.4	155.5	155.2	149.8	162.5
291	327.6	151.1	157.0	156.1	155.7	150.4	163.1
292	328.7	151.7	157.5	156.7	156.3	151.0	163.7
293	329.9	152.2	158.1	157.3	156.9	151.6	164.3
294	331.0	152.8	158.7	157.9	157.5	152.2	164.9
295	332.1	153.4	159.3	158.5	158.1	152.8	165.4
296	333.3	153.9	159.9	159.0	158.7	153.4	166.0
297	334.4	154.5	160.5	159.6	159.3	154.0	166.6
298	335.5	155.1	161.0	160.2	159.9	154.6	167.2
299	336.6	155.6	161.6	160.8	160.4	155.2	167.8
300	337.8	156.2	162.2	161.4	161.0	155.7	168.4
301	338.9	156.8	162.8	162.0	161.6	156.3	169.0
302	340.0	157.3	163.4	162.5	162.2	156.9	169.6
303	341.1	157.9	164.0	163.1	162.8	157.5	170.2
304	342.3	158.5	164.5	163.7	163.4	158.1	170.8
305	343.4	159.0	165.1	164.3	164.0	158.7	171.4
306	344.5	159.6	165.7	164.9	164.6	159.3	172.0
307	345.6	160.2	166.3	165.5	165.1	159.9	172.6
308	346.8	160.7	166.9	166.1	165.7	160.5	173.2
309	347.9	161.3	167.5	166.7	166.3	161.1	173.8
310	349.0	161.9	168.0	167.2	166.9	161.7	174.4
311	350.1	162.5	168.6	167.8	167.5	162.3	175.0
312	351.3	163.0	169.2	168.4	168.1	162.9	175.6
313	352.4	163.6	169.8	169.0	168.7	163.5	176.2
314	353.5	164.2	170.4	169.6	169.3	164.1	176.8
315	354.6	164.7	171.0	170.2	169.9	164.7	177.4
316	355.8	165.3	171.6	170.8	170.5	165.3	178.0
317	356.9	165.9	172.2	171.4	171.1	165.9	178.6
318	358.0	166.5	172.8	172.0	171.7	166.5	179.2
319	359.1	167.0	173.3	172.6	172.2	167.1	179.8
320	360.3	167.6	173.9	173.1	172.8	167.7	180.4
321	361.4	168.2	174.5	173.7	173.4	168.3	181.0
322	362.5	168.8	175.1	174.3	174.0	168.9	181.6
323	363.6	169.3	175.7	174.9	174.6	169.5	182.2
324	364.8	169.9	176.3	175.5	175.2	170.1	182.8
325	365.9	170.5	176.9	176.1	175.8	170.7	183.4
326	367.0	171.1	177.5	176.7	176.4	171.3	184.0
327	368.2	171.6	178.1	177.3	177.0	171.9	184.6
328	369.3	172.2	178.7	177.9	177.6	172.5	185.2
329	370.4	172.8	179.2	178.5	178.2	173.1	185.8
330	371.5	173.4	179.8	179.1	178.8	173.7	186.4
331	372.7	173.9	180.4	179.7	179.4	174.3	187.0
332	373.8	174.5	181.0	180.3	180.0	174.9	187.6
333	374.9	175.1	181.6	180.9	180.6	175.5	188.2
334	376.0	175.7	182.2	181.5	181.2	176.1	188.8

MUNSON-WALKER-HAMMOND REDUCING-SUGAR VALUES

Copper (Cu)	Cuprous Oxide (Cu_2O)	Dextrose (*d*-Glucose)	Invert Sugar	Invert Sugar and Sucrose			Levulose
				Weight of Total Sugar			
				0.3 g.	0.4 g.	2.0 g.	
335	377.2	176.3	182.8	182.1	181.8	176.7	189.4
336	378.3	176.8	183.4	182.6	182.4	177.3	190.1
337	379.4	177.4	184.0	183.2	183.0	178.0	190.7
338	380.5	178.0	184.6	183.8	183.6	178.6	191.3
339	381.7	178.6	185.2	184.4	184.2	179.2	191.9
340	382.8	179.2	185.8	185.0	184.8	179.8	192.5
341	383.9	179.7	186.4	185.6	185.4	180.4	193.1
342	385.0	180.3	187.0	186.2	186.0	181.0	193.7
343	386.2	180.9	187.6	186.8	186.6	181.6	194.3
344	387.3	181.5	188.2	187.4	187.2	182.2	194.9
345	388.4	182.1	188.8	188.0	187.8	182.8	195.5
346	389.5	182.7	189.4	188.6	188.4	183.4	196.1
347	390.7	183.2	190.0	189.2	189.0	184.0	196.7
348	391.8	183.8	190.6	189.8	189.6	184.6	197.3
349	392.9	184.4	191.2	190.4	190.2	185.3	197.9
350	394.0	185.0	191.8	191.0	190.8	185.9	198.5
351	395.2	185.6	192.4	191.6	191.4	186.5	199.2
352	396.3	186.2	193.0	192.2	192.0	187.1	199.8
353	397.4	186.8	193.6	192.8	192.6	187.7	200.4
354	398.5	187.3	194.2	193.4	193.2	188.3	201.0
355	399.7	187.9	194.8	194.0	193.8	188.9	201.6
356	400.8	188.5	195.4	194.6	194.4	189.5	202.2
357	401.9	189.1	196.0	195.2	195.0	190.2	202.8
358	403.1	189.7	196.6	195.8	195.7	190.8	203.4
359	404.2	190.3	197.2	196.4	196.3	191.4	204.0
360	405.3	190.9	197.8	197.1	196.9	192.0	204.7
361	406.4	191.5	198.4	197.7	197.5	192.6	205.3
362	407.6	192.0	199.0	198.3	198.1	193.2	205.9
363	408.7	192.6	199.6	198.9	198.7	193.9	206.5
364	409.8	193.2	200.2	199.5	199.3	194.5	207.1
365	410.9	193.8	200.8	200.1	199.9	195.1	207.7
366	412.1	194.4	201.4	200.7	200.5	195.7	208.3
367	413.2	195.0	202.0	201.3	201.1	196.3	209.0
368	414.3	195.6	202.6	201.9	201.7	196.9	209.6
369	415.4	196.2	203.2	202.5	202.4	197.6	210.2
370	416.6	196.8	203.8	203.1	203.0	198.2	210.8
371	417.7	197.4	204.4	203.7	203.6	198.8	211.4
372	418.8	198.0	205.0	204.3	204.2	199.4	212.0
373	419.9	198.5	205.7	204.9	204.8	200.0	212.6
374	421.1	199.1	206.3	205.6	205.4	200.7	213.3
375	422.2	199.7	206.9	206.2	206.0	201.3	213.9
376	423.3	200.3	207.5	206.8	206.6	201.9	214.5
377	424.4	200.9	208.1	207.4	207.3	202.5	215.1
378	425.6	201.5	208.7	208.0	207.9	203.1	215.7
379	426.7	202.1	209.3	208.6	208.5	203.8	216.3
380	427.8	202.7	209.9	209.2	209.1	204.4	217.0
381	428.9	203.3	210.5	209.8	209.7	205.0	217.6
382	430.1	203.9	211.1	210.4	210.3	205.6	218.2
383	431.2	204.5	211.8	211.1	211.0	206.3	218.8
384	432.3	205.1	212.4	211.7	211.6	206.9	219.5
385	433.5	205.7	213.0	212.3	212.2	207.5	220.1
386	434.6	206.3	213.6	212.9	212.8	208.1	220.7
387	435.7	206.9	214.2	213.5	213.4	208.8	221.3
388	436.8	207.5	214.8	214.1	214.0	209.4	221.9
389	438.0	208.1	215.4	214.7	214.7	210.0	222.6
390	439.1	208.7	216.0	215.4	215.3	210.6	223.2
391	440.2	209.3	216.7	216.0	215.9	211.3	223.8
392	441.3	209.9	217.3	216.6	216.5	211.9	224.4
393	442.5	210.5	217.9	217.2	217.1	212.5	225.1
394	443.6	211.1	218.5	217.8	217.8	213.2	225.7

MUNSON-WALKER-HAMMOND REDUCING-SUGAR VALUES

Copper (Cu)	Cuprous Oxide (Cu_2O)	Dextrose (*d*-Glucose)	Invert Sugar	Invert Sugar and Sucrose			Levulose
				Weight of Total Sugar			
				0.3 g.	0.4 g.	2.0 g.	
395	444.7	211.7	219.1	218.5	218.4	213.8	226.3
396	445.8	212.3	219.8	219.1	219.0	214.4	226.9
397	447.0	212.9	220.4	219.7	219.6	215.1	227.6
398	448.1	213.5	221.0	220.3	220.3	215.7	228.2
399	449.2	214.1	221.6	220.9	220.9	216.3	228.8
400	450.3	214.7	222.2	221.5	221.5	217.0	229.4
401	451.5	215.3	222.9	222.2	222.1	217.6	230.1
402	452.6	215.9	223.5	222.8	222.8	218.2	230.7
403	453.7	216.5	224.1	223.4	223.4	218.9	231.3
404	454.8	217.1	224.7	224.0	224.0	219.5	232.0
405	456.0	217.8	225.4	224.7	224.7	220.1	232.6
406	457.1	218.4	226.0	225.3	225.3	220.8	233.2
407	458.2	219.0	226.6	225.9	225.9	221.4	233.9
408	459.3	219.6	227.2	226.6	226.5	222.0	234.5
409	460.5	220.2	227.9	227.2	227.2	222.7	235.1
410	461.6	220.8	228.5	227.8	227.8	223.3	235.8
411	462.7	221.4	229.1	228.4	228.4	224.0	236.4
412	463.8	222.0	229.7	229.1	229.1	224.6	237.1
413	465.0	222.6	230.4	229.7	229.7	225.3	237.7
414	466.1	223.3	231.0	230.4	230.4	225.9	238.4
415	467.2	223.9	231.7	231.0	231.0	226.6	239.0
416	468.4	224.5	232.3	231.6	231.7	227.2	239.7
417	469.5	225.1	232.9	232.3	232.3	227.8	240.3
418	470.6	225.7	233.6	232.9	232.9	228.5	241.0
419	471.7	226.3	234.2	233.5	233.6	229.1	241.6
420	472.9	227.0	234.8	234.2	234.2	229.8	242.2
421	474.0	227.6	235.5	234.8	234.9	230.4	242.9
422	475.1	228.2	236.1	235.5	235.5	231.1	243.6
423	476.2	228.8	236.8	236.2	236.2	231.8	244.3
424	477.4	229.5	237.5	236.8	236.9	232.4	244.9
425	478.5	230.1	238.1	237.5	237.5	233.1	245.6
426	479.6	230.7	238.8	238.2	238.2	233.8	246.3
427	480.7	231.4	239.5	238.8	238.9	234.5	247.0
428	481.9	232.0	240.2	239.5	239.6	235.1	247.8
429	483.0	232.7	240.8	240.2	240.3	235.8	248.5
430	484.1	233.3	241.5	240.9	241.0	236.5	249.2
431	485.2	234.0	242.3	241.7	241.7	237.2	250.0
432	486.4	234.7	243.0	242.4	242.5	238.0	250.8
433	487.5	235.3	243.8	243.2	243.3	238.7	251.6
434	488.6	236.1	244.7	244.1	244.2	239.6	252.7
435	489.7	236.9	245.6	245.1	245.1	240.4	253.7

REDUCTION VALUES OF GLUCOSE IN BLOOD

Method of Hagedorn and Jensen, *Biochem. Zeit*, 135, 46; 137, 92 (1923).

Required solutions. *Aklaline ferricyanide*, 1.65 g potassium ferricyanide, and 10.6 g anhydrous sodium carbonate in 1000 cc of water; *acetic acid* (3%), 15 g glacial acetic acid in 485 cc of water; *iodide-sulfate*, 5 g potassium iodide, 50 g sodium chloride and 10 g zinc sulfate in sufficient water to make 200 cc of solution; 2.25 g *zinc sulfate* in sufficient water to make 500 cc of solution; standard 0.005 *N sodium thiosulfate*; standard 0.1 *N sodium hydroxide*; starch indicator solution.

Procedure. This method depends upon the reduction of potassium ferricyanide in alkaline solution by the glucose in the blood with subsequent titration of excess unreduced ferricyanide according to the reaction: $2H_3Fe(CN)_6+2HI=2H_4Fe(CN)_6+I_2$. One cc of 0.1 *N* sodium hydroxide and 5 cc of 0.45% zinc sulfate are mixed in a 15×150 mm test tube and to this is added 0.1 cc of blood from a capillary pipette which is then washed out with the mixture in the test tube; after heating this mixture for three minutes in a boiling water bath, then filtering through cotton into a 30×90 mm test tube and washing the filter with two 3 cc portions of distilled water, 2 cc of alkaline ferricyanide solution is added and the heating continued in the boiling water bath for 15 minutes; after cooling, adding 3 cc of the iodide-sulfate solution and 2 cc of 3% acetic acid solution, it is titrated with 0.005 *N* sodium thiosulfate with starch indicator.

Amount of Glucose in 0.1 cc of Blood Expressed in Milligrams

	Number of cubic centimeters of 0.005 *N* sodium thiosulfate									
	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
0.0	0.385	0.382	0.379	0.376	0.373	0.370	0.367	0.364	0.361	0.358
0.1	0.355	0.352	0.350	0.348	0.345	0.343	0.341	0.338	0.336	0.333
0.2	0.331	0.329	0.327	0.325	0.323	0.321	0.318	0.316	0.314	0.312
0.3	0.310	0.308	0.306	0.304	0.302	0.300	0.298	0.296	0.294	0.292
0.4	0.290	0.288	0.286	0.284	0.282	0.280	0.278	0.276	0.274	0.272
0.5	0.270	0.268	0.266	0.264	0.262	0.260	0.259	0.257	0.255	0.253
0.6	0.251	0.249	0.247	0.245	0.243	0.241	0.240	0.238	0.236	0.234
0.7	0.232	0.230	0.228	0.226	0.224	0.222	0.221	0.219	0.217	0.215
0.8	0.213	0.211	0.209	0.208	0.206	0.204	0.202	0.200	0.199	0.197
0.9	0.195	0.193	0.191	0.190	0.188	0.186	0.184	0.182	0.181	0.179
1.0	0.177	0.175	0.173	0.172	0.170	0.168	0.166	0.164	0.163	0.161
1.1	0.159	0.157	0.155	0.154	0.152	0.150	0.148	0.146	0.145	0.143
1.2	0.141	0.139	0.138	0.136	0.134	0.132	0.131	0.129	0.127	0.125
1.3	0.124	0.122	0.120	0.119	0.117	0.115	0.113	0.111	0.110	0.108
1.4	0.106	0.104	0.102	0.101	0.099	0.097	0.095	0.093	0.092	0.090
1.5	0.088	0.086	0.084	0.083	0.081	0.079	0.077	0.075	0.074	0.072
1.6	0.070	0.068	0.066	0.065	0.063	0.061	0.059	0.057	0.056	0.054
1.7	0.052	0.050	0.048	0.047	0.045	0.043	0.041	0.039	0.038	0.036
1.8	0.034	0.032	0.031	0.029	0.027	0.025	0.024	0.022	0.020	0.019
1.9	0.017	0.015	0.014	0.012	0.010	0.008	0.007	0.005	0.003	0.002

Methods of Somogyi, *J. Biol. Chem.* 70, 599 (1926).

For 1:10 Blood Filtrate

Required solutions. *Copper reagent*, 6.5 g crystalline copper sulfate, 12 g rochelle salt, 20 g anhydrous sodium carbonate, 10 g potassium iodide, 0.08 g potassium iodate, 18 g potassium oxalate, 25 g sodium bicarbonate and sufficient water to make one liter of solution. *Sulfuric acid*, 5 *N*. Standard sodium thiosulfate, 0.005 *N*.

Procedure. Five cc of the sugar solution (containing between 0.1 and 2.0 milligrams of glucose) is added to 5 cc of copper reagent in a 25×250 mm test tube, then heated for 15 minutes in a boiling water bath; after cooling to 35°C and mixing with 1 cc 5 *N* sulfuric acid, it is titrated two minutes later with 0.005 *N* sodium thiosulfate. A blank titration using 5 cc of water in place of the blood is run simultaneously.

REDUCTION VALUES OF GLUCOSE IN BLOOD

Amount of Glucose in 100 cc of Blood Expressed in Milligrams

	Number of cubic centimeters of 0.005 N sodium thiosulfate									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	...	..	21	23	26	29	31	34	36	39
1	41	44	46	49	51	53	56	58	61	63
2	65	68	70	72	75	77	80	82	84	86
3	89	92	94	97	99	101	103	106	108	110
4	113	115	117	119	121	124	126	128	130	132
5	135	137	139	141	143	146	148	150	152	154
6	157	159	161	163	165	168	170	172	174	176
7	179	181	183	185	187	190	192	194	196	199
8	201	203	205	207	210	212	214	216	218	221
9	223	225	227	230	232	234	237	239	241	243
10	245	248	250	252	254	256	259	261	263	265
11	267	270	272	274	276	279	281	283	285	288
12	290	292	294	296	299	301	303	305	308	310
13	312	314	316	318	321	323	326	328	330	332
14	334	337	339	341	343	345	347	350	352	354
15	356	359	361	363	365	367	370	372	374	376
16	378	381	383	386	388	390	392	394	396	398

For 1:15 Filtrate

Required solutions. *Sulfuric acid*, 0.067 N and 2 N. 2.5% *sodium tungstate* solution. *Copper reagent* prepared as described above. Standard *sodium thiosulfate*, 0.005 N.

Procedure. Two tenths (0.2) cc of blood is added to 2 cc of 0.067 N sulfuric acid in a test tube and the pipette washed several times with the mixture in the test tube; exactly 0.8 cc of 2.5% sodium tungstate is added, the mixture centrifugated and 2 cc of the liquid withdrawn with a pipette filtering the solution through a layer of cotton fastened over the end of the pipette; this 2 cc is added to exactly 2 cc of copper reagent in a 16×150 mm test tube, mixed and heated for 15 minutes in a boiling water bath; after cooling to 35°C, adding 1 cc of 2 N sulfuric acid, it is titrated with 0.005 N sodium thiosulfate. A blank using 0.2 cc of water in place of the blood is run simultaneously.

Amount of Glucose in 100 cc of Blood Expressed in Milligrams

	Number of cubic centimeters of 0.005 N sodium thiosulfate									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	..	..	42	53	63	74	83	91	100	108
1	117	125	134	142	150	159	168	176	185	193
2	202	210	219	227	236	245	253	262	270	279
3	288	296	305	313	322	330	339	347	355	364
4	373	381	390	399	407	416	424	433	441	450

SOLUBILITIES OF INORGANIC COMPOUNDS

This table shows the amount of anhydrous substance which is soluble in 100 grams of water at the temperature in degrees Centigrade as indicated; where the formula is preceded by † the value is expressed in grams of substance in 100 ml of saturated

	Substance	Formula	Solid Phase	0°C.	10°C.
1	**Aluminum** chloride	$AlCl_3$	$6H_2O$	....	....
2	sulfate	$Al_2(SO_4)_3$	$18H_2O$	31.2	33.5
3	**Ammonium** aluminum sulfate	$(NH_4)_2Al_2(SO_4)_4$	$24H_2O$	2.1	4.99
4	bicarbonate	NH_4HCO_3	....	11.9	15.8
5	bromide	NH_4Br	....	60.6	68
6	cadmium sulfate	$(NH_4)_2Cd(SO_4)_2$	$6H_2O$	....	....
7	chloride	NH_4Cl	....	29.4	33.3
8	chloroplatinate	$(NH_4)_2PtCl_6$	....	....	0.7
9	chromate	$(NH_4)_2CrO_4$	....	....	....
10	chromium sulfate	$(NH_4)_2Cr_2(SO_4)_4$	$24H_2O$	....	....
11	cobaltous sulfate	$(NH_4)_2Co(SO_4)_2$	$6H_2O$	6.0	9.5
12	dichromate	$(NH_4)_2Cr_2O_7$	....	....	....
13	dihydrogen phosphite	$NH_4H_2PO_3$	....	171	....
14	ferric sulfate	$(NH_4)_2Fe_2(SO_4)_4$	$24H_2O$	....	....
15	ferrous sulfate	$(NH_4)_2Fe(SO_4)_2$	$6H_2O$	12.5	17.2
16	hydrogen phosphate	$(NH_4)_2HPO_4$	....	....	....
17	iodide	NH_4I	....	154.2	163.2
18	lithium sulfate	NH_4LiSO_4	....	....	55.23
19	magnesium phosphate	NH_4MgPO_4	$6H_2O$	0.023	....
20	manganese phosphate	NH_4MnPO_4	$7H_2O$	....	....
21	nitrate	NH_4NO_3	....	118.3	....
22	oxalate	$(NH_4)_2C_2O_4$	$1H_2O$	2.2	3.1
23	†perchlorate	NH_4ClO_4†	....	11.56	....
24	persulfate	$(NH_4)_2S_2O_8$	....	58.2	....
25	selenate	$(NH_4)_2SeO_4$	....	....	$1.22^{12°}$
26	sulfate	$(NH_4)_2SO_4$	....	70.6	73.0
27	thioantimonate	$(NH_4)_3SbS_4$	$4H_2O$	71.2	....
28	thiocyanate	NH_4CNS	....	119.8	144
29	vanadate (meta)	NH_4VO_3	....	....	....
30	**Antimonous** chloride	$SbCl_3$	....	601.6	....
31	fluoride	SbF_3	....	384.7	....
32	sulfide	Sb_2S_3	....	....	....
33	**Arsenic oxide**	As_2O_5	....	59.5	62.1
34	**Arsenious sulfide**	As_2S_3	....	5.17×10^{-5} at 18°	
35	**Barium** acetate	$Ba(C_2H_3O_2)_2$	$3H_2O$	59	63
36	acetate	$Ba(C_2H_3O_2)_2$	$1H_2O$	....	....
37	bromate	$Ba(BrO_3)_2$	$1H_2O$	0.287	0.441
38	bromide	$BaBr_2$	$2H_2O$	98	101
39	carbonate	$BaCO_3$	....	....	$0.0016^{8°}$
40	chlorate	$Ba(ClO_3)_2$	$1H_2O$	20.34	26.95
41	chloride	$BaCl_2$	$2H_2O$	31.6	33.3
42	chromate	$BaCrO_4$	....	0.0002	0.00028
43	hydroxide	$Ba(OH)_2$	$8H_2O$	1.67	2.48
44	iodate	$Ba(IO_3)_2$	$1H_2O$	0.008	0.014
45	iodide	BaI_2	$6H_2O$	170.2	185.7
46	iodide	BaI_2	$2H_2O$	....	....
47	molybdate	$BaMoO_4$	....	....	....
48	nitrate	$Ba(NO_3)_2$	....	5.0	7.0
49	nitrite	$Ba(NO_2)_2$	$1H_2O$	....	....

IN WATER AT VARIOUS TEMPERATURES

solution. Solid Phase gives the hydrated form in equilibrium with the saturated solution.

20°C.	30°C.	40°C.	50°C.	60°C.	70°C.	80°C.	90°C.	100°C.	
69.86$^{15°}$	.....	.....	.....	....	....	....	....	.....	1
36.4	40.4	46.1	52.2	59.2	66.1	73.0	80.8	89.0	2
7.74	10.94	14.88	20.10	26.70	....	....	....	109.7$^{95°}$	3
21	27	.....	.....	....	....	....	....	.....	4
75.5	83.2	91.1	99.2	107.8	116.8	126	135.6	145.6	5
72.3$^{25°}$	.....	.....	.....	....	....	....	....	.....	6
37.2	41.4	45.8	50.4	55.2	60.2	65.6	71.3	77.3	7
....	.....	.....	.....	....	....	....	....	1.25	8
....	40.4	.....	.....	....	....	....	....	.....	9
10.78$^{25°}$	.....	.....	.....	....	....	....	....	.....	10
13.0	17.0	22.0	27.0	33.5	40.0	49.0	....	.....	11
....	47.17	.....	.....	....	....	....	....	.....	12
190$^{14.5°}$	260$^{31°}$	.....	.....	....	....	....	....	.....	13
....	44.15$^{25°}$	.....	.....	....	....	....	....	.....	14
....	.....	33	40	....	52	....	....	.....	15
131^{15}	.....	.....	.....	....	....	....	....	.....	16
172.3	181.4	190.5	199.6	208.9	218.7	228.8	....	250.3	17
....	55.93	.....	56.25	....	56.69	....	....	.....	18
0.052	.....	0.036	0.030	0.040	0.016	0.019	....	.....	19
0	.....	0	.....	0	0.005	0.007	....	.....	20
192	241.8	297.0	344.0	421.0	499.0	580.0	740.0	871.0	21
4.4	5.9	8.0	10.3	....	....	....	....	.....	22
20.85	.....	30.58	.....	39.05	....	48.19	....	57.01	23
....	.....	.....	.....	....	....	....	....	.....	24
....	.....	.....	.....	....	....	....	....	.....	25
75.4	78.0	81.0	.....	88.0	....	95.3	....	103.3	26
91.2	119.8	.....	.....	....	....	....	....	.....	27
170	207.7	.....	.....	....	....	....	....	.....	28
0.48	0.84	1.32	1.78	....	3.05	....	....	.....	29
931.5	1068.0	1368.0	1917.0	4531.0	....	∞	....	.....	30
444.7	563.6	.....	.....	....	....	....	....	.....	31
0.000175$^{18°}$	.....	.....	.....	....	....	....	....	.....	32
65.8	69.5	71.2	.....	73.0	....	75.1	....	76.7	33
....	.....	.....	.....	....	....	....	....	.....	34
71	.....	.....	.....	....	....	....	....	.....	35
....	75	79	77	74	74	....	....	75	36
0.656	0.959	1.33	1.75	2.32	3.01	3.65	4.45	5.71	37
104	109	114	118	123	128	135	....	149	38
0.0022$^{18°}$	0.0024 at 24.2°	.....	.....	....	....	....	....	.....	39
33.80	41.70	49.61	.....	66.81	....	84.84	....	104.9	40
35.7	38.2	40.7	43.6	46.4	49.4	52.4	....	58.8	41
0.00037	0.00046	.....	.....	....	....	....	....	.....	42
3.89	5.59	8.22	13.12	20.94	....	101.4	....	.....	43
0.022	0.031	0.041	0.056	0.074	0.093	0.115	0.141	0.197	44
203.1	219.6	.....	.....	....	....	....	....	.....	45
....	.....	231.9	.....	247.3	....	261.0	....	271.7	46
0.0058$^{23°}$	.....	.....	.....	....	....	....	....	.....	47
9.2	11.6	14.2	17.1	20.3	....	27.0	....	34.2	48
67.5	.....	.....	.....	....	....	205.8	....	300	49

SOLUBILITIES OF INORGANIC COMPOUNDS

	Substance	Formula	Solid Phase	0°C.	10°C.
1	**Barium** oxalate	BaC_2O_4	....	....	$0.0016^{8°}$
2	perchlorate	$Ba(ClO_4)_2$	$3H_2O$	205.8	....
3	sulfate	$BaSO_4$	....	1.15×10^{-4}	2.0×10^{-4}
4	**Beryllium** potassium fluoride	$BeF_2.2KF$	....	....	....
5	sodium fluoride	$BeF_2.2NaF$	....	....	....
6	sulfate	$BeSO_4$	$6H_2O$	....	....
7	sulfate	$BeSO_4$	$4H_2O$	....	....
8	sulfate	$BeSO_4$	$2H_2O$	....	....
9	**Bismuth** sulfide	Bi_2S_3	....	....	....
10	**Boric acid**	H_3BO_3	....	2.66	3.57
11	**Boron oxide**	B_2O_3	....	1.1	1.5
12	**Bromine**	Br_2	....	4.22	3.4
13	**Cadmium** bromide	$CdBr_2$	....	61.08	....
14	chloride	$CdCl_2$	$4H_2O$	97.59	125.1
15	chloride	$CdCl_2$	$2\frac{1}{2}H_2O$	90.01	....
16	chloride	$CdCl_2$	$1H_2O$	....	135.1
17	cyanide	$Cd(CN)_2$	....	....	....
18	hydroxide	$Cd(OH)_2$	....	....	....
19	iodide	CdI_2	....	79.8	83.2
20	sulfate	$CdSO_4$	....	76.48	76.00
21	sulfide	CdS	....	....	....
22	**Calcium** acetate	$Ca(C_2H_3O_2)_2$	$2H_2O$	37.4	36.0
23	acetate	$Ca(C_2H_3O_2)_2$	$1H_2O$	....	....
24	bicarbonate	$Ca(HCO_3)_2$	....	16.15	....
25	bromide	$CaBr_2$	$6H_2O$	125	132
26	bromide	$CaBr_2$	$4H_2O$		....
27	chloride	$CaCl_2$	$6H_2O$	59.5	65.0
28	chloride	$CaCl_2$	$2H_2O$	....	....
29	fluoride	CaF_2	....	....	....
30	hydroxide	$Ca(OH)_2$	....	0.185	0.176
31	iodate	$Ca(IO_3)_2$	$6H_2O$	0.10	0.17
32	iodate	$Ca(IO_3)_2$	$1H_2O$	....	....
33	iodide	CaI_2	....	181.9	194.1
34	nitrate	$Ca(NO_3)_2$	$4H_2O$	102.0	115.3
35	nitrate	$Ca(NO_3)_2$	$3H_2O$	....	....
36	nitrate	$Ca(NO_3)_2$	....	....	....
37	nitrite	$Ca(NO_2)_2$	$4H_2O$	62.07	....
38	nitrite	$Ca(NO_2)_2$	$2H_2O$	....	....
39	oxalate	CaC_2O_4	....	....	6.7×10^{-4} at 13°
40	sulfate	$CaSO_4$	$2H_2O$	0.1759	0.1928
41	**Carbon** dioxide, 760 mm	CO_2	....	0.3346	0.2318
42	monoxide, 760 mm	CO	....	0.0044	0.0035
43	**Cerous** sulfate	$Ce_2(SO_4)_3$	$9H_2O$	20.75	....
44	sulfate	$Ce_2(SO_4)_3$	$8H_2O$	18.98	....
45	sulfate	$Ce_2(SO_4)_3$	$5H_2O$	....	....
46	sulfate	$Ce_2(SO_4)_3$	$4H_2O$	....	....
47	**Cesium** chlorate	$CsClO_3$	......	2.46	3.8
48	chloride	$CsCl$	....	161.4	174.7
49	fluoride	CsF	$1\frac{1}{2}H_2O$	....	....

IN WATER AT VARIOUS TEMPERATURES

20°C.	30°C.	40°C.	50°C.	60°C.	70°C.	80°C.	90°C.	100°C.	
$0.0022^{18°}$	0.0024 at 24.2°	.....	.....	....	....	....	....	.....	1
289.1	.....	358.7	426.3	....	495.2	....	562.3	.....	2
2.4×10^{-4}	2.85×10^{-4}	.....	3.36×10^{-4}	....	....	....	....	4.13×10^{-4}	3
2	.....	.....	.....	....	....	....	....	5.2	4
1.4	.....	.....	.....	....	....	....	....	2.9	5
....	52	.....	60.67	....	....	....	....	.....	6
....	43.78	46.74	.....	....	62	....	83	100	7
....	.....	.....	.....	....	....	84.76	98	110	8
1.8×10^{-5} at 18°	.....	.....	.....	....	....	....	....	.....	9
5.04	6.60	8.72	11.54	14.81	18.62	23.75	30.38	40.25	10
2.2	.....	4.0	.....	6.2	....	9.5	....	15.7	11
3.20	3.13	.....	.....	....	....	....	....	.....	12
....	132.0	154.1	.....	157.1	....	165.2	....	.....	13
....	.....	.....	.....	....	....	....	....	.....	14
....	132.1	.....	.....	....	....	....	....	.....	15
134.5	.....	135.3	.....	136.5	....	140.4	....	147.0	16
$1.7^{15°}$	.....	.....	.....	....	....	....	....	.....	17
....	2.6×10^{-4} at 25°	.....	.....	....	....	....	....	.....	18
86.2	89.7	93.8	97.4	....	....	....	....	127.6	19
76.60	.....	78.54	.....	83.68	....	....	63.13	60.77	20
9×10^{-7} at 18°	.....	.....	.....	....	....	....	....	.....	21
34.7	33.8	33.2	.....	32.7	....	33.5	....	.....	22
....	.....	.....	.....	....	....	....	31.1	29.7	23
16.60	.....	17.05	.....	17.50	....	17.95	....	18.40	24
143	.....	.....	.....	....	....	....	....	.....	25
....	.....	213	.....	278	....	295	....	.....	26
74.5	102	.....	.....	....	....	....	....	.....	27
....	.....	.....	.....	136.8	141.7	147.0	152.7	159	28
$0.0016^{18°}$	$0.0017^{26°}$	.....	.....	....	....	....	....	.....	29
0.165	0.153	0.141	0.128	0.116	0.106	0.094	0.085	0.077	30
....	0.42	0.61	0.90	1.38	....	....	....	.....	31
....	.....	0.52	0.59	0.65	....	0.80	...	0.95	32
208.8	222.6	242.5	.....	284.6	....	354.5	....	426.3	33
129.3	152.6	195.9	.....	....	....	....	....	.....	34
....	.....	237.5	281.5	....	....	....	....	.....	35
....	.....	.....	.....	....	....	358.7	....	363.6	36
76.68	.....	.....	.....	....	....	....	....	.....	37
....	.....	.....	.....	132.6	151.9	....	244.8	.....	38
6.8×10^{-4} at 25°	9.5×10^{-4} at 50°	14×10^{-4} at 95°	.....	....	....	....	....	.....	39
....	0.2090	0.2097	0.2038	....	0.1966	....	.....	0.1619	40
0.1688	0.1257	0.0973	0.0761	0.0576	....	....	....	0	41
0.0028	0.0024	0.0021	0.0018	0.0015	0.0013	0.0010	0.0006	0	42
10.08	6.79	.....	4.674	3.874	....	....	....	.....	43
9.52	.....	5.947	.....	4.04	....	....	....	.....	44
....	.....	.....	.....	3.247	....	1.204	....	0.46	45
....	.....	6.056	3.42	2.35	....	1.01	....	0.42	46
6.2	9.5	13.8	19.4	26.2	34.7	45.0	58.0	79.0	47
186.5	197.3	208.0	218.5	229.7	239.5	250.0	260.1	270.5	48
$366.5^{18°}$	.....	.....	.....	....	....	....	....	.....	49

	Substance	Formula	Solid Phase	0°C.	10°C.
1	**Cesium** hydroxide	$CsOH$	....	....	....
2	iodate	$CsIO_3$	....	....	....
3	nitrate	$CsNO_3$	....	9.33	14.9
4	perchlorate	$CsClO_4$	....	0.8	1.0
5	periodate	$CsIO_4$	....	....	2.15^{15}
6	sulfate	Cs_2SO_4	....	167.1	173.1
7	**Chlorine, 760 mm**	Cl_2	....	1.46	0.980
8	**Chromic anhydride**	CrO_3	....	164.9	....
9	**Cobaltous** chloride	$CoCl_2$	$6H_2O$	41.6	46.0
10	chloride	$CoCl_2$	$1H_2O$	....	....
11	iodide	CoI_2	$1H_2O$	138.1	159.7
12	nitrate	$Co(NO_3)_2$	$6H_2O$	84.03	....
13	nitrate	$Co(NO_3)_2$	$3H_2O$	....	....
14	sulfate	$CoSO_4$	$7H_2O$	25.55	30.55
15	sulfide	CoS	....	....	....
16	**Cupric** chloride	$CuCl_2$	$2H_2O$	70.7	73.76
17	iodide	CuI_2	....	....	....
18	nitrate	$Cu(NO_3)_2$	$6H_2O$	81.8	95.28
19	nitrate	$Cu(NO_3)_2$	$3H_2O$	....	....
20	sulfate	$CuSO_4$	$5H_2O$	14.3	17.4
21	sulfide	CuS	....	....	....
22	**Cuprous chloride**	$CuCl$	....	....	....
23	**Ferric chloride**	$FeCl_3$	....	74.4	81.9
24	**Ferrous** bromide	$FeBr_2$	$6H_2O$	102.0	....
25	chloride	$FeCl_2$	$4H_2O$	....	64.5
26	chloride	$FeCl_2$	....	....	....
27	nitrate	$Fe(NO_3)_2$	$6H_2O$	71.02	....
28	sulfate	$FeSO_4$	$7H_2O$	15.65	20.51
29	sulfate	$FeSO_4$	$1H_2O$	....	....
30	sulfide	FeS	....	....	....
31	**Hydrobromic acid, 760 mm**	HBr	....	221.2	210.3
32	**Hydrochloric acid, 760 mm**	HCl	....	82.3	....
33	**Iodine**	I_2	....	....	....
34	**Lanthanum sulfate**	$La_2(SO_4)_3$	$9H_2O$	3	....
35	**Lead** acetate	$Pb(C_2H_3O_2)_2$	$3H_2O$	....	....
36	bromide	$PbBr_2$	....	0.4554	....
37	carbonate	$PbCO_3$	....	....	....
38	chloride	$PbCl_2$	....	0.6728	....
39	chromate	$PbCrO_4$	....	....	....
40	fluoride	PbF_2	....	....	0.060
41	iodide	PbI_2	....	0.0442	....
42	nitrate	$Pb(NO_3)_2$	....	38.8	48.3
43	sulfate	$PbSO_4$	....	0.0028	0.0035
44	sulfide	PbS	....	....	....
45	**Lithium** bromide	$LiBr$	$2H_2O$	143	166
46	bromide	$LiBr$	$1H_2O$	....	....
47	carbonate	Li_2CO_3	....	1.54	1.43
48	chloride	$LiCl$	....	67	72
49	hydroxide	$LiOH$	$1H_2O$	12.7	12.7
50	iodide	LiI	$3H_2O$	151	157
51	iodide	LiI	$1H_2O$	....	....
52	nitrate	$LiNO_3$	$3H_2O$	53.4	61.0
53	nitrate	$LiNO_3$	$1\frac{1}{2}H_2O$	....	....

IN WATER AT VARIOUS TEMPERATURES

20°C.	30°C.	40°C.	50°C.	60°C.	70°C.	80°C.	90°C.	100°C.	
385.7^{15°	.....	.....	.....	....	....	....	....	.....	1
2.6^{24°	.....	.....	.....	.....	....	....	....	.....	2
23.0	33.9	47.2	64.4	83.8	107.0	134.0	163.0	197.0	3
1.6	2.6	4.0	5.4	7.3	9.8	14.4	20.5	30.0	4
....	.....	.....	.....	....	....	....	....	.....	5
178.7	184.1	189.9	194.9	199.9	205.0	210.3	214.9	220.3	6
0.716	0.562	0.451	0.386	0.324	0.274	0.219	0.125	0	7
....	.....	174.0	182.1	....	....	....	217.5	206.8	8
50.4	53.5	.....	.....	....	....	....	....	.....	9
....	.....	69.5	88.7	90.5	....	98.0	....	104.1	10
187.4	233.3	300.0	376.2	....	....	400.0	....	.....	11
100.0	.....	126.8	.....	....	....	....	....	.....	12
....	.....	.....	.....	163.2	184.8	212.5	334.9	.....	13
36.21	42.26	48.85	55.2	60.4	65.7	70	....	83	14
3.79×10^{-4} at 18°	.....	.....	.....	....	....	....	....	.....	15
77.0	80.34	83.8	87.44	91.2	....	99.2	....	107.9	16
1.107	.....	.....	.....	....	....	....	....	.....	17
125.1	.....	.....	.....	....	....	....	....	.....	18
....	.....	159.8	.....	178.8	....	207.8	....	.....	19
20.7	25	28.5	33.3	40	....	55	....	75.4	20
3.3×10^{-5} at 18°	.....	.....	.....	....	....	....	....	.....	21
1.52^{25°	.....	.....	.....	....	....	....	....	.....	22
91.8	.....	.....	315.1	....	....	525.8	....	535.7	23
115.1	122.2	128.3	.....	144	....	159.7	....	177.8	24
....	73.0	77.3	82.5	88.7	....	100	....	.....	25
....	.....	.....	.....	....	....	....	105.3	105.8	26
83.8	.....	.....	.....	165.6	....	....	....	.....	27
26.5	32.9	40.2	48.6	....	....	....	....	.....	28
....	.....	.....	.....	....	50.9	43.6	37.3	.....	29
0.000616^{18°	.....	.....	.....	....	....	....	....	.....	30
198	.....	.....	171.5	....	....	....	....	130	31
....	67.3	63.3	59.6	56.1	....	....	....	.....	32
0.029	0.04	0.056	0.078	....	....	....	....	.....	33
....	1.9	.....	1.5	....	....	....	....	0.69	34
....	55.04^{25°	.....	.....	....	....	....	....	.....	35
0.85	1.15	1.53	1.94	2.36	....	3.34	....	4.75	36
0.00011	.....	.....	.....	....	....	....	....	.....	37
0.99	1.20	1.45	1.70	1.98	....	2.62	....	3.34	38
7×10^{-6}	.....	.....	.....	....	....	....	....	.....	39
0.064	0.068	.....	.....	....	....	....	....	.....	40
0.068	0.090	0.125	0.164	0.197	....	0.302	....	0.436	41
56.5	66	75	85	95	....	115	....	138.8	42
0.0041	0.0049	0.0056	.....	....	....	....	....	.....	43
8.6×10^{-5} at 18°		.....	.....	....	....	....	....	.....	44
177	191	205	.....	....	....	....	....	.....	45
....	.....	.....	214	224	....	245	....	266	46
1.33	1.25	1.17	1.08	1.01	....	0.85	....	0.72	47
78.5	84.5	90.5	97	103	....	115	....	127.5	48
12.8	12.9	13	13.3	13.8	....	15.3	....	17.5	49
165	171	179	187	202	230	....	....	.....	50
....	.....	.....	.....	....	....	435	....	481	51
....	132.6	.....	.....	....	....	....	....	.....	52
....	.....	.....	156.4	175.3	....	....	....	.....	53

SOLUBILITIES OF INORGANIC COMPOUNDS

	Substance	Formula	Solid Phase	0°C.	10°C.
1	**Lithium** nitrate	$LiNO_3$	....	....	....
2	sulfate	Li_2SO_4	$1H_2O$	35.3	35.0
3	**Magnesium** bromide	$MgBr_2$	$6H_2O$	91.0	94.5
4	chloride	$MgCl_2$	$6H_2O$	52.8	53.5
5	hydroxide	$Mg(OH)_2$	....	....	....
6	iodide	MgI_2	$8H_2O$	120.8	....
7	nitrate	$Mg(NO_3)_2$	$6H_2O$	66.55	....
8	sulfate	$MgSO_4$	$7H_2O$	....	30.9
9	sulfate	$MgSO_4$	$6H_2O$	40.8	42.2
10	sulfate	$MgSO_4$	$1H_2O$	....	....
11	**Manganous** bromide	$MnBr_2$	$4H_2O$	127.3	135.9
12	bromide	$MnBr_2$	$2H_2O$	....	....
13	chloride	$MnCl_2$	$4H_2O$	63.4	68.1
14	chloride	$MnCl_2$	$2H_2O$	....	....
15	nitrate	$Mn(NO_3)_2$	$6H_2O$	101.98	118.0
16	nitrate	$Mn(NO_3)_2$	$3H_2O$	....	....
17	sulfate	$MnSO_4$	$7H_2O$	53.23	60.01
18	sulfate	$MnSO_4$	$5H_2O$	....	59.5
19	sulfate	$MnSO_4$	$4H_2O$	....	....
20	sulfate	$MnSO_4$	$1H_2O$	....	....
21	sulfide	MnS	....	....	....
22	**Mercuric** bromide	$HgBr_2$	....	....	....
23	chloride	$HgCl_2$	....	3.6	4.8
24	cyanide	$Hg(CN)_2$	....	....	$9.3^{13.5°}$
25	iodide	HgI_2	....	....	....
26	**Mercurous** bromide	$HgBr$	....	....	....
27	chloride	$HgCl$	....	0.00014	....
28	iodide	HgI	....	....	....
29	**Molybdic oxide**	MoO_3	$2H_2O$	....	....
30	**Neodymium sulfate**	$Nd_2(SO_4)_3$	....	9.5	....
31	**Nickel** bromide	$NiBr_2$	$6H_2O$	112.8	122.2
32	carbonate	$NiCO_3$	....	....	....
33	chloride	$NiCl_2$	$6H_2O$	53.9	59.5
34	iodide	NiI_2	$6H_2O$	124.2	135.3
35	nitrate	$Ni(NO_3)_2$	$6H_2O$	79.58	....
36	nitrate	$Ni(NO_3)_2$	$3H_2O$	....	....
37	sulfate	$NiSO_4$	$7H_2O$	27.22	32
38	sulfate	$NiSO_4$	$6H_2O$	....	....
39	sulfide	NiS	....	....	....
40	**Nitric oxide, 760 mm**	NO	....	0.00984	0.00757
41	**Nitrous oxide**	N_2O	....	....	0.1705
42	**Ozone**	O_3	....	0.0039	0.0029
43	**Potassium** acetate	$KC_2H_3O_2$	$1\frac{1}{2}H_2O$	216.7	233.9
44	acetate	$KC_2H_3O_2$	$\frac{1}{2}H_2O$	....	....
45	alum	$K_2SO_4 \cdot Al_2(SO_4)_3$	$24H_2O$	3.0	4.0
46	bicarbonate	$KHCO_3$	....	22.4	27.7
47	bisulfate	$KHSO_4$	....	36.3	....
48	bitartrate	$KHC_4H_4O_6$	....	0.32	0.40
49	bromate	$KBrO_3$	....	3.1	4.8
50	bromide	KBr	....	53.5	59.5
51	carbonate	K_2CO_3	$2H_2O$	105.5	108
52	chlorate	$KClO_3$	....	3.3	5
53	chloride	KCl	....	27.6	31.0
54	chloroplatinate	K_2PtCl_6	....	0.74	0.90

IN WATER AT VARIOUS TEMPERATURES

20°C.	30°C.	40°C.	50°C.	60°C.	70°C.	80°C.	90°C.	100°C.	
....	.....	.....	.....	....	194.1	....	....	.....	1
34.2	33.5	32.7	32.5	31.9	....	30.7	....	29.9	2
96.5	99.2	101.6	104.1	107.5	....	113.7	....	120.2	3
54.5	.....	57.5	.....	61.0	....	66.0	....	73.0	4
$0.0009^{18°}$	.....	.....	.....	....	....	....	....	.....	5
139.8	.....	173.2	.....	....	....	....	....	.....	6
....	.....	84.74	.....	....	....	....	137.0	.....	7
35.5	40.8	45.6	.....	....	....	....	....	.....	8
44.5	45.3	.....	50.4	53.5	59.5	64.2	69.0	74.0	9
....	.....	.....	.....	....	....	62.9	....	68.3	10
146.9	157.1	169.0	181.7	197.0	212.5	....	....	.....	11
....	.....	.....	.....	....	....	224.7	225.7	228.0	12
73.9	80.71	88.59	98.15	....	....	....	....	.....	13
....	.....	.....	.....	108.6	110.6	112.7	114.1	115.3	14
142.7	.....	.....	.....	....	....	....	....	.....	15
....	206.6	.....	.....	....	....	....	....	.....	16
....	.....	.....	.....	....	....	....	....	.....	17
62.9	67.76	.....	.....	....	....	....	....	.....	18
64.5	66.44	68.8	72.6	....	....	....	....	.....	19
....	.....	.....	58.17	55.0	52.0	48.0	42.5	34.0	20
$0.00062^{18°}$	.....	.....	.....	....	....	....	....	.....	21
0.5	.....	.....	.....	....	....	....	....	25	22
6.5	8.3	10.2	.....	16.2	....	30.0	....	61.3	23
....	.....	.....	.....	....	....	....	....	$53.85^{101.1°}$	24
....	$0.00591^{25°}$	.....	.....	....	....	....	....	.....	25
3.9×10^{-6} at 25°	.....	.....	.....	....	....	....	....	.....	26
0.0002	.....	0.0007	.....	....	....	....	....	.....	27
2×10^{-8} at 25°	.....	.....	.....	....	....	....	....	.....	28
0.138	0.264	0.476	0.687	1.206	2.055	2.106	....	.....	29
....	5	.....	3.7	....	....	2.7	....	....	30
130.9	138.1	144.5	150	152.5	....	153.8	....	155.1	31
$0.00925^{25°}$	.....	.....	.....	....	....	....	....	.....	32
64.2	68.9	73.3	78.3	82.2	85.2	....	....	87.6	33
148.1	161.1	173.9	183.0	184.1	185.7	187.4	188.2	.....	34
96.31	.....	122.2	.....	....	....	....	....	.....	35
....	.....	.....	.....	163.1	169.1	....	235.1	.....	36
....	42.46	.....	.....	....	....	....	....	.....	37
....	.....	.....	50.15	54.80	59.44	63.17	....	76.7	38
$0.00036^{18°}$	.....	.....	.....	....	....	....	....	.....	39
0.00618	0.00517	0.00440	0.00376	0.00324	0.00267	0.00199	0.00114	0	40
0.1211	.....	.....	.....	....	....	....	....	.....	41
0.0021	0.0007	0.0004	0.0001	0	....	....	....	.....	42
255.6	283.8	323.3	.....	....	....	....	....	.....	43
....	.....	.....	337.3	350	364.8	380.1	396.3	.....	44
5.9	8.39	11.70	17.00	24.75	40.0	71.0	109.0	.....	45
33.2	39.1	45.4	.....	60.0	....	....	....	.....	46
51.4	.....	67.3	.....	....	....	....	....	121.6	47
0.53	0.90	1.32	1.83	2.46	....	4.6	....	6.95	48
6.9	9.5	13.2	17.5	22.7	....	34.0	....	50.0	49
65.2	70.6	75.5	80.2	85.5	90.0	95.0	99.2	104.0	50
110.5	113.7	116.9	121.2	126.8	133.1	139.8	147.5	155.7	51
7.4	10.5	14	19.3	24.5	....	38.5	....	57	52
34.0	37.0	40.0	42.6	45.5	48.3	51.1	54.0	56.7	53
1.12	1.41	1.76	2.17	2.64	3.19	3.79	4.45	5.18	54

	Substance	Formula	Solid Phase	0°C.	10°C,
1	**Potassium** chromate	K_2CrO_4	....	58.2	60.0
2	dichromate	$K_2Cr_2O_7$	....	5	7
3	ferricyanide	$K_3Fe(CN)_6$	....	31	36
4	hydroxide	KOH	$2H_2O$	97	103
5	hydroxide	KOH	$1H_2O$	....	....
6	iodate	KIO_3	....	4.73	....
7	iodide	KI	....	127.5	136
8	nitrate	KNO_3	....	13.3	20.9
9	nitrite	KNO_2	....	278.8	....
10	perchlorate	$KClO_4$	....	0.75	1.05
11	permanganate	$KMnO_4$	....	2.83	4.4
12	†persulfate	$K_2S_2O_8$†	†	1.62	2.60
13	sulfate	K_2SO_4	....	7.35	9.22
14	thiocyanate	$KCNS$	....	177.0	....
15	**Rubidium** chlorate	$RbClO_3$	....	2.14	......
16	chloride	$RbCl$	....	77	84.4
17	nitrate	$RbNO_3$	....	19.5	33
18	perchlorate	$RbClO_4$	....	0.5	0.6
19	sulfate	Rb_2SO_4	....	36.4	42.6
20	**Selenic** acid	H_2SeO_4	$1H_2O$	426	....
21	acid	H_2SeO_4	....	....	....
22	**Selenious acid**	H_2SeO_3	....	90.1	122.2
23	**Silver** acetate	$AgC_2H_3O_2$	....	0.72	0.88
24	arsenate	Ag_3AsO_4	....	....	....
25	arsenite	Ag_3AsO_3	....	....	....
26	bromide	$AgBr$	....	....	....
27	carbonate	Ag_2CO_3	....	....	....
28	chloride	$AgCl$	....	....	8.9×10^{-5}
29	chromate	Ag_2CrO_4	....	0.0014	....
30	cyanide	$AgCN$	....	....	....
31	ferricyanide	$Ag_3Fe(CN)_6$	....	....	....
32	iodate	$AgIO_3$	....	....	0.003
33	iodide	AgI	....	....	....
34	nitrate	$AgNO_3$	....	122	170
35	nitrite	$AgNO_2$	....	0.155	0.220
36	sulfate	Ag_2SO_4	....	0.573	0.695
37	sulfide	Ag_2S	....	....	....
38	**Sodium** acetate	$NaC_2H_3O_2$	$3H_2O$	36.3	40.8
39	acetate	$NaC_2H_3O_2$	....	119	121
40	bicarbonate	$NaHCO_3$	....	6.9	8.15
41	bromate	$NaBrO_3$	....	27.5	....
42	bromide	$NaBr$	$2H_2O$	79.5	....
43	bromide	$NaBr$	....	....	....
44	carbonate	Na_2CO_3	$10H_2O$	7	12.5
45	carbonate	Na_2CO_3	$1H_2O$	....	....
46	chlorate	$NaClO_3$	....	79	89
47	chloride	$NaCl$	....	35.7	35.8
48	chromate	Na_2CrO_4	$10H_2O$	31.70	50.17
49	chromate	Na_2CrO_4	$4H_2O$	....	....
50	chromate	Na_2CrO_4	....	....	....
51	dichromate	$Na_2Cr_2O_7$	$2H_2O$	163.0	....
52	dichromate	$Na_2Cr_2O_7$	....	....	....
53	dihydrogen phosphate	NaH_2PO_4	$2H_2O$	57.9	69.9
54	dihydrogen phosphate	NaH_2PO_4	$1H_2O$	....	....
55	dihydrogen phosphate	NaH_2PO_4	....	....	....
56	ferrocyanide	$Na_4Fe(CN)_6$	....	....	....

IN WATER AT VARIOUS TEMPERATURES

20°C.	30°C.	40°C.	50°C.	60°C.	70°C.	80°C.	90°C.	100°C.	
61.7	63.4	65.2	66.8	68.6	70.4	72.1	73.9	75.6	1
12	20	26	34	43	52	61	70	80	2
43	50	60	.....	66	....	....	....	82.6[104]	3
112	126	.....	.....	....	....	....	....	.....	4
....	.....	.....	140	....	....	....	....	178	5
8.13	11.73	12.8	.....	18.5	....	24.8	....	32.2	6
144	152	160	168	176	184	192	200	208	7
31.6	45.8	63.9	85.5	110.0	138	169	202	246	8
298.4	.....	334.9	.....	....	....	....	....	412.8	9
1.80	2.6	4.4	6.5	9	11.8	14.8	18	21.8	10
6.4	9.0	12.56	16.89	22.2	....	....	....	.....	11
4.49	7.19	9.89	.....	....	....	....	....	.....	12
11.11	12.97	14.76	16.50	18.17	19.75	21.4	22.8	24.1	13
217.5	.....	.....	.....	....	....	....	....	.....	14
5.4	8	.....	15.98	....	....	....	....	62.8	15
91.1	97.6	103.5	109.3	115.5	121.4	127.2	133.1	138.9	16
53.3	81.3	116.7	155.6	200	251	309	375	452	17
1.0	1.5	2.3	3.5	4.85	6.72	9.2	12.7	18	18
48.2	53.5	58.5	63.1	67.4	71.4	75.0	78.7	81.8	19
567	.....	.....	.....	....	....	....	....	.....	20
1329	1718	2757	∞	....	....	....	....	.....	21
166.7	235.6	344.4	380.8	383.9	383.9	383.9	385.4	.....	22
1.04	1.21	1.41	1.64	1.89	2.18	2.52	....	.....	23
0.00085	.....	.....	.....	....	....	....	....	.....	24
0.00115	.....	.....	.....	....	....	....	....	.....	25
8.4×10^{-6}	.....	.....	.....	....	....	....	....	.....	26
0.0032	.....	.....	.....	....	....	....	....	0.05	27
1.5×10^{-4}	.....	.....	0.0005	....	....	....	....	0.002	28
....	0.0036	.....	0.0053	....	0.008	....	....	0.011	29
2.2×10^{-5}	.....	.....	.....	....	....	....	....	.....	30
6.6×10^{-5}	.....	.....	.....	....	....	....	....	.....	31
0.004	.....	.....	.....	0.018	....	....	....	.....	32
....	3×10^{-7}	.....	.....	3×10^{-6}	....	....	....	.....	33
222	300	376	455	525	....	669	....	952	34
0.340	0.5	0.715	0.995	1.363	....	....	....	.....	35
0.796	0.888	0.979	1.08	1.15	1.22	1.30	1.36	1.41	36
1.3×10^{-16}	.....	.....	.....	....	....	....	....	.....	37
46.5	54.5	65.5	83	139	....	....	....	.....	38
123.5	126	129.5	134	139.5	146	153	161	170	39
9.6	11.1	12.7	14.45	16.4	....	....	....	.....	40
34.5	.....	50.2	.....	62.5	....	75.7	....	90.9	41
90.5	97.6	105.8	116.0	....	....	....	....	.....	42
....	.....	.....	.....	....	....	118.3	....	121.2	43
21.5	38.8	.....	.....	....	....	....	....	.....	44
....	50.5	48.5	.....	46.4	....	45.8	....	45.5	45
101	113	126	140	155	172	189	....	230	46
36.0	36.3	36.6	37.0	37.3	37.8	38.4	39.0	39.8	47
88.7	.....	.....	.....	....	....	....	....	.....	48
....	88.7	95.96	104	114.6	....	....	....	.....	49
....	.....	.....	.....	....	123.0	124.8	....	125.9	50
177.8	.....	.....	244.8	....	316.7	376.2	....	.....	51
....	.....	.....	.....	....	....	....	....	426.3	52
85.2	106.5	138.2	.....	....	....	....	....	.....	53
....	.....	.....	158.6	....	....	....	....	.....	54
....	.....	.....	.....	179.3	190.3	207.3	225.3	246.6	55
17.9	.....	30	.....	....	....	59	....	63	56

	Substance	Formula	Solid Phase	0°C.	10°C.
1	**Sodium** hydrogen arsenate	Na_2HAsO_4	$12H_2O$	7.3	15.5
2	hydrogen phosphate	Na_2HPO_4	$12H_2O$	1.67	3.6
3	hydrogen phosphate	Na_2HPO_4	$7H_2O$	....	....
4	hydrogen phosphate	Na_2HPO_4	$2H_2O$	....	....
5	hydrogen phosphate	Na_2HPO_4	....	....	....
6	hydroxide	$NaOH$	$4H_2O$	42	....
7	hydroxide	$NaOH$	$3\frac{1}{2}H_2O$	....	51.5
8	hydroxide	$NaOH$	$1H_2O$	....	....
9	hydroxide	$NaOH$	....	....	....
10	iodate	$NaIO_3$	....	2.5	....
11	iodide	NaI	$2H_2O$	158.7	168.6
12	iodide	NaI	....	....	....
13	nitrate	$NaNO_3$	....	73	80
14	nitrite	$NaNO_2$	....	72.1	78.0
15	oxalate	$Na_2C_2O_4$	....	....	....
16	phosphate, tri-	Na_3PO_4	$12H_2O$	1.5	4.1
17	pyrophosphate	$Na_4P_2O_7$	$10H_2O$	3.16	3.95
18	selenate	Na_2SeO_4	$10H_2O$	13.30	....
19	selenate	Na_2SeO_4	....	....	....
20	sulfate	Na_2SO_4	$10H_2O$	5.0	9.0
21	sulfate	Na_2SO_4	$7H_2O$	19.5	30
22	sulfate	Na_2SO_4	....	....	....
23	sulfide	Na_2S	$9H_2O$	....	15.42
24	sulfide	Na_2S	$5\frac{1}{2}H_2O$	....	....
25	sulfide	Na_2S	$6H_2O$	....	....
26	sulfite	Na_2SO_3	$7H_2O$	13.9	20
27	sulfite	Na_2SO_3	....	....	....
28	tetraborate	$Na_2B_4O_7$	$10H_2O$	1.3	1.6
29	tetraborate	$Na_2B_4O_7$	$5H_2O$	....	....
30	tungstate	Na_2WO_4	$10H_2O$	57.58	....
31	tungstate	Na_2WO_4	$2H_2O$	71.61	....
32	vanadate (meta)	$NaVO_3$	$2H_2O$	....	....
33	vanadate (meta)	$NaVO_3$	....	....	....
34	**Stannous** chloride	$SnCl_2$	....	83.9	....
35	iodide	SnI_2	....	....	....
36	sulfate	$SnSO_4$	....	....	....
37	**Strontium** acetate	$Sr(C_2H_3O_2)_2$	$4H_2O$	36.9	43.61
38	acetate	$Sr(C_2H_3O_2)_2$	$\frac{1}{2}H_2O$	....	42.95
39	bromide	$SrBr_2$	$6H_2O$	85.2	93
40	chloride	$SrCl_2$	$6H_2O$	43.5	47.7
41	chloride	$SrCl_2$	$2H_2O$	....	....
42	iodide	SrI_2	$6H_2O$	165.3	....
43	iodide	SrI_2	$2H_2O$	....	....
44	nitrate	$Sr(NO_3)_2$	$1H_2O$	52.7	....
45	nitrate	$Sr(NO_3)_2$	$4H_2O$	40.1	....
46	nitrate	$Sr(NO_3)_2$	....	....	....
47	oxalate	SrC_2O_4	$1H_2O$	0.0033	0.0044
48	sulfate	$SrSO_4$	....	0.0113	....
49	**Sulfur dioxide, 760 mm**	SO_2	....	22.83	16.21
50	**Telluric** acid	H_2TeO_4	$6H_2O$	16.17	35.52
51	acid	H_2TeO_4	$2H_2O$	....	33.85
52	**Thallium** bromate	$TlBrO_3$	....	....	....
53	bromide	$TlBr$	....	0.024	0.029
54	chlorate	$TlClO_3$	....	2.8	....
55	chloride	$TlCl$	....	0.21	0.25

IN WATER AT VARIOUS TEMPERATURES

20°C.	30°C.	40°C.	50°C.	60°C.	70°C.	80°C.	90°C.	100°C.	
26.5	37	47	.....	65	....	85	....	.....	1
7.7	20.8	.....	.....	....	....	....	....	.....	2
....	.....	51.8	.....	....	....	....	....	.....	3
....	.....	.....	80.2	82.9	88.1	92.4	102.9	.....	4
....	.....	.....	.....	....	....	....	....	102.2	5
....	.....	.....	.....	....	....	....	....	.....	6
....	.....	.....	.....	....	....	....	....	.....	7
109	119	129	145	174	....	....	....	.....	8
....	.....	.....	.....	....	....	....	313	347	9
9	.....	15	.....	21	....	27	....	34	10
178.7	190.3	205.0	227.8	256.8	....	....	....	.....	11
....	.....	.....	.....	....	294	296	....	302	12
88	96	104	114	124	....	148	....	180	13
84.5	91.6	98.4	104.1	....	....	132.6	....	163.2	14
3.7	.....	.....	.....	....	....	....	....	6.33	15
11	20	31	43	55	....	81	....	108	16
6.23	9.95	13.50	17.45	21.83	....	30.04	....	40.26	17
....	78.73	.....	.....	....	....	....	....	.....	18
....	.....	.....	80.15	....	....	....	....	72.83	19
19.4	40.8	.....	.....	....	....	....	....	.....	20
44	.....	.....	.....	....	....	....	....	.....	21
....	.....	48.8	46.7	45.3	....	43.7	....	42.5	22
18.8	22.5	28.5	....	....	....	....	....	.....	23
....	.....	.....	39.82	42.69	45.73	51.40	59.23	.....	24
....	.....	.....	36.4	39.1	43.31	49.14	57.28	.....	25
26.9	36	.....	.....	....	....	....	....	.....	26
....	.....	28	28.2	28.8	....	28.3	....	.....	27
2.7	3.9	.....	10.5	20.3	....	....	....	.....	28
....	.....	.....	.....	....	24.4	31.5	41	52.5	29
....	.....	.....	.....	....	....	....	....	.....	30
72.4	.....	.....	.....	....	....	91.2	....	97.2	31
15.3$^{25°}$	.....	30.2	.....	68.4	....	....	....	.....	32
21.10$^{25°}$	.....	26.23	.....	32.97	36.9	38.8$^{75°}$	....	.....	33
269.8$^{15°}$	.....	.....	.....	....	....	....	....	.....	34
1.0	1.2	1.4	1.7	2.1	2.5	3.0	3.4	4.0	35
19	...,.	.....	.....	....	....	....	....	18	36
....	.....	.....	.....	....	....	....	....	.....	37
41.6	39.5	.....	37.35	....	36.24	36.10	....	36.4	38
102.4	111.9	123.2	135.8	150	....	181.8	....	222.5	39
52.9	58.7	65.3	72.4	81.8	....	....	....	.....	40
....	.....	.....	.....	....	85.9	90.5	....	100.8	41
177.8	.....	191.5	.....	217.5	....	270.4	....	.....	42
....	.....	.....	.....	....	....	....	365.2	383.1	43
64.0	.....	.....	83.8	97.2	....	....	130.4	139	44
70.5	.....	.....	.....	....	....	....	....	.....	45
....	88.6	90.1	.....	93.8	96	98	100	.....	46
0.0046	0.0057	.....	.....	....	....	....	....	.....	47
0.0114	0.0114	.....	.....	....	....	....	....	.....	48
11.29	7.81	5.41	4.5	....	....	....	....	.....	49
....	.....	.....	.....	....	....	....	....	.....	50
....	50.06	57.19	.....	77.52	....	106.4	....	155.3	51
0.346	.....	0.736	.....	....	....	....	....	.....	52
0.042	.....	.....	.....	....	....	....	....	.....	53
3.92	.....	.....	12.67	....	....	35.65	....	57.31	54
0.33	0.42	0.52	0.63	0.8	....	1.2	....	1.8	55

SOLUBILITIES OF INORGANIC COMPOUNDS

	Substance	Formula	Solid Phase	0°C.	10°C.
1	**Thallium** hydroxide	$TlOH$	....	25.44	....
2	iodide	TlI	....	....	0.0036
3	nitrate	$TlNO_3$	....	3.91	6.22
4	perchlorate	$TlClO_4$	....	6	8.04
5	selenate	Tl_2SeO_4	....	....	2.13
6	sulfate	Tl_2SO_4	....	2.70	3.70
7	sulfide	Tl_2S	....	....	....
8	**Thorium** selenate	$Th(SeO_4)_2$	....	0.498	....
9	sulfate	$Th(SO_4)_2$	$9H_2O$	0.74	0.98
10	sulfate	$Th(SO_4)_2$	$8H_2O$	1.0	1.25
11	sulfate	$Th(SO_4)_2$	$6H_2O$	1.50	....
12	sulfate	$Th(SO_4)_2$	$4H_2O$	....	....
13	**Uranyl nitrate**	$UO_2(NO_3)_2$	$6H_2O$	98.0	108.3
14	**Ytterbium sulfate**	$Yb_2(SO_4)_3$	$8H_2O$	44.2	38.4
15	**Zinc** bromide	$ZnBr_2$	$2H_2O$	389.0	....
16	bromide	$ZnBr_2$	....	....	....
17	chlorate	$ZnClO_3$	$6H_2O$	145.0	152.5
18	chlorate	$ZnClO_3$	$4H_2O$	....	....
19	iodide	ZnI_2	$2H_2O$	430.9	457.4
20	iodide	ZnI_2	....	429.4	....
21	nitrate	$Zn(NO_3)_2$	$6H_2O$	94.78	....
22	nitrate	$Zn(NO_3)_2$	$3H_2O$	....	....
23	sulfate	$ZnSO_4$	$7H_2O$	41.9	47
24	sulfate	$ZnSO_4$	$6H_2O$	....	....
25	sulfate	$ZnSO_4$	$1H_2O$	....	....

SOLUBILITY OF CANE (OR BEET) SUGAR IN WATER

Temp. °C.	Per cent sugar	Grams of sugar in 100g H_2O
0	64.18	179.2
5	64.87	184.7
10	65.58	190.5
15	66.33	197.0
20	67.09	203.9
25	67.89	211.4
30	68.80	219.5
35	69.55	228.4
40	70.42	238.1
45	71.32	248.7

Temp. °C.	Per cent sugar	Grams of sugar in 100g H_2O
50	72.25	260.4
55	73.20	273.1
60	74.18	287.3
66	75.88	315.0
	76.22	320.4
75	77.27	339.9
30	78.36	362.1
85	79.46	386.9
90	80.61	415.7
95	81.77	448.5
100	82.97	487.2

IN WATER AT VARIOUS TEMPERATURES

20°C.	30°C.	40°C.	50°C.	60°C.	70°C.	80°C.	90°C.	100°C.	
....	39.9	49.5	.....	73.8	....	106	126.1	148.3	1
0.006	0.008	0.015	.....	0.035	.....	0.070	....	0.120	2
9.55	14.3	20.9	30.4	46.2	69.5	111.0	200.0	414.0	3
....	19.72	.....	39.62	....	65.32	81.49	....	166.6	4
2.8	.....	.....	.....	.....	....	8.5	....	10.9	5
4.87	6.16	.....	9.21	10.92	12.74	14.61	16.53	18.45	6
0.0022	.....	.....	.....	....	....	....	....	.....	7
....	.....	.....	.....	....	....	....	....	1.97	8
1.38	1.995	2.998	5.22	....	....	....	....	.....	9
1.62	.....	.....	.....	....	....	....	....	.....	10
1.90	2.45	.....	.....	6.64	....	....	....	.....	11
....	.....	4.04	2.54	1.63	1.09	....	....	.....	12
125.5	.....	.....	203	....	....	....	....	.....	13
....	21.0	.....	....	10.4	7.22	6.92	5.83	4.67	14
446.4	528.1	.....	.....	....	....	....	....	.....	15
....	.....	591.1	.....	618.4	....	644.6	....	672.2	16
....	.....	.....	.....	....	....	....	....	.....	17
200.3	209.2	223.2	273.1	....	....	....	....	.....	18
484.8	.....	.....	.....	....	....	....	....	.....	19
....	.....	445.2	.....	467.2	....	490	....	510.5	20
118.3	.....	.....	.....	....	....	....	....	.....	21
....	.....	206.9	.....	....	....	....	....	.....	22
54.4	.....	.....	.....	.....	....	....	....	.....	23
....	.....	70.1	76.8	....	....	....	....	.....	24
....	.....	.....	.....	....	....	.86.6	83.7	80.8	25

SEA WATER

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The table below lists all of the elements known to occur in sea water as dissolved solids, except hydrogen, oxygen and dissolved gases. They are not given as ions but as the amounts of the individual elements which occur in water of 19.00% chlorinity. Cadmium, chromium, cobalt and tin are merely mentioned because they have been found in the ash of marine organisms, and hence it is implied that they occur in sea water although so far they have not been obtained directly.

Element	parts per million, mg/kg	Element	parts per million, mg/kg
Chlorine	18980	Copper	0.001–0.01
Sodium	10561	Zinc	0.005
Magnesium	1272	Lead	0.004
Sulfur	884	Selenium	0.004
Calcium	400	Cesium	0.002
Potassium	380	Uranium	0.0015
Bromine	65	Molybdenum	0.0005
Carbon	28	Thorium	<0.0005
Strontium	13	Cerium	0.0004
Boron	4.6	Silver	0.0003
Silicon	0.02–4.0	Vanadium	0.0003
Fluorine	1.4	Lanthanum	0.0003
Nitrogen*	0.01–0.7	Yttrium	0.0003
Aluminum	0.5	Nickel	0.0001
Rubidium	0.2	Scandium	0.00004
Lithium	0.1	Mercury	0.00003
Phosphorus	0.001–0.10	Gold	0.000006
Barium	0.05	Radium	$0.2\text{–}3\times10^{10}$
Iodine	0.05	Cadmium	
Arsenic	0.01–0.02	Chromium	
Iron	0.002–0.02	Cobalt	
Manganese	0.001-0.01	Tin	

* In dissolved compounds and not as dissolved atmospheric nitrogen.

SOLUBILITY OF GASES IN WATER

The column headed "α" gives the volume of gas reduced to standard conditions (0°C and 760 mm) dissolved in one volume of water when the pressure of the gas (without the aqueous tension) is 760 mm; this value "α" is the "absorption coefficient." The column headed "l" gives the volume of the gas expressed in cubic centimeters dissolved in one volume of water at a total pressure (partial pressure of the gas plus the aqueous tension at the stated temperature) of 760 mm. The column headed "q" gives the weight of gas in grams dissolved in 100 grams of water at a total pressure (partial pressure of the gas plus the aqueous tension at the stated temperature) of 760 mm.

Temp. Deg. C.	ACETYLENE		AIR*		AMMONIA		BROMINE	
	α	q	cc/1000cc	%Oxygen in dissd. air	α	q	α	q
0	1.73	0.200	29.18	34.91	1176	89.5	60.5	42.9
1	1.68	0.194	28.42	34.87	....	....	....	....
2	1.63	0.188	27.69	34.82	....	....	54.1	38.3
3	1.58	0.182	26.99	34.78	....	....	....	....
4	1.53	0.176	26.32	34.74	1047	79.6	48.3	34.2
5	1.49	0.171	25.68	34.69	....	....	....	....
6	1.45	0.167	25.06	34.65	....	....	43.3	30.6
7	1.41	0.162	24.47	34.60	....	....	....	....
8	1.37	0.157	23.90	34.56	947	72.0	38.9	27.5
9	1.34	0.154	23.36	34.52	....	....	....	....
10	1.31	0.150	22.84	34.47	....	....	35.1	24.8
11	1.27	0.146	22.34	34.43	....	....	....	....
12	1.24	0.142	21.87	34.38	857	65.1	31.5	22.2
13	1.21	0.138	21.41	34.34	837	63.6	....	....
14	1.18	0.135	20.97	34.30	....	....	28.4	20.0
15	1.15	0.131	20.55	34.25	....	....	....	....
16	1.13	0.129	20.14	34.21	775	58.7	25.7	18.0
17	1.10	0.125	19.75	34.17	....	....	....	....
18	1.08	0.123	19.38	34.12	....	....	23.4	16.4
19	1.05	0.119	19.02	34.08	....	....	....	....
20	1.03	0.117	18.68	34.03	702	53.1	21.3	14.9
21	1.01	0.115	18.34	33.99	....	....	....	....
22	0.99	0.112	18.01	33.95	....	....	19.4	13.5
23	0.97	0.110	17.69	33.90	....	....	....	....
24	0.95	0.107	17.38	33.86	639	48.2	17.7	12.3
25	0.93	0.105	17.08	33.82	....	....	....	....
26	0.91	0.102	16.79	33.77	....	....	16.3	11.3
27	0.89	0.100	16.50	33.73	....	....	....	....
28	0.87	0.098	16.21	33.68	586	44.0	15.0	10.3
29	0.85	0.095	15.92	33.64	....	....	....	....
30	0.84	0.094	15.64	33.60	....	....	13.8	9.5
35	....	.....	.....	.....	....	....	....	....
40	....	.....	.....	.....	....	....	9.4	6.3
45	....	.....	.....	.....	....	....	....	....
50	....	.....	.....	.....	....	....	6.5	4.1
60	....	.....	.....	.....	....	....	4.9	2.9
70	....	.....	.....	.....	....	....	3.8	1.9
80	....	.....	.....	.....	....	....	3.0	1.2
90	....	.....	.....	.....	....	....	....	....
100	....	.....	.....	.....	....	....	....	....

* Free from NH_3 and CO_2; total pressure of air + aq. tension is 760 mm.

SOLUBILITY OF GASES IN WATER

Temp °C.	CARBON DIOXIDE		CARBON MONOXIDE		CHLORINE		ETHANE		ETHYLENE		HYDROGEN	
	α	q	α	q	l	q	α	q	α	q	α	q
0	1.713	0.3346	0.03537	0.004397	.....	......	0.09874	0.01317	0.226	0.0281	0.02148	0.0001922
1	1.646	0.3213	0.03455	0.004293	.....	......	0.09476	0.01263	0.219	0.0272	0.02126	0.0001901
2	1.584	0.3091	0.03375	0.004191	.....	......	0.09093	0.01212	0.211	0.0262	0.02105	0.0001881
3	1.527	0.2978	0.03297	0.004092	.....	......	0.08725	0.01162	0.204	0.0253	0.02084	0.0001862
4	1.473	0.2871	0.03222	0.003996	.....	......	0.08372	0.01114	0.197	0.0244	0.02064	0.0001843
5	1.424	0.2774	0.03149	0.003903	.....	......	0.08033	0.01069	0.191	0.0237	0.02044	0.0001824
6	1.377	0.2681	0.03078	0.003813	.....	......	0.07709	0.01025	0.184	0.0228	0.02025	0.0001806
7	1.331	0.2589	0.03009	0.003725	.....	......	0.07400	0.00983	0.178	0.0220	0.02007	0.0001789
8	1.282	0.2492	0.02942	0.003640	.....	......	0.07106	0.00943	0.173	0.0214	0.01989	0.0001772
9	1.237	0.2403	0.02878	0.003559	.....	......	0.06826	0.00906	0.167	0.0207	0.01972	0.0001756
10	1.194	0.2318	0.02816	0.003479	3.148	0.9972	0.06561	0.00870	0.162	0.0200	0.01955	0.0001740
11	1.154	0.2239	0.02757	0.003405	3.047	0.9654	0.06328	0.00838	0.157	0.0194	0.01940	0.0001725
12	1.117	0.2165	0.02701	0.003332	2.950	0.9346	0.06106	0.00808	0.152	0.0188	0.01925	0.0001710
13	1.083	0.2098	0.02646	0.003261	2.856	0.9050	0.05894	0.00780	0.148	0.0183	0.01911	0.0001696
14	1.050	0.2032	0.02593	0.003194	2.767	0.8768	0.05694	0.00753	0.143	0.0176	0.01897	0.0001682
15	1.019	0.1970	0.02543	0.003130	2.680	0.8495	0.05504	0.00727	0.139	0.0171	0.01883	0.0001668
16	0.985	0.1903	0.02494	0.003066	2.597	0.8232	0.05326	0.00703	0.136	0.0167	0.01869	0.0001654
17	0.956	0.1845	0.02448	0.003007	2.517	0.7979	0.05159	0.00680	0.132	0.0162	0.01856	0.0001641
18	0.928	0.1789	0.02402	0.002947	2.440	0.7738	0.05003	0.00659	0.129	0.0158	0.01844	0.0001628
19	0.902	0.1737	0.02360	0.002891	2.368	0.7510	0.04858	0.00639	0.125	0.0153	0.01831	0.0001616
20	0.878	0.1688	0.02319	0.002838	2.299	0.7293	0.04724	0.00620	0.122	0.0149	0.01819	0.0001603
21	0.854	0.1640	0.02281	0.002789	2.238	0.7100	0.04589	0.00602	0.119	0.0146	0.01805	0.0001588
22	0.829	0.1590	0.02244	0.002739	2.180	0.6918	0.04459	0.00584	0.116	0.0142	0.01792	0.0001575
23	0.804	0.1540	0.02208	0.002691	2.123	0.6739	0.04335	0.00567	0.114	0.0139	0.01779	0.0001561
24	0.781	0.1493	0.02174	0.002646	2.070	0.6572	0.04217	0.00551	0.111	0.0135	0.01766	0.0001548
25	0.759	0.1449	0.02142	0.002603	2.019	0.6413	0.04104	0.00535	0.108	0.0131	0.01754	0.0001535
26	0.738	0.1406	0.02110	0.002560	1.970	0.6259	0.03997	0.00520	0.106	0.0129	0.01742	0.0001522
27	0.718	0.1366	0.02080	0.002519	1.923	0.6112	0.03895	0.00506	0.104	0.0126	0.01731	0.0001509
28	0.699	0.1327	0.02051	0.002479	1.880	0.5975	0.03799	0.00493	0.102	0.0123	0.01720	0.0001496
29	0.682	0.1292	0.02024	0.002442	1.839	0.5847	0.03709	0.00480	0.100	0.0121	0.01709	0.0001484
30	0.665	0.1257	0.01998	0.002405	1.799	0.5723	0.03624	0.00468	0.098	0.0118	0.01699	0.0001474
35	0.592	0.1105	0.01877	0.002231	1.602	0.5104	0.03230	0.00412	.....	......	0.01666	0.0001425
40	0.530	0.0973	0.01775	0.002075	1.438	0.4590	0.02915	0.00366	.....	......	0.01644	0.0001384
45	0.479	0.0860	0.01690	0.001933	1.322	0.4228	0.02660	0.00327	.....	......	0.01624	0.0001341
50	0.436	0.0761	0.01615	0.001797	1.225	0.3925	0.02459	0.00294	.....	......	0.01608	0.0001287
60	0.359	0.0576	0.01488	0.001522	1.023	0.3295	0.02177	0.00239	.....	.....	0.01600	0.0001178
70	......	......	0.01440	0.001276	0.862	0.2793	0.01948	0.00185	.....	.....	0.0160	0.000102
80	......	......	0.01430	0.000980	0.683	0.2227	0.01826	0.00134	.....	......	0.0160	0.000079
90	......	......	0.0142	0.00057	0.39	0.127	0.0176	0.0008	.....	......	0.0160	0.000046
100	......	......	0.0141	0.00000	0.00	0.000	0.0172	0.0000	.....	......	0.0160	0.000000

SOLUBILITY OF GASES IN WATER

Temp. °C.	HYDROGEN SULFIDE		METHANE		NITRIC OXIDE		NITROGEN*		OXYGEN		SULFUR DIOXIDE	
	α	q	α	q	α	q	α	q	α	q	l	q
0	4.670	0.7066	0.05563	0.003959	0.07381	0.009833	0.02354	0.002942	0.04889	0.006945	79.789	22.83
1	4.522	0.6839	0.05401	0.003842	0.07184	0.009564	0.02297	0.002869	0.04758	0.006756	77.210	22.09
2	4.379	0.6619	0.05244	0.003728	0.06993	0.009305	0.02241	0.002798	0.04633	0.006574	74.691	21.37
3	4.241	0.6407	0.05093	0.003619	0.06809	0.009057	0.02187	0.002730	0.04512	0.006400	72.230	20.66
4	4.107	0.6201	0.04946	0.003513	0.06632	0.008816	0.02135	0.002663	0.04397	0.006232	69.828	19.98
5	3.977	0.6001	0.04805	0.003410	0.06461	0.008584	0.02086	0.002600	0.04287	0.006072	67.485	19.31
6	3.852	0.5809	0.04669	0.003312	0.06298	0.008361	0.02037	0.002537	0.04180	0.005918	65.200	18.65
7	3.732	0.5624	0.04539	0.003217	0.06140	0.008147	0.01990	0.002477	0.04080	0.005773	62.973	18.02
8	3.616	0.5446	0.04413	0.003127	0.05990	0.007943	0.01945	0.002419	0.03983	0.005632	60.805	17.40
9	3.505	0.5276	0.04292	0.003039	0.05846	0.007747	0.01902	0.002365	0.03891	0.005498	58.697	16.80
10	3.399	0.5112	0.04177	0.002955	0.05709	0.007560	0.01861	0.002312	0.03802	0.005368	56.647	16.21
11	3.300	0.4960	0.04072	0.002879	0.05587	0.007393	0.01823	0.002263	0.03718	0.005246	54.655	15.64
12	3.206	0.4814	0.03970	0.002805	0.05470	0.007233	0.01786	0.002216	0.03637	0.005128	52.723	15.09
13	3.115	0.4674	0.03872	0.002733	0.05357	0.007078	0.01750	0.002170	0.03559	0.005014	50.849	14.56
14	3.028	0.4540	0.03779	0.002665	0.05250	0.006930	0.01717	0.002126	0.03486	0.004906	49.033	14.04
15	2.945	0.4411	0.03690	0.002599	0.05147	0.006788	0.01685	0.002085	0.03415	0.004802	47.276	13.54
16	2.865	0.4287	0.03606	0.002538	0.05049	0.006652	0.01654	0.002045	0.03348	0.004703	45.578	13.05
17	2.789	0.4169	0.03525	0.002478	0.04956	0.006524	0.01625	0.002006	0.03283	0.004606	43.939	12.59
18	2.717	0.4056	0.03448	0.002422	0.04868	0.006400	0.01597	0.001970	0.03220	0.004514	42.360	12.14
19	2.647	0.3948	0.03376	0.002369	0.04785	0.006283	0.01570	0.001935	0.03161	0.004426	40.838	11.70
20	2.582	0.3846	0.03308	0.002319	0.04706	0.006173	0.01545	0.001901	0.03102	0.004339	39.374	11.28
21	2.517	0.3745	0.03243	0.002270	0.04625	0.006059	0.01522	0.001869	0.03044	0.004252	37.970	10.88
22	2.456	0.3648	0.03180	0.002222	0.04545	0.005947	0.01498	0.001838	0.02988	0.004169	36.617	10.50
23	2.396	0.3554	0.03119	0.002177	0.04469	0.005838	0.01475	0.001809	0.02934	0.004087	35.302	10.12
24	2.338	0.3463	0.03061	0.002133	0.04395	0.005733	0.01454	0.001780	0.02881	0.004007	34.026	9.76
25	2.282	0.3375	0.03006	0.002091	0.04323	0.005630	0.01434	0.001751	0.02831	0.003931	32.786	9.41
26	2.229	0.3290	0.02952	0.002050	0.04254	0.005530	0.01413	0.001724	0.02783	0.003857	31.584	9.06
27	2.177	0.3208	0.02901	0.002011	0.04188	0.005435	0.01394	0.001698	0.02736	0.003787	30.422	8.73
28	2.128	0.3130	0.02852	0.001974	0.04124	0.005342	0.01376	0.001672	0.02691	0.003718	29.314	8.42
29	2.081	0.3055	0.02806	0.001938	0.04063	0.005252	0.01358	0.001647	0.02649	0.003651	28.210	8.10
30	2.037	0.2983	0.02762	0.001904	0.04004	0.005165	0.01342	0.001624	0.02608	0.003588	27.161	7.80
35	1.831	0.2648	0.02546	0.001733	0.03734	0.004757	0.01256	0.001501	0.02440	0.003315	22.489	6.47
40	1.660	0.2361	0.02369	0.001586	0.03507	0.004394	0.01184	0.001391	0.02306	0.003082	18.766	5.41
45	1.516	0.2110	0.02238	0.001466	0.03311	0.004059	0.01130	0.001300	0.02187	0.002858	......	.....
50	1.392	0.1883	0.02134	0.001359	0.03152	0.003758	0.01088	0.001216	0.02090	0.002657	......	.....
60	1.190	0.1480	0.01954	0.001144	0.02954	0.003237	0.01023	0.001052	0.01946	0.002274	......	.....
70	1.022	0.1101	0.01825	0.000926	0.02810	0.002668	0.00977	0.000851	0.01833	0.001856	......	.....
80	0.917	0.0765	0.01770	0.000695	0.02700	0.001984	0.00958	0.000660	0.01761	0.001381	......	.....
90	0.84	0.041	0.01735	0.00040	0.0265	0.00113	0.0095	0.00038	0.0172	0.00079	......	.....
100	0.81	0.000	0.0170	0.00000	0.0263	0.00000	0.0095	0.00000	0.0170	0.00000	......	.....

*Atmospheric Nitrogen containing 98.815% N_2 by volume + 1.185% inert gases.

SOLUBILITY PRODUCT

In a saturated solution of any given salt, the product of the concentrations of the ions which are combining to form the salt, is a constant. If more than one ion of the same kind enters into the formation of one molecule of the compound then the concentration of that ion must be raised to a power equal to the number of such ions entering into one molecule of the compound. The concentrations are expressed as gram molecular concentrations per liter. For example, silver acetate has a solubility of 10.07 grams per liter at 16°C. Its molecular weight is 167 and it is 70.8% ionized. Therefore, its molar concentration would be 10.07/167 and since it is 70.8% ionized, the Ag ion concentration would be $10.07/167 \times 70.8\%$ or 0.0427. Since for each silver ion there is an acetate ion, the acetate ion concentration would be the same as for the silver ion. Hence the solubility product would be $0.0427 \times 0.0427 = 0.00182$ at 16 °C.

Substance	Formula	Temp. °C.	Solubility-Product
Aluminum hydroxide	$Al(OH)_3$	15°	4×10^{-13}
Aluminum hydroxide	$Al(OH)_3$	18°	1.1×10^{-15}
Aluminum hydroxide	$Al(OH)_3$	25°	3.7×10^{-15}
Barium carbonate	$BaCO_3$	16°	7×10^{-9}
Barium carbonate	$BaCO_3$	18°	8.1×10^{-9}
Barium chromate	$BaCrO_4$	18°	1.6×10^{-10}
Barium chromate	$BaCrO_4$	28°	2.4×10^{-10}
Barium fluoride	BaF_2	9.5°	1.6×10^{-6}
Barium fluoride	BaF_2	18°	1.7×10^{-6}
Barium fluoride	BaF_2	25.8°	1.73×10^{-6}
Barium iodate	$Ba(IO_3)_2\cdot 2H_2O$	10°	8.4×10^{-11}
Barium iodate	$Ba(IO_3)_2\cdot 2H_2O$	25°	6.5×10^{-10}
Barium oxalate	$BaC_2O_4\cdot 3\frac{1}{2}H_2O$	18°	1.62×10^{-7}
Barium oxalate	$BaC_2O_4\cdot 2H_2O$	18°	1.2×10^{-7}
Barium oxalate	$BaC_2O_4\cdot \frac{1}{2}H_2O$	18°	2.18×10^{-7}
Barium sulfate	$BaSO_4$	18°	0.87×10^{-10}
Barium sulfate	$BaSO_4$	25°	1.08×10^{-10}
Barium sulfate	$BaSO_4$	50°	1.98×10^{-10}
Cadmium oxalate	$CdC_2O_4\cdot 3H_2O$	18°	1.53×10^{-8}
Cadmium sulfide	CdS	18°	3.6×10^{-29}
Calcium carbonate	$CaCO_3$	15°	0.99×10^{-8}
Calcium carbonate	$CaCO_3$	25°	0.87×10^{-8}
Calcium chromate	$CaCrO_4$	18°	2.3×10^{-2}
Calcium fluoride	CaF_2	18°	3.4×10^{-11}
Calcium fluoride	CaF_2	26°	3.95×10^{-11}
Calcium iodate	$Ca(IO_3)_2\cdot 6H_2O$	10°	22.2×10^{-8}
Calcium iodate	$Ca(IO_3)_2\cdot 6H_2O$	18°	64.4×10^{-8}
Calcium oxalate	$CaC_2O_4\cdot H_2O$	18°	1.78×10^{-9}
Calcium oxalate	$CaC_2O_4\cdot H_2O$	25°	2.57×10^{-9}
Calcium sulfate	$CaSO_4$	10°	6.1×10^{-5}
Calcium tartrate	$CaC_4H_4O_6\cdot 2H_2O$	18°	0.77×10^{-6}
Cobalt sulfide	CoS	18°	3×10^{-26}
Cupric iodate	$Cu(IO_3)_2$	25°	1.4×10^{-7}
Cupric oxalate	CuC_2O_4	25°	2.87×10^{-8}
Cupric sulfide	CuS	18°	8.5×10^{-45}
Cuprous bromide	$CuBr$	18°	4.1×10^{-8}
Cuprous chloride	$CuCl$	18°	1.0×10^{-6}
Cuprous iodide	CuI	18°	5.0×10^{-12}
Cuprous sulfide	Cu_2S	16°-18°	2×10^{-47}
Cuprous thiocyanate	$CuSCN$	18°	1.6×10^{-11}
Ferric hydroxide	$Fe(OH)_3$	18°	1.1×10^{-36}
Ferrous hydroxide	$Fe(OH)_2$	18°	1.64×10^{-14}
Ferrous oxalate	FeC_2O_4	25°	2.1×10^{-7}
Ferrous sulfide	FeS	18°	3.7×10^{-19}

SOLUBILITY PRODUCT

Substance	Formula	Temp. °C.	Solubility-Product
Lead carbonate	$PbCO_3$	18°	3.3×10^{-14}
Lead chloride	$PbCl_2$	25.2°	1.0×10^{-4}
Lead chromate	$PbCrO_4$	18°	1.77×10^{-14}
Lead fluoride	PbF_2	9°	2.7×10^{-8}
Lead fluoride	PbF_2	18°	3.2×10^{-8}
Lead fluoride	PbF_2	26.6°	3.7×10^{-8}
Lead iodate	$Pb(IO_3)_2$	9.2°	5.3×10^{-14}
Lead iodate	$Pb(IO_3)_2$	18°	1.2×10^{-13}
Lead iodate	$Pb(IO_3)_2$	25.8°	2.6×10^{-13}°
Lead iodide	PbI_2	15°	7.47×10^{-9}
Lead iodide	PbI_2	25°	1.39×10^{-8}
Lead oxalate	PbC_2O_4	18°	2.74×10^{-11}
Lead sulfate	$PbSO_4$	18°	1.06×10^{-8}
Lead sulfide	PbS	18°	3.4×10^{-28}
Lithium carbonate	Li_2CO_3	25°	1.7×10^{-3}
Magnesium ammonium phosphate	$MgNH_4PO_4$	25°	2.5×10^{-13}
Magnesium carbonate	$MgCO_3$	12°	2.6×10^{-5}
Magnesium fluoride	MgF_2	18°	7.1×10^{-9}
Magnesium fluoride	MgF_2	27°	6.4×10^{-9}
Magnesium hydroxide	$Mg(OH)_2$	18°	1.2×10^{-11}
Magnesium oxalate	MgC_2O_4	18°	8.57×10^{-5}
Manganese hydroxide	$Mn(OH)_2$	18°	4×10^{-14}
Manganese sulfide	MnS	18°	1.4×10^{-15}
Mercuric bromide	$HgBr_2$	25°	8×10^{-20}
Mercuric chloride	$HgCl_2$	25°	2.6×10^{-15}
Mercuric iodide	HgI_2	25°	3.2×10^{-29}
Mercuric sulfide	HgS	18°	4×10^{-53} to 2×10^{-49}
Mercurous bromide	$HgBr$	25°	1.3×10^{-21}
Mercurous chloride	$HgCl$	25°	2×10^{-18}
Mercurous iodide	HgI	25°	1.2×10^{-28}
Nickel sulfide	NiS	18°	1.4×10^{-24}
Potassium acid tartrate	$KHC_4H_4O_6$	18°	3.8×10^{-4}
Silver acetate	$AgC_2H_3O_2$	16°	1.82×10^{-3}
Silver bromate	$AgBrO_3$	20°	3.97×10^{-5}
Silver bromate	$AgBrO_3$	25°	5.77×10^{-5}
Silver bromide	$AgBr$	18°	4.1×10^{-13}
Silver bromide	$AgBr$	25°	7.7×10^{-13}
Silver carbonate	Ag_2CO_3	25°	6.15×10^{-12}
Silver chloride	$AgCl$	4.7°	0.21×10^{-10}
Silver chloride	$AgCl$	9.7°	0.37×10^{-10}
Silver chloride	$AgCl$	25°	1.56×10^{-10}
Silver chloride	$AgCl$	50°	13.2×10^{-10}
Silver chloride	$AgCl$	100°	21.5×10^{-10}
Silver chromate	Ag_2CrO_4	14.8°	1.2×10^{-12}
Silver chromate	Ag_2CrO_4	25°	9×10^{-12}
Silver cyanide	$Ag_2(CN)_2$	20°	2.2×10^{-12}
Silver dichromate	$Ag_2Cr_2O_7$	25°	2×10^{-7}
Silver hydroxide	$AgOH$	20°	1.52×10^{-8}
Silver iodate	$AgIO_3$	9.4°	0.92×10^{-8}
Silver iodide	AgI	13°	0.32×10^{-16}
Silver iodide	AgI	25°	1.5×10^{-16}
Silver nitrite	$AgNO_2$	25°	5.86×10^{-4}
Silver oxalate	$Ag_2C_2O_4$	25°	1.3×10^{-11}
Silver sulfide	Ag_2S	18°	1.6×10^{-49}
Silver thiocyanate	$AgSCN$	18°	0.49×10^{-12}

SOLUBILITY PRODUCT

Substance	Formula	Temp. °C.	Solubility-Product
Silver thiocyanate	$AgSCN$	25°	1.16×10^{-12}
Strontium carbonate	$SrCO_3$	25°	1.6×10^{-9}
Strontium fluoride	SrF_2	18°	2.8×10^{-9}
Strontium oxalate	SrC_2O_4	18°	5.61×10^{-8}
Strontium sulfate	$SrSO_4$	2.9°	2.77×10^{-7}
Strontium sulfate	$SrSO_4$	17.4°	2.81×10^{-7}
Thallous bromide	$TlBr$	25°	4×10^{-6}
Thallous chloride	$TlCl$	25°	2.65×10^{-4}
Thallous sulfate	Tl_2SO_4	25°	3.6×10^{-4}
Thallous thiocyanate	$TlSCN$	25°	2.25×10^{-4}
Zinc hydroxide	$Zn(OH)_2$	18°-20°	1.8×10^{-14}
Zinc oxalate	$ZnC_2O_4 \cdot 2H_2O$	18°	1.35×10^{-9}
Zinc sulfide	ZnS	18°	1.2×10^{-23}

GUM AND

The time for evaporation is based upon the time required to completely evaporate 0.5 cc of solvent on filter paper as compared with the corresponding time for ethyl ether which is given a value of 1.

*indicates that dilution causes cloudiness or precipitation.

† Other grades of shellac are less soluble.

No.	Name of Solvent	Boiling Range °C.	Time for Evaporation	Gum Benzoin (Siam)	Dammar	Elemi
1	Acetone	55-56	2.1	s.	i.	i.
2	Benzene	80-81	3	i.	i.s.	s.
3	Benzine	67-100	3.5	i.	i.s.*	s.*
4	Benzyl alcohol	204-208	1767	s.	s.	s.
5	*n*-Butyl acetate (98%)	121-127	11.8	s.	i.s.*	s.
6	*n*-Butyl acetate (85%)	110-132	12.5	s.	i.s.*	s.
7	*n*-Butyl alcohol	114-118	33	s.	i.	s.
8	*iso*-Butyl alcohol	104-107	24	s.	i.	i.s.
9	*n*-Butyl glycol	164-182	163	s.	i.	s.
10	*n*-Butyl lactate	170-195	443	s.	i.	i.s.
11	Cyclohexanone	150-156	40.4	s.	i.s.	s.
12	Diacetone alcohol	150-165	147	s.	i.	i.
13	Ethyl acetate (98%)	74-77	2.9	s.	i.	i.
14	Ethyl acetylglycolate	181-195	464	s.	i.	i.
15	Ethyl ether	34-35	1	s.	s.*	s.
16	Ethyl glycol	126-138	43	s.	i.	s.
17	Ethyl glycolacetate	149-160	52	s.	i.	s.
18	Ethylene chloride	81-87	4.1	i.s.	i.s.*	i.s.
19	Methyl acetate	56-62	2.2	s.	i.	i.
20	Methyl alcohol	64-65	6.3	s.	i.	i.
21	Methyl cyclohexanone	165-171	47	s.	i.s.	s.
22	Methyl glycol	115-130	34.5	s.	i.	i.
23	Methyl glycolacetate	138-152	35	s.	i.	i.
24	Methylene chloride	40-42	1.8	i.s.	i.	i.s.
25	*n*-Propyl acetate	97-101	6.1	s.	i.	i.
26	*iso*-Propyl acetate	84-93	4.2	s.	i.	i.
27	*iso*-Propyl alcohol	79.5-81.5	21	s.	i.	i.
28	Toluene	109.5-110.5	6.1	i.	i.s.	s.
29	Xylene	137-139	13.5	i.	s.	s.

ORGANIC SOLVENTS ARRANGED

BOILING

Name	B. P. Deg. C.
Ethyl ether	34.6
Carbon disulfide	46.3
Acetone	56.5
Methyl acetate	57.1
Chloroform	61.2
Methyl alcohol	64.7
Carbon tetrachloride	76.8
Ethyl acetate	77.1
Ethyl alcohol	78.4
Benzene	79.6
iso-Propyl alcohol	82.5
Ethylene chloride	83.7
iso-Propyl acetate	90
Ethyl propionate	99.1
n-Propyl acetate	101.6

Name	B. P. Deg. C.
iso-Butyl alcohol	108
Toluene	110.8
n-Butyl alcohol	117.4
Ethyl butyrate	121
Ethylene glycol monomethyl ether (methyl cellosolve)	124.5
Diethyl carbonate	126
Butyl acetate	126
Ethylene chlorohydrin	128.8
Ethylene glycol monoethyl ether (cellosolve)	134.8
Ethyl benzene	136.2
n-Amyl alcohol	137.9
m-Xylene	139

RESIN SOLVENTS

s. = soluble in an equal weight of solvent at room or slightly raised temperature; Natural resins, especially gum benzoin, contain more or less insoluble impurities. i. = insoluble; i.s. = partly soluble.

Ester Gum	Gum Mastic	Kauri	Manila Spirit Soluble	Rosin	Rubber	Sandarak	Shellac (bleached) †	No.
s.*	i.	i.s.*	s.	s.	i.	s.	i.	1
s.	s.	i.	i.s.*	s.	s.	i.	i.	2
i.	i.	i.	i.	i.s.*	s.	i.	i.	3
s.	s.	s.	s.	s.	i.	s.	s.	4
s.	s.	s.*	s.*	s.	i.	s.*	i.	5
s.	s.	s.	s.	s.	i.	s.	i.	6
s.*	s.	s.	s.	s.	i.	s.	s.	7
s.*	i.s.*	s.	s.	s.	i.	s.	s.	8
s.	s.	s.	s.	s.	i.	s.	s.	9
s.	i.s.*	s.	s.	s.	i.	s.	s.	10
s.	s.	s.	s.	s.	s.	s.	i.s.	11
i.	s.*	s.*	s.	s.	i.	s.	s.	12
s.	i.s.*	s.*	s.	s.	i.	s.	i.	13
i.	i.	i.	i.	s.	i.	s.*	i.	14
s.*	s.*	i.	s.*	s.	i.s.	s.*	i.	15
s.*	s.*	s.	s.	s.	i.	s.	s.	16
s.*	i.s.*	s.*	s.	s.	i.	s.	i.	17
s.	s.	i.	i.s.*	s.	s.	i.s.*	i.	18
s.*	i.s.*	i.	s.	s.	i.	s.	i.*	19
i.	i.s.*	s.*	s.*	s.	i.	s.*	s.	20
s.	s.	s.*	s.	s.	i.	s.	i.s.	21
i.	i.	s.*	s.	s.	i.	s.	s.	22
s.	i.s.*	s.	s.	s.	i.	s.	i.	23
s.	s.	s.	s.*	s.	s.	s.*	i.	24
s.	s.	s.*	s.	s.	i.	s.*	i.	25
s.	s.	s.*	s.	s.	i.	s.	i.	26
i.	i.s.*	s.*	s.	s.	i.	s.	s.	27
s.	s.	i.	i.s.*	s.	s.	i.	i.	28
s.	s.	i.	i.s.*	s.	s.	i.	i.	29

IN THE ORDER OF THEIR POINTS

Name	B. P. Deg. C.
n-Amyl acetate	148
Acetate of glycol monoethyl ether (cellosolve acetate)	153
Ethyl lactate	155
Cyclohexanone	156
Furfural	161
Diacetone alcohol	166
Butyl cellosolve	170.6
Ethyl acetoacetate	180
Aniline	184.4
Diethyl oxalate	186
n-Butyl lactate	195
Ethylene glycol	197.4
Carbitol	198

Name	B. P. Deg. C.
Benzyl alcohol	205
Nitrobenzene	210.9
Ethyl benzoate	212
n-Butyl stearate	220-5^{25mm}
Acetamide	222
Butyl carbitol	222
Diethylene glycol	250
Triphenyl phosphate	245^{11mm}
Triacetin	259
Diacetin	261
Dimethyl phthalate	282
Diethyl phthalate	298
Dibutyl phthalate	340
Diamyl phthalate	344

HYDROMETERS

Various hydrometers and the relation between the various scales.

Alcoholometer. This hydrometer is used in determining the density of aqueous ethyl alcohol solutions; the reading in degrees is numerically the same as the percentage of alcohol by volume. The scale known as *Tralle* gives the precentage by volume. (See also formulas for conversion to percent by weight, percent by volume, and percent proof.) *Wine* and *Must* hydrometer relations are given below.

Ammoniameter. This hydrometer, employed in finding the density of aqueous ammonia solutions, has a scale graduated in equal divisions from 0° to 40°. To convert the reading to specific gravity multiply by 3 and subtract the resulting number from 1000.

Balling Hydrometer. See under **Saccharometer.**

Barkometer or **Barktrometer.** This hydrometer which is used in determining the density of tanning liquors has a scale from 0° to 80° Bk; the number to the right of the decimal point of a specific gravity reading is the corresponding Bk degree; thus, a specific gravity of 1.015 is 15°Bk.

Baumé Hydrometers. For liquids heavier than water.—This hydrometer was originally based on the density of a 10% sodium chloride solution which was given the value of 10° and the density of pure water which was given the value of 0°, the interval between these two values was divided into 10 equal parts. Other reference points have been taken with the result that so much confusion exists that there are about 36 different scales in use, many of which are incorrect. In general a Baumé hydrometer should have inscribed on it the temperature at which it was calibrated and also the temperature of the water used in relating the density to a specific gravity. The following expression gives the relation between the specific gravity and several of the Baumé scales:—

$$\text{Specific gravity} = \frac{m}{m - \text{Baumé}}$$

m = 145 at 60°/60°F (15.56°C) for the American Scale

m = 144 for the old scale used in Holland

m = 146.3 at 15°C for the Gerlach Scale

m = 144.3 at 15°C for the Rational Scale generally used in Germany

See also special table for conversion to density and Twaddell scale.

For liquids lighter than water.—Originally the density of a solution of 1 gram of sodium chloride in 9 grams of water at 12.5°C was given a value of 0°Bé and pure water a value of 10°Bé. The scale between these points was divided into ten equal parts and these divisions were repeated throughout the scale giving a relation which could be expressed by the formula: Specific gravity = 145.88/(135.88 + Bé), which is approximately equal to 146/(136 + Bé.) Other scales have since come into more general use such as that of the Bu. of Standards in which the specific gravity at 60°/60°F = 140/(130 + Bé.) and that of the American Petroleum Institute (A.P.I. Scale) in which the specific gravity at 60°/60°F = 141.5/(131.5 + API°.)

See also special table for conversion to density and Twaddell scale.

Beck's Hydrometer. This hydrometer is graduated to show a reading of 0° in pure water and a reading of 30° in a solution with a specific gravity of 0.850, with equal scale divisions above and below these two points.

Brix Hydrometer. See under Saccharometers.

Cartier's Hydrometer. This hydrometer shows a reading of 22° when immersed in a solution having a density of 22° Baumé but the scale divisions are smaller than on the Baumé hydrometer in the ratio of 16 Cartier to 15 Baumé.

Fatty Oil Hydrometer. The graduations on this hydrometer are in specific gravity within the range 0.908 to 0.938. The letters on the scale correspond to the specific gravity of the various common oils as follows: *R*, rape; *O*, olive; *A*, almond; *S*, sesame; *HL*, hoof oil; *HP*, hemp; *C*, cotton seed; *L*, linseed. See also Oleometer below.

Lactometers. These hydrometers are used in determining the density of milk. The various scales in common use are the following:

New York Board of Health has a scale graduated into 120 equal parts, 0° being equal to the specific gravity of water and 100° being equal to a specific gravity of 1.029.

Quevenne lactometer is graduated from 15° to 40° corresponding to specific gravities from 1.015 to 1.040.

Soxhlet lactometer has a scale from 25° to 35° corresponding to specific gravities from 1.025 to 1.035 respectively.

Oleometer. A hydrometer for determining the density of vegetable and sperm oils with a scale from 50° to 0° corresponding to specific gravities from 0.870 to 0.970. See also *Fatty Oil* hydrometer above.

Saccharometers. These hydrometers are used in determining the density of sugar solutions. Solutions of the same concentration but of different carbohydrates have very nearly the same specific gravity and in general a concentration of 10 grams of carbohydrate per 100 cc of solution shows a specific gravity of 1.0386. Thus, the wt. of sugar in 1000 ml soln. is, (a) For conc. $<$ 12g/100 ml: (wt. of 1000 ml soln. $-$ 1000) $\div$ 0.386; (b) for conc. $>$ 12g/100 ml: (wt. of 1000 ml soln. $-$ 1000) $\div$ 0.385.

Brix hydrometer is graduated so that the number of degrees is identical with the percentage by weight of cane sugar and is used at the temperature indicated on the hydrometer.

Balling's saccharometer is used in Europe and is practically identical with the Brix hydrometer.

Bates brewers' saccharometer which is used in determining the density of malt worts is graduated so that the divisions express pounds per barrel (32 gallons). The relation between degrees Bates (=b) and degrees Balling (=B) is shown by the following formula: $B = 260b/(360+b)$.

See also below under *Wine and Must.*

Salinometer. This hydrometer, which is used in the pickling and meat packing plants, is graduated to show percentage of saturation of a sodium chloride solution. An aqueous solution is completely saturated when it contains 26.4% pure sodium chloride. The range from 0% to 26.4% is divided into 100 parts, each division therefore representing 1% of saturation. In another type of salinometer, the degrees correspond to percentages of sodium chloride expressed in grams of sodium chloride per 100 cc of water.

Sprayometer (Parrot and Stewart).—This hydrometer which is used in determining the density of *lime sulfur* solutions has two scales; one scale is graduated from 0° to 38° Baumé and the other scale is from 1.000 to 1.350 specific gravity.

Tralle Hydrometer. See *alcoholometer* above.

Twaddell Hydrometer. This hydrometer which is used only for liquids heavier than water, has a scale such that when the reading is multiplied by 5 and added to 1000 the resulting number is the specific gravity with reference to water as 1000. To convert specific gravity at 60°/60°F to Twaddell degrees, take the decimal portion of the specific gravity value and multiply it by 200; thus a specific gravity of $1.032 = 0.032 \times 200 = 6.4°$ Tw. See also special table for conversion to density and Baumé scale.

Wine and Must Hydrometer—This instrument has three scales. One scale shows readings of 0° to 30° Brix for sugar (see Brix hydrometer above); another scale from 0° to 15° Tralle is used for sweet wines to indicate the percentage of alcohol by volume; and a third scale from 0° to 20° Tralle is used for tart wines to indicate the percentage of alcohol by volume.

SPECIFIC GRAVITY CORRECTIONS FOR THE BUOYANT EFFECT OF THE AIR

Determinations made with a pyknometer.

$$D_{vac} = \frac{W_2}{W_1} d - 0.0012 \left(\frac{W_2 d}{W_1} - 1 \right)$$

$$S_{vac} = \frac{W_2}{W_1} - 0.0012 \left(\frac{W_2}{W_1} - 1 \right)$$

Where

D_{vac} = density of the liquid in grams per milliliter at t°C corrected for the buoyant effect of air.

W_1 = weight in air of the water required to fill the pykometer at t°C.

W_2 = weight in air of the liquid required to fill the pyknometer at t°C.

d = density of water in grams per milliliter at t°C.

S_{vac} = specific gravity of the liquid at t°C. referred to water at t°C corrected for the buoyant effect of air.

When the weight of the water is determined at a temperature of t°C, and that of the liquid at a different temperature t′, the equations above are modified as follows:

$$D_{vac} = \frac{W_2}{W_1} d - 0.0012 \left(\frac{W_2}{W_1} d - 1 \right) + 0.000026 \, (t' - t^\circ) \left(\frac{W_2}{W_1} d \right)$$

$$S_{vac} = \frac{W_2}{W_1} - 0.0012 \left(\frac{W_2}{W_1} - 1 \right) + 0.000026 \, (t' - t^\circ) \left(\frac{W_2}{W_1} \right)$$

Determinations made with a plummet or sinker.

The equations above may also be used when the density is determined with a plummet or sinker, but in this case

W_1 = weight of the plummet in air minus its weight in water.

W_2 = weight of the plummet in air minus its weight in the liquid.

CONVERSION OF SPECIFIC GRAVITY AT 25°/25° C. TO DENSITY AT ANY TEMPERATURE FROM 0° TO 40° C.

Cf. Dreisbach, *Ind. Eng. Chem., Anal. Ed. 12, 160 (1940).*

Liquids change volume with change in temperature but the amount of this change, β (coefficient of cubical expansion), varies widely with different liquids, and to some extent for the same liquid at different temperatures. See special table, *Coefficients of Cubical Expansion for Various Liquids and Aqueous Solutions.*

The table below, which is calculated from the relationship:

$$F_{\beta_t} = \frac{\text{density of water at } 25^\circ\text{C. } (=0.99705)}{[1-\beta\ (25-t)]} \quad (1)$$

may be used to find d^t, the density (weight of 1 cc.), of a liquid at any temperature (t) between 0° and 40°C. if the specific gravity at 25°/25°C. (S) and the coefficient of cubical expansion (β) are known. Substitutions are made in the equations:

$$d^t = SF_{\beta_t} \quad (2)$$

$$S = \frac{d^t}{F_{\beta_t}} \quad (3)$$

TABLE—FACTORS (F_{β_t})

Density t°C. = Sp. Gr. 25°/25° $\times F_{\beta_t}$

°C. *$\beta \times 10^3$	0	5	10	15	20	25	30	35	40
1.3	1.0306	1.0237	1.0169	1.0102	1.0036	0.99705	0.99065	0.9843	0.9780
1.2	1.0279	1.0216	1.0154	1.0092	1.0031	0.99705	0.9911	0.9853	0.9794
1.1	1.0253	1.0195	1.0138	1.0082	1.0026	0.99705	0.9916	0.9963	0.9809
1.0	1.0227	1.0174	1.0123	1.0072	1.0021	0.99705	0.9921	0.9872	0.98234
0.9	1.0200	1.0153	1.0107	1.0060	1.0016	0.99705	0.99262	0.9882	0.9838
0.8	1.0174	1.0133	1.0092	1.0051	1.0011	0.99705	0.9931	0.98918	0.9851
0.7	1.0148	1.0113	1.0077	1.0041	1.0006	0.99705	0.9936	0.99015	0.98672
0.6	1.0122	1.0092	1.0061	1.0031	1.0001	0.99705	0.9941	0.9911	0.9882
0.5	1.0097	1.0072	1.0046	1.0021	0.99958	0.99705	0.9944	0.9921	0.9897
0.4	1.0071	1.0051	1.0031	1.0011	0.99908	0.99705	0.9951	0.9931	0.9911

* β = coefficient of cubical expansion.

EXAMPLES

All examples are based upon an assumed coefficient of cubical expansion, β, of 1.3×10^{-3}.

Example 1. To find the density of a liquid at 20°C., d^{20}, which has a specific gravity (S) of $1.2500^{25^\circ}_{25^\circ}$.

From the table above F_{β_t} at 20°C. = 1.0036.

$$d^{20} = d^t = SF_{\beta_t} = 1.2500 \times 1.0036 = 1.2545$$

CONVERSIONS OF DENSITY—SPECIFIC GRAVITY

Example 2. To find the density at 20°C. (d^{20}) of a liquid which has a specific gravity of $1.2500\frac{17^\circ}{4^\circ}$.

Since the density of water at 4°C. is equal to 1, specific gravity at $17^\circ/4^\circ = d^{17} = 1.2500$.

Substitution in equation *3* with F_{β_t} at 17°C., by interpolation from the table, equal to 1.00756, gives

$$Sp.\ gr.\ 25^\circ/25^\circ = S = 1.2500 \div 1.00756$$

Substitution of this value for S in equation *2* with F_{β_t} at 20°C., from the table, equal to 1.0036, gives

$$d^{20} = d^t = (1.2500 \div 1.00756) \times 1.0036 = 1.2451$$

Example 3. To find the specific gravity at 20°/4°C. of a liquid which has a specific gravity of $1.2500\frac{25^\circ}{4^\circ}$.

Since the density of water at 4°C. is equal to 1, specific gravity $25^\circ/4^\circ = d^{25} = 1.2500$; and, specific gravity $20^\circ/4^\circ = d^{20}$.

Substitution in equation *3*, with $d^t = 1.2500$; and, with F_{β_t} at 25°C., from the table, equal to 0.99705, gives

$$Sp.\ gr.\ 25^\circ/25^\circ = S = 1.2500 \div 0.99705$$

Substitution of this value for S in equation *2*, with F_{β_t} at 20°C., from the table, equal to 1.0036, gives

$$Sp.\ gr.\ 20^\circ/4^\circ = d^{20} = (1.2500 \div 0.99705) \times 1.0036 = 1.2582$$

Example 4. To find the density at 25°C. of a liquid which has a specific gravity of $1.2500\frac{15^\circ}{15^\circ}$.

Since the density of water (see special table, *Absolute Density of Water*) at 15°C. = 0.99910,

$$d^{15} = sp.\ gr.\ 15^\circ/15^\circ \times 0.99910 = 1.2500 \times 0.99910$$

Substitution in equation *3*, with F_{β_t} at 15°C., from the table, equal to 1.0102, gives

$$Sp.\ gr.\ 25^\circ/25^\circ = S = (1.2500 \times 0.99910) \div 1.0102$$

Substitution of this value for S in equation *2*, with F_{β_t} at 25°, from the table, equal to 0.99705, gives

$$d^{25} = d^t = (1.2500 \times 0.99910 \div 1.0102) \times 0.99705 = 1.2326$$

DENSITY OF AQUEOUS SOLUTIONS

The values in the following tables have been computed from the values given under *specific gravity* and *per cent by weight* by means of the following factors:

$$\text{Degrees Baumé} = 145 - \frac{145}{\text{Sp. gravity}}$$

Degrees Twaddell = (Sp. gravity −1)×200
Grams per Liter = Sp. gravity × per cent by weight × 10
Pounds per U. S. Gallon = Grams per Liter × 0.0083454
Pounds per Cubic Foot = Grams per Liter × 0.06243

See also the tables:—"*Specific Gravity of Aqueous Solutions*", "*Specific Gravity of Alcohol Water Solutions,*" and "*Hydrometer Conversion Tables.*"

ACETIC ACID

Density of Aqueous Acetic Acid Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $HC_2H_3O_2$ in solution expressed in			Per Cent $HC_2H_3O_2$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
0.9982	....	....	....	0	....	....
0.9996	9.996	0.08342	0.6241	1	....	....
1.0012	20.02	0.1671	1.250	2	0.2	0.24
1.0025	30.08	0.2510	1.878	3	0.4	0.50
1.0040	40.16	0.3352	2.507	4	0.6	0.80
1.0055	50.28	0.4196	3.139	5	0.8	1.10
1.0069	60.41	0.5042	3.772	6	1.0	1.38
1.0083	70.58	0.5890	4.406	7	1.2	1.66
1.0097	80.78	0.6741	5.043	8	1.4	1.94
1.0111	91.00	0.7594	5.681	9	1.6	2.22
1.0125	101.3	0.8450	6.321	10	1.8	2.50
1.0139	111.5	0.9308	6.963	11	2.0	2.78
1.0154	121.8	1.017	7.607	12	2.2	3.08
1.0168	132.2	1.103	8.252	13	2.4	3.36
1.0182	142.5	1.190	8.899	14	2.6	3.64
1.0195	152.9	1.276	9.547	15	2.8	3.90
1.0209	163.3	1.363	10.20	16	3.0	4.18
1.0223	173.8	1.450	10.85	17	3.2	4.46
1.0236	184.2	1.538	11.50	18	3.3	4.72
1.0250	194.8	1.625	12.16	19	3.5	5.00
1.0263	205.3	1.713	12.81	20	3.7	5.26
1.0276	215.8	1.801	13.47	21	3.9	5.52
1.0288	226.3	1.889	14.13	22	4.1	5.76
1.0301	236.9	1.977	14.79	23	4.2	6.02
1.0313	247.5	2.066	15.45	24	4.4	6.26
1.0326	258.2	2.154	16.12	25	4.6	6.52
1.0338	268.8	2.243	16.78	26	4.7	6.76
1.0349	279.4	2.332	17.44	27	4.9	6.98
1.0361	290.1	2.421	18.11	28	5.1	7.22
1.0372	300.8	2.510	18.78	29	5.2	7.44
1.0384	311.5	2.600	19.45	30	5.4	7.68
1.0395	322.2	2.689	20.12	31	5.5	7.90
1.0406	333.0	2.779	20.79	32	5.7	8.12
1.0417	343.8	2.869	21.46	33	5.8	8.34
1.0428	354.6	2.959	22.13	34	6.0	8.56
1.0438	365.3	3.049	22.81	35	6.1	8.76
1.0449	376.2	3.139	23.48	36	6.2	8.98
1.0459	387.0	3.230	24.16	37	6.4	9.18
1.0469	397.8	3.320	24.84	38	6.5	9.38
1.0479	408.7	3.411	25.51	39	6.6	9.58

ACETIC ACID (Continued)

	Weight of $HC_2H_3O_2$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $HC_2H_3O_2$	Baumé	Twaddell
1.0488	419.5	3.501	26.19	40	6.8	9.76
1.0498	430.4	3.592	26.87	41	6.9	9.96
1.0507	441.3	3.683	27.55	42	7.0	10.14
1.0516	452.2	3.774	28.23	43	7.1	10.32
1.0525	463.1	3.865	28.91	44	7.2	10.50
1.0534	474.0	3.956	29.59	45	7.4	10.68
1.0542	484.9	4.047	30.27	46	7.5	10.84
1.0551	495.9	4.138	30.96	47	7.6	11.02
1.0559	506.8	4.230	31.64	48	7.7	11.18
1.0567	517.8	4.321	32.33	49	7.8	11.34
1.0575	528.8	4.413	33.01	50	7.9	11.50
1.0582	539.7	4.504	33.69	51	8.0	11.64
1.0590	550.7	4.596	34.38	52	8.1	11.80
1.0597	561.6	4.687	35.06	53	8.2	11.94
1.0604	572.6	4.779	35.75	54	8.3	12.08
1.0611	583.6	4.870	36.43	55	8.4	12.22
1.0618	594.6	4.962	37.12	56	8.4	12.36
1.0624	605.6	5.054	37.81	57	8.5	12.48
1.0631	616.6	5.146	38.49	58	8.6	12.62
1.0637	627.6	5.237	39.18	59	8.7	12.74
1.0642	638.5	5.329	39.86	60	8.8	12.84
1.0648	649.5	5.421	40.55	61	8.8	12.96
1.0653	660.5	5.512	41.23	62	8.9	13.06
1.0658	671.5	5.604	41.92	63	9.0	13.16
1.0662	682.4	5.695	42.60	64	9.0	13.24
1.0666	693.3	5.786	43.28	65	9.1	13.32
1.0671	704.3	5.878	43.97	66	9.1	13.42
1.0675	715.2	5.969	44.65	67	9.2	13.50
1.0678	726.1	6.060	45.33	68	9.2	13.56
1.0682	737.1	6.151	46.01	69	9.3	13.64
1.0685	748.0	6.242	46.69	70	9.3	13.70
1.0687	758.8	6.332	47.37	71	9.3	13.74
1.0690	769.7	6.423	48.05	72	9.4	13.80
1.0693	780.6	6.514	48.73	73	9.4	13.86
1.0694	791.4	6.604	49.40	74	9.4	13.88
1.0696	802.2	6.695	50.08	75	9.4	13.92
1.0698	813.0	6.785	50.76	76	9.5	13.96
1.0699	823.8	6.875	51.43	77	9.5	13.98
1.0700	834.6	6.965	52.10	78	9.5	14.00
1.0700	845.3	7.054	52.77	79	9.5	14.00
1.0700	856.0	7.144	53.44	80	9.5	14.00
1.0699	866.6	7.232	54.10	81	9.5	13.98
1.0698	877.2	7.321	54.77	82	9.5	13.96
1.0696	887.8	7.409	55.42	83	9.4	13.92
1.0693	898.2	7.496	56.08	84	9.4	13.86
1.0689	908.6	7.582	56.72	85	9.4	13.78
1.0685	918.9	7.669	57.37	86	9.3	13.70
1.0680	929.2	7.754	58.01	87	9.2	13.60
1.0675	939.4	7.840	58.65	88	9.2	13.50
1.0668	949.5	7.924	59.27	89	9.1	13.36
1.0661	959.5	8.007	59.90	90	9.0	13.22
1.0652	969.3	8.089	60.52	91	8.9	13.04
1.0643	979.2	8.171	61.13	92	8.8	12.86
1.0632	988.8	8.252	61.73	93	8.6	12.64
1.0619	998.2	8.330	62.32	94	8.5	12.38
1.0605	1007	8.408	62.90	95	8.3	12.10
1.0588	1016	8.483	63.46	96	8.1	11.76
1.0570	1025	8.556	64.01	97	7.8	11.40
1.0549	1034	8.627	64.54	98	7.6	10.98
1.0524	1042	8.695	65.04	99	7.2	10.48
1.0498	1050	8.761	65.54	100	6.9	9.96

ALBUMEN

Density of Aqueous Albumen Solutions at 15.5°C.

Specific Gravity	Weight of Albumen in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Albumen	Degrees: Baumé	Twaddell
1.0026	10.03	0.08367	0.6259	1	0.37	0.52
1.0054	20.11	0.1678	1.255	2	0.77	1.08
1.0078	30.23	0.2523	1.888	3	1.12	1.56
1.0130	50.65	0.4227	3.162	5	1.85	2.60
1.0261	102.6	0.8563	6.406	10	3.66	5.22
1.0384	155.8	1.300	9.724	15	5.32	7.68
1.0515	210.3	1.755	13.13	20	7.06	10.30
1.0644	266.1	2.221	16.61	25	8.72	12.88
1.0780	323.4	2.699	20.19	30	10.42	15.60
1.0919	382.2	3.189	23.86	35	13.12	18.38
1.1058	442.3	3.691	27.61	40	13.78	21.16
1.1204	504.2	4.208	31.48	45	15.48	24.08
1.1352	567.6	4.737	35.44	50	17.16	27.04
1.1511	633.1	5.283	39.52	55	18.90	30.22

ALUMINUM CHLORIDE

Density of Aqueous Aluminum Chloride Solutions at $\frac{18^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $AlCl_3$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $AlCl_3$	Degrees: Baumé	Twaddell
1.0075	10.08	0.08408	0.6290	1	1.1	1.50
1.0164	20.33	0.1696	1.269	2	2.3	3.28
1.0344	41.38	0.3453	2.583	4	4.8	6.88
1.0526	63.16	0.5271	3.943	6	7.3	10.52
1.0711	85.69	0.7151	5.350	8	9.6	14.22
1.0900	109.0	0.9096	6.805	10	12.0	18.00
1.1093	133.1	1.111	8.310	12	14.3	21.86
1.1290	158.1	1.319	9.868	14	16.6	25.80
1.1491	183.9	1.534	11.48	16	18.8	29.82

Density of Aqueous Aluminum Chloride Solutions at $\frac{60}{60}$°F. Computed from the Values of Bischoff.

Specific Gravity	Weight of Al_2Cl_6 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Al_2Cl_6	Degrees: Baumé	Twaddell
1.0085	10.07	0.08405	0.6288	1	1.2	1.70
1.0175	20.29	0.1693	1.267	2	2.5	3.50
1.0266	30.65	0.2558	1.913	3	3.8	5.32
1.0357	41.16	0.3435	2.569	4	5.0	7.14
1.0449	51.80	0.4323	3.234	5	6.2	8.98
1.0541	62.61	0.5225	3.909	6	7.4	10.82
1.0634	73.57	0.6140	4.593	7	8.7	12.68
1.0727	84.68	0.7067	5.287	8	9.8	14.54
1.0821	95.93	0.8006	5.989	9	11.0	16.42
1.0915	107.3	0.8958	6.701	10	12.2	18.30
1.1010	118.9	0.9925	7.425	11	13.3	20.20
1.1105	130.7	1.091	8.158	12	14.4	22.10
1.1201	142.6	1.190	8.902	13	15.6	24.02
1.1298	154.7	1.291	9.655	14	16.7	25.96
1.1396	166.9	1.393	10.42	15	17.8	27.92

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ALUMINUM CHLORIDE (*Continued*)

Specific Gravity	Weight of Al_2Cl_6 in solution expressed in			Per Cent Al_2Cl_6	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.1495	179.3	1.496	11.19	16	18.9	29.90
1.1595	191.9	1.602	11.98	17	20.0	31.90
1.1707	204.7	1.708	12.78	18	21.1	34.14
1.1811	217.6	1.816	13.59	19	22.2	36.22
1.1918	230.7	1.926	14.41	20	23.3	38.36
1.2028	244.1	2.037	15.24	21	24.5	40.56
1.2141	257.6	2.150	16.08	22	25.6	42.82
1.2255	271.3	2.264	16.94	23	26.7	45.10
1.2371	285.2	2.380	17.80	24	27.8	47.42
1.2488	299.2	2.497	18.68	25	28.9	49.76
1.2606	313.5	2.616	19.57	26	30.0	52.12
1.2726	328.0	2.737	20.48	27	31.1	54.52
1.2848	342.7	2.860	21.40	28	32.2	56.96
1.2973	357.6	2.984	22.32	29	33.2	59.46
1.3098	372.7	3.110	23.26	30	34.3	61.96
1.3224	388.1	3.238	24.23	31	35.4	64.48
1.3350	403.7	3.369	25.20	32	36.4	67.00

ALUMINUM SULFATE

Density of Aqueous Aluminum Sulfate Solutions at $\frac{15^\circ}{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Al_2(SO_4)_3$ in solution expressed in			Per Cent $Al_2(SO_4)_3$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0093	10.09	0.08423	0.6301	1	1.3	1.86
1.0195	20.39	0.1702	1.273	2	2.8	3.90
1.0404	41.62	0.3473	2.598	4	5.6	8.08
1.0618	63.71	0.5317	3.977	6	8.4	12.36
1.0837	86.70	0.7235	5.412	8	11.2	16.74
1.1062	110.6	0.9232	6.906	10	13.9	21.24
1.1293	135.5	1.131	8.460	12	16.6	25.86
1.1529	161.4	1.347	10.08	14	19.2	30.58
1.1770	188.3	1.572	11.76	16	21.8	35.40
1.2017	216.3	1.805	13.50	18	24.3	40.34
1.2272	245.4	2.048	15.32	20	26.8	45.44
1.2534	275.7	2.301	17.21	22	29.3	50.68
1.2803	307.3	2.564	19.18	24	31.7	56.06
1.3079	340.1	2.838	21.23	26	34.1	61.58

Specific Gravity	Weight of $Al_2(SO_4)_3\cdot18H_2O$ in solution expressed in			Per Cent $Al_2(SO_4)_3\cdot18H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds Per Cubic Foot		Baumé	Twaddell
1.0093	19.66	0.1641	1.227	1.948	1.3	1.86
1.0195	39.72	0.3315	2.480	3.896	2.8	3.90
1.0404	81.06	0.6765	5.060	7.791	5.6	8.08

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ALUMINUM SULFATE (Continued)

Specific Gravity	Weight of $Al_2(SO_4)_3 \cdot 18H_2O$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Al_2(SO_4)_3 \cdot 18H_2O$	Degrees Baumé	Twaddell
1.0618	124.1	1.036	7.749	11.69	8.4	12.36
1.0837	168.8	1.409	10.54	15.58	11.2	16.74
1.1062	215.5	1.798	13.45	19.48	13.9	21.24
1.1293	263.9	2.202	16.48	23.37	16.6	25.86
1.1529	314.4	2.624	19.63	27.27	19.2	30.58
1.1770	366.9	3.062	22.90	31.17	21.8	35.40
1.2017	421.3	3.516	26.30	35.06	24.3	40.34
1.2272	478.1	3.990	29.85	38.96	26.8	45.44
1.2534	537.1	4.482	33.53	42.85	29.3	50.68
1.2803	598.5	4.995	37.37	46.75	31.7	56.06
1.3079	662.3	5.527	41.35	50.64	34.1	61.58

AMMONIA

Specific Gravity of Aqueous Ammonia Solutions.

Adopted 1903 as Standard by the Manufacturing Chemists' Association of the United States.

Authority: W. C. Ferguson.

Specific Gravity determinations were made at 60° F., compared with water at 60°F.

From the Specific Gravities the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = \frac{140}{\text{Sp. Gr.}} - 130.$$

* Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should always be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

Be°	Sp. Gr.	$\%NH_3$	Be°	Sp. Gr.	$\%NH_3$	Be°	Sp. Gr.	$\%NH_3$
10.00	1.0000	.00	16.50	.9556	11.18	23.00	.9150	23.52
10.25	.9982	.40	16.75	.9540	11.64	23.25	.9135	24.01
10.50	.9964	.80	17.00	.9524	12.10	23.50	.9121	24.50
10.75	.9947	1.21	17.25	.9508	12.56	23.75	.9106	24.99
11.00	.9929	1.62	17.50	.9492	13.02	24.00	.9091	25.48
11.25	.9912	2.04	17.75	.9475	13.49	24.25	.9076	25.97
11.50	.9894	2.46	18.00	.9459	13.96	24.50	.9061	26.46
11.75	.9876	2.88	18.25	.9444	14.43	24.75	.9047	26.95
12.00	.9859	3.30	18.50	.9428	14.90	25.00	.9032	27.44
12.25	.9842	3.73	18.75	.9412	15.37	25.25	.9018	27.93
12.50	.9825	4.16	19.00	.9396	15.84	25.50	.9003	28.42
12.75	.9807	4.59	19.25	.9380	16.32	25.75	.8989	28.91
13.00	.9790	5.02	19.50	.9365	16.80	26.00	.8974	29.40
13.25	.9773	5.45	19.75	.9349	17.28	26.25	.8960	29.89
13.50	.9756	5.88	20.00	.9333	17.76	26.50	.8946	30.38
13.75	.9739	6.31	20.25	.9318	18.24	26.75	.8931	30.87
14.00	.9722	6.74	20.50	.9302	18.72	27.00	.8917	31.36
14.25	.9705	7.17	20.75	.9287	19.20	27.25	.8903	31.85
14.50	.9689	7.61	21.00	.9272	19.68	27.50	.8889	32.34
14.75	.9672	8.05	21.25	.9256	20.16	27.75	.8875	32.83
15.00	.9655	8.49	21.50	.9241	20.64	28.00	.8861	33.32
15.25	.9639	8.93	21.75	.9226	21.12	28.25	.8847	33.81
15.50	.9622	9.33	22.00	.9211	21.60	28.50	.8833	34.30
15.75	.9605	9.83	22.25	.9195	22.08	28.75	.8819	34.79
16.00	.9589	10.28	22.50	.9180	22.56	29.00	.8805	35.28
16.25	.9573	10.73	22.75	.9165	23.04			

AMMONIA (Continued)

Allowance For Temperature:

The coefficient of expansion for Ammonia Solutions, varying with the temperature, correction must be applied according to the following table:

	Corrections to be added for each degree below 60° F.		Corrections to be subtracted for each degree above 60° F.			
Degrees Baumé	40° F.	50° F.	70° F.	80° F.	90° F.	100° F.
14°	.015° Bé	.017° Bé	.020° Bé	.022° Bé	.024° Bè	.026° Be
16°	.021° Bé	.023° Bé	.026° Bé	.028° Bé	.030° Bé	.032° Bé
18°	.027° Bé	.029° Bé	.031° Bé	.033° Bé	.035° Bé	.037° Bé
20°	.033° Bé	.036° Bé	.037° Bé	.038° Bé	.040° Bé	.042° Bé
22°	.039° Bé	.042° Bé	.043° Bé	.045° Bé	.047° Bé	
26°	.053° Bé	.057° Bé	.057° Bé	.059° Bé		

AMMONIA

Density of Aqueous Ammonia Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

	Weight of NH_3 in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent NH_3	Baumé	Twaddell
0.9939	9.939	0.08294	0.6205	1	10.9	.....
0.9895	19.79	0.1652	1.235	2	11.5	.....
0.9811	39.24	0.3275	2.450	4	12.7	.....
0.9730	58.38	0.4872	3.645	6	13.9	.....
0.9651	77.21	0.6443	4.820	8	15.1	.....
0.9575	95.75	0.7991	5.978	10	16.2	.....
0.9501	114.0	0.9515	7.118	12	17.3	.....
0.9430	132.0	1.102	8.242	14	18.5	.....
0.9362	149.8	1.250	9.352	16	19.5	.....
0.9295	167.3	1.396	10.45	18	20.6	.....
0.9229	184.6	1.540	11.52	20	21.7	.....
0.9164	201.6	1.682	12.59	22	22.8	.....
0.9101	218.4	1.823	13.64	24	23.8	.....
0.9040	235.0	1.962	14.67	26	24.9	.....
0.8980	251.4	2.098	15.70	28	25.9	.....
0.8920	267.6	2.233	16.71	30	27.0	.....

Determined in Sealed Tubes at $\frac{15^\circ}{4^\circ}$ C.

	Weight of NH_3 in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent NH_3	Baumé	Twaddell
0.849	382.1	3.188	23.85	45	34.9	.....
0.832	416.0	3.472	25.97	50	38.3	.....
0.815	448.3	3.741	27.98	55	41.8	.....
0.796	477.6	3.986	29.82	60	45.9	.....
0.776	504.4	4.209	31.49	65	50.4	.....
0.755	528.5	4.411	32.99	70	55.4	.....
0.733	549.8	4.588	34.32	75	61.0	.....
0.711	568.8	4.747	35.51	80	66.9	.....
0.688	584.8	4.880	36.51	85	73.5	.....
0.665	598.5	4.995	37.36	90	80.5	.....
0.642	609.9	5.090	38.08	95	88.1	.....
0.618	618.0	5.157	38.58	100	96.5	.....

AMMONIUM CHLORIDE

Density of Aqueous Ammonium Chloride Solutions at $^{20^\circ}_{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of NH_4Cl in solution expressed in			Per Cent NH_4Cl	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0013	10.01	0.08356	0.6251	1	0.2	0.26
1.0045	20.09	0.1677	1.254	2	0.6	0.90
1.0107	40.43	0.3374	2.524	4	1.5	2.14
1.0168	61.01	0.5091	3.809	6	2.4	3.36
1.0227	81.82	0.6828	5.108	8	3.2	4.54
1.0286	102.9	0.8584	6.421	10	4.0	5.72
1.0344	124.1	1.036	7.749	12	4.8	6.88
1.0401	145.6	1.215	9.090	14	5.6	8.02
1.0457	167.3	1.396	10.44	16	6.3	9.14
1.0512	189.2	1.579	11.81	18	7.1	10.24
1.0567	211.3	1.764	13.19	20	7.8	11.34
1.0621	233.7	1.950	14.59	22	8.5	12.42
1.0674	256.2	2.138	15.99	24	9.2	13.48

AMMONIUM NITRATE

Density of Aqueous Ammonium Nitrate Solutions at $^{20^\circ}_{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of NH_4NO_3 in solution expressed in			Per Cent NH_4NO_3	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0023	10.02	0.08365	0.6257	1	0.3	0.46
1.0064	20.13	0.1680	1.257	2	0.9	1.28
1.0147	40.59	0.3387	2.534	4	2.1	2.94
1.0230	61.38	0.5122	3.832	6	3.3	4.60
1.0313	82.50	0.6885	5.151	8	4.4	6.26
1.0397	104.0	0.8677	6.491	10	5.5	7.94
1.0482	125.8	1.050	7.853	12	6.7	9.64
1.0567	147.9	1.235	9.236	14	7.8	11.34
1.0653	170.4	1.422	10.64	16	8.9	13.06
1.0740	193.3	1.613	12.07	18	10.0	14.80
1.0828	216.6	1.807	13.52	20	11.1	16.56
1.0916	240.2	2.004	14.99	22	12.2	18.32
1.1005	264.1	2.204	16.49	24	13.2	20.10
1.1095	288.5	2.407	18.01	26	14.3	21.90
1.1186	313.2	2.614	19.55	28	15.4	23.72
1.1277	338.3	2.823	21.12	30	16.4	25.54
1.1512	402.9	3.363	25.15	35	19.0	30.24
1.1754	470.2	3.924	29.35	40	21.6	35.08
1.2003	540.1	4.508	33.72	45	24.2	40.06
1.2258	612.9	5.115	38.26	50	26.7	45.16

AMMONIUM NITRATE

Density of Aqueous Ammonium Nitrate Solutions at 17.5° C. Computed from the Values of Gerlach.

Specific Gravity	Weight of NH_4NO_3 in solution expressed in			Per cent NH_4NO_3	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0042	10.04	0.08380	0.6269	1	0.6	0.84
1.0085	20.17	0.1683	1.259	2	1.2	1.70
1.0127	30.38	0.2535	1.897	3	1.8	2.54
1.0170	40.68	0.3395	2.540	4	2.4	3.40

AMMONIUM NITRATE (Continued)

Specific Gravity	Weight of NH_4NO_3 in solution expressed in			Per Cent NH_4NO_3	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0212	51.06	0.4261	3.188	5	3.0	4.24
1.0255	61.53	0.5135	3.841	6	3.6	5.10
1.0297	72.08	0.6015	4.500	7	4.2	5.94
1.0340	82.72	0.6903	5.164	8	4.8	6.80
1.0382	93.44	0.7798	5.833	9	5.3	7.64
1.0425	104.3	0.8700	6.508	10	5.9	8.50
1.0468	115.1	0.9610	7.189	11	6.5	9.36
1.0512	126.1	1.053	7.875	12	7.1	10.24
1.0555	137.2	1.145	8.566	13	7.6	11.10
1.0599	148.4	1.238	9.264	14	8.2	11.98
1.0642	159.6	1.332	9.966	15	8.8	12.84
1.0686	171.0	1.427	10.67	16	9.3	13.72
1.0729	182.4	1.522	11.39	17	9.9	14.58
1.0773	193.9	1.618	12.11	18	10.4	15.46
1.0816	205.5	1.715	12.83	19	10.9	16.32
1.0860	217.2	1.813	13.56	20	11.5	17.20
1.0905	229.0	1.911	14.30	21	12.0	18.10
1.0950	240.9	2.010	15.04	22	12.6	19.00
1.0995	252.9	2.110	15.79	23	13.1	19.90
1.1040	265.0	2.211	16.54	24	13.7	20.80
1.1085	277.1	2.313	17.30	25	14.2	21.70
1.1130	289.4	2.415	18.07	26	14.7	22.60
1.1175	301.7	2.518	18.84	27	15.2	23.50
1.1220	314.2	2.622	19.61	28	15.8	24.40
1.1265	326.7	2.726	20.39	29	16.3	25.30
1.1310	339.3	2.832	21.18	30	16.8	26.20
1.1358	352.1	2.938	21.98	31	17.3	27.16
1.1406	365.0	3.046	22.79	32	17.9	28.12
1.1454	378.0	3.154	23.60	33	18.4	29.08
1.1502	391.1	3.264	24.41	34	18.9	30.04
1.1550	404.3	3.374	25.24	35	19.5	31.00
1.1598	417.5	3.484	26.07	36	20.0	31.96
1.1646	430.9	3.596	26.90	37	20.5	32.92
1.1694	444.4	3.708	27.74	38	21.0	33.88
1.1743	458.0	3.822	28.59	39	21.5	34.86
1.1790	471.6	3.936	29.44	40	22.0	35.80
1.1841	485.5	4.052	30.31	41	22.5	36.82
1.1892	499.5	4.168	31.18	42	23.1	37.84
1.1942	513.5	4.285	32.06	43	23.6	38.84
1.1994	527.7	4.404	32.95	44	24.1	39.88
1.2045	542.0	4.523	33.84	45	24.6	40.90
1.2096	556.4	4.644	34.74	46	25.1	41.92
1.2147	570.9	4.764	35.64	47	25.6	42.94
1.2198	585.5	4.886	36.55	48	26.1	43.96
1.2249	600.2	5.009	37.47	49	26.6	44.98
1.2300	615.0	5.132	38.39	50	27.1	46.00
1.2353	630.0	5.258	39.33	51	27.6	47.06
1.2407	645.2	5.384	40.28	52	28.1	48.14
1.2460	660.4	5.511	41.23	53	28.6	49.20
1.2514	675.8	5.639	42.19	54	29.1	50.28
1.2567	691.2	5.768	43.15	55	29.6	51.34
1.2621	706.8	5.898	44.12	56	30.1	52.42
1.2674	722.4	6.029	45.10	57	30.6	53.48
1.2728	738.2	6.161	46.09	58	31.1	54.56
1.2781	754.1	6.293	47.08	59	31.6	55.62
1.2835	770.1	6.427	48.08	60	32.0	56.70
1.2888	786.2	6.561	49.08	61	32.5	57.76
1.2942	802.4	6.696	50.09	62	33.0	58.84
1.3005	819.3	6.838	51.15	63	33.5	60.10
1.3059	835.8	6.975	52.18	64	34.0	61.18

AMMONIUM SULFATE

Density of Aqueous Ammonium Sulfate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from the Values Given in the International Critical Tables.

	Weight of $(NH_4)_2SO_4$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $(NH_4)_2SO_4$	Baumé	Twaddell
1.0041	10.04	0.08380	0.6269	1	0.6	0.82
1.0101	20.20	0.1686	1.261	2	1.5	2.02
1.0220	40.88	0.3412	2.552	4	3.1	4.40
1.0338	62.03	0.5176	3.872	6	4.7	6.76
1.0456	83.65	0.6981	5.222	8	6.3	9.12
1.0574	105.7	0.8824	6.601	10	7.9	11.48
1.0691	128.3	1.071	8.009	12	9.4	13.82
1.0808	151.3	1.263	9.446	14	10.8	16.16
1.0924	174.8	1.459	10.91	16	12.3	18.48
1.1039	198.7	1.658	12.40	18	13.7	20.78
1.1154	223.1	1.862	13.93	20	15.0	23.08
1.1269	247.9	2.069	15.48	22	16.3	25.38
1.1383	273.2	2.280	17.06	24	17.6	27.66
1.1496	298.9	2.494	18.66	26	18.9	29.92
1.1609	325.1	2.713	20.29	28	20.1	32.18
1.1721	351.6	2.934	21.95	30	21.3	34.42
1.2000	420.0	3.505	26.22	35	24.2	40.00
1.2277	491.1	4.098	30.66	40	26.9	45.54
1.2552	564.8	4.714	35.26	45	29.5	51.04
1.2825	641.3	5.351	40.03	50	31.9	56.50

AMMONIUM SULFATE

Density of Aqueous Ammonium Sulfate Solutions at 19° C. Computed from the Values of Schiff.

	Weight of $(NH_4)_2SO_4$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $(NH_4)_2SO_4$	Baumé	Twaddell
1.0057	10.06	0.08393	0.6279	1	0.8	1.14
1.0115	20.23	0.1688	1.263	2	1.6	2.30
1.0172	30.52	0.2547	1.905	3	2.5	3.44
1.0230	40.92	0.3415	2.555	4	3.3	4.60
1.0287	51.44	0.4292	3.211	5	4.0	5.74
1.0345	62.07	0.5180	3.875	6	4.8	6.90
1.0403	72.82	0.6077	4.546	7	5.6	8.06
1.0460	83.68	0.6983	5.224	8	6.4	9.20
1.0518	94.66	0.7900	5.910	9	7.1	10.36
1.0575	105.8	0.8825	6.602	10	7.9	11.50
1.0632	117.0	0.9760	7.301	11	8.6	12.64
1.0690	128.3	1.071	8.009	12	9.4	13.80
1.0747	139.7	1.166	8.722	13	10.1	14.94
1.0805	151.3	1.262	9.444	14	10.8	16.10
1.0862	162.9	1.360	10.17	15	11.5	17.24
1.0920	174.7	1.458	10.91	16	12.2	18.40
1.0977	186.6	1.557	11.65	17	12.9	19.54
1.1035	198.6	1.658	12.40	18	13.6	20.70
1.1092	210.7	1.759	13.16	19	14.3	21.84
1.1149	223.0	1.861	13.92	20	14.9	22.98
1.1207	235.3	1.964	14.69	21	15.6	24.14
1.1265	247.8	2.068	15.47	22	16.3	25.30
1.1323	260.4	2.173	16.26	23	16.9	26.46
1.1381	273.1	2.279	17.05	24	17.6	27.62
1.1439	286.0	2.387	17.85	25	18.2	28.78

AMMONIUM SULFATE (Continued)

Specific Gravity	Weight of $(NH_4)_2SO_4$ in solution expressed in			Per Cent $(NH_4)_2SO_4$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.1496	298.9	2.494	18.66	26	18.9	29.92
1.1554	312.0	2.603	19.48	27	19.5	31.08
1.1612	325.1	2.713	20.30	28	20.1	32.24
1.1670	338.4	2.824	21.13	29	20.8	33.40
1.1724	351.7	2.935	21.96	30	21.3	34.48
1.1780	365.2	3.048	22.80	31	21.9	35.60
1.1836	378.8	3.161	23.65	32	22.5	36.72
1.1892	392.4	3.275	24.50	33	23.1	37.84
1.1948	406.2	3.390	25.36	34	23.6	38.96
1.2004	420.1	3.506	26.23	35	24.2	40.08
1.2060	434.2	3.623	27.10	36	24.8	41.20
1.2116	448.3	3.741	27.99	37	25.3	42.32
1.2172	462.5	3.860	28.88	38	25.9	43.44
1.2228	476.9	3.980	29.77	39	26.4	44.56
1.2284	491.4	4.101	30.68	40	27.0	45.68
1.2343	506.1	4.223	31.59	41	27.5	46.86
1.2402	520.9	4.347	32.52	42	28.1	48.04
1.2462	535.9	4.472	33.45	43	28.6	49.24
1.2522	551.0	4.598	34.40	44	29.2	50.44
1.2583	566.2	4.725	35.35	45	29.8	51.66
1.2644	581.6	4.854	36.31	46	30.3	52.88
1.2705	597.1	4.983	37.28	47	30.9	54.10
1.2766	612.8	5.114	38.25	48	31.4	55.32
1.2828	628.6	5.246	39.24	49	32.0	56.56
1.2890	644.5	5.379	40.24	50	32.5	57.80

ARSENIC ACID

Density of Aqueous Arsenic Acid Solutions at $\frac{15°}{4°}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of H_3AsO_4 in solution expressed in			Per Cent H_3AsO_4	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0057	10.06	0.08393	0.6279	1	0.8	1.14
1.0124	20.25	0.1690	1.264	2	1.8	2.48
1.0260	41.04	0.3425	2.562	4	3.7	5.20
1.0398	62.39	0.5207	3.895	6	5.6	7.96
1.0538	84.30	0.7036	5.263	8	7.4	10.76
1.0681	106.8	0.8914	6.668	10	9.3	13.62
1.0826	129.9	1.084	8.110	12	11.1	16.52
1.0975	153.7	1.282	9.592	14	12.9	19.50
1.1128	178.0	1.486	11.12	16	14.7	22.56
1.1285	203.1	1.695	12.68	18	16.5	25.70
1.1447	228.9	1.911	14.29	20	18.3	28.94
1.1614	255.5	2.132	15.95	22	20.2	32.28
1.1785	282.8	2.360	17.66	24	22.0	35.70
1.1961	311.0	2.595	19.41	26	23.8	39.22
1.2143	340.0	2.837	21.23	28	25.6	42.86
1.2331	369.9	3.087	23.09	30	27.4	46.62
1.2829	449.0	3.747	28.03	35	32.0	56.58
1.3370	534.8	4.463	33.39	40	36.6	67.40
1.3959	628.2	5.242	39.22	45	41.1	79.18
1.4602	730.1	6.093	45.58	50	45.7	92.40
1.5304	841.7	7.024	52.55	55	50.3	106.08
1.6070	964.2	8.047	60.20	60	54.8	121.40
1.6904	1099	9.170	68.60	65	59.2	138.08
1.7811	1247	10.40	77.84	70	63.6	156.22

(Completed on following page.)

ARSENIC ACID (Continued)

Specific Gravity	Weight of As_2O_5 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent As_2O_5	Degrees: Baumé	Twaddell
1.0057	8.142	0.06795	0.5083	0.8096	0.8	1.14
1.0124	16.39	0.1368	1.023	1.619	1.8	2.48
1.0260	33.23	0.2773	2.075	3.239	3.7	5.20
1.0398	50.51	0.4216	3.154	4.858	5.6	7.96
1.0538	68.25	0.5696	4.261	6.477	7.4	10.76
1.0681	86.47	0.7217	5.399	8.096	9.3	13.62
1.0826	105.2	0.8778	6.567	9.716	11.1	16.52
1.0975	124.3	1.038	7.763	11.33	12.9	19.50
1.1128	144.1	1.203	8.997	12.95	14.7	22.56
1.1285	164.4	1.372	10.26	14.57	16.5	25.70
1.1447	185.3	1.547	11.57	16.19	18.3	28.94
1.1614	206.8	1.726	12.91	17.81	20.2	32.28
1.1785	229.0	1.911	14.30	19.43	22.0	35.70
1.1961	251.8	2.101	15.72	21.05	23.8	39.22
1.2143	275.3	2.297	17.19	22.67	25.6	42.86
1.2331	299.5	2.500	18.70	24.29	27.4	46.62
1.2829	363.6	3.034	22.70	28.34	32.0	56.58
1.3370	433.1	3.614	27.04	32.39	36.6	67.40
1.3959	508.5	4.244	31.75	36.43	41.1	79.18
1.4602	591.1	4.933	36.90	40.48	45.7	92.40
1.5304	681.5	5.687	42.55	44.53	50.3	106.08
1.6070	780.7	6.515	48.74	48.58	54.8	121.40
1.6904	889.7	7.425	55.54	52.63	59.2	138.08
1.7811	1009	8.423	63.01	56.67	63.6	156.22

BARIUM CHLORIDE

Density of Aqueous Barium Chloride Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $BaCl_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $BaCl_2$	Degrees: Baumé	Twaddell
1.0159	20.32	0.1696	1.268	2	2.3	3.18
1.0341	41.36	0.3452	2.582	4	4.8	6.82
1.0528	63.17	0.5272	3.944	6	7.3	10.56
1.0721	85.77	0.7158	5.354	8	9.8	14.42
1.0921	109.2	0.9114	6.818	10	12.2	18.42
1.1128	133.5	1.114	8.337	12	14.7	22.56
1.1342	158.8	1.325	9.913	14	17.2	26.84
1.1564	185.0	1.544	11.55	16	19.6	31.28
1.1793	212.3	1.772	13.25	18	22.0	35.86
1.2031	240.6	2.008	15.02	20	24.5	40.62
1.2277	270.1	2.254	16.86	22	26.9	45.54
1.2531	300.7	2.510	18.78	24	29.3	50.62
1.2793	332.6	2.776	20.77	26	31.7	55.86

Specific Gravity	Weight of $BaCl_2 \cdot 2H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $BaCl_2 \cdot 2H_2O$	Degrees: Baumé	Twaddell
1.0159	23.83	0.1989	1.488	2.346	2.3	3.18
1.0341	48.52	0.4049	3.029	4.692	4.8	6.82
1.0528	74.10	0.6184	4.626	7.038	7.3	10.56
1.0721	100.6	0.8396	6.281	9.384	9.8	14.42
1.0921	128.1	1.069	7.997	11.73	12.2	18.42
1.1128	156.7	1.308	9.782	14.08	14.7	22.56
1.1342	186.2	1.554	11.63	16.42	17.2	26.84

BARIUM CHLORIDE (Continued)

Specific Gravity	Weight of $BaCl_2 \cdot 2H_2O$ in solution expressed in			Per Cent $BaCl_2 \cdot 2H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.1564	217.1	1.812	13.56	18.77	19.6	31.28
1.1793	249.0	2.078	15.54	21.11	22.0	35.86
1.2031	282.2	2.355	17.62	23.46	24.5	40.62
1.2277	316.9	2.644	19.78	25.81	26.9	45.54
1.2531	352.7	2.944	22.02	28.15	29.3	50.62
1.2793	390.2	3.256	24.36	30.50	31.7	55.86

CADMIUM NITRATE

Density of Aqueous Cadmium Nitrate Solutions at $\frac{18^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Cd(NO_3)_2$ in solution expressed in			Per Cent $Cd(NO_3)_2$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0154	20.31	0.1695	1.268	2	2.2	3.08
1.0326	41.30	0.3447	2.579	4	4.6	6.52
1.0502	63.01	0.5259	3.934	6	6.9	10.04
1.0683	85.46	0.7132	5.336	8	9.3	13.66
1.0869	108.7	0.9071	6.786	10	11.6	17.38
1.1061	132.7	1.108	8.286	12	13.9	21.22
1.1261	157.7	1.316	9.842	14	16.2	25.22
1.1468	183.5	1.530	11.45	16	18.6	29.36
1.1682	210.3	1.755	13.13	18	20.9	33.64
1.1904	238.1	1.987	14.86	20	23.2	38.08
1.2488	312.2	2.605	19.49	25	28.9	49.76
1.3124	393.7	3.286	24.58	30	34.5	62.48
1.3822	483.8	4.037	30.20	35	40.1	76.44
1.4590	583.6	4.870	36.43	40	45.6	91.80
1.5438	694.7	5.798	43.37	45	51.1	108.76
1.6356	817.8	6.825	51.06	50	56.4	127.12

CALCIUM CHLORIDE

Density of Aqueous Calcium Chloride Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $CaCl_2$ in solution expressed in			Per Cent $CaCl_2$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0148	20.30	0.1694	1.267	2	2.1	2.96
1.0316	41.26	0.3444	2.576	4	4.4	6.32
1.0486	62.92	0.5251	3.928	6	6.7	9.72
1.0659	85.27	0.7116	5.324	8	9.0	13.18
1.0835	108.4	0.9042	6.764	10	11.2	16.70
1.1015	132.2	1.103	8.252	12	13.4	20.30
1.1198	156.8	1.308	9.787	14	15.5	23.96
1.1386	182.2	1.520	11.37	16	17.7	27.72
1.1578	208.4	1.739	13.01	18	19.8	31.56
1.1775	235.5	1.965	14.70	20	21.9	35.50
1.2284	307.1	2.563	19.17	25	27.0	45.68
1.2816	384.5	3.209	24.00	30	31.9	56.32
1.3373	468.1	3.906	29.22	35	36.6	67.46
1.3957	558.3	4.659	34.85	40	41.1	79.14

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CALCIUM CHLORIDE (Continued)

Specific Gravity	Weight of $CaCl_2 \cdot 6H_2O$ in solution expressed in			Per Cent $CaCl_2 \cdot 6H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0148	40.06	0.3344	2.501	3.948	2.1	2.96
1.0316	81.46	0.6798	5.085	7.896	4.4	6.32
1.0486	124.2	1.036	7.751	11.84	6.7	9.72
1.0659	168.3	1.405	10.51	15.79	9.0	13.18
1.0835	213.9	1.785	13.35	19.74	11.2	16.70
1.1015	260.9	2.178	16.29	23.69	13.4	20.30
1.1198	309.5	2.583	19.32	27.64	15.5	23.96
1.1386	359.6	3.008	22.45	31.58	17.7	27.72
1.1578	411.4	3.433	25.68	35.53	19.8	31.56
1.1775	465.9	3.888	29.08	39.48	21.9	35.50
1.2284	606.2	5.059	37.85	49.35	27.0	45.68
1.2816	759.0	6.334	47.38	59.22	31.9	56.32
1.3373	923.9	7.711	57.68	69.09	36.6	67.46
1.3957	1102.0	9.197	68.80	78.96	41.1	79.14

CHROMIC ACID

Density of Aqueous Chromic Acid Solutions at $\frac{15^\circ}{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of CrO_3 in solution expressed in			Per Cent CrO_3	Degrees	
	Grams per Liter	Pounds Per U S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.006	10.06	0.08395	0.6280	1	0.9	1.2
1.014	20.28	0.1692	1.266	2	2.0	2.8
1.030	41.20	0.3438	2.572	4	4.2	6.0
1.045	62.70	0.5233	3.914	6	6.2	9.0
1.060	84.80	0.7077	5.294	8	8.2	12.0
1.076	107.6	0.8980	6.717	10	10.2	15.2
1.093	131.2	1.095	8.188	12	12.3	18.6
1.110	155.4	1.297	9.702	14	14.4	22.0
1.127	180.3	1.505	11.26	16	16.3	25.4
1.145	206.1	1.720	12.87	18	18.4	29.0
1.163	232.6	1.941	14.52	20	20.3	32.6
1.181	259.8	2.168	16.22	22	22.2	36.2
1.200	288.0	2.403	17.98	24	24.2	40.0
1.220	317.2	2.647	19.80	26	26.2	44.0
1.240	347.2	2.898	21.68	28	28.1	48.0
1.260	378.0	3.155	23.60	30	29.9	52.0
1.313	459.6	3.835	28.69	35	34.6	62.6
1.371	548.4	4.577	34.24	40	39.2	74.2
1.435	645.8	5.389	40.31	45	44.0	87.0
1.505	752.5	6.280	46.98	50	48.7	101.0
1.581	869.6	7.257	54.29	55	53.3	116.2
1.663	997.8	8.327	62.29	60	57.8	132.6

CHROMIUM SULFATE

Density of Aqueous Chromium Sulfate Solutions at $\frac{15^\circ}{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Cr_2(SO_4)_3$ (green) in solution expressed in			Per Cent $Cr_2(SO_4)_3$ (green)	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0081	10.08	0.08413	0.6294	1	1.2	1.62
1.0172	20.34	0.1698	1.270	2	2.5	3.44
1.0358	41.43	0.3458	2.587	4	5.0	7.16
1.0551	63.31	0.5283	3.952	6	7.6	11.02
1.0751	86.01	0.7178	5.369	8	10.1	15.02

CHROMIUM SULFATE (Continued)

Specific Gravity	Weight of $Cr_2(SO_4)_3$ (green) in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Cr_2(SO_4)_3$ (green)	Degrees: Baumé	Twaddell
1.0958	109.6	0.9145	6.841	10	12.7	19.16
1.1172	134.1	1.119	8.370	12	15.2	23.44
1.1392	159.5	1.331	9.957	14	17.7	27.84
1.1618	185.9	1.551	11.60	16	20.2	32.36
1.1851	213.3	1.780	13.32	18	22.7	37.02
1.2091	241.8	2.018	15.10	20	25.1	41.82
1.2339	271.5	2.265	16.95	22	27.5	46.78
1.2594	302.3	2.522	18.87	24	29.9	51.88
1.2856	334.3	2.790	20.87	26	32.2	57.12
1.3125	367.5	3.067	22.94	28	34.5	62.50
1.3401	402.0	3.355	25.10	30	36.8	68.02
1.4123	494.3	4.125	30.86	35	42.3	82.46
1.4893	595.7	4.972	37.19	40	47.6	97.86

Specific Gravity	Weight of $Cr_2(SO_4)_3$ (violet) in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Cr_2(SO_4)_3$ (violet)	Degrees: Baumé	Twaddell
1.0091	10.09	0.08421	0.6300	1	1.3	1.82
1.0191	20.38	0.1701	1.272	2	2.7	3.82
1.0395	41.58	0.3470	2.596	4	5.5	7.90
1.0604	63.62	0.5310	3.972	6	8.3	12.08
1.0817	86.54	0.7222	5.403	8	11.0	16.34
1.1034	110.3	0.9208	6.889	10	13.6	20.68
1.1257	135.1	1.127	8.433	12	16.2	25.14
1.1486	160.8	1.342	10.04	14	18.8	29.72
1.1722	187.6	1.565	11.71	16	21.3	34.44
1.1966	215.4	1.797	13.45	18	23.8	39.32
1.2218	244.4	2.039	15.26	20	26.3	44.36
1.2479	274.5	2.291	17.14	22	28.8	49.58
1.2750	306.0	2.554	19.10	24	31.3	55.00
1.3032	338.8	2.828	21.15	26	33.7	60.64
1.3325	373.1	3.114	23.29	28	36.2	66.50

CITRIC ACID

Density of Aqueous Citric Acid Solutions at 15° C. Computed from the Values of Gerlach.

Specific Gravity	Weight of $C_6H_8O_7 \cdot H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $C_6H_8O_7 \cdot H_2O$	Degrees: Baumé	Twaddell
1.0074	20.15	0.1681	1.258	2	1.1	1.48
1.0149	40.60	0.3388	2.534	4	2.1	2.98
1.0227	61.36	0.5121	3.831	6	3.2	4.54
1.0309	82.47	0.6883	5.149	8	4.3	6.18
1.0392	103.9	0.8673	6.488	10	5.5	7.84
1.0470	125.6	1.049	7.844	12	6.5	9.40
1.0549	147.7	1.232	9.220	14	7.6	10.98
1.0632	170.1	1.420	10.62	16	8.6	12.64
1.0718	192.9	1.610	12.04	18	9.7	14.36
1.0805	216.1	1.803	13.49	20	10.8	16.10
1.0889	239.6	1.999	14.96	22	11.8	17.78
1.0972	263.3	2.198	16.44	24	12.8	19.44
1.1060	287.6	2.400	17.95	26	13.9	21.20
1.1152	312.3	2.606	19.49	28	15.0	23.04
1.1244	337.3	2.815	21.06	30	16.0	24.88

(Completed on

CITRIC ACID (Continued)

Specific Gravity	Weight of $C_6H_8O_7 \cdot H_2O$ in solution expressed in			Per Cent $C_6H_8O_7 \cdot H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.1332	362.6	3.026	22.64	32	17.1	26.66
1.1422	388.3	3.241	24.24	34	18.1	28.44
1.1515	414.5	3.460	25.88	36	19.1	30.30
1.1612	441.3	3.682	27.55	38	20.1	32.24
1.1709	468.4	3.909	29.24	40	21.2	34.18
1.1814	496.2	4.141	30.98	42	22.3	36.28
1.1899	523.6	4.369	32.69	44	23.1	37.98
1.1998	551.9	4.606	34.46	46	24.2	39.96
1.2103	580.9	4.848	36.27	48	25.2	42.06
1.2204	610.2	5.092	38.09	50	26.2	44.08
1.2307	640.0	5.341	39.95	52	27.2	46.14
1.2410	670.1	5.593	41.84	54	28.2	48.20
1.2514	700.8	5.848	43.75	56	29.1	50.28
1.2627	732.4	6.112	45.72	58	30.2	52.54
1.2738	764.3	6.378	47.71	60	31.2	54.76
1.2849	796.6	6.648	49.73	62	32.2	56.98
1.2960	829.4	6.922	51.78	64	33.1	59.20
1.3071	862.7	7.199	53.86	66	34.1	61.42

COPPER NITRATE

Density of Aqueous Copper Nitrate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Cu(NO_3)_2$ in solution expressed in			Per Cent $Cu(NO_3)_2$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.007	10.07	0.08404	0.6287	1	1.0	1.4
1.015	20.30	0.1694	1.267	2	2.1	3.0
1.032	41.28	0.3445	2.577	4	4.5	6.4
1.050	63.00	0.5258	3.933	6	6.9	10.0
1.069	85.52	0.7137	5.339	8	9.4	13.8
1.088	108.8	0.9080	6.792	10	11.7	17.6
1.107	132.8	1.109	8.293	12	14.0	21.4
1.126	157.6	1.316	9.841	14	16.2	25.2
1.147	183.5	1.532	11.46	16	18.6	29.4
1.168	210.2	1.755	13.13	18	20.9	33.6
1.189	237.8	1.985	14.85	20	23.1	37.8
1.248	312.0	2.604	19.48	25	28.8	49.6

COPPER SULFATE

Density of Aqueous Copper Sulfate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $CuSO_4$ in solution expressed in			Per Cent $CuSO_4$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.009	10.09	0.08421	0.6299	1	1.3	1.8
1.019	20.38	0.1701	1.272	2	2.7	3.8
1.040	41.60	0.3472	2.597	4	5.6	8.0
1.062	63.72	0.5318	3.978	6	8.5	12.4
1.084	86.72	0.7237	5.414	8	11.2	16.8
1.107	110.7	0.9238	6.911	10	14.0	21.4
1.131	135.7	1.133	8.473	12	16.8	26.2
1.154	161.6	1.348	10.09	14	19.4	30.8
1.180	188.8	1.576	11.79	16	22.1	36.0
1.206	217.1	1.812	13.55	18	24.8	41.2

COPPER SULFATE (Continued)

Specific Gravity	Weight of $CuSO_4 \cdot 5H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $CuSO_4 + 5H_2O$	Degrees: Baumé	Twaddell
1.009	15.78	0.1317	0.9852	1.564	1.3	1.8
1.019	31.88	0.2661	1.991	3.129	2.7	3.8
1.040	65.07	0.5431	4.062	6.257	5.6	8.0
1.062	99.68	0.8319	6.223	9.386	8.5	12.4
1.084	135.6	1.132	8.466	12.51	11.2	16.8
1.107	173.1	1.445	10.81	15.64	14.0	21.4
1.131	212.3	1.772	13.25	18.77	16.8	26.2
1.154	252.7	2.109	15.78	21.90	19.4	30.8
1.180	295.3	2.465	18.44	25.03	22.1	36.0
1.206	339.6	2.834	21.20	28.16	24.8	41.2

Density of Aqueous Copper Sulfate Solutions at 18° C. Computed from the Values of Schiff and Gerlach.

Specific Gravity	Weight of $CuSO_4 \cdot 5H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $CuSO_4 \cdot 5H_2O$	Degrees: Baumé	Twaddell
1.0063	10.06	0.08398	0.6282	1	0.9	1.26
1.0126	20.25	0.1690	1.264	2	1.8	2.52
1.0190	30.57	0.2551	1.908	3	2.7	3.80
1.0254	41.02	0.3423	2.561	4	3.6	5.08
1.0319	51.60	0.4306	3.221	5	4.5	6.38
1.0384	62.30	0.5200	3.890	6	5.4	7.68
1.0450	73.15	0.6105	4.567	7	6.2	9.00
1.0516	84.13	0.7021	5.252	8	7.1	10.32
1.0582	95.24	0.7948	5.946	9	8.0	11.64
1.0649	106.5	0.8887	6.648	10	8.8	12.98
1.0716	117.9	0.9837	7.359	11	9.7	14.32
1.0785	129.4	1.080	8.080	12	10.6	15.70
1.0854	141.1	1.178	8.809	13	11.4	17.08
1.0923	152.9	1.276	9.547	14	12.3	18.46
1.0993	164.9	1.376	10.29	15	13.1	19.86
1.1063	177.0	1.477	11.05	16	13.9	21.26
1.1135	189.3	1.580	11.82	17	14.8	22.70
1.1208	201.7	1.684	12.59	18	15.6	24.16
1.1281	214.3	1.789	13.38	19	16.5	25.62
1.1354	227.1	1.895	14.18	20	17.3	27.08
1.1427	240.0	2.003	14.98	21	18.1	28.54
1.1501	253.0	2.112	15.80	22	18.9	30.02
1.1585	266.5	2.224	16.63	23	19.8	31.70
1.1659	279.8	2.335	17.47	24	20.6	33.18
1.1738	293.5	2.449	18.32	25	21.5	34.76
1.1817	307.2	2.564	19.18	26	22.3	36.34
1.1898	321.2	2.681	20.06	27	23.1	37.96
1.1980	335.4	2.799	20.94	28	24.0	39.60
1.2063	349.8	2.919	21.84	29	24.8	41.26
1.2146	364.4	3.041	22.75	30	25.6	42.92

Specific Gravity	Weight of $CuSO_4$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $CuSO_4$	Degrees: Baumé	Twaddell
1.0063	6.433	0.05369	0.4016	0.6393	0.9	1.26
1.0126	12.95	0.1081	0.8085	1.279	1.8	2.52
1.0190	19.54	0.1631	1.220	1.918	2.7	3.80
1.0254	26.22	0.2188	1.637	2.557	3.6	5.08
1.0319	32.98	0.2752	2.059	3.196	4.5	6.38

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COPPER SULFATE (Continued)

	Weight of $CuSO_4$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds Per Cubic Foot	Per Cent $CuSO_4$	Baumé	Twaddell
1.0384	39.83	0.3324	2.487	3.836	5.4	7.68
1.0450	46.76	0.3903	2.919	4.475	6.2	9.00
1.0516	53.78	0.4488	3.357	5.114	7.1	10.32
1.0582	60.88	0.5081	3.801	5.753	8.0	11.64
1.0649	68.08	0.5681	4.250	6.393	8.8	12.98
1.0716	75.35	0.6289	4.704	7.032	9.7	14.32
1.0785	82.73	0.6904	5.165	7.671	10.6	15.70
1.0854	90.20	0.7527	5.631	8.310	11.4	17.08
1.0923	97.76	0.8159	6.103	8.950	12.3	18.46
1.0993	105.4	0.8797	6.581	9.589	13.1	19.86
1.1063	113.2	0.9445	7.065	10.23	13.9	21.26
1.1135	121.0	1.010	7.556	10.87	14.8	22.70
1.1208	129.0	1.077	8.054	11.51	15.6	24.16
1.1281	137.1	1.144	8.557	12.15	16.5	25.62
1.1354	145.2	1.212	9.066	12.79	17.3	27.08
1.1427	153.4	1.280	9.574	13.42	18.1	28.54
1.1501	161.7	1.349	10.10	14.06	18.9	30.02
1.1585	170.3	1.421	10.63	14.70	19.8	31.70
1.1659	178.8	1.493	11.17	15.34	20.6	33.18
1.1738	187.6	1.565	11.71	15.98	21.5	34.76
1.1817	196.4	1.639	12.26	16.62	22.3	36.34
1.1898	205.4	1.714	12.82	17.26	23.1	37.96
1.1980	214.4	1.790	13.39	17.90	24.0	39.60
1.2063	223.6	1.866	13.96	18.54	24.8	41.26
1.2146	233.0	1.944	14.54	19.18	25.6	42.92

CUPRIC CHLORIDE

Density of Aqueous Cupric Chloride Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

	Weight of $CuCl_2$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $CuCl_2$	Baumé	Twaddell
1.007	10.07	0.08404	0.6287	1	1.0	1.4
1.017	20.34	0.1697	1.270	2	2.4	3.4
1.036	41.44	0.3458	2.587	4	5.0	7.2
1.056	63.36	0.5288	3.956	6	7.7	11.2
1.075	86.00	0.7177	5.369	8	10.1	15.0
1.096	109.6	0.9147	6.842	10	12.7	19.2
1.117	134.0	1.119	8.368	12	15.2	23.4
1.138	159.3	1.330	9.946	14	17.6	27.6
1.160	185.6	1.549	11.59	16	20.0	32.0
1.182	212.8	1.776	13.28	18	22.3	36.4
1.205	241.0	2.011	15.05	20	24.7	41.0

Density of Aqueous Cupric Chloride Solutions at 17.5° C. Computed from the Values of Franz.

	Weight of $CuCl_2$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $CuCl_2$	Baumé	Twaddell
1.0091	10.09	0.08421	0.6300	1	1.3	1.82
1.0182	20.36	0.1699	1.271	2	2.6	3.64
1.0273	30.82	0.2572	1.924	3	3.9	5.46
1.0364	41.46	0.3460	2.588	4	5.1	7.28
1.0455	52.28	0.4363	3.264	5	6.3	9.10

CUPRIC CHLORIDE (Continued)

Specific Gravity	Weight of $CuCl_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $CuCl_2$	Degrees: Baumé	Twaddell
1.0548	63.29	0.5282	3.951	6	7.5	10.96
1.0641	74.49	0.6216	4.650	7	8.7	12.82
1.0734	85.87	0.7166	5.361	8	9.9	14.68
1.0827	97.44	0.8132	6.083	9	11.1	16.54
1.0920	109.2	0.9113	6.817	10	12.2	18.40
1.1049	121.5	1.014	7.588	11	13.8	20.98
1.1178	134.1	1.119	8.374	12	15.3	23.56
1.1307	147.0	1.227	9.177	13	16.8	26.14
1.1436	160.1	1.336	9.995	14	18.2	28.72
1.1565	173.5	1.448	10.83	15	19.6	31.30
1.1696	187.1	1.562	11.68	16	21.0	33.92
1.1827	201.1	1.678	12.55	17	22.4	36.54
1.1958	215.2	1.796	13.44	18	23.7	39.16
1.2089	229.7	1.917	14.34	19	25.1	41.78
1.2223	244.5	2.040	15.26	20	26.4	44.46
1.2362	259.6	2.166	16.21	21	27.7	47.24
1.2501	275.0	2.295	17.17	22	29.0	50.02
1.2640	290.7	2.426	18.15	23	30.3	52.80
1.2779	306.7	2.560	19.15	24	31.5	55.58
1.2918	323.0	2.695	20.16	25	32.8	58.36
1.3058	339.5	2.833	21.20	26	34.0	61.16
1.3198	356.3	2.974	22.25	27	35.1	63.96
1.3338	373.5	3.117	23.32	28	36.3	66.76
1.3478	390.9	3.262	24.40	29	37.4	69.56
1.3618	408.5	3.409	25.51	30	38.5	72.36
1.3784	427.3	3.566	26.08	31	39.8	75.68
1.3950	446.4	3.725	27.87	32	41.1	79.00
1.4116	465.8	3.888	29.08	33	42.3	82.32
1.4287	485.8	4.054	30.33	34	43.5	85.74
1.4447	505.6	4.220	31.57	35	44.6	88.94
1.4615	526.1	4.391	32.85	36	45.8	92.30
1.4782	546.9	4.564	34.15	37	46.9	95.64
1.4949	568.1	4.741	35.46	38	48.0	98.98
1.5116	589.5	4.920	36.80	39	49.1	102.32
1.5284	611.4	5.102	38.17	40	50.1	105.68

FERRIC CHLORIDE

Density of Aqueous Ferric Chloride Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $FeCl_3$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $FeCl_3$	Degrees: Baumé	Twaddell
1.007	10.07	0.08404	0.6287	1	1.0	1.4
1.015	20.30	0.1694	1.267	2	2.1	3.0
1.032	41.28	0.3445	2.577	4	4.5	6.4
1.049	62.94	0.5253	3.929	6	6.8	9.8
1.067	85.36	0.7124	5.329	8	9.1	13.4
1.085	108.5	0.9055	6.774	10	11.4	17.0
1.104	132.5	1.106	8.271	12	13.7	20.8
1.123	157.2	1.312	9.815	14	15.9	24.6
1.142	182.7	1.525	11.41	16	18.0	28.4
1.162	209.2	1.746	13.06	18	20.2	32.4
1.182	236.4	1.973	14.76	20	22.3	36.4
1.234	308.5	2.575	19.26	25	27.5	46.8
1.291	387.3	3.232	24.18	30	32.7	58.2
1.353	473.6	3.952	29.56	35	37.8	70.6
1.418	567.2	4.734	35.41	40	42.7	83.6
1.485	668.3	5.577	41.72	45	47.4	97.0
1.551	775.5	6.472	48.41	50	51.5	110.2

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FERRIC CHLORIDE (Continued)

Density of Aqueous Ferric Chloride Solutions at 17.5° C. Computed from the Values of Franz.

	Weight of $FeCl_3$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $FeCl_3$	Baumé	Twaddell
1.0073	10.07	0.08406	0.6289	1	1.1	1.46
1.0146	20.29	0.1693	1.267	2	2.1	2.92
1.0219	30.66	0.2558	1.914	3	3.1	4.38
1.0292	41.17	0.3436	2.570	4	4.1	5.84
1.0365	51.83	0.4325	3.235	5	5.1	7.30
1.0439	62.63	0.5227	3.910	6	6.1	8.78
1.0513	73.59	0.6141	4.594	7	7.0	10.26
1.0587	84.70	0.7068	5.288	8	8.0	11.74
1.0661	95.95	0.8007	5.990	9	9.0	13.22
1.0734	107.3	0.8958	6.701	10	9.9	14.68
1.0814	119.0	0.9927	7.426	11	10.9	16.28
1.0894	130.7	1.091	8.161	12	11.9	17.88
1.0974	142.7	1.191	8.906	13	12.9	19.48
1.1054	154.8	1.292	9.661	14	13.8	21.08
1.1134	167.0	1.394	10.43	15	14.8	22.68
1.1215	179.4	1.497	11.20	16	15.7	24.30
1.1297	192.0	1.603	11.99	17	16.6	25.94
1.1378	204.8	1.709	12.79	18	17.6	27.56
1.1458	217.7	1.817	13.59	19	18.4	29.16
1.1542	230.8	1.926	14.41	20	19.4	30.84
1.1644	244.5	2.041	15.27	21	20.5	32.88
1.1746	258.4	2.157	16.13	22	21.6	34.92
1.1848	272.5	2.274	17.01	23	22.6	36.96
1.1950	286.8	2.393	17.90	24	23.7	39.00
1.2052	301.3	2.514	18.81	25	24.7	41.04
1.2155	316.0	2.637	19.73	26	25.7	43.10
1.2258	331.0	2.762	20.66	27	26.7	45.16
1.2365	346.2	2.889	21.61	28	27.7	47.30
1.2464	361.5	3.016	22.57	29	28.7	49.28
1.2568	377.0	3.147	23.54	30	29.6	51.36
1.2673	392.9	3.279	24.53	31	30.6	53.46
1.2778	408.9	3.412	25.53	32	31.5	55.56
1.2883	425.1	3.548	26.54	33	32.5	57.66
1.2988	441.6	3.685	27.57	34	33.4	59.76
1.3093	458.3	3.824	28.61	35	34.3	61.86
1.3199	475.2	3.965	29.66	36	35.1	63.98
1.3305	492.3	4.108	30.73	37	36.0	66.10
1.3411	509.6	4.253	31.82	38	36.9	68.22
1.3517	527.2	4.399	32.91	39	37.7	70.34
1.3622	544.9	4.547	34.02	40	38.6	72.44
1.3746	563.6	4.703	35.18	41	39.5	74.92
1.3870	582.5	4.862	36.37	42	40.5	77.40
1.3994	601.7	5.022	37.57	43	41.4	79.88
1.4118	621.2	5.184	38.78	44	42.3	82.36
1.4242	640.9	5.348	40.01	45	43.2	84.84
1.4367	660.9	5.515	41.26	46	44.1	87.34
1.4492	681.1	5.684	42.52	47	44.9	89.84
1.4617	701.6	5.855	43.80	48	45.8	92.34
1.4742	722.4	6.028	45.10	49	46.6	94.84
1.4867	743.4	6.204	46.41	50	47.5	97.34
1.5010	765.5	6.388	47.79	51	48.4	100.20
1.5153	788.0	6.576	49.19	52	49.3	103.06
1.5296	810.7	6.766	50.61	53	50.2	105.92
1.5439	833.7	6.958	52.05	54	51.1	108.78
1.5582	857.0	7.152	53.50	55	51.9	111.64
1.5729	880.8	7.351	54.99	56	52.8	114.58
1.5876	904.9	7.552	56.49	57	53.7	117.52
1.6023	929.3	7.756	58.02	58	54.5	120.46
1.6170	954.0	7.962	59.56	59	55.3	123.40
1.6317	979.0	8.170	61.12	60	56.1	126.34

FERRIC NITRATE

Density of Aqueous Ferric Nitrate Solutions at $\frac{18°}{4°}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Fe(NO_3)_3$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Fe(NO_3)_3$	Degrees Baumé	Twaddell
1.0065	10.07	0.08400	0.6284	1	0.9	1.30
1.0144	20.29	0.1693	1.267	2	2.1	2.88
1.0304	41.22	0.3440	2.573	4	4.3	6.08
1.0468	62.81	0.5242	3.921	6	6.5	9.36
1.0636	85.09	0.7101	5.312	8	8.7	12.72
1.0810	108.1	0.9021	6.749	10	10.9	16.20
1.0989	131.9	1.100	8.233	12	13.1	19.78
1.1172	156.4	1.305	9.765	14	15.2	23.44
1.1359	181.7	1.517	11.35	16	17.3	27.18
1.1551	207.9	1.735	12.98	18	19.5	31.02
1.1748	235.0	1.961	14.67	20	21.6	34.96
1.2281	307.0	2.562	19.17	25	26.9	45.62

Density of Aqueous Ferric Nitrate Solutions at 17.5° C. Computed from the Values of Franz.

Specific Gravity	Weight of $Fe(NO_3)_3$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Fe(NO_3)_3$	Degrees Baumé	Twaddell
1.0080	10.08	0.08412	0.6293	1	1.2	1.60
1.0160	20.32	0.1696	1.269	2	2.3	3.20
1.0240	30.72	0.2564	1.918	3	3.4	4.80
1.0320	41.28	0.3445	2.577	4	4.5	6.40
1.0398	51.99	0.4339	3.246	5	5.6	7.96
1.0472	62.83	0.5244	3.923	6	6.5	9.44
1.0546	73.82	0.6161	4.609	7	7.5	10.92
1.0620	84.96	0.7090	5.304	8	8.5	12.40
1.0694	96.25	0.8032	6.009	9	9.4	13.88
1.0770	107.7	0.8988	6.724	10	10.4	15.40
1.0852	119.4	0.9962	7.452	11	11.4	17.04
1.0934	131.2	1.095	8.191	12	12.4	18.68
1.1016	143.2	1.195	8.940	13	13.4	20.32
1.1098	155.4	1.297	9.700	14	14.3	21.96
1.1182	167.7	1.400	10.47	15	15.3	23.64
1.1268	180.3	1.505	11.26	16	16.3	25.36
1.1354	193.0	1.611	12.05	17	17.3	27.08
1.1440	205.9	1.718	12.86	18	18.3	28.80
1.1526	219.0	1.828	13.67	19	19.2	30.52
1.1612	232.2	1.938	14.50	20	20.1	32.24
1.1712	246.0	2.053	15.35	21	21.2	34.24
1.1812	259.9	2.169	16.22	22	22.2	36.24
1.1912	274.0	2.286	17.10	23	23.3	38.24
1.2012	288.3	2.406	18.00	24	24.3	40.24
1.2110	302.8	2.527	18.90	25	25.3	42.20
1.2212	317.5	2.650	19.82	26	26.3	44.24
1.2314	332.5	2.775	20.76	27	27.3	46.28
1.2416	347.6	2.901	21.70	28	28.2	48.32
1.2518	363.0	3.030	22.66	29	29.2	50.36
1.2622	378.7	3.160	23.64	30	30.1	52.44
1.2730	394.6	3.293	24.64	31	31.1	54.60
1.2838	410.8	3.428	25.65	32	32.1	56.76
1.2946	427.2	3.565	26.67	33	33.0	58.92
1.3054	443.8	3.704	27.71	34	33.9	61.08
1.3164	460.7	3.845	28.76	35	34.9	63.28

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FERRIC NITRATE (Continued)

Specific Gravity	Weight of $Fe(NO_3)_3$ in solution expressed in			Per Cent $Fe(NO_3)_3$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.3280	478.1	3.990	29.85	36	35.8	65.60
1.3396	495.7	4.136	30.94	37	36.8	67.92
1.3512	513.5	4.285	32.06	38	37.7	70.24
1.3628	531.5	4.436	33.18	39	38.6	72.56
1.3746	549.8	4.589	34.33	40	39.5	74.92
1.3864	568.4	4.744	35.49	41	40.4	77.28
1.3982	587.2	4.901	36.66	42	41.3	79.64
1.4100	606.3	5.060	37.85	43	42.2	82.00
1.4218	625.6	5.221	39.06	44	43.0	84.36
1.4338	645.2	5.385	40.28	45	43.9	86.76
1.4465	665.4	5.553	41.54	46	44.8	89.30
1.4592	685.8	5.723	42.82	47	45.6	91.84
1.4719	706.5	5.896	44.11	48	46.5	94.38
1.4846	727.5	6.071	45.41	49	47.3	96.92
1.4972	748.6	6.247	46.74	50	48.2	99.44
1.5122	771.2	6.436	48.15	51	49.1	102.44
1.5272	794.1	6.627	49.58	52	50.1	105.44
1.5422	817.4	6.821	51.03	53	51.0	108.44
1.5572	840.9	7.018	52.50	54	51.9	111.44
1.5722	864.7	7.216	53.98	55	52.8	114.44
1.5892	890.0	7.427	55.56	56	53.8	117.84
1.6062	915.5	7.640	57.16	57	54.7	121.24
1.6232	941.5	7.857	58.78	58	55.7	124.64
1.6402	967.7	8.076	60.41	59	56.6	128.04
1.6572	994.3	8.298	62.08	60	57.5	131.44
1.6764	1023	8.534	63.84	61	58.5	135.28
1.6956	1051	8.773	65.63	62	59.5	139.12
1.7148	1080	9.016	67.44	63	60.4	142.96
1.7340	1110	9.261	69.28	64	61.4	146.80
1.7532	1140	9.510	71.14	65	62.3	150.64

FERRIC SULFATE

Density of Aqueous Ferric Sulfate Solutions at $\frac{17.5^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Fe_2(SO_4)_3$ in solution expressed in			Per Cent $Fe_2(SO_4)_3$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.007	10.07	0.08404	0.6287	1	1.0	1.4
1.016	20.32	0.1696	1.269	2	2.3	3.2
1.033	41.32	0.3448	2.580	4	4.7	6.6
1.050	63.00	0.5258	3.933	6	6.9	10.0
1.067	85.36	0.7124	5.329	8	9.1	13.4
1.084	108.4	0.9046	6.767	10	11.2	16.8
1.103	132.4	1.105	8.263	12	13.5	20.6
1.122	157.1	1.311	9.807	14	15.8	24.4
1.141	182.6	1.524	11.40	16	17.9	28.2
1.161	209.0	1.744	13.05	18	20.1	32.2
1.181	236.2	1.971	14.75	20	22.2	36.2
1.241	310.3	2.589	19.37	25	28.2	48.2
1.307	392.1	3.272	24.48	30	34.1	61.4
1.376	481.6	4.019	30.07	35	39.6	75.2
1.449	579.6	4.837	36.18	40	44.9	89.8
1.528	687.6	5.738	42.93	45	50.1	105.6
1.613	806.5	6.731	50.35	50	55.1	122.6
1.703	936.7	7.817	58.48	55	59.9	140.6
1.798	1079	9.003	67.35	60	64.4	159.6

FERROUS SULFATE

Density of Aqueous Ferrous Sulfate Solutions at $\frac{18^{\circ}}{4^{\circ}}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $FeSO_4$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $FeSO_4$	Degrees: Baumé	Twaddell
1.0007	2.001	0.01670	0.1249	0.2	0.1	0.14
1.0028	4.011	0.03348	0.2504	0.4	0.4	0.56
1.0046	6.028	0.05030	0.3763	0.6	0.7	0.92
1.0065	8.052	0.06720	0.5027	0.8	0.9	1.30
1.0085	10.09	0.08416	0.6296	1.0	1.2	1.70
1.0180	20.36	0.1699	1.271	2	2.6	3.60
1.0375	41.50	0.3463	2.591	4	5.2	7.50
1.0575	63.45	0.5295	3.961	6	7.9	11.50
1.0785	86.28	0.7200	5.386	8	10.6	15.70
1.1000	110.0	0.9180	6.867	10	13.2	20.00
1.1220	134.6	1.124	8.406	12	15.8	24.40
1.1445	160.2	1.337	10.00	14	18.3	28.90
1.1675	186.8	1.559	11.66	16	20.8	33.50
1.1905	214.3	1.788	13.38	18	23.2	38.10
1.2135	242.7	2.025	15.15	20	25.5	42.70

Specific Gravity	Weight of $FeSO_4 \cdot 7H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $FeSO_4 \cdot 7H_2O$	Degrees: Baumé	Twaddell
1.0007	3.663	0.03057	0.2287	0.3660	0.1	0.14
1.0028	7.341	0.06127	0.4583	0.7321	0.4	0.56
1.0046	11.03	0.09205	0.6886	1.098	0.7	0.92
1.0065	14.74	0.1230	0.9199	1.464	0.9	1.30
1.0085	18.46	0.1540	1.152	1.830	1.2	1.70
1.0180	37.26	0.3109	2.326	3.660	2.6	3.60
1.0375	75.96	0.6339	4.742	7.321	5.2	7.50
1.0575	116.1	0.9690	7.249	10.98	7.9	11.50
1.0785	157.9	1.318	9.857	14.64	10.6	15.70
1.1000	201.3	1.680	12.57	18.30	13.2	20.00
1.1220	246.4	2.056	15.38	21.96	15.8	24.40
1.1445	293.2	2.447	18.31	25.62	18.3	28.90
1.1675	341.8	2.853	21.34	29.28	20.8	33.50
1.1905	392.2	3.273	24.48	32.94	23.2	38.10
1.2135	444.1	3.707	27.73	36.60	25.5	42.70

FORMIC ACID

Density of Aqueous Formic Acid Solutions at $\frac{20^{\circ}}{4^{\circ}}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of HCO_2H in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent HCO_2H	Degrees: Baumé	Twaddell
0.9982	.....	....	.....	0	....	.....
1.0019	10.02	0.08361	0.6255	1	0.3	0.38
1.0044	20.09	0.1676	1.254	2	0.6	0.88
1.0070	30.21	0.2521	1.886	3	1.0	1.40
1.0093	40.37	0.3369	2.520	4	1.3	1.86
1.0115	50.58	0.4221	3.157	5	1.6	2.30
1.0141	60.85	0.5078	3.799	6	2.0	2.82
1.0170	71.19	0.5941	4.444	7	2.4	3.40
1.0196	81.57	0.6807	5.092	8	2.8	3.92
1.0221	91.99	0.7677	5.743	9	3.1	4.42

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FORMIC ACID (Continued)

	Weight of HCO_2H in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent HCO_2H	Baumé	Twaddell
1.0246	102.5	0.8551	6.397	10	3.5	4.92
1.0271	113.0	0.9429	7.053	11	3.8	5.42
1.0296	123.6	1.031	7.713	12	4.2	5.92
1.0321	134.2	1.120	8.376	13	4.5	6.42
1.0345	144.8	1.209	9.042	14	4.8	6.90
1.0370	156.6	1.298	9.711	15	5.2	7.40
1.0393	166.3	1.388	10.38	16	5.5	7.86
1.0417	177.1	1.478	11.06	17	5.8	8.34
1.0441	187.9	1.568	11.73	18	6.1	8.82
1.0464	198.8	1.659	12.41	19	6.4	9.28
1.0488	209.8	1.751	13.10	20	6.8	9.76
1.0512	220.8	1.842	13.78	21	7.1	10.24
1.0537	231.8	1.935	14.47	22	7.4	10.74
1.0561	242.9	2.027	15.16	23	7.7	11.22
1.0585	254.0	2.120	15.86	24	8.0	11.70
1.0609	265.2	2.213	16.56	25	8.3	12.18
1.0633	276.5	2.307	17.26	26	8.6	12.66
1.0656	287.7	2.401	17.96	27	8.9	13.12
1.0681	299.1	2.496	18.67	28	9.3	13.62
1.0705	310.4	2.591	19.38	29	9.6	14.10
1.0729	321.9	2.686	20.09	30	9.9	14.58
1.0753	333.3	2.782	20.81	31	10.2	15.06
1.0777	344.9	2.878	21.53	32	10.5	15.54
1.0800	356.4	2.974	22.25	33	10.7	16.00
1.0823	368.0	3.071	22.97	34	11.0	16.46
1.0847	379.6	3.168	23.70	35	11.3	16.94
1.0871	391.4	3.266	24.43	36	11.6	17.42
1.0895	403.1	3.364	25.17	37	11.9	17.90
1.0919	414.9	3.463	25.90	38	12.2	18.38
1.0940	426.7	3.561	26.64	39	12.5	18.80
1.0963	438.5	3.660	27.38	40	12.7	19.26
1.0990	450.6	3.760	28.13	41	13.1	19.80
1.1015	462.6	3.861	28.88	42	13.4	20.30
1.1038	474.6	3.961	29.63	43	13.6	20.76
1.1062	486.7	4.062	30.39	44	13.9	21.24
1.1085	498.8	4.163	31.14	45	14.2	21.70
1.1108	511.0	4.264	31.90	46	14.5	22.16
1.1130	523.1	4.366	32.66	47	14.7	22.60
1.1157	535.5	4.469	33.43	48	15.0	23.14
1.1185	548.1	4.574	34.22	49	15.4	23.70
1.1207	560.4	4.676	34.98	50	15.6	24.14
1.1223	572.4	4.777	35.73	51	15.8	24.46
1.1244	584.7	4.879	36.50	52	16.0	24.88
1.1269	597.3	4.984	37.29	53	16.3	25.38
1.1295	609.9	5.090	38.08	54	16.6	25.90
1.1320	622.6	5.196	38.87	55	16.9	26.40
1.1342	635.2	5.301	39.65	56	17.2	26.84
1.1361	647.6	5.404	40.43	57	17.4	27.22
1.1381	660.1	5.509	41.21	58	17.6	27.62
1.1401	672.7	5.614	41.99	59	17.8	28.02
1.1424	685.4	5.720	42.79	60	18.1	28.48
1.1448	698.3	5.828	43.60	61	18.3	28.96
1.1473	711.3	5.936	44.41	62	18.6	29.46
1.1493	724.1	6.043	45.20	63	18.8	29.86
1.1517	737.1	6.151	46.02	64	19.1	30.34
1.1543	750.3	6.262	46.84	65	19.4	30.86
1.1565	763.3	6.370	47.65	66	19.6	31.30
1.1584	776.1	6.477	48.45	67	19.8	31.68
1.1604	789.1	6.585	49.26	68	20.0	32.08
1.1628	802.3	6.696	50.09	69	20.3	32.56

FORMIC ACID (Continued)

Specific Gravity	Weight of HCO_2H in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent HCO_2H	Degrees: Baumé	Twaddell
1.1655	815.9	6.809	50.93	70	20.6	33.10
1.1677	829.1	6.919	51.76	71	20.8	33.54
1.1702	842.5	7.031	52.60	72	21.1	34.04
1.1728	856.1	7.145	53.45	73	21.4	34.56
1.1752	869.6	7.258	54.29	74	21.6	35.04
1.1769	882.7	7.366	55.11	75	21.8	35.38
1.1785	895.7	7.475	55.92	76	22.0	35.70
1.1801	908.7	7.583	56.73	77	22.1	36.02
1.1818	921.8	7.693	57.55	78	22.3	36.36
1.1837	935.1	7.804	58.38	79	22.5	36.74
1.1860	948.8	7.918	59.23	80	22.7	37.20
1.1876	962.0	8.028	60.05	81	22.9	37.52
1.1896	975.5	8.141	60.90	82	23.1	37.92
1.1914	988.9	8.252	61.73	83	23.3	38.28
1.1929	1002	8.362	62.56	84	23.5	38.59
1.1953	1016	8.479	63.43	85	23.7	39.06
1.1976	1030	8.595	64.30	86	23.9	39.52
1.1994	1043	8.708	65.14	87	24.1	39.88
1.2012	1057	8.822	65.99	88	24.3	40.24
1.2028	1070	8.934	66.83	89	24.5	40.56
1.2044	1084	9.046	67.67	90	24.6	40.88
1.2059	1097	9.158	68.51	91	24.8	41.18
1.2078	1111	9.273	69.37	92	25.0	41.56
1.2099	1125	9.390	70.25	93	25.2	41.98
1.2117	1139	9.505	71.11	94	25.3	42.34
1.2140	1153	9.625	72.00	95	25.6	42.80
1.2158	1167	9.741	72.87	96	25.7	43.16
1.2170	1180	9.852	73.70	97	25.9	43.40
1.2183	1194	9.964	74.54	98	26.0	43.66
1.2202	1208	10.08	75.42	99	26.2	44.04
1.2212	1221	10.19	76.24	100	26.3	44.24

GLYCEROL

Density of Aqueous Glycerol Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from the Values of Bosart and Snoddy. *Ind. Eng. Chem. 20, 1377 (1928).*

Specific Gravity	Weight of $C_3H_8O_3$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $C_3H_8O_3$	Degrees: Baume	Twaddell
0.99823	.....	....	......	0	...	....
1.00060	10.01	0.08350	0.6247	1	0.1	0.12
1.00300	20.06	0.1674	1.252	2	0.4	0.60
1.00540	30.16	0.2517	1.883	3	0.8	1.08
1.00780	40.31	0.3364	2.516	4	1.1	1.56
1.01015	50.51	0.4215	3.153	5	1.5	2.03
1.01255	60.75	0.5070	3.793	6	1.8	2.51
1.01495	71.05	0.5929	4.436	7	2.1	2.99
1.01730	81.38	0.6792	5.081	8	2.5	3.46
1.01970	91.77	0.7659	5.729	9	2.8	3.94
1.02210	102.2	0.8530	6.381	10	3.1	4.42
1.02455	112.7	0.9406	7.036	11	3.5	4.91
1.02705	123.2	1.028	7.691	12	3.8	5.41
1.02955	133.7	1.116	8.347	13	4.1	5.91
1.03200	144.5	1.206	9.020	14	4.5	6.40

(Continued on following page.)

GLYCEROL (Continued)

	Weight of $C_3H_8O_3$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $C_3H_8O_3$	Baume	Twaddell
1.03450	155.2	1.295	9.688	15	4.8	6.90
1.03695	165.9	1.385	10.36	16	5.2	7.39
1.03945	176.7	1.475	11.03	17	5.5	7.89
1.04195	187.6	1.565	11.71	18	5.8	8.39
1.04440	198.4	1.656	12.39	19	6.2	8.88
1.04690	209.4	1.748	13.07	20	6.5	9.38
1.04950	220.4	1.839	13.76	21	6.8	9.90
1.05205	231.5	1.932	14.45	22	7.2	10.41
1.05465	242.6	2.025	15.15	23	7.5	10.93
1.05720	253.7	2.117	15.84	24	7.8	11.44
1.05980	265.0	2.212	16.54	25	8.2	11.96
1.06240	276.2	2.305	17.24	26	8.5	12.48
1.06495	287.5	2.399	17.95	27	8.8	12.99
1.06755	298.9	2.494	18.66	28	9.2	13.51
1.07010	310.3	2.590	19.37	29	9.5	14.02
1.07270	321.8	2.686	20.09	30	9.8	14.54
1.07535	333.4	2.782	20.81	31	10.2	15.07
1.07800	345.0	2.879	21.54	32	10.5	15.60
1.08070	356.6	2.976	22.26	33	10.8	16.14
1.08335	368.3	3.074	22.99	34	11.2	16.67
1.08600	380.1	3.172	23.73	35	11.5	17.20
1.08865	391.9	3.271	24.47	36	11.8	17.73
1.09135	403.8	3.370	25.21	37	12.1	18.27
1.09400	415.7	3.469	25.95	38	12.5	18.80
1.09665	427.7	3.569	26.70	39	12.8	19.33
1.09930	439.7	3.669	27.45	40	13.1	19.86
1.10200	451.8	3.770	28.21	41	13.4	20.40
1.10470	464.0	3.872	28.97	42	13.8	20.94
1.10740	476.2	3.974	29.73	43	14.1	21.48
1.11010	488.4	4.076	30.49	44	14.4	22.02
1.11280	500.8	4.179	31.26	45	14.7	22.56
1.11550	513.1	4.282	32.03	46	15.0	23.10
1.11820	525.6	4.386	32.81	47	15.3	23.64
1.12090	538.0	4.490	33.59	48	15.6	24.18
1.12360	550.6	4.595	34.37	49	16.0	24.72
1.12630	563.2	4.700	35.16	50	16.3	25.26
1.12905	575.8	4.805	35.95	51	16.6	25.81
1.13180	588.5	4.911	36.74	52	16.9	26.36
1.13455	601.3	5.018	37.54	53	17.2	26.91
1.13730	614.1	5.125	38.34	54	17.5	27.46
1.14005	627.0	5.233	39.14	55	17.8	28.01
1.14280	640.0	5.341	39.96	56	18.1	28.56
1.14555	653.0	5.450	40.77	57	18.4	29.11
1.14830	665.9	5.557	41.57	58	18.7	29.66
1.15105	679.1	5.667	42.40	59	19.0	30.21
1.15380	692.3	5.778	43.22	60	19.3	30.76
1.15655	705.5	5.887	44.04	61	19.6	31.31
1.15930	718.8	5.999	44.87	62	19.9	31.86
1.16205	732.1	6.110	45.71	63	20.2	32.41
1.16475	745.4	6.221	46.54	64	20.5	32.95
1.16750	758.9	6.333	47.38	65	20.8	33.50
1.17025	772.4	6.446	48.22	66	21.0	34.05
1.17300	785.9	6.559	49.06	67	21.3	34.60
1.17575	800.0	6.676	49.94	68	21.6	35.15
1.17850	813.2	6.786	50.77	69	21.9	35.70
1.18125	826.9	6.901	51.62	70	22.2	36.25
1.18395	840.6	7.015	52.48	71	22.5	36.79
1.18670	854.4	7.130	53.34	72	22.8	37.34
1.18940	868.3	7.246	54.21	73	23.1	37.88
1.19215	882.2	7.362	55.08	74	23.3	38.43

GLYCEROL (Continued)

Specific Gravity	Weight of $C_3H_8O_3$ in solution expressed in			Per Cent $C_3H_8O_3$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baume	Twaddell
1.19485	896.1	7.478	55.93	75	23.6	38.97
1.19760	910.0	7.594	56.81	76	23.9	39.52
1.20030	924.2	7.713	57.70	77	24.2	40.06
1.20305	938.4	7.831	58.58	78	24.4	40.61
1.20575	952.4	7.948	59.46	79	24.7	41.15
1.20850	966.8	8.068	60.36	80	25.0	41.70
1.21115	981.0	8.187	61.24	81	25.2	42.23
1.21380	995.3	8.306	62.14	82	25.5	42.76
1.21650	1010	8.429	63.05	83	25.8	43.30
1.21915	1024	8.543	63.91	84	26.0	43.83
1.22180	1039	8.671	64.86	85	26.3	44.36
1.22445	1053	8.785	65.72	86	26.5	44.89
1.22710	1068	8.913	66.68	87	26.8	45.42
1.22975	1082	9.029	67.54	88	27.1	45.95
1.23245	1097	9.155	68.49	89	27.3	46.49
1.23510	1112	9.280	68.42	90	27.6	47.02
1.23770	1126	9.397	70.30	91	27.8	47.54
1.24035	1141	9.521	71.23	92	28.1	48.07
1.24300	1156	9.646	72.16	93	28.3	48.60
1.24560	1171	9.771	73.09	94	28.6	49.12
1.24825	1186	9.896	74.03	95	28.8	49.65
1.25080	1201	10.02	74.96	96	29.1	50.16
1.25335	1216	10.15	75.90	97	29.3	50.67
1.25590	1231	10.27	76.84	98	29.5	51.18
1.25850	1246	10.40	77.78	99	29.8	51.70
1.26108	1261	10.52	78.72	100	30.0	52.216

HYDROCHLORIC ACID

Specific Gravity of Aqueous Hydrochloric Acid Solutions. Adopted 1903 as Standard by the Manufacturing Chemists' Association of the United States.

Authority: W. C. Ferguson.

Specific Gravity determinations were made at 60° F., compared with water at 60°F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}$$

* Baumé Hydrometers for use with this table must be graduated by the above formula which formula should always be printed on the scale.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

ALLOWANCE FOR TEMPERATURE:

10 — 15° Be. — 1/40° Be. or .0002 Sp. Gr. for 1° F.
15 — 22° Be. — 1/30° Be. or .0003 Sp. Gr. for 1° F.
22 — 25° Be. — 1/28° Be. or .00035 Sp. Gr. for 1° F.

Be.°	Sp. Gr.	Tw.°	%HCl.
1.00	1.0069	1.38	1.40
2.00	1.0140	2.80	2.82
3.00	1.0211	4.22	4.25
4.00	1.0284	5.68	5.69
5.00	1.0357	7.14	7.15
5.25	1.0375	7.50	7.52
5.50	1.0394	7.88	7.89
5.75	1.0413	8.26	8.26
6.00	1.0432	8.64	8.64
6.25	1.0450	9.00	9.02
6.50	1.0469	9.38	9.40
6.75	1.0488	9.76	9.78
7.00	1.0507	10.14	10.17
7.25	1.0526	10.52	10.55
7.50	1.0545	10.90	10.94
7.75	1.0564	11.28	11.32
8.00	1.0584	11.68	11.71
8.25	1.0603	12.06	12.09
8.50	1.0623	12.46	12.48
8.75	1.0642	12.84	12.87
9.00	1.0662	13.24	13.26
9.25	1.0681	13.62	13.65
9.50	1.0701	14.02	14.04
9.75	1.0721	14.42	14.43
10.00	1.0741	14.82	14.83
10.25	1.0761	15.22	15.22
10.50	1.0781	15.62	15.62
10.75	1.0801	16.02	16.01
11.00	1.0821	16.42	16.41
11.25	1.0841	16.82	16.81

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HYDROCHLORIC ACID (Continued)

Be.°	Sp. Gr.	Tw.°	%HCl.	Be.°	Sp. Gr.	Tw.°	%HCl.	Be.°	Sp. Gr.	Tw.°	%HCl.
11.50	1.0861	17.22	17.21	18.0	1.1417	28.34	27.92	21.8	1.1770	35.40	34.83
11.75	1.0881	17.62	17.61	18.1	1.1426	28.52	28.09	21.9	1.1779	35.58	35.02
12.00	1.0902	18.04	18.01	18.2	1.1435	28.70	28.26	22.0	1.1789	35.78	35.21
12.25	1.0922	18.44	18.41	18.3	1.1444	28.88	28.44	22.1	1.1798	35.96	35.40
12.50	1.0943	18.86	18.82	18.4	1.1453	29.06	28.61	22.2	1.1808	36.16	35.59
12.75	1.0964	19.28	19.22	18.5	1.1462	29.24	28.78	22.3	1.1817	36.34	35.78
13.00	1.0985	19.70	19.63	18.6	1.1471	29.42	28.95	22.4	1.1827	36.54	35.97
13.25	1.1006	20.12	20.04	18.7	1.1480	29.60	29.13	22.5	1.1836	36.72	36.16
13.50	1.1027	20.54	20.45	18.8	1.1489	29.78	29.30	22.6	1.1846	36.92	36.35
13.75	1.1048	20.96	20.86	18.9	1.1498	29.96	29.48	22.7	1.1856	37.12	36.54
14.00	1.1069	21.38	21.27	19.0	1.1508	30.16	29.65	22.8	1.1866	37.32	36.73
14.25	1.1090	21.80	21.68	19.1	1.1517	30.34	29.83	22.9	1.1875	37.50	36.93
14.50	1.1111	22.22	22.09	19.2	1.1526	30.52	30.00	23.0	1.1885	37.70	37.14
14.75	1.1132	22.64	22.50	19.3	1.1535	30.70	30.18	23.1	1.1895	37.90	37.36
15.00	1.1154	23.08	22.92	19.4	1.1544	30.88	30.35	23.2	1.1904	38.08	37.58
15.25	1.1176	23.52	23.33	19.5	1.1554	31.08	30.53	23.3	1.1914	38.28	37.80
15.50	1.1197	23.94	23.75	19.6	1.1563	31.26	30.71	23.4	1.1924	38.48	38.03
15.75	1.1219	24.38	24.16	19.7	1.1572	31.44	30.90	23.5	1.1934	38.68	38.26
16.0	1.1240	24.80	24.57	19.8	1.1581	31.62	31.08	23.6	1.1944	38.88	38.49
16.1	1.1248	24.96	24.73	19.9	1.1590	31.80	31.27	23.7	1.1953	39.06	38.72
16.2	1.1256	25.12	24.90	20.0	1.1600	32.00	31.45	23.8	1.1963	39.26	38.95
16.3	1.1265	25.30	25.06	20.1	1.1609	32.18	31.64	23.9	1.1973	39.46	39.18
16.4	1.1274	25.48	25.23	20.2	1.1619	32.38	31.82	24.0	1.1983	39.66	39.41
16.5	1.1283	25.66	25.39	20.3	1.1628	32.56	32.01	24.1	1.1993	39.86	39.64
16.6	1.1292	25.84	25.56	20.4	1.1637	32.74	32.19	24.2	1.2003	40.06	39.86
16.7	1.1301	26.02	25.72	20.5	1.1647	32.94	32.38	24.3	1.2013	40.26	40.09
16.8	1.1310	26.20	25.89	20.6	1.1656	33.12	32.56	24.4	1.2023	40.46	40.32
16.9	1.1319	26.38	26.05	20.7	1.1666	33.32	32.75	24.5	1.2033	40.66	40.55
17.0	1.1328	26.56	26.22	20.8	1.1675	33.50	32.93	24.6	1.2043	40.86	40.78
17.1	1.1336	26.72	26.39	20.9	1.1684	33.68	33.12	24.7	1.2053	41.06	41.01
17.2	1.1345	26.90	26.56	21.0	1.1694	33.88	33.31	24.8	1.2063	41.26	41.24
17.3	1.1354	27.08	26.73	21.1	1.1703	34.06	33.50	24.9	1.2073	41.46	41.48
17.4	1.1363	27.26	26.90	21.2	1.1713	34.26	33.69	25.0	1.2083	41.66	41.72
17.5	1.1372	27.44	27.07	21.3	1.1722	34.44	33.88	25.1	1.2093	41.86	41.99
17.6	1.1381	27.62	27.24	21.4	1.1732	34.64	34.07	25.2	1.2103	42.06	42.30
17.7	1.1390	27.80	27.41	21.5	1.1741	34.82	34.26	25.3	1.2114	42.28	42.64
17.8	1.1399	27.98	27.58	21.6	1.1751	35.02	34.45	25.4	1.2124	42.48	43.01
17.9	1.1408	28.16	27.75	21.7	1.1760	35.20	34.64	25.5	1.2134	42.68	43.40

HYDROCHLORIC ACID

Density of Aqueous Hydrochloric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of HCl in solution expressed in					Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	*N*	%	Baumé	Twaddell
1.0032	10.03	0.08372	0.6263	0.275	1	0.5	0.64
1.0082	20.16	0.1683	1.259	0.553	2	1.2	1.64
1.0181	40.72	0.3399	2.542	1.12	4	2.6	3.62
1.0279	61.67	0.5147	3.850	1.69	6	3.9	5.58
1.0376	83.01	0.6927	5.182	2.28	8	5.3	7.52
1.0474	104.7	0.8741	6.539	2.87	10	6.6	9.48
1.0574	126.9	1.059	7.922	3.48	12	7.9	11.48
1.0675	149.5	1.247	9.330	4.10	14	9.2	13.50
1.0776	172.4	1.439	10.76	4.73	16	10.4	15.52
1.0878	195.8	1.634	12.22	5.37	18	11.7	17.56
1.0980	219.6	1.833	13.71	6.02	20	12.9	19.60
1.1083	243.8	2.035	15.22	6.69	22	14.2	21.66
1.1187	268.5	2.241	16.76	7.36	24	15.4	23.74
1.1290	293.5	2.450	18.33	8.05	26	16.6	25.80
1.1392	319.0	2.662	19.91	8.75	28	17.7	27.84

HYDROCHLORIC ACID (Continued)

Specific Gravity	Weight of HCl in solution expressed in					Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	*N*	%	Baumé	Twaddell
1.1492	344.8	2.877	21.53	9.46	30	18.8	29.84
1.1593	371.0	3.096	23.16	10.2	32	19.9	31.86
1.1691	397.5	3.317	24.82	10.9	34	21.0	33.82
1.1789	424.4	3.542	26.50	11.6	36	22.0	35.78
1.1885	451.6	3.769	28.20	12.4	38	23.0	37.70
1.1980	479.2	3.999	29.92	13.1	40	24.0	39.60

HYDROCYANIC ACID

Density of Aqueous Hydrocyanic Acid Solutions at $\frac{15^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of HCN in solution expressed in			Per Cent HCN	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
0.998	9.980	0.08329	0.6231	1	10.3	.....
0.996	19.92	0.1662	1.244	2	10.6	.....
0.993	39.72	0.3315	2.480	4	11.0	.....
0.989	59.34	0.4952	3.705	6	11.4	.....
0.984	78.72	0.6569	4.914	8	12.3	.....
0.978	97.80	0.8162	6.106	10	13.2	.....
0.971	116.5	0.9724	7.274	12	14.2	.....
0.964	135.0	1.126	8.426	14	15.2	.....
0.956	153.0	1.277	9.549	16	16.4	.....

Density of Aqueous Hydrocyanic Acid Solutions at $\frac{20^\circ}{4^\circ}$ C.

Specific Gravity	Weight of HCN in solution expressed in			Per Cent HCN	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
0.759	607.2	5.067	37.91	80	54.4	.....
0.752	616.6	5.146	38.50	82	56.2	.....
0.745	625.8	5.223	39.07	84	57.9	.....
0.738	634.7	5.297	39.62	86	59.7	.....
0.731	643.3	5.368	40.16	88	61.5	.....
0.724	651.6	5.438	40.68	90	63.4	.....
0.717	659.6	5.505	41.18	92	65.3	.....
0.711	668.3	5.578	41.72	94	66.9	.....
0.704	675.8	5.640	42.19	96	68.9	.....
0.697	683.1	5.700	42.64	98	70.9	.....
0.691	691.0	5.767	43.14	100	72.6	.....

HYDROFLUOSILICIC ACID

Density of Aqueous Hydrofluosilicic Acid Solutions at 17.5° C. Computed from the Values of Stolba.

Specific Gravity	Weight of H_2SiF_6 in solution expressed in			Per Cent H_2SiF_6	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0040	5.020	0.04189	0.3134	0.5	0.6	0.80
1.0080	10.08	0.08412	0.6293	1.0	1.2	1.60
1.0120	15.18	0.1267	0.9477	1.5	1.7	2.40
1.0161	20.32	0.1696	1.269	2.0	2.3	3.22
1.0201	25.50	0.2128	1.592	2.5	2.9	4.02
1.0242	30.73	0.2564	1.918	3.0	3.4	4.84
1.0283	35.99	0.3004	2.247	3.5	4.0	5.66
1.0324	41.30	0.3446	2.578	4.0	4.6	6.48

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HYDROFLUOSILICIC ACID (Continued)

Specific Gravity	Weight of H_2SiF_6 in solution expressed in			Per Cent H_2SiF_6	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0366	46.65	0.3893	2.912	4.5	5.1	7.32
1.0407	52.04	0.4343	3.249	5.0	5.7	8.14
1.0449	57.47	0.4796	3.588	5.5	6.2	8.98
1.0491	62.95	0.5253	3.930	6.0	6.8	9.82
1.0533	68.46	0.5714	4.274	6.5	7.3	11.06
1.0576	74.03	0.6178	4.622	7.0	7.9	11.52
1.0618	79.64	0.6646	4.972	7.5	8.4	12.36
1.0661	85.29	0.7118	5.325	8.0	9.0	13.22
1.0704	90.98	0.7593	5.680	8.5	9.5	14.08
1.0747	96.72	0.8072	6.038	9.0	10.1	14.94
1.0791	102.5	0.8555	6.400	9.5	10.6	15.82
1.0834	108.3	0.9041	6.764	10.0	11.2	16.68
1.0878	114.2	0.9532	7.131	10.5	11.7	17.56
1.0922	120.1	1.003	7.500	11.0	12.2	18.44
1.0966	126.1	1.052	7.873	11.5	12.8	19.32
1.1011	132.1	1.103	8.249	12.0	13.3	20.22
1.1055	138.2	1.153	8.627	12.5	13.8	21.10
1.1100	144.3	1.204	9.009	13.0	14.4	22.00
1.1145	150.5	1.256	9.393	13.5	14.9	22.90
1.1190	156.7	1.307	9.780	14.0	15.4	23.80
1.1236	162.9	1.360	10.17	14.5	16.0	24.72
1.1281	169.2	1.412	10.56	15.0	16.5	25.62
1.1327	175.6	1.465	10.96	15.5	17.0	26.54
1.1373	182.0	1.519	11.36	16.0	17.5	27.46
1.1419	188.4	1.572	11.76	16.5	18.0	28.38
1.1466	194.9	1.627	12.17	17.0	18.5	29.32
1.1512	201.5	1.681	12.58	17.5	19.0	30.24
1.1559	208.1	1.736	12.99	18.0	19.6	31.18
1.1606	214.7	1.792	13.40	18.5	20.1	32.12
1.1653	221.4	1.848	13.82	19.0	20.6	33.06
1.1701	228.2	1.904	14.24	19.5	21.1	34.02
1.1748	235.0	1.961	14.67	20.0	21.6	34.96
1.1796	241.8	2.018	15.10	20.5	22.1	35.92
1.1844	248.7	2.076	15.53	21.0	22.6	36.88
1.1892	255.7	2.134	15.96	21.5	23.1	37.84
1.1941	262.7	2.192	16.40	22.0	23.6	38.82
1.1989	269.8	2.251	16.84	22.5	24.1	39.78
1.2038	276.9	2.311	17.29	23.0	24.6	40.76
1.2087	284.0	2.370	17.73	23.5	25.0	41.74
1.2136	291.3	2.431	18.18	24.0	25.5	42.72
1.2186	298.6	2.492	18.64	24.5	26.0	43.72
1.2235	305.9	2.553	19.10	25.0	26.5	44.70
1.2285	313.3	2.614	19.56	25.5	27.0	45.70
1.2335	320.7	2.676	20.02	26.0	27.5	46.70
1.2385	328.2	2.739	20.49	26.5	27.9	47.70
1.2436	335.8	2.802	20.96	27.0	28.4	48.72
1.2486	343.4	2.866	21.44	27.5	28.9	49.72
1.2537	351.0	2.930	21.92	28.0	29.3	50.74
1.2588	358.8	2.994	22.40	28.5	29.8	51.76
1.2639	366.5	3.059	22.88	29.0	30.3	52.78
1.2691	374.4	3.124	23.37	29.5	30.7	53.82
1.2742	382.3	3.190	23.86	30.0	31.2	54.84
1.2794	390.2	3.257	24.36	30.5	31.7	55.88
1.2846	398.2	3.323	24.86	31.0	32.1	56.92
1.2898	406.3	3.391	25.36	31.5	32.6	57.96
1.2951	414.4	3.459	25.87	32.0	33.0	59.02
1.3003	422.6	3.527	26.38	32.5	33.5	60.06
1.3065	431.1	3.598	26.92	33.0	34.0	61.30
1.3109	439.2	3.665	27.42	33.5	34.4	62.18
1.3162	447.5	3.735	27.94	34.0	34.8	63.24

MAGNESIUM CHLORIDE

Density of Aqueous Magnesium Chloride Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $MgCl_2$ in solution expressed in			Per Cent $MgCl_2$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0146	20.29	0.1693	1.267	2	2.1	2.92
1.0311	41.24	0.3442	2.575	4	4.4	6.22
1.0478	62.87	0.5247	3.925	6	6.6	9.56
1.0646	85.17	0.7108	5.317	8	8.8	12.92
1.0816	108.2	0.9026	6.752	10	10.9	16.32
1.0989	131.9	1.100	8.233	12	13.1	19.78
1.1164	156.3	1.304	9.758	14	15.1	23.28
1.1342	181.5	1.514	11.33	16	17.2	26.84
1.1523	207.4	1.731	12.95	18	19.2	30.46
1.1706	234.1	1.954	14.62	20	21.1	34.12
1.2184	304.6	2.542	19.02	25	26.0	43.68
1.2688	380.6	3.177	23.76	30	30.7	53.76

Specific Gravity	Weight of $MgCl_2 \cdot 6H_2O$ in solution expressed in			Per Cent $MgCl_2 + 6H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0146	43.32	0.3616	2.705	4.270	2.1	2.92
1.0311	88.07	0.7349	5.498	8.541	4.4	6.22
1.0478	134.2	1.120	8.380	12.81	6.6	9.56
1.0646	181.8	1.517	11.35	17.08	8.8	12.92
1.0816	230.9	1.927	14.42	21.35	10.9	16.32
1.0989	281.5	2.350	17.58	25.62	13.1	19.78
1.1164	333.7	2.785	20.83	29.89	15.1	23.28
1.1342	387.4	3.233	24.19	34.16	17.2	26.84
1.1523	442.8	3.696	27.65	38.43	19.2	30.46
1.1706	499.8	4.171	31.21	42.70	21.1	34.12
1.2184	650.4	5.428	40.60	53.38	26.0	43.68
1.2688	812.7	6.782	50.73	64.05	30.7	53.76

MAGNESIUM CHLORIDE

Density of Aqueous Magnesium Chloride Solutions at 14° C. Computed from the Values of Oudemans.

Specific Gravity	Weight of $MgCl_2 \cdot 6H_2O$ in solution expressed in			Per Cent $MgCl_2 + 6H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0033	10.03	0.08373	0.6264	1	0.5	0.66
1.0073	20.15	0.1681	1.258	2	1.1	1.46
1.0113	30.34	0.2532	1.894	3	1.6	2.26
1.0154	40.62	0.3390	2.536	4	2.2	3.08
1.0194	50.97	0.4254	3.182	5	2.8	3.88
1.0234	61.40	0.5124	3.833	6	3.3	4.68
1.0274	71.92	0.6002	4.490	7	3.9	5.48
1.0314	82.51	0.6886	5.151	8	4.4	6.28
1.0355	93.20	0.7777	5.818	9	5.0	7.10
1.0395	104.0	0.8675	6.490	10	5.5	7.90
1.0435	114.8	0.9579	7.166	11	6.0	8.70
1.0476	125.7	1.049	7.848	12	6.6	9.52
1.0517	136.7	1.141	8.535	13	7.1	10.34
1.0558	147.8	1.234	9.228	14	7.7	11.16
1.0599	159.0	1.327	9.925	15	8.2	11.98

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MAGNESIUM CHLORIDE (Continued)

Specific Gravity	Weight of $MgCl_2 \cdot 6H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $MgCl_2 + 6H_2O$	Degrees: Baumé	Twaddell
1.0641	170.3	1.421	10.63	16	8.7	12.82
1.0682	181.6	1.515	11.34	17	9.3	13.64
1.0724	193.0	1.611	12.05	18	9.8	14.48
1.0765	204.5	1.707	12.77	19	10.3	15.30
1.0807	216.1	1.804	13.49	20	10.8	16.14
1.0849	227.8	1.901	14.22	21	11.4	16.98
1.0891	239.6	2.000	14.96	22	11.9	17.82
1.0933	251.5	2.099	15.70	23	12.4	18.66
1.0976	263.4	2.198	16.45	24	12.9	19.52
1.1018	275.5	2.299	17.20	25	13.4	20.36
1.1061	287.6	2.400	17.95	26	13.9	21.22
1.1103	299.8	2.502	18.72	27	14.4	22.06
1.1146	312.1	2.604	19.48	28	14.9	22.92
1.1189	324.5	2.708	20.26	29	15.4	23.78
1.1232	337.0	2.812	21.04	30	15.9	24.64
1.1275	349.5	2.917	21.82	31	16.4	25.50
1.1319	362.2	3.022	22.61	32	16.9	26.38
1.1363	375.0	3.129	23.41	33	17.4	27.26
1.1407	387.8	3.237	24.21	34	17.9	28.14
1.1451	400.8	3.345	25.02	35	18.4	29.02
1.1495	413.8	3.453	25.83	36	18.9	29.90
1.1540	427.0	3.563	26.66	37	19.4	30.80
1.1584	440.2	3.674	27.48	38	19.8	31.68
1.1628	453.5	3.785	28.31	39	20.3	32.56
1.1673	466.9	3.897	29.15	40	20.8	33.46
1.1718	480.4	4.009	29.99	41	21.3	34.36
1.1763	494.0	4.123	30.84	42	21.7	35.26
1.1809	507.8	4.238	31.70	43	22.2	36.18
1.1855	521.6	4.353	32.56	44	22.7	37.10
1.1901	535.5	4.469	33.43	45	23.2	38.02
1.1948	549.6	4.587	34.31	46	23.6	38.96
1.1995	563.8	4.705	35.20	47	24.1	39.90
1.2042	578.0	4.824	36.09	48	24.6	40.84

MAGNESIUM CHLORIDE

Density of Aqueous Magnesium Chloride Solutions at 14° C. Computed from the Values of Oudemans.

Specific Gravity	Weight of $MgCl_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $MgCl_2$	Degrees: Baumé	Twaddell
1.0033	4.699	0.03922	0.2934	0.4684	0.5	0.66
1.0073	9.435	0.07874	0.5891	0.9367	1.1	1.46
1.0113	14.21	0.1186	0.8871	1.405	1.6	2.26
1.0154	19.02	0.1587	1.187	1.873	2.2	3.08
1.0194	23.87	0.1992	1.490	2.342	2.8	3.88
1.0234	28.76	0.2400	1.795	2.810	3.3	4.68
1.0274	33.68	0.2811	2.103	3.278	3.9	5.18
1.0314	38.65	0.3225	2.413	3.747	4.4	6.28
1.0355	43.65	0.3642	2.725	4.215	5.0	7.10
1.0395	48.69	0.4063	3.040	4.684	5.5	7.90
1.0435	53.76	0.4487	3.356	5.152	6.0	8.70
1.0476	58.88	0.4913	3.676	5.620	6.6	9.52
1.0517	64.04	0.5344	3.998	6.089	7.1	10.34
1.0558	69.23	0.5777	4.322	6.557	7.7	11.16
1.0599	74.46	0.6214	4.648	7.025	8.2	11.98

MAGNESIUM CHLORIDE (Continued)

Specific Gravity	Weight of $MgCl_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $MgCl_2$	Degrees: Baumé	Twaddell
1.0641	79.74	0.6655	4.978	7.494	8.7	12.82
1.0682	85.05	0.7098	5.310	7.962	9.3	13.64
1.0724	90.40	0.7545	5.644	8.430	9.8	14.48
1.0765	95.80	0.7995	5.981	8.899	10.3	15.30
1.0807	101.2	0.8448	6.320	9.367	10.8	16.14
1.0849	106.7	0.8905	6.661	9.835	11.4	16.98
1.0891	112.2	0.9362	7.003	10.30	11.9	17.82
1.0933	117.7	0.9827	7.351	10.77	12.4	18.66
1.0976	123.4	1.030	7.702	11.24	12.9	19.52
1.1018	129.0	1.077	8.055	11.71	13.4	20.36
1.1061	134.7	1.124	8.411	12.18	13.9	21.22
1.1103	140.5	1.172	8.768	12.65	14.4	22.06
1.1146	146.1	1.219	9.123	13.11	14.9	22.92
1.1189	151.9	1.268	9.486	13.58	15.4	23.78
1.1232	157.8	1.317	9.852	14.05	15.9	24.64
1.1275	163.7	1.366	10.22	14.52	16.4	25.50
1.1319	169.7	1.416	10.59	14.99	16.9	26.38
1.1363	175.7	1.466	10.97	15.46	17.4	27.26
1.1407	181.6	1.516	11.34	15.92	17.9	28.14
1.1451	187.7	1.566	11.72	16.39	18.4	29.02
1.1495	193.8	1.617	12.10	16.86	18.9	29.90
1.1540	200.0	1.669	12.49	17.33	19.4	30.80
1.1584	206.2	1.721	12.87	17.80	19.8	31.68
1.1628	212.4	1.773	13.26	18.27	20.3	32.56
1.1673	218.6	1.825	13.65	18.73	20.8	33.46
1.1718	225.0	1.878	14.05	19.20	21.3	34.36
1.1763	231.4	1.931	14.44	19.67	21.7	35.26
1.1809	237.8	1.985	14.85	20.14	22.2	36.18
1.1855	244.3	2.039	15.25	20.61	22.7	37.10
1.1901	250.9	2.094	15.66	21.08	23.2	38.02
1.1948	257.4	2.148	16.07	21.54	23.6	38.96
1.1995	264.0	2.203	16.48	22.01	24.1	39.90
1.2042	270.7	2.259	16.90	22.48	24.6	40.84

MAGNESIUM SULFATE

Density of Aqueous Magnesium Sulfate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $MgSO_4$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $MgSO_4$	Degrees: Baumé	Twaddell
1.0186	20.37	0.1700	1.272	2	2.6	3.72
1.0392	41.57	0.3469	2.595	4	5.5	7.84
1.0602	63.61	0.5309	3.971	6	8.2	12.04
1.0816	86.53	0.7221	5.402	8	10.9	16.32
1.1034	110.3	0.9208	6.889	10	13.6	20.68
1.1256	135.1	1.127	8.433	12	16.2	25.12
1.1484	160.8	1.342	10.04	14	18.7	29.68
1.1717	187.5	1.565	11.70	16	21.3	34.34
1.1955	215.2	1.796	13.43	18	23.3	39.10
1.2198	244.0	2.036	15.23	20	26.1	43.96
1.2447	273.8	2.285	17.10	22	28.5	48.94
1.2701	304.8	2.544	19.03	24	30.8	54.02
1.2961	337.0	2.812	21.04	26	33.1	59.22

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MAGNESIUM SULFATE (Continued)

Specific Gravity	Weight of $MgSO_4 \cdot 7H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $MgSO_4 + 7H_2O$	Degrees: Baumé	Twaddell
1.0186	41.71	0.3481	2.604	4.095	2.6	3.72
1.0392	85.11	0.7103	5.313	8.190	5.5	7.84
1.0602	130.3	1.087	8.135	12.29	8.2	12.04
1.0816	177.2	1.479	11.06	16.38	10.9	16.32
1.1034	226.0	1.886	14.11	20.48	13.6	20.68
1.1256	276.6	2.308	17.27	24.57	16.2	25.12
1.1484	329.2	2.748	20.55	28.67	18.7	29.68
1.1717	383.8	3.203	23.96	32.76	21.3	34.34
1.1955	440.7	3.677	27.51	36.86	23.3	39.10
1.2198	499.5	4.169	31.18	40.95	26.1	43.96
1.2447	560.7	4.680	35.01	45.05	28.5	48.94
1.2701	624.1	5.209	38.96	49.14	30.8	54.02
1.2961	690.0	5.759	43.08	53.24	33.1	59.22

NICKEL CHLORIDE

Density of Aqueous Nickel Chloride Solutions at $\frac{20^\circ}{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $NiCl_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $NiCl_2$	Degrees: Baumé	Twaddell
1.008	10.08	0.08412	0.6293	1	1.2	1.6
1.018	20.36	0.1699	1.271	2	2.6	3.6
1.037	41.48	0.3462	2.590	4	5.2	7.4
1.057	63.42	0.5293	3.959	6	7.8	11.4
1.078	86.24	0.7197	5.384	8	10.5	15.6
1.099	109.9	0.9172	6.861	10	13.1	19.8
1.121	134.5	1.123	8.398	12	15.7	24.2
1.143	160.0	1.335	9.990	14	18.1	28.6
1.167	186.7	1.558	11.66	16	20.8	33.4
1.191	214.4	1.789	13.38	18	23.3	38.2
1.215	243.0	2.028	15.17	20	25.7	43.0
1.280	320.0	2.671	19.98	25	31.7	56.0
1.353	405.9	3.387	25.34	30	37.8	70.6

NICKEL NITRATE

Density of Aqueous Nickel Nitrate Solutions at $\frac{20^\circ}{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Ni(NO_3)_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Ni(NO_3)_2$	Degrees: Baumé	Twaddell
1.007	10.07	0.08404	0.6286	1	1.0	1.4
1.015	20.30	0.1694	1.267	2	2.1	3.0
1.033	41.32	0.3448	2.580	4	4.6	6.6
1.050	63.00	0.5258	3.933	6	6.9	10.0
1.069	85.52	0.7137	5.339	8	9.4	13.8
1.088	108.8	0.9080	6.792	10	11.7	17.6
1.107	132.8	1.109	8.293	12	14.0	21.4
1.127	157.8	1.317	9.850	14	16.3	25.4
1.148	183.7	1.533	11.47	16	18.7	29.6
1.169	210.4	1.756	13.14	18	21.0	33.8
1.191	238.2	1.988	14.87	20	23.3	38.2
1.249	312.3	2.606	19.49	25	28.9	49.8
1.311	393.3	3.282	24.55	30	34.4	62.2
1.377	482.0	4.022	30.09	35	39.7	75.4

NICKEL SULFATE

Density of Aqueous Nickel Sulfate Solutions at $\frac{18°}{4°}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $NiSO_4$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $NiSO_4$	Degrees: Baumé	Twaddell
1.009	10.09	0.08421	0.6299	1	1.3	1.8
1.020	20.40	0.1702	1.274	2	2.8	4.0
1.042	41.68	0.3478	2.602	4	5.8	8.4
1.063	63.78	0.5323	3.982	6	8.6	12.6
1.085	86.80	0.7244	5.419	8	11.4	17.0
1.109	110.9	0.9255	6.923	10	14.3	21.8
1.133	136.0	1.135	8.488	12	17.0	26.6
1.158	162.1	1.353	10.12	14	19.8	31.6
1.183	189.3	1.580	11.82	16	22.4	36.6
1.209	217.6	1.816	13.59	18	25.1	41.8

NITRIC ACID

Specific Gravity of Aqueous Nitric Acid Solutions. Adopted 1903 as Standard by the Manufacturing Chemists' Association of the United States.

Authority: W. C. Ferguson.

Specific Gravity determinations were made at 60° F., compared with water at 60° F.

From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should always be printed on the scale.

Atomic weight from F. W. Clarke's table of 1901. O = 16.

ALLOWANCE FOR TEMPERATURE:

At 10° — 20° Be. — 1/30° Be. or .00029 Sp. Gr. = 1° F.
20° — 30° Be. — 1/23° Be. or .00044 Sp. Gr. = 1° F.
30° — 40° Be. — 1/20° Be. or .00060 Sp. Gr. = 1° F.
40° — 48.5° Be. — 1/17° Be. or .00084 Sp. Gr. = 1° F.

Be.°	Sp. Gr.	Tw.°	% HNO_3.
10.00	1.0741	14.82	12.86
10.25	1.0761	15.22	13.18
10.50	1.0781	15.62	13.49
10.75	1.0801	16.02	13.81
11.00	1.0821	16.42	14.13
11.25	1.0841	16.82	14.44
11.50	1.0861	17.22	14.76
11.75	1.0881	17.62	15.07
12.00	1.0902	18.04	15.41
12.25	1.0922	18.44	15.72
12.50	1.0943	18.86	16.05
12.75	1.0964	19.28	16.39
13.00	1.0985	19.70	16.72
13.25	1.1006	20.12	17.05
13.50	1.1027	20.54	17.38
13.75	1.1048	20.96	17.71
14.00	1.1069	21.38	18.04
14.25	1.1090	21.80	18.37
14.50	1.1111	22.22	18.70
14.75	1.1132	22.64	19.02
15.00	1.1154	23.08	19.36
15.25	1.1176	23.52	19.70
15.50	1.1197	23.94	20.02
15.75	1.1219	24.38	20.36
16.00	1.1240	24.80	20.69

Be.°	Sp. Gr.	Tw.°	% HNO_3.
16.25	1.1262	25.24	21.03
16.50	1.1284	25.68	21.36
16.75	1.1306	26.12	21.70
17.00	1.1328	26.56	22.04
17.25	1.1350	27.00	22.38
17.50	1.1373	27.46	22.74
17.75	1.1395	27.90	23.08
18.00	1.1417	28.34	23.42
18.25	1.1440	28.80	23.77
18.50	1.1462	29.24	24.11
18.75	1.1485	29.70	24.47
19.00	1.1508	30.16	24.82
19.25	1.1531	30.62	25.18
19.50	1.1554	31.08	25.53
19.75	1.1577	31.54	25.88
20.00	1.1600	32.00	26.24
20.25	1.1624	32.48	26.61
20.50	1.1647	32.94	26.96
20.75	1.1671	33.42	27.33
21.00	1.1694	33.88	27.67
21.25	1.1718	34.36	28.02
21.50	1.1741	34.82	28.36
21.75	1.1765	35.30	28.72
22.00	1.1789	35.78	29.07
22.25	1.1813	36.26	29.43

Be.°	Sp. Gr.	Tw.°	% HNO_3.
22.50	1.1837	36.74	29.78
22.75	1.1861	37.22	30.14
23.00	1.1885	37.70	30.49
23.25	1.1910	38.20	30.86
23.50	1.1934	38.68	31.21
23.75	1.1959	39.18	31.58
24.00	1.1983	39.66	31.94
24.25	1.2008	40.16	32.31
24.50	1.2033	40.66	32.68
24.75	1.2058	41.16	33.05
25.00	1.2083	41.66	33.42
25.25	1.2109	42.18	33.80
25.50	1.2134	42.68	34.17
25.75	1.2160	43.20	34.56
26.00	1.2185	43.70	34.94
26.25	1.2211	44.22	35.33
26.50	1.2236	44.72	35.70
26.75	1.2262	45.24	36.09
27.00	1.2288	45.76	36.48
27.25	1.2314	46.28	36.87
27.50	1.2340	46.80	37.26
27.75	1.2367	47.34	37.67
28.00	1.2393	47.86	38.06
28.25	1.2420	48.40	38.46
28.50	1.2446	48.92	38.85

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NITRIC ACID (Continued)

Be.°	Sp. Gr.	Tw.°	% HNO_3.
28.75	1.2473	49.46	39.25
29.00	1.2500	50.00	39.66
29.25	1.2527	50.54	40.06
29.50	1.2554	51.08	40.47
29.75	1.2582	51.64	40.89
30.00	1.2609	52.18	41.30
30.25	1.2637	52.74	41.72
30.50	1.2664	53.28	42.14
30.75	1.2692	53.84	42.58
31.00	1.2719	54.38	43.00
31.25	1.2747	54.94	43.44
31.50	1.2775	55.50	43.89
31.75	1.2804	56.08	44.34
32.00	1.2832	56.64	44.78
32.25	1.2861	57.22	45.24
32.50	1.2889	57.78	45.68
32.75	1.2918	58.36	46.14
33.00	1.2946	58.92	46.58
33.25	1.2975	59.50	47.04
33.50	1.3004	60.08	47.49
33.75	1.3034	60.68	47.95
34.00	1.3063	61.26	48.42
34.25	1.3093	61.86	48.90
34.50	1.3122	62.44	49.35
34.75	1.3152	63.04	49.83
35.00	1.3182	63.64	50.32
35.25	1.3212	64.24	50.81
35.50	1.3242	64.84	51.30
35.75	1.3273	65.46	51.80
36.00	1.3303	66.06	52.30
36.25	1.3334	66.68	52.81
36.50	1.3364	67.28	53.32
36.75	1.3395	67.90	53.84
37.00	1.3426	68.52	54.36
37.25	1.3457	69.14	54.89
37.50	1.3488	69.76	55.43
37.75	1.3520	70.40	55.97
38.00	1.3551	71.02	56.52
38.25	1.3583	71.66	57.08
38.50	1.3615	72.30	57.65
38.75	1.3647	72.94	58.23
39.00	1.3679	73.58	58.82
39.25	1.3712	74.24	59.43
39.50	1.3744	74.88	60.06
39.75	1.3777	75.54	60.71
40.00	1.3810	76.20	61.38
40.25	1.3843	76.86	62.07
40.50	1.3876	77.52	62.77
40.75	1.3909	78.18	63.48
41.00	1.3942	78.84	64.20
41.25	1.3976	79.52	64.93
41.50	1.4010	80.20	65.67
41.75	1.4044	80.88	66.42
42.00	1.4078	81.56	67.18
42.25	1.4112	82.24	67.95
42.50	1.4146	82.92	68.73
42.75	1.4181	83.62	69.52
43.00	1.4216	84.32	70.33
43.25	1.4251	85.02	71.15
43.50	1.4286	85.72	71.98
43.75	1.4321	86.42	72.82
44.00	1.4356	87.12	73.67
44.25	1.4392	87.84	74.53
44.50	1.4428	88.56	75.40
44.75	1.4464	89.28	76.28
45.00	1.4500	90.00	77.17
45.25	1.4536	90.72	78.07
45.50	1.4573	91.46	79.03
45.75	1.4610	92.20	80.04
46.00	1.4646	92.92	81.08
46.25	1.4684	93.68	82.18
46.50	1.4721	94.42	83.33
46.75	1.4758	95.16	84.48
47.00	1.4796	95.92	85.70
47.25	1.4834	96.68	86.98
47.50	1.4872	97.44	88.32
47.75	1.4910	98.20	89.76
48.00	1.4948	98.96	91.35
48.25	1.4987	99.74	93.13
48.50	1.5026	100.52	95.11

NITRIC ACID

Density of Aqueous Nitric Acid Solutions at $\frac{20}{4}$° C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of HNO_3 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	N	%	Degrees: Baumé	Twaddell
1.0036	10.04	0.08375	0.6265	0.159	1	0.5	0.72
1.0091	20.18	0.1684	1.260	0.320	2	1.3	1.82
1.0146	30.44	0.2540	1.900	0.483	3	2.1	2.92
1.0201	40.80	0.3405	2.547	0.647	4	2.9	4.02
1.0256	51.28	0.4280	3.201	0.814	5	3.6	5.12
1.0312	61.87	0.5163	3.863	0.982	6	4.4	6.24
1.0369	72.58	0.6057	4.531	1.15	7	5.2	7.38
1.0427	83.42	0.6961	5.208	1.32	8	5.9	8.54
1.0485	94.37	0.7875	5.891	1.50	9	6.7	9.70
1.0543	105.4	0.8799	6.582	1.67	10	7.5	10.86
1.0602	116.6	0.9733	7.281	1.85	11	8.2	12.04
1.0661	127.9	1.068	7.987	2.03	12	9.0	13.22
1.0721	139.4	1.163	8.701	2.21	13	9.8	14.42
1.0781	150.9	1.260	9.423	2.39	14	10.5	15.62
1.0842	162.6	1.357	10.15	2.58	15	11.3	16.84
1.0903	174.4	1.456	10.89	2.77	16	12.0	18.06
1.0964	186.4	1.555	11.64	2.96	17	12.8	19.28
1.1026	198.5	1.656	12.39	3.15	18	13.5	20.52
1.1088	210.7	1.758	13.15	3.34	19	14.2	21.76
1.1150	223.0	1.861	13.92	3.54	20	15.0	23.00
1.1213	235.5	1.965	14.70	3.74	21	15.7	24.26
1.1276	248.1	2.070	15.49	3.94	22	16.4	25.52
1.1340	260.8	2.177	16.28	4.13	23	17.1	26.80
1.1404	273.7	2.284	17.09	4.34	24	17.9	28.08
1.1469	286.7	2.393	17.90	4.55	25	18.6	29.38

NITRIC ACID (Continued)

Specific Gravity	Weight of HNO_3 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	*N*	%	Degrees: Baumé	Twaddell
1.1534	299.9	2.503	18.72	4.76	26	19.4	30.68
1.1600	313.2	2.614	19.55	4.97	27	20.0	32.00
1.1666	326.6	2.726	20.39	5.18	28	20.7	33.32
1.1733	340.3	2.840	21.24	5.40	29	21.4	34.66
1.1800	354.0	2.954	22.10	5.62	30	22.1	36.00
1.1867	367.9	3.070	22.97	5.84	31	22.8	37.34
1.1934	381.9	3.187	23.84	6.06	32	23.5	38.68
1.2002	396.1	3.305	24.73	6.29	33	24.2	40.04
1.2071	410.4	3.425	25.62	6.51	34	24.9	41.42
1.2140	424.9	3.546	26.53	6.74	35	25.6	42.80
1.2205	439.4	3.667	27.43	6.97	36	26.2	44.10
1.2270	454.0	3.789	28.34	7.20	37	26.8	45.40
1.2335	468.7	3.912	29.26	7.44	38	27.5	46.70
1.2399	483.6	4.036	30.19	7.67	39	28.1	47.98
1.2463	498.5	4.160	31.12	7.91	40	28.7	49.26
1.2527	513.6	4.286	32.06	8.15	41	29.3	50.54
1.2591	528.8	4.413	33.01	8.39	42	29.8	51.82
1.2655	544.2	4.541	33.97	8.64	43	30.4	53.10
1.2719	559.6	4.670	34.94	8.88	44	31.0	54.38
1.2783	575.2	4.801	35.91	9.13	45	31.6	55.66
1.2847	591.0	4.932	36.89	9.38	46	32.1	56.94
1.2911	606.8	5.064	37.88	9.63	47	32.7	58.22
1.2975	622.8	5.198	38.88	9.88	48	33.2	59.50
1.3040	639.0	5.332	39.89	10.1	49	33.8	60.80
1.3100	655.0	5.466	40.89	10.4	50	34.3	62.00
1.3160	671.2	5.601	41.90	10.7	51	34.8	63.20
1.3219	687.4	5.737	42.91	10.9	52	35.3	64.38
1.3278	703.7	5.873	43.93	11.1	53	35.8	65.56
1.3336	720.1	6.010	44.96	11.4	54	36.3	66.72
1.3393	736.6	6.147	45.99	11.7	55	36.7	67.86
1.3449	753.1	6.285	47.02	12.0	56	37.2	68.98
1.3505	769.8	6.424	48.06	12.2	57	37.6	70.10
1.3560	786.5	6.563	49.10	12.5	58	38.1	71.20
1.3614	803.2	6.703	50.15	12.7	59	38.5	72.28
1.3667	820.0	6.843	51.19	13.0	60	38.9	73.34
1.3719	836.9	6.984	52.25	13.3	61	39.3	74.38
1.3769	853.7	7.124	53.30	13.5	62	39.7	75.38
1.3818	870.5	7.265	54.35	13.8	63	40.1	76.36
1.3866	887.4	7.406	55.40	14.1	64	40.4	77.32
1.3913	904.3	7.547	56.46	14.4	65	40.8	78.26
1.3959	921.3	7.689	57.52	14.6	66	41.1	79.18
1.4004	938.3	7.830	58.58	14.9	67	41.5	80.08
1.4048	955.3	7.972	59.64	15.2	68	41.8	80.96
1.4091	972.3	8.114	60.70	15.4	69	42.1	81.82
1.4134	989.4	8.257	61.77	15.7	70	42.4	82.68
1.4176	1006	8.400	62.84	16.0	71	42.7	83.52
1.4218	1024	8.543	63.91	16.3	72	43.0	84.36
1.4258	1041	8.686	64.98	16.5	73	43.3	85.16
1.4298	1058	8.830	66.05	16.8	74	43.6	85.96
1.4337	1075	8.974	67.13	17.1	75	43.9	86.74
1.4375	1093	9.117	68.20	17.3	76	44.1	87.50
1.4413	1110	9.262	69.28	17.6	77	44.4	88.26
1.4450	1127	9.406	70.36	17.9	78	44.7	89.00
1.4486	1144	9.550	71.44	18.2	79	44.9	89.72
1.4521	1162	9.695	72.52	18.4	80	45.1	90.42
1.4555	1179	9.839	73.60	18.7	81	45.4	91.10
1.4589	1196	9.984	74.69	19.0	82	45.6	91.78
1.4622	1214	10.13	75.77	19.3	83	45.8	92.44
1.4655	1231	10.27	76.85	19.5	84	46.1	93.10
1.4686	1248	10.42	77.93	19.8	85	46.3	93.72

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NITRIC ACID (Continued)

Specific Gravity	Weight of HNO_3 in solution expressed in					Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	*N*	%	Baumé	Twaddell
1.4716	1266	10.56	79.01	20.1	86	46.5	94.32
1.4745	1283	10.71	80.09	20.4	87	46.7	94.90
1.4773	1300	10.85	81.16	20.6	88	46.8	95.46
1.4800	1317	10.99	82.23	20.9	89	47.0	96.00
1.4826	1334	11.14	83.30	21.2	90	47.2	96.52
1.4850	1351	11.28	84.36	21.4	91	47.4	97.00
1.4873	1368	11.42	85.42	21.7	92	47.5	97.46
1.4892	1385	11.56	86.46	22.0	93	47.6	97.84
1.4912	1402	11.70	87.51	22.3	94	47.8	98.24
1.4932	1419	11.84	88.56	22.5	95	47.9	98.64
1.4952	1435	11.98	89.61	22.8	96	48.0	99.04
1.4974	1452	12.12	90.68	23.0	97	48.2	99.48
1.5008	1471	12.27	91.82	23.3	98	48.4	100.16
1.5056	1491	12.44	93.05	23.7	99	48.7	101.12
1.5129	1513	12.63	94.45	24.0	100	49.2	102.58

OXALIC ACID

Density of Aqueous Oxalic Acid Solutions at 17.5° C. Computed from the Values of Gerlach.

Specific Gravity	Weight of $H_2C_2O_4{\cdot}2H_2O$ in solution expressed in			Per Cent $H_2C_2O_4 + 2H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0035	10.04	0.08375	0.6265	1	0.5	0.70
1.0070	20.14	0.1681	1.257	2	1.0	1.40
1.0105	30.32	0.2530	1.893	3	1.5	2.10
1.0140	40.56	0.3385	2.532	4	2.0	2.80
1.0175	50.88	0.4246	3.176	5	2.5	3.50
1.0210	61.26	0.5112	3.824	6	3.0	4.20
1.0245	71.72	0.5985	4.477	7	3.5	4.90
1.0280	82.24	0.6863	5.134	8	4.0	5.60
1.0315	92.84	0.7747	5.796	9	4.4	6.30
1.0350	103.5	0.8637	6.462	10	4.9	7.00
1.0385	114.2	0.9533	7.132	11	5.4	7.70
1.0420	125.0	1.044	7.806	12	5.8	8.40
1.0455	135.9	1.134	8.485	13	6.3	9.10

Specific Gravity	Weight of $H_2C_2O_4$ in solution expressed in			Per Cent $H_2C_2O_4$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0035	7.166	0.05980	0.4474	0.7141	0.5	0.70
1.0070	14.38	0.1200	0.8977	1.428	1.0	1.40
1.0105	21.64	0.1806	1.351	2.142	1.5	2.10
1.0140	28.97	0.2418	1.809	2.857	2.0	2.80
1.0175	36.33	0.3032	2.268	3.571	2.5	3.50
1.0210	43.75	0.3651	2.731	4.285	3.0	4.20
1.0245	51.21	0.4274	3.197	4.999	3.5	4.90
1.0280	58.73	0.4901	3.666	5.713	4.0	5.60
1.0315	66.29	0.5533	4.139	6.427	4.4	6.30
1.0350	73.91	0.6168	4.614	7.141	4.9	7.00
1.0385	81.58	0.6809	5.093	7.856	5.4	7.70
1.0420	89.30	0.7452	5.575	8.570	5.8	8.40
1.0455	97.06	0.8100	6.060	9.284	6.3	9.10

PHOSPHORIC ACID

Density of Aqueous Phosphoric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of H_3PO_4 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent H_3PO_4	Degrees: Baumé	Twaddell
1.0038	10.04	0.08377	0.6267	1	0.6	0.76
1.0092	20.18	0.1684	1.260	2	1.3	1.84
1.0200	40.80	0.3405	2.547	4	2.8	4.00
1.0309	61.85	0.5162	3.862	6	4.3	6.18
1.0420	83.36	0.6957	5.204	8	5.8	8.40
1.0532	105.3	0.8789	6.575	10	7.3	10.64
1.0647	127.8	1.066	7.976	12	8.8	12.94
1.0764	150.7	1.258	9.408	14	10.3	15.28
1.0884	174.1	1.453	10.87	16	11.8	17.68
1.1008	198.1	1.654	12.37	18	13.3	20.16
1.1134	222.7	1.858	13.90	20	14.8	22.68
1.1263	247.8	2.068	15.47	22	16.3	25.26
1.1395	273.5	2.282	17.07	24	17.8	27.90
1.1529	299.8	2.502	18.71	26	19.2	30.58
1.1665	326.6	2.726	20.39	28	20.7	33.30
1.1805	354.2	2.956	22.11	30	22.2	36.10
1.216	425.6	3.552	26.57	35	25.8	43.2
1.254	501.6	4.186	31.31	40	29.4	50.8
1.293	581.9	4.856	36.32	45	32.9	58.6
1.335	667.5	5.571	41.67	50	36.4	67.0
1.379	758.5	6.330	47.35	55	39.9	75.8
1.426	855.6	7.140	53.42	60	43.3	85.2
1.475	958.8	8.001	59.85	65	46.7	95.0
1.526	1068	8.915	66.69	70	50.0	105.2
1.579	1184	9.883	73.93	75	53.2	115.8
1.633	1306	10.90	81.56	80	56.2	126.6
1.689	1436	11.98	89.63	85	59.2	137.8
1.746	1571	13.11	98.10	90	62.0	149.2
1.770	1628	13.59	101.7	92	63.1	154.0
1.794	1686	14.07	105.3	94	64.2	158.8
1.819	1746	14.57	109.0	96	65.3	163.8
1.844	1807	15.08	112.8	98	66.4	168.8
1.870	1870	15.61	116.7	100	67.5	174.0

PHOSPHORIC ACID

Density of Aqueous Phosphoric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of P_2O_5 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent P_2O_5	Degrees: Baumé	Twaddell
1.0038	7.272	0.06068	0.4540	0.7244	0.6	0.76
1.0092	14.62	0.1220	0.9129	1.449	1.3	1.84
1.0200	29.56	0.2467	1.845	2.898	2.8	4.00
1.0309	44.80	0.3739	2.797	4.346	4.3	6.18
1.0420	60.38	0.5039	3.770	5.795	5.8	8.40
1.0532	76.29	0.6367	4.763	7.244	7.3	10.64
1.0647	92.55	0.7724	5.778	8.693	8.8	12.94
1.0764	109.1	0.9109	6.814	10.14	10.3	15.28
1.0884	126.1	1.053	7.875	11.59	11.8	17.68
1.1008	143.5	1.198	8.961	13.04	13.3	20.16
1.1134	161.3	1.346	10.07	14.49	14.8	22.68
1.1263	179.5	1.498	11.21	15.94	16.3	25.26
1.1395	198.2	1.654	12.37	17.39	17.8	27.90
1.1529	217.1	1.812	13.55	18.83	19.2	30.58
1.1665	236.6	1.974	14.77	20.28	20.7	33.30

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PHOSPHORIC ACID (Continued)

Specific Gravity	Weight of P_2O_5 in solution expressed in			Per Cent P_2O_5	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.1805	256.5	2.141	16.01	21.73	22.2	36.10
1.216	308.3	2.573	19.24	25.35	25.8	43.2
1.254	363.4	3.033	22.69	28.98	29.4	50.8
1.293	421.5	3.518	26.32	32.60	32.9	58.6
1.335	483.5	4.035	30.19	36.22	36.4	67.0
1.379	549.4	4.585	34.30	39.84	39.9	75.8
1.426	619.7	5.172	38.69	43.46	43.3	85.2
1.475	694.6	5.797	43.36	47.09	46.7	95.0
1.526	773.8	6.458	48.31	50.71	50.0	105.2
1.579	857.9	7.159	53.56	54.33	53.2	115.8
1.633	946.3	7.897	59.08	57.95	56.2	126.6
1.689	1040	8.679	64.92	61.57	59.2	137.8
1.746	1138	9.500	71.07	65.20	62.0	149.2
1.770	1180	9.844	73.64	66.64	63.1	154.0
1.794	1222	10.19	76.26	68.09	64.2	158.8
1.819	1265	10.56	78.97	69.54	65.3	163.8
1.844	1309	10.92	81.72	70.99	66.4	168.8
1.870	1355	11.30	84.57	72.44	67.5	174.0

POTASSIUM BROMIDE

Density of Aqueous Potassium Bromide Solutions at $\frac{20°}{4°}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of KBr in solution expressed in			Per Cent KBr	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0054	10.05	0.08390	0.6277	1	0.8	1.08
1.0127	20.25	0.1690	1.264	2	1.8	2.54
1.0275	41.10	0.3430	2.566	4	3.9	5.50
1.0426	62.56	0.5221	3.905	6	5.9	8.52
1.0581	84.65	0.7064	5.285	8	8.0	11.62
1.0740	107.4	0.8963	6.705	10	10.0	14.80
1.0903	130.8	1.092	8.168	12	12.0	18.06
1.1070	155.0	1.293	9.675	14	14.0	21.40
1.1242	179.9	1.501	11.23	16	16.0	24.84
1.1419	205.5	1.715	12.83	18	18.0	28.38
1.1601	232.0	1.936	14.49	20	20.0	32.02
1.1788	259.3	2.164	16.19	22	22.0	35.76
1.1980	287.5	2.399	17.95	24	24.0	39.60
1.2178	316.6	2.642	19.77	26	25.9	43.56
1.2383	346.7	2.894	21.65	28	27.9	47.66
1.2593	377.8	3.153	23.59	30	29.9	51.86
1.3147	460.1	3.840	28.73	35	34.7	62.94
1.3746	549.8	4.589	34.33	40	39.5	74.92

POTASSIUM CARBONATE

Density of Aqueous Potassium Carbonate Solutions at $\frac{20°}{4°}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of K_2CO_3 in solution expressed in			Per Cent K_2CO_3	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0072	10.07	0.08405	0.6288	1	1.0	1.44
1.0163	20.33	0.1696	1.269	2	2.3	3.26
1.0345	41.38	0.3453	2.583	4	4.8	6.90
1.0529	63.17	0.5272	3.944	6	7.3	10.58
1.0715	85.72	0.7154	5.351	8	9.7	14.30

POTASSIUM CARBONATE (Continued)

Specific Gravity	Weight of K_2CO_3 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent K_2CO_3	Degrees: Baumé	Twaddell
1.0904	109.0	0.9100	6.807	10	12.0	18.08
1.1096	133.2	1.111	8.313	12	14.3	21.92
1.1291	158.1	1.319	9.869	14	16.6	25.82
1.1490	183.8	1.534	11.48	16	18.8	29.80
1.1692	210.5	1.756	13.14	18	21.0	33.84
1.1898	238.0	1.986	14.86	20	23.1	37.96
1.2107	266.4	2.223	16.63	22	25.2	42.14
1.2320	295.7	2.468	18.46	24	27.3	46.40
1.2536	325.9	2.720	20.35	26	29.3	50.72
1.2756	357.2	2.981	22.30	28	31.3	55.12
1.2979	389.4	3.249	24.31	30	33.3	59.58
1.3548	474.2	3.957	29.60	35	38.0	70.96
1.4141	565.6	4.720	35.31	40	42.5	82.82
1.4759	664.2	5.543	41.46	45	46.8	95.18
1.5404	770.2	6.428	48.08	50	50.9	108.08

POTASSIUM CHLORIDE

Density of Aqueous Potassium Chloride Solutions at $\frac{20°}{4°}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of KCl in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent KCl	Degrees: Baumé	Twaddell
1.0046	10.05	0.08384	0.6272	1	0.7	0.92
1.0110	20.22	0.1687	1.262	2	1.6	2.20
1.0239	40.96	0.3418	2.557	4	3.4	4.78
1.0369	62.21	0.5192	3.884	6	5.2	7.38
1.0500	84.00	0.7010	5.244	8	6.9	10.00
1.0633	106.3	0.8874	6.638	10	8.6	12.66
1.0768	129.2	1.078	8.067	12	10.3	15.36
1.0905	152.7	1.274	9.531	14	12.0	18.10
1.1043	176.7	1.475	11.03	16	13.7	20.86
1.1185	201.3	1.680	12.57	18	15.4	23.70
1.1328	226.6	1.891	14.14	20	17.0	26.56
1.1474	252.4	2.107	15.76	22	18.6	29.48
1.1623	279.0	2.328	17.41	24	20.2	32.46

POTASSIUM CHROMATE

Density of Aqueous Potassium Chromate Solutions at $\frac{18°}{4°}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of K_2CrO_4 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent K_2CrO_4	Degrees: Baumé	Twaddell
1.0066	10.07	0.08400	0.6284	1	1.0	1.32
1.0147	20.29	0.1694	1.267	2	2.1	2.94
1.0311	41.24	0.3442	2.575	4	4.4	6.22
1.0477	62.86	0.5246	3.924	6	6.6	9.54
1.0647	85.18	0.7108	5.318	8	8.8	12.94
1.0821	108.2	0.9031	6.756	10	11.0	16.42
1.0999	132.0	1.101	8.240	12	13.2	19.98
1.1181	156.5	1.306	9.772	14	15.3	23.62
1.1366	181.9	1.518	11.35	16	17.4	27.32
1.1555	208.0	1.736	12.98	18	19.5	31.10

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POTASSIUM CHROMATE (Continued)

Specific Gravity	Weight of K_2CrO_4 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent K_2CrO_4	Degrees: Baumé	Twaddell
1.1748	235.0	1.961	14.67	20	21.6	34.96
1.1945	262.8	2.193	16.41	22	23.6	38.90
1.2147	291.5	2.433	18.20	24	25.6	42.94
1.2354	321.2	2.681	20.05	26	27.6	47.08
1.2566	351.8	2.936	21.97	28	29.6	51.32
1.2784	383.5	3.201	23.94	30	31.6	55.68

Density of Aqueous Potassium Chromate Solutions at 19.5° C. Computed from the Values of Schiff.

Specific Gravity	Weight of K_2CrO_4 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent K_2CrO_4	Degrees: Baumé	Twaddell
1.0080	10.08	0.08412	0.6293	1	1.2	1.60
1.0161	20.32	0.1696	1.269	2	2.3	3.22
1.0243	30.73	0.2564	1.918	3	3.4	4.86
1.0325	41.30	0.3447	2.578	4	4.6	6.50
1.0408	52.04	0.4343	3.249	5	5.7	8.16
1.0492	62.95	0.5254	3.930	6	6.8	9.84
1.0576	74.03	0.6178	4.622	7	7.9	11.52
1.0663	85.30	0.7119	5.326	8	9.0	13.26
1.0750	96.75	0.8074	6.040	9	10.1	15.00
1.0837	108.4	0.9044	6.766	10	11.2	16.74
1.0925	120.2	1.003	7.503	11	12.3	18.50
1.1014	132.2	1.103	8.251	12	13.4	20.28
1.1104	144.4	1.205	9.012	13	14.4	22.08
1.1195	156.7	1.308	9.785	14	15.5	23.90
1.1287	169.3	1.413	10.57	15	16.5	25.74
1.1380	182.1	1.520	11.37	16	17.6	27.60
1.1474	195.1	1.628	12.18	17	18.6	29.48
1.1570	208.3	1.738	13.00	18	19.7	31.40
1.1667	221.7	1.850	13.84	19	20.7	33.34
1.1765	235.3	1.964	14.69	20	21.8	35.30
1.1864	249.1	2.079	15.55	21	22.8	37.28
1.1964	263.2	2.197	16.43	22	23.8	39.28
1.2066	277.5	2.316	17.33	23	24.8	41.32
1.2169	292.1	2.437	18.23	24	25.8	43.38
1.2274	306.9	2.561	19.16	25	26.9	45.48
1.2379	321.9	2.686	20.09	26	27.9	47.58
1.2485	337.1	2.813	21.04	27	28.9	49.70
1.2592	352.6	2.942	22.01	28	29.8	51.84
1.2700	368.3	3.074	22.99	29	30.8	54.00
1.2808	384.2	3.207	23.99	30	31.8	56.16
1.2921	400.6	3.343	25.01	31	32.8	58.42
1.3035	417.1	3.481	26.04	32	33.8	60.70
1.3151	434.0	3.622	27.09	33	34.7	63.02
1.3268	451.1	3.765	28.16	34	35.7	65.36
1.3386	468.5	3.910	29.25	35	36.7	67.72
1.3505	486.2	4.057	30.35	36	37.6	70.10
1.3625	504.1	4.207	31.47	37	38.6	72.50
1.3746	522.3	4.359	32.61	38	39.5	74.92
1.3868	540.9	4.514	33.77	39	40.4	77.36
1.3991	559.6	4.670	34.94	40	41.4	79.82

POTASSIUM CHROME ALUM (GREEN)

Density of Aqueous Potassium Chrome Alum Solutions at $\frac{15^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $K_2Cr_2(SO_4)_4$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $K_2Cr_2(SO_4)_4$	Degrees: Baumé	Twaddell
1.007	10.07	0.08404	0.6287	1	1.0	1.4
1.016	20.32	0.1696	1.269	2	2.3	3.2
1.034	41.36	0.3452	2.582	4	4.8	6.8
1.052	63.12	0.5268	3.941	6	7.2	10.4
1.070	85.60	0.7144	5.344	8	9.5	14.0
1.089	108.9	0.9088	6.799	10	11.9	17.8
1.109	133.1	1.111	8.308	12	14.3	21.8
1.129	158.1	1.319	9.868	14	16.6	25.8
1.150	184.0	1.536	11.49	16	18.9	30.0
1.171	210.8	1.759	13.16	18	21.2	34.2
1.193	238.6	1.991	14.90	20	23.5	38.6
1.216	267.5	2.233	16.70	22	25.8	43.2
1.239	297.4	2.482	18.56	24	28.0	47.8
1.263	328.4	2.740	20.50	26	30.2	52.6
1.289	360.9	3.012	22.53	28	32.5	57.8
1.315	394.5	3.292	24.63	30	34.7	63.0
1.383	484.1	4.040	30.22	35	40.2	76.6
1.456	582.4	4.860	36.36	40	45.4	91.2
1.533	689.9	5.757	43.07	45	50.4	106.6
1.615	807.5	6.739	50.41	50	55.2	123.0

Specific Gravity	Weight of $K_2Cr_2(SO_4)_4 \cdot 24H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $K_2Cr_2(SO_4)_4 + 24H_2O$	Degrees: Baumé	Twaddell
1.007	17.76	0.1482	1.109	1.763	1.0	1.4
1.016	35.83	0.2991	2.237	3.527	2.3	3.2
1.034	72.93	0.6086	4.553	7.053	4.8	6.8
1.052	111.3	0.9289	6.949	10.58	7.2	10.4
1.070	151.0	1.260	9.425	14.11	9.5	14.0
1.089	192.0	1.602	11.99	17.63	11.9	17.8
1.109	234.7	1.958	14.65	21.16	14.3	21.8
1.129	278.8	2.326	17.40	24.69	16.6	25.8
1.150	324.4	2.707	20.25	28.21	18.9	30.0
1.171	371.7	3.102	23.20	31.74	21.2	34.2
1.193	420.8	3.512	26.27	35.27	23.5	38.6
1.216	471.7	3.936	29.45	38.79	25.8	43.2
1.239	524.3	4.376	32.73	42.32	28.0	47.8
1.263	579.1	4.833	36.15	45.85	30.2	52.6
1.289	636.4	5.311	39.73	49.37	32.5	57.8
1.315	695.6	5.805	43.43	52.90	34.7	63.0
1.383	853.6	7.124	53.29	61.72	40.2	76.6
1.456	1026.9	8.570	64.11	70.53	45.4	91.2
1.533	1216.4	10.15	75.94	79.35	50.4	106.6
1.615	1423.9	11.88	88.90	88.17	55.2	123.0

POTASSIUM DICHROMATE

Density of Aqueous Potassium Dichromate Solutions at $\frac{20^\circ}{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $K_2Cr_2O_7$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $K_2Cr_2O_7$	Degrees Baumé	Degrees Twaddell
1.0052	10.05	0.08389	0.6275	1	0.8	1.04
1.0122	20.24	0.1689	1.264	2	1.7	2.44
1.0264	41.06	0.3426	2.563	4	3.7	5.28
1.0408	62.45	0.5212	3.899	6	5.7	8.16
1.0554	84.43	0.7046	5.271	8	7.6	11.08
1.0703	107.0	0.8932	6.682	10	9.5	14.06

POTASSIUM HYDROXIDE

Density of Aqueous Potassium Hydroxide Solutions at $\frac{15^\circ}{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of KOH in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent KOH	Degrees Baumé	Degrees Twaddell
1.0083	10.08	0.08415	0.6295	1	1.2	1.66
1.0175	20.35	0.1698	1.270	2	2.5	3.50
1.0267	30.80	0.2570	1.923	3	3.8	5.34
1.0359	41.44	0.3458	2.587	4	5.0	7.18
1.0452	52.26	0.4361	3.263	5	6.3	9.04
1.0544	63.26	0.5280	3.950	6	7.5	10.88
1.0637	74.46	0.6214	4.648	7	8.7	12.74
1.0730	85.84	0.7164	5.359	8	9.9	14.60
1.0824	97.42	0.8130	6.082	9	11.0	16.48
1.0918	109.2	0.9112	6.816	10	12.2	18.36
1.1013	121.1	1.011	7.563	11	13.3	20.26
1.1108	133.3	1.112	8.322	12	14.5	22.16
1.1203	145.6	1.215	9.092	13	15.6	24.06
1.1299	158.2	1.320	9.874	14	16.7	25.98
1.1396	170.9	1.427	10.67	15	17.8	27.92
1.1493	183.9	1.535	11.48	16	18.8	29.86
1.1590	197.0	1.644	12.30	17	19.9	31.80
1.1688	210.4	1.756	13.13	18	20.9	33.76
1.1786	223.9	1.869	13.98	19	22.0	35.72
1.1884	237.7	1.984	14.84	20	23.0	37.68
1.1984	251.7	2.100	15.71	21	24.0	39.68
1.2083	265.8	2.218	16.60	22	25.0	41.66
1.2184	280.2	2.339	17.49	23	26.0	43.68
1.2285	294.8	2.461	18.41	24	27.0	45.70
1.2387	309.7	2.584	19.33	25	27.9	47.74
1.2489	324.7	2.710	20.27	26	28.9	49.78
1.2592	340.0	2.837	21.23	27	29.8	51.84
1.2695	355.5	2.966	22.19	28	30.8	53.90
1.2800	371.2	3.098	23.17	29	31.7	56.00
1.2905	387.2	3.231	24.17	30	32.6	58.10
1.3010	403.3	3.366	25.18	31	33.6	60.20
1.3117	419.7	3.503	26.20	32	34.5	62.34
1.3224	436.4	3.642	27.24	33	35.4	64.48
1.3331	453.3	3.783	28.30	34	36.2	66.62
1.3440	470.4	3.926	29.37	35	37.1	68.80
1.3549	487.8	4.071	30.45	36	38.0	70.98
1.3659	505.4	4.218	31.55	37	38.8	73.18
1.3769	523.2	4.365	32.66	38	39.7	75.38
1.3879	541.3	4.517	33.79	39	40.5	77.58
1.3991	559.6	4.670	34.94	40	41.4	79.82

POTASSIUM HYDROXIDE (Continued)

Specific Gravity	Weight of KOH in solution expressed in			Per Cent KOH	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.4103	578.2	4.826	36.10	41	42.2	82.06
1.4215	597.0	4.982	37.27	42	43.0	84.30
1.4329	616.1	5.142	38.47	43	43.8	86.58
1.4443	635.5	5.303	39.67	44	44.6	88.86
1.4558	655.1	5.467	40.90	45	45.4	91.16
1.4673	675.0	5.633	42.14	46	46.2	93.46
1.4790	695.1	5.801	43.40	47	47.0	95.80
1.4907	715.5	5.971	44.67	48	47.7	98.14
1.5025	736.2	6.144	45.96	49	48.5	100.50
1.5143	757.2	6.319	47.27	50	49.2	102.86
1.5262	778.4	6.496	48.59	51	50.0	105.24
1.5382	799.9	6.675	49.94	52	50.7	107.64

POTASSIUM IODIDE

Density of Aqueous Potassium Iodide Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of KI in solution expressed in			Per Cent KI	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0055	10.06	0.08391	0.6277	1	0.8	1.10
1.0130	20.26	0.1691	1.265	2	1.9	2.60
1.0281	41.12	0.3432	2.567	4	4.0	5.62
1.0437	62.62	0.5226	3.909	6	6.1	8.74
1.0597	84.78	0.7075	5.293	8	8.2	11.94
1.0761	107.6	0.8980	6.718	10	10.3	15.22
1.0930	131.2	1.095	8.188	12	12.3	18.60
1.1104	155.5	1.297	9.705	14	14.4	22.08
1.1284	180.5	1.507	11.27	16	16.5	25.68
1.1469	206.4	1.723	12.89	18	18.6	29.38
1.1660	233.2	1.946	14.56	20	20.6	33.20
1.1857	260.9	2.177	16.29	22	23.7	37.14
1.2060	289.4	2.415	18.07	24	24.8	41.20
1.2270	319.0	2.662	19.92	26	26.8	45.40
1.2487	349.6	2.918	21.83	28	28.9	49.74
1.2712	381.4	3.183	23.81	30	30.9	54.24
1.3308	465.8	3.887	29.08	35	36.0	66.16
1.3959	558.4	4.660	34.86	40	41.1	79.18
1.4672	660.2	5.510	41.22	45	46.2	93.44
1.5458	772.9	6.450	48.25	50	51.2	109.16
1.6327	898.0	7.494	56.06	55	56.2	126.54

POTASSIUM NITRATE

Density of Aqueous Potassium Nitrate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of KNO_3 in solution expressed in			Per Cent KNO_3	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0045	10.05	0.08383	0.6271	1	0.6	0.90
1.0108	20.22	0.1687	1.262	2	1.5	2.16
1.0234	40.94	0.3416	2.556	4	3.3	4.68
1.0363	62.18	0.5189	3.882	6	5.1	7.26
1.0494	83.95	0.7006	5.241	8	6.8	9.88

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POTASSIUM NITRATE (Continued)

	Weight of KNO_3 in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent KNO_3	Baumé	Twaddell
1.0627	106.3	0.8869	6.634	10	8.6	12.54
1.0762	129.1	1.078	8.062	12	10.3	15.24
1.0899	153.6	1.273	9.526	14	12.0	17.98
1.1039	176.6	1.474	11.03	16	13.7	20.78
1.1181	201.3	1.680	12.56	18	15.3	23.62
1.1326	226.5	1.890	14.14	20	17.0	26.52
1.1473	252.4	2.106	15.76	22	18.6	29.46
1.1623	279.0	2.328	17.41	24	20.2	32.46

POTASSIUM SULFATE

Density of Aqueous Potassium Sulfate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

	Weight of K_2SO_4 in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent K_2SO_4	Baumé	Twaddell
1.0063	10.06	0.08398	0.6282	1	0.9	1.26
1.0145	20.29	0.1693	1.267	2	2.1	2.90
1.0310	41.24	0.3442	2.575	4	4.4	6.20
1.0477	62.86	0.5246	3.924	6	6.6	9.54
1.0646	85.17	0.7108	5.317	8	8.8	12.92
1.0817	108.17	0.9027	6.753	10	11.0	16.34

POTASSIUM TARTRATE

Density of Aqueous Potassium Tartrate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

	Weight of $K_2C_4H_4O_6$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $K_2C_4H_4O_6$	Baumé	Twaddell
1.0048	10.05	0.08385	0.6273	1	0.7	0.96
1.0114	20.23	0.1688	1.263	2	1.6	2.28
1.0248	40.99	0.3421	2.559	4	3.5	4.96
1.0383	62.30	0.5199	3.889	6	5.4	7.66
1.0519	84.15	0.7023	5.254	8	7.2	10.38
1.0657	106.6	0.8894	6.653	10	8.9	13.14
1.0798	129.6	1.081	8.089	12	10.7	15.96
1.0941	153.2	1.278	9.563	14	12.5	18.82
1.1087	177.4	1.480	11.07	16	14.2	21.74
1.1236	202.2	1.688	12.63	18	16.0	24.72
1.1387	227.7	1.901	14.22	20	17.7	27.74
1.1540	253.9	2.119	15.85	22	19.4	30.80
1.1696	280.7	2.343	17.52	24	21.0	33.92
1.1855	308.2	2.572	19.24	26	22.7	37.10
1.2017	336.5	2.808	21.01	28	24.3	40.34
1.2181	365.4	3.050	22.81	30	26.0	43.62
1.2606	441.2	3.682	27.54	35	30.0	52.12
1.3051	522.0	4.357	32.59	40	33.9	61.02
1.3516	608.2	5.076	37.97	45	37.7	70.32
1.4001	700.1	5.842	43.70	50	41.4	80.02

POTASSIUM TARTRATE (Continued)

Specific Gravity	Weight of $K_2C_4H_4O_6 \cdot \frac{1}{2}H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $K_2C_4H_4O_6 + \frac{1}{2}H_2O$	Degrees: Baumé	Twaddell
1.0048	10.45	0.08719	0.6523	1.040	0.7	0.96
1.0114	21.03	0.1755	1.313	2.080	1.6	2.28
1.0248	42.62	0.3557	2.661	4.159	3.5	4.96
1.0383	64.78	0.5406	4.044	6.239	5.4	7.66
1.0519	87.50	0.7303	5.463	8.319	7.2	10.38
1.0657	110.8	0.9248	6.918	10.40	8.9	13.14
1.0798	134.7	1.124	8.412	12.48	10.7	15.96
1.0941	159.3	1.329	9.944	14.56	12.5	18.82
1.1087	184.5	1.539	11.52	16.64	14.2	21.74
1.1236	210.3	1.755	13.13	18.72	16.0	24.72
1.1387	236.8	1.976	14.78	20.80	17.7	27.74
1.1540	264.0	2.203	16.48	22.88	19.4	30.80
1.1696	291.9	2.436	18.22	24.96	21.0	33.92
1.1855	320.5	2.675	20.01	27.04	22.7	37.10
1.2017	349.9	2.920	21.84	29.12	24.3	40.34
1.2181	380.0	3.171	23.72	31.19	26.0	43.62
1.2606	458.8	3.829	28.64	36.39	30.0	52.12
1.3051	542.8	4.530	33.89	41.59	33.9	61.02
1.3516	632.4	5.278	39.48	46.79	37.7	70.32
1.4001	727.9	6.075	45.44	51.99	41.4	80.02

SODIUM ACETATE

Density of Aqueous Sodium Acetate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $NaC_2H_3O_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $NaC_2H_3O_2$	Degrees: Baumé	Twaddell
1.0033	10.03	0.08373	0.6264	1	0.5	0.66
1.0084	20.17	0.1683	1.259	2	1.2	1.68
1.0186	40.74	0.3400	2.544	4	2.6	3.72
1.0289	61.73	0.5152	3.854	6	4.1	5.78
1.0392	83.14	0.6938	5.190	8	5.5	7.84
1.0495	105.0	0.8758	6.552	10	6.8	9.90
1.0598	127.2	1.061	7.940	12	8.2	11.96
1.0702	149.8	1.250	9.354	14	9.5	14.04
1.0807	172.9	1.443	10.79	16	10.8	16.14
1.0913	196.4	1.639	12.26	18	12.1	18.26
1.1021	220.4	1.839	13.76	20	13.4	20.42
1.1130	244.9	2.043	15.29	22	14.7	22.60
1.1240	269.8	2.251	16.84	24	16.0	24.80
1.1351	295.1	2.463	18.42	26	17.3	27.02
1.1462	320.9	2.678	20.04	28	18.5	29.24

SODIUM ARSENATE

Density of Aqueous Di-sodium Arsenate Solutions at $\frac{14^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of Na_2HAsO_4 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Na_2HAsO_4	Degrees: Baumé	Twaddell
1.0083	10.08	0.08415	0.6295	1	1.2	1.66
1.0175	20.35	0.1698	1.270	2	2.5	3.50
1.0365	41.46	0.3460	2.588	4	5.1	7.30
1.0563	63.38	0.5289	3.957	6	7.7	11.26
1.0768	86.14	0.7189	5.378	8	10.3	15.36

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SODIUM ARSENATE (Continued)

Specific Gravity	Weight of Na_2HAsO_4 in solution expressed in			Per Cent Na_2HAsO_4	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0980	109.8	0.9163	6.855	10	12.9	19.60
1.1197	134.4	1.121	8.388	12	15.5	23.94
1.1419	159.9	1.334	9.980	14	18.0	28.38
1.1645	186.3	1.555	11.63	16	20.5	32.90

Specific Gravity	Weight of $Na_2HAsO_4 \cdot 12H_2O$ in solution expressed in			Per Cent $Na_2HAsO_4 + 12H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0083	21.81	0.1820	1.361	2.163	1.2	1.66
1.0175	44.01	0.3673	2.748	4.325	2.5	3.50
1.0365	89.67	0.7483	5.598	8.651	5.1	7.30
1.0563	137.1	1.144	8.557	12.98	7.7	11.26
1.0768	186.3	1.555	11.63	17.30	10.3	15.36
1.0980	237.5	1.982	14.83	21.63	12.9	19.60
1.1197	290.6	2.425	18.14	25.95	15.5	23.94
1.1419	345.7	2.885	21.58	30.28	18.0	28.38
1.1645	403.0	3.363	25.16	34.60	20.5	32.90

SODIUM ARSENATE

Density of Aqueous Di-sodium Arsenate Solutions at 14° C. Computed from the Values of Schiff.

Specific Gravity	Weight of $Na_2HAsO_4 \cdot 12H_2O$ in solution expressed in			Per Cent $Na_2HAsO_4 + 12H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0042	10.04	0.08380	0.6269	1	0.6	0.84
1.0084	20.17	0.1683	1.259	2	1.2	1.68
1.0126	30.38	0.2535	1.896	3	1.8	2.52
1.0168	40.67	0.3394	2.539	4	2.4	3.36
1.0212	51.06	0.4261	3.188	5	3.0	4.24
1.0256	61.54	0.5135	3.842	6	3.6	5.12
1.0300	72.10	0.6017	4.501	7	4.2	6.00
1.0344	82.75	0.6906	5.166	8	4.8	6.88
1.0389	93.50	0.7803	5.837	9	5.4	7.78
1.0434	104.3	0.8708	6.514	10	6.0	8.68
1.0479	115.3	0.9620	7.196	11	6.6	9.58
1.0525	126.3	1.054	7.885	12	7.2	10.50
1.0571	137.4	1.147	8.579	13	7.8	11.42
1.0618	148.7	1.241	9.280	14	8.4	12.36
1.0665	160.0	1.335	9.987	15	9.0	13.30
1.0712	171.4	1.430	10.70	16	9.6	14.24
1.0759	182.9	1.526	11.42	17	10.2	15.18
1.0807	194.5	1.623	12.14	18	10.8	16.14
1.0855	206.2	1.721	12.88	19	11.4	17.10
1.0904	218.1	1.820	13.61	20	12.0	18.08
1.0953	230.0	1.920	14.36	21	12.6	19.06
1.1002	242.0	2.020	15.11	22	13.2	20.04
1.1052	254.2	2.121	15.87	23	13.8	21.04
1.1102	266.4	2.224	16.63	24	14.4	22.04
1.1153	278.8	2.327	17.41	25	15.0	23.06

SODIUM ARSENATE (Continued)

Specific Gravity	Weight of $Na_2HAsO_4 \cdot 12\ H_2O$ in solution expressed in			Per Cent $Na_2HAsO_4 + 12H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.1204	291.3	2.431	18.19	26	15.6	24.08
1.1255	303.9	2.536	18.97	27	16.2	25.10
1.1306	316.6	2.642	19.76	28	16.8	26.12
1.1358	329.4	2.749	20.56	29	17.3	27.16
1.1410	342.3	2.857	21.37	30	17.9	28.20
1.1463	355.4	2.966	22.18	31	18.5	29.26
1.1516	368.5	3.075	23.01	32	19.1	30.32
1.1569	381.8	3.186	23.83	33	19.7	31.38
1.1623	395.2	3.298	24.67	34	20.2	32.46
1.1677	408.7	3.411	25.51	35	20.8	33.54
1.1731	422.3	3.524	26.37	36	21.4	34.62
1.1786	436.1	3.639	27.22	37	22.0	35.72
1.1838	449.8	3.754	28.08	38	22.5	36.76
1.1896	464.0	3.872	28.96	39	23.1	37.92
1.1952	478.1	3.990	29.85	40	23.7	39.04

SODIUM ARSENATE

Density of Aqueous Tri-sodium Arsenate Solutions at $\frac{17^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of Na_3AsO_4 in solution expressed in			Per Cent Na_3AsO_4	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0097	10.10	0.08426	0.6304	1	1.4	1.94
1.0207	20.41	0.1704	1.274	2	2.9	4.14
1.0431	41.72	0.3482	2.605	4	6.0	8.62
1.0659	63.95	0.5337	3.993	6	9.0	13.18
1.0892	87.14	0.7272	5.440	8	11.9	17.84
1.1130	111.3	0.9288	6.948	10	14.7	22.60
1.1373	136.5	1.1389	8.520	12	17.5	27.46

Specific Gravity	Weight of $Na_3AsO_4 \cdot 12H_2O$ in solution expressed in			Per Cent $Na_3AsO_4 + 12H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0097	20.60	0.1719	1.286	2.040	1.4	1.94
1.0207	41.64	0.3475	2.600	4.080	2.9	4.14
1.0431	85.11	0.7103	5.313	8.159	6.0	8.62
1.0659	130.5	1.089	8.144	12.24	9.0	13.18
1.0892	177.7	1.483	11.10	16.32	11.9	17.84
1.1130	227.0	1.895	14.17	20.40	14.7	22.60
1.1373	278.4	2.323	17.38	24.48	17.5	27.46

Density of Aqueous Tri-sodium Arsenate Solutions at 17° C. Computed from the Values of Schiff.

Specific Gravity	Weight of $Na_3AsO_4 \cdot 12H_2O$ in solution expressed in			PerCent $Na_3AsO_4 + 12H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0053	10.05	0.08390	0.6276	1	0.8	1.06
1.0107	20.21	0.1687	1.262	2	1.5	2.14
1.0161	30.48	0.2544	1.903	3	2.3	3.22
1.0215	40.86	0.3410	2.551	4	3.1	4.30
1.0270	51.35	0.4285	3.206	5	3.8	5.40

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SODIUM ARSENATE (Continued)

Specific Gravity	Weight of $Na_3AsO_4 \cdot 12\ H_2O$ in solution expressed in			Per Cent $Na_3AsO_4 + 12H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0325	61.95	0.5170	3.868	6	4.6	6.50
1.0380	72.66	0.6064	4.536	7	5.3	7.60
1.0435	83.48	0.6967	5.212	8	6.0	8.70
1.0491	94.42	0.7880	5.895	9	6.8	9.82
1.0547	105.5	0.8802	6.584	10	7.5	10.94
1.0603	116.6	0.9733	7.281	11	8.3	12.06
1.0659	127.9	1.067	7.985	12	9.0	13.18
1.0716	139.3	1.163	8.697	13	9.7	14.32
1.0773	150.8	1.259	9.416	14	10.4	15.46
1.0830	162.5	1.356	10.14	15	11.1	16.60
1.0887	174.2	1.454	10.87	16	11.8	17.74
1.0945	186.1	1.553	11.62	17	12.5	18.90
1.1003	198.1	1.653	12.36	18	13.2	20.06
1.1061	210.2	1.754	13.12	19	13.9	21.22
1.1120	222.4	1.856	13.88	20	14.6	22.40
1.1179	234.8	1.959	14.66	21	15.3	23.58
1.1238	247.2	2.063	15.43	22	16.0	24.78

SODIUM BROMIDE

Density of Aqueous Sodium Bromide Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of NaBr in solution expressed in			Per Cent NaBr	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0060	10.06	0.08395	0.6280	1	0.9	1.20
1.0139	20.28	0.1692	1.266	2	2.0	2.78
1.0298	41.19	0.3438	2.572	4	4.2	5.96
1.0462	62.77	0.5239	3.919	6	6.4	9.24
1.0631	85.05	0.7098	5.310	8	8.6	12.62
1.0803	108.0	0.9016	6.744	10	10.8	16.06
1.0981	131.8	1.100	8.227	12	13.0	19.62
1.1164	156.3	1.304	9.758	14	15.1	23.28
1.1352	181.6	1.516	11.34	16	17.3	27.04
1.1546	207.8	1.734	12.97	18	19.4	30.92
1.1745	234.9	1.960	14.66	20	21.5	34.90
1.1951	262.9	2.194	16.41	22	23.7	39.02
1.2163	291.9	2.436	18.22	24	25.8	43.26
1.2382	321.9	2.687	20.10	26	27.9	47.64
1.2608	353.0	2.946	22.04	28	30.0	52.16
1.2841	385.2	3.215	24.05	30	32.1	56.82
1.3462	471.2	3.932	29.42	35	37.3	69.24
1.4138	565.5	4.719	35.31	40	42.4	82.76

SODIUM CARBONATE

Density of Aqueous Sodium Carbonate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of Na_2CO_3 in solution expressed in			Per Cent Na_2CO_3	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0086	10.09	0.08417	0.6297	1	1.2	1.72
1.0190	20.38	0.1701	1.272	2	2.7	3.80

SODIUM CARBONATE (Continued)

Specific Gravity	Weight of Na_2CO_3 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Na_2CO_3	Degrees: Baumé	Twaddell
1.0398	41.59	0.3471	2.597	4	5.6	7.96
1.0606	63.64	0.5311	3.973	6	8.3	12.12
1.0816	86.53	0.7221	5.402	8	10.9	16.32
1.1029	110.3	0.9204	6.885	10	13.5	20.58
1.1244	134.9	1.126	8.424	12	16.0	24.88
1.1463	160.5	1.339	10.02	14	18.5	29.26

Specific Gravity	Weight of $Na_2CO_3 \cdot 10H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2CO_3 + 10H_2O$	Degrees: Baumé	Twaddell
1.0086	27.23	0.2272	1.700	2.700	1.2	1.72
1.0190	55.02	0.4592	3.435	5.400	2.7	3.80
1.0398	112.3	0.9371	7.010	10.80	5.6	7.96
1.0606	171.8	1.434	10.73	16.20	8.3	12.12
1.0816	233.6	1.950	14.58	21.60	10.9	16.32
1.1029	297.8	2.485	18.59	27.00	13.5	20.58
1.1244	364.3	3.040	22.74	32.40	16.0	24.88
1.1463	433.3	3.616	27.05	37.80	18.5	29.26

SODIUM CHLORIDE

Density of Aqueous Sodium Chloride Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of NaCl in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent NaCl	Degrees: Baumé	Twaddell
1.0053	10.05	0.08390	0.6276	1	0.8	1.06
1.0125	20.25	0.1690	1.264	2	1.8	2.50
1.0268	41.07	0.3428	2.564	4	3.8	5.36
1.0413	62.48	0.5214	3.901	6	5.8	8.26
1.0559	84.47	0.7050	5.274	8	7.7	11.18
1.0707	107.1	0.8935	6.684	10	9.6	14.14
1.0857	130.3	1.087	8.134	12	11.5	17.14
1.1009	154.1	1.286	9.622	14	13.3	20.18
1.1162	178.6	1.490	11.15	16	15.1	23.24
1.1319	203.7	1.700	12.72	18	16.9	26.38
1.1478	229.6	1.916	14.33	20	18.7	29.56
1.1640	256.1	2.137	15.99	22	20.4	32.80
1.1804	283.3	2.364	17.69	24	22.2	36.08
1.1972	311.3	2.598	19.43	26	23.9	39.44

SODIUM CHROMATE

Density of Aqueous Sodium Chromate Solutions at $\frac{18^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of Na_2CrO_4 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Na_2CrO_4	Degrees: Baumé	Twaddell
1.0074	10.07	0.08407	0.6289	1	1.1	1.48
1.0163	20.33	0.1696	1.269	2	2.3	3.26
1.0344	41.38	0.3453	2.583	4	4.8	6.88
1.0529	63.17	0.5272	3.944	6	7.3	10.58
1.0718	85.74	0.7156	5.353	8	9.7	14.36

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SODIUM CHROMATE (Continued)

Specific Gravity	Weight of Na_2CrO_4 in solution expressed in			Per Cent Na_2CrO_4	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0912	109.1	0.9107	6.812	10	12.1	18.24
1.1110	133.3	1.113	8.323	12	14.5	22.20
1.1312	158.4	1.322	9.887	14	16.8	26.24
1.1518	184.3	1.538	11.51	16	19.1	30.36
1.1728	211.1	1.762	13.18	18	21.4	34.56
1.1942	238.8	1.993	14.91	20	23.6	38.84
1.2160	267.5	2.233	16.70	22	25.8	43.20
1.2383	297.2	2.480	18.55	24	27.9	47.66
1.2611	327.9	2.736	20.47	26	30.0	52.22

SODIUM DICHROMATE

Density of Aqueous Sodium Dichromate Solutions at $^{15°}_{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Na_2Cr_2O_7$ in solution expressed in			Per Cent $Na_2Cr_2O_7$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.006	10.06	0.08395	0.6280	1	0.9	1.2
1.013	20.26	0.1691	1.265	2	1.9	2.6
1.027	41.08	0.3428	2.565	4	3.8	5.4
1.041	62.46	0.5213	3.899	6	5.7	8.2
1.056	84.48	0.7050	5.274	8	7.7	11.2
1.070	107.0	0.8930	6.680	10	9.5	14.0
1.084	130.1	1.086	8.121	12	11.2	16.8
1.098	153.7	1.283	9.597	14	12.9	19.6
1.112	177.9	1.485	11.11	16	14.6	22.4
1.126	202.7	1.691	12.65	18	16.2	25.2
1.140	228.0	1.903	14.23	20	17.8	28.0
1.153	253.7	2.117	15.84	22	19.2	30.6
1.166	279.8	2.335	17.47	24	20.6	33.2
1.179	306.5	2.558	19.14	26	22.0	35.8
1.193	334.0	2.788	20.85	28	23.5	38.6
1.207	362.1	3.022	22.61	30	24.9	41.4
1.244	435.4	3.634	27.18	35	28.4	48.8
1.279	511.6	4.270	31.94	40	31.6	55.8
1.312	590.4	4.927	36.86	45	34.5	62.4
1.342	671.0	5.600	41.89	50	37.0	68.4

SODIUM HYDROXIDE

Density of Aqueous Sodium Hydroxide Solutions at $^{20°}_{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of NaOH in solution expressed in			Per Cent NaOH	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0095	10.10	0.08425	0.6302	1	1.4	1.90
1.0207	20.41	0.1704	1.274	2	2.9	4.14
1.0318	30.95	0.2583	1.932	3	4.5	6.36
1.0428	41.71	0.3481	2.604	4	6.0	8.56
1.0538	52.69	0.4397	3.289	5	7.4	10.76
1.0648	63.89	0.5332	3.989	6	8.8	12.96
1.0758	75.31	0.6285	4.701	7	10.2	15.16
1.0869	86.95	0.7256	5.428	8	11.6	17.38

SODIUM HYDROXIDE (Continued) *

Specific Gravity	Weight of NaOH in solution expressed in			Per Cent NaOH	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0979	98.81	0.8246	6.169	9	12.9	19.58
1.1089	110.9	0.9254	6.923	10	14.2	21.78
1.1309	135.7	1.133	8.472	12	16.8	26.18
1.1530	161.4	1.347	10.08	14	19.2	30.60
1.1751	188.0	1.569	11.74	16	21.6	35.02
1.1972	215.5	1.798	13.45	18	23.9	39.44
1.2191	243.8	2.035	15.22	20	26.1	43.82
1.2411	273.0	2.279	17.05	22	28.2	48.22
1.2629	303.1	2.529	18.92	24	30.2	52.58
1.2848	334.0	2.788	20.85	26	32.1	56.96
1.3064	365.8	3.053	22.84	28	34.0	61.28
1.3279	398.4	3.325	24.87	30	35.8	65.58
1.3490	431.7	3.603	26.95	32	37.5	69.80
1.3696	465.7	3.886	29.07	34	39.1	73.92
1.3900	500.4	4.176	31.24	36	40.7	78.00
1.4101	535.8	4.472	33.45	38	42.2	82.02
1.4300	572.0	4.774	35.71	40	43.6	86.00
1.4494	608.7	5.080	38.00	42	45.0	89.88
1.4685	646.1	5.392	40.34	44	46.3	93.70
1.4873	684.2	5.710	42.71	46	47.5	97.46
1.5065	723.1	6.035	45.14	48	48.8	101.30
1.5253	762.7	6.365	47.61	50	49.9	105.06

* For a table giving corrections to readings between 50° F and 130° F and taken with an hydrometer graduated at 60/60° F, see table by Griswold, Ind. Eng. Chem., Analytical Ed., 9, 388 (1937).

SODIUM NITRATE

Density of Aqueous Sodium Nitrate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $NaNO_3$ in solution expressed in			Per Cent $NaNO_3$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0049	10.05	0.08386	0.6274	1	0.7	0.98
1.0117	20.23	0.1689	1.263	2	1.7	2.34
1.0254	41.02	0.3423	2.561	4	3.6	5.08
1.0392	62.35	0.5204	3.893	6	5.5	7.84
1.0532	84.26	0.7032	5.260	8	7.3	10.64
1.0674	106.7	0.8908	6.664	10	9.2	13.48
1.0819	129.8	1.083	8.105	12	11.0	16.38
1.0967	153.5	1.281	9.585	14	12.8	19.34
1.1118	177.9	1.485	11.11	16	14.6	22.36
1.1272	202.9	1.693	12.67	18	16.4	25.44
1.1429	228.6	1.908	14.27	20	18.1	28.58
1.1589	255.0	2.128	15.92	22	19.9	31.78
1.1752	282.0	2.354	17.61	24	21.6	35.04
1.1917	309.8	2.586	19.34	26	23.3	38.34
1.2085	338.4	2.824	21.13	28	25.0	41.70
1.2256	367.7	3.068	22.95	30	26.7	45.12
1.2701	444.5	3.710	27.75	35	30.8	54.02
1.3175	527.0	4.398	32.90	40	34.9	63.50
1.3683	615.7	5.139	38.44	45	39.0	73.66

SODIUM NITRITE

Density of Aqueous Sodium Nitrite Solutions at $\frac{15^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $NaNO_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $NaNO_2$	Degrees: Baumé	Twaddell
1.0058	10.06	0.08394	0.6279	1	0.8	1.16
1.0125	20.25	0.1690	1.264	2	1.8	2.50
1.0260	41.04	0.3425	2.562	4	3.7	5.20
1.0397	62.38	0.5206	3.894	6	5.5	7.94
1.0535	84.28	0.7034	5.261	8	7.4	10.70
1.0675	106.8	0.8909	6.664	10	9.2	13.50
1.0816	129.8	1.083	8.103	12	10.9	16.32
1.0959	153.4	1.280	9.578	14	12.7	19.18
1.1103	177.6	1.483	11.09	16	14.4	22.06
1.1248	202.5	1.690	12.64	18	16.1	24.96
1.1394	227.9	1.902	14.23	20	17.7	27.88

SODIUM POTASSIUM TARTRATE—Rochelle Salt

Density of Aqueous Sodium Potassium Tartrate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $NaKC_4H_4O_6$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $NaKC_4H_4O_6$	Degrees: Baumé	Twaddell
1.0049	10.05	0.08386	0.6274	1	0.7	0.98
1.0116	20.23	0.1688	1.263	2	1.7	2.32
1.0252	41.01	0.3422	2.560	4	3.6	5.04
1.0390	62.34	0.5203	3.892	6	5.4	7.80
1.0530	84.24	0.7030	5.259	8	7.3	10.60
1.0673	106.7	0.8907	6.663	10	9.1	13.46
1.0818	129.8	1.083	8.104	12	11.0	16.36
1.0965	153.5	1.281	9.584	14	12.8	19.30
1.1114	177.8	1.484	11.10	16	14.5	22.28
1.1265	202.8	1.692	12.66	18	16.3	25.30
1.1419	228.4	1.906	14.26	20	18.0	28.38
1.1576	254.7	2.125	15.90	22	19.7	31.52
1.1735	281.6	2.350	17.58	24	21.4	34.70
1.1896	309.3	2.581	19.31	26	23.1	37.92
1.2059	337.7	2.818	21.08	28	24.8	41.18
1.2225	366.8	3.061	22.90	30	26.4	44.50
1.2394	396.6	3.310	24.76	32	28.0	47.88
1.2566	427.2	3.566	26.67	34	29.6	51.32
1.2742	458.7	3.828	28.64	36	31.2	54.84

Specific Gravity	Weight of $NaKC_4H_4O_6 \cdot 4H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $NaKC_4H_4O_6 + 4H_2O$	Degrees: Baumé	Twaddell
1.0049	13.50	0.1126	0.8425	1.343	0.7	0.98
1.0116	27.17	0.2267	1.696	2.686	1.7	2.32
1.0252	55.07	0.4596	3.438	5.372	3.6	5.04
1.0390	83.72	0.6987	5.227	8.058	5.4	7.80
1.0530	113.1	0.9441	7.063	10.74	7.3	10.60
1.0673	143.3	1.196	8.948	13.43	9.1	13.46
1.0818	174.3	1.455	10.88	16.12	11.0	16.36
1.0965	206.2	1.720	12.87	18.80	12.8	19.30

SODIUM POTASSIUM TARTRATE—Rochelle Salt (Continued)

Specific Gravity	Weight of $NaKC_4H_4O_6{\cdot}4H_2O$ in solution expressed in			Per Cent $NaKC_4H_4O_6 + 4H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.1114	238.8	1.993	14.91	21.49	14.5	22.28
1.1265	272.3	2.272	17.00	24.17	16.3	25.30
1.1419	306.7	2.560	19.15	26.86	18.0	28.38
1.1576	342.0	2.854	21.35	29.54	19.7	31.52
1.1735	378.2	3.156	23.61	32.23	21.4	34.70
1.1896	415.4	3.466	25.93	34.92	23.1	37.92
1.2059	453.4	3.784	28.31	37.60	24.8	41.18
1.2225	492.5	4.110	30.75	40.29	26.4	44.50
1.2394	532.6	4.445	33.25	42.97	28.0	47.88
1.2566	573.8	4.788	35.82	45.66	29.6	51.32
1.2742	616.0	5.141	38.46	48.35	31.2	54.84

SODIUM SILICATE

Density of Aqueous Sodium Silicate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Na_2O + 3.9SiO_2$ in solution expressed in			Per Cent $Na_2O + 3.9SiO_2$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.006	10.06	0.08395	0.6280	1	0.9	1.2
1.014	20.28	0.1692	1.266	2	2.0	2.8
1.030	41.20	0.3438	2.572	4	4.2	6.0
1.046	62.76	0.5238	3.918	6	6.4	9.2
1.063	85.04	0.7097	5.309	8	8.6	12.6
1.080	108.0	0.9013	6.742	10	10.7	16.0
1.098	131.8	1.100	8.226	12	12.9	19.6
1.116	156.2	1.304	9.754	14	14.6	23.2
1.134	181.4	1.514	11.33	16	17.1	26.8
1.153	207.5	1.732	12.96	18	19.2	30.6
1.172	234.4	1.956	14.63	20	21.3	34.4
1.191	262.0	2.187	16.36	22	23.3	38.2
1.211	290.6	2.426	18.14	24	25.3	42.2
1.232	320.3	2.673	20.00	26	27.3	46.4
1.253	350.8	2.928	21.90	28	29.3	50.6
1.275	382.5	3.192	23.88	30	31.3	55.0
1.298	415.4	3.466	25.93	32	33.3	59.6

Specific Gravity	Weight of $Na_2O + 3.36SiO_2$ in solution expressed in			Per Cent $Na_2O + 3.36SiO_2$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.006	10.06	0.08395	0.6280	1	0.9	1.2
1.014	20.28	0.1692	1.266	2	2.0	2.8
1.030	41.20	0.3438	2.572	4	4.2	6.0
1.047	62.82	0.5243	3.922	6	6.5	9.4
1.065	85.20	0.7110	5.319	8	8.9	13.0
1.083	108.3	0.9038	6.761	10	11.1	16.6
1.101	132.1	1.103	8.248	12	13.3	20.2
1.120	156.8	1.309	9.789	14	15.5	24.0
1.139	182.2	1.521	11.38	16	17.7	27.8
1.159	208.6	1.741	13.02	18	19.9	31.8

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SODIUM SILICATE (Continued)

Specific Gravity	Weight of $Na_2O+3.36SiO_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2O+3.36SiO_2$	Degrees: Baumé	Twaddell
1.179	235.8	1.968	14.72	20	22.0	35.8
1.200	264.0	2.203	16.48	22	24.2	40.0
1.222	293.3	2.448	18.31	24	26.3	44.4
1.244	323.4	2.699	20.19	26	28.4	48.8
1.267	354.8	2.961	22.15	28	30.6	53.4
1.290	387.0	3.230	24.16	30	32.6	58.0
1.314	420.5	3.509	26.25	32	34.7	62.8
1.339	455.3	3.799	28.42	34	36.7	67.8
1.365	491.4	4.101	30.68	36	38.8	73.0
1.393	529.3	4.418	33.05	38	40.9	78.6

Specific Gravity	Weight of $Na_2O+2.40SiO_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2O+2.40SiO_2$	Degrees: Baumé	Twaddell
1.007	10.07	0.08404	0.6287	1	1.0	1.4
1.016	20.32	0.1696	1.269	2	2.3	3.2
1.034	41.36	0.3452	2.582	4	4.8	6.8
1.052	63.12	0.5268	3.941	6	7.2	10.4
1.071	85.68	0.7150	5.349	8	9.6	14.2
1.090	109.0	0.9096	6.805	10	12.0	18.0
1.110	133.2	1.112	8.316	12	14.4	22.0
1.130	158.2	1.320	9.876	14	16.7	26.0
1.151	184.2	1.537	11.50	16	19.0	30.2

Specific Gravity	Weight of $Na_2O+2.44SiO_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2O+2.44SiO_2$	Degrees: Baumé	Twaddell
1.285	359.8	3.003	22.46	28	32.2	57.0
1.309	392.7	3.277	24.52	30	34.2	61.8
1.334	426.9	3.562	26.65	32	36.3	66.8
1.360	462.4	3.859	28.87	34	38.4	72.0
1.387	499.3	4.167	31.17	36	40.5	77.4
1.415	537.7	4.487	33.57	38	42.5	83.0
1.445	578.0	4.824	36.08	40	44.7	89.0

Specific Gravity	Weight of $Na_2O+2.06SiO_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2O+2.06SiO_2$	Degrees: Baumé	Twaddell
1.007	10.07	0.08404	0.6287	1	1.0	1.4
1.016	20.32	0.1696	1.269	2	2.3	3.2
1.035	41.40	0.3455	2.585	4	4.9	7.0
1.054	63.24	0.5278	3.948	6	7.4	10.8
1.073	85.84	0.7164	5.359	8	9.9	14.6
1.093	109.3	0.9122	6.824	10	12.3	18.6
1.113	133.6	1.115	8.338	12	14.7	22.6
1.134	158.8	1.325	9.911	14	17.1	26.8
1.156	185.0	1.544	11.55	16	19.6	31.2
1.178	212.0	1.770	13.24	18	21.9	35.6
1.200	240.0	2.003	14.98	20	24.2	40.0
1.223	269.1	2.245	16.80	22	26.4	44.6
1.247	299.3	2.498	18.68	24	28.7	49.4

SODIUM SILICATE (Continued)

Specific Gravity	Weight of $Na_2O+2.06SiO_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2O+2.06SiO_2$	Degrees: Baumé	Twaddell
1.271	330.5	2.758	20.63	26	30.9	54.2
1.296	362.9	3.028	22.65	28	33.1	59.2
1.321	396.3	3.307	24.74	30	35.2	64.2
1.346	430.7	3.595	26.89	32	37.3	69.2
1.371	466.1	3.890	29.10	34	39.2	74.2
1.397	502.9	4.197	31.40	36	41.2	79.4
1.423	540.7	4.513	33.76	38	43.1	84.6
1.450	580.0	4.840	36.21	40	45.0	90.0
1.520	684.0	5.708	42.70	45	49.6	104.0
1.594	797.0	6.651	49.76	50	54.0	118.8
1.673	920.2	7.679	57.44	55	58.3	134.6

Specific Gravity	Weight of $Na_2O+1.69SiO_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2O+1.69SiO_2$	Degrees: Baumé	Twaddell
1.007	10.07	0.08404	0.6287	1	1.0	1.4
1.017	20.34	0.1697	1.270	2	2.4	3.4
1.036	41.44	0.3458	2.587	4	5.0	7.2
1.056	63.36	0.5288	3.956	6	7.7	11.2
1.077	86.16	0.7190	5.379	8	10.4	15.4
1.098	109.8	0.9163	6.855	10	12.9	19.6
1.119	134.3	1.121	8.383	12	15.4	23.8
1.141	159.7	1.333	9.973	14	17.9	28.2
1.163	186.1	1.553	11.62	16	20.3	32.6
1.186	213.5	1.782	13.33	18	22.7	37.2
1.210	242.0	2.020	15.11	20	25.2	42.0
1.234	271.5	2.266	16.95	22	27.5	46.8
1.259	302.2	2.522	18.86	24	29.8	51.8
1.284	333.8	2.786	20.84	26	32.1	56.8
1.310	366.8	3.061	22.90	28	34.3	62.0
1.337	401.1	3.347	25.04	30	36.6	67.4
1.365	436.8	3.645	27.27	32	38.8	73.0
1.394	474.0	3.955	29.59	34	41.0	78.8
1.424	512.6	4.278	32.00	36	43.2	84.8
1.456	553.3	4.617	34.54	38	45.4	91.2

SODIUM SULFATE

Density of Aqueous Sodium Sulfate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of Na_2SO_4 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Na_2SO_4	Degrees: Baumé	Twaddell
1.0073	10.07	0.08406	0.6289	1	1.1	1.46
1.0164	20.33	0.1696	1.269	2	2.3	3.28
1.0348	41.39	0.3454	2.584	4	4.9	6.96
1.0535	63.21	0.5275	3.946	6	7.4	10.70
1.0724	85.79	0.7160	5.356	8	9.8	14.48
1.0915	109.2	0.9109	6.814	10	12.2	18.30
1.1109	133.3	1.113	8.322	12	14.5	22.18
1.1306	158.3	1.321	9.882	14	16.8	26.12
1.1506	184.1	1.536	11.49	16	19.0	30.12
1.1709	210.8	1.759	13.16	18	21.2	34.18
1.1915	238.3	1.989	14.88	20	23.3	38.30
1.2124	266.7	2.226	16.65	22	25.4	42.48
1.2336	296.1	2.471	18.48	24	27.5	46.72

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SODIUM SULFATE (Continued)

Specific Gravity	Weight of $Na_2SO_4 \cdot 10H_2O$ in solution expressed in			Per Cent Na_2SO_4 $+10H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0073	22.85	0.1907	1.426	2.268	1.1	1.46
1.0164	46.11	0.3848	2.879	4.537	2.3	3.28
1.0348	93.89	0.7835	5.861	9.073	4.9	6.96
1.0535	143.4	1.197	8.951	13.61	7.4	10.70
1.0724	194.6	1.624	12.15	18.15	9.8	14.48
1.0915	247.6	2.066	15.46	22.68	12.2	18.30
1.1109	302.4	2.523	18.88	27.22	14.5	22.18
1.1306	359.0	2.996	22.41	31.76	16.8	26.12
1.1506	417.6	3.485	26.07	36.29	19.0	30.12
1.1709	478.1	3.990	29.85	40.83	21.2	34.18
1.1915	540.5	4.511	33.75	45.37	23.3	38.30
1.2124	605.0	5.049	37.77	49.90	25.4	42.48
1.2336	671.6	5.604	41.93	54.44	27.5	46.72

Density of Aqueous Sodium Sulfate Solutions at 15° C. Computed from the Values of Gerlach.

Specific Gravity	Weight of $Na_2SO_4 \cdot 10H_2O$ in solution expressed in			Per Cent Na_2SO_4+ $10H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.004	10.04	0.08379	0.6268	1	0.6	0.8
1.008	20.16	0.1682	1.259	2	1.2	1.6
1.013	30.39	0.2536	1.897	3	1.9	2.6
1.016	40.64	0.3392	2.537	4	2.3	3.2
1.020	51.00	0.4256	3.184	5	2.8	4.0
1.024	61.44	0.5127	3.836	6	3.4	4.8
1.028	71.96	0.6005	4.492	7	4.0	5.6
1.032	82.56	0.6890	5.154	8	4.5	6.4
1.036	93.24	0.7781	5.821	9	5.0	7.2
1.040	104.0	0.8679	6.493	10	5.6	8.0
1.044	114.8	0.9584	7.169	11	6.1	8.8
1.047	125.6	1.049	7.844	12	6.5	9.4
1.052	136.8	1.141	8.538	13	7.2	10.4
1.056	147.8	1.234	9.230	14	7.7	11.2
1.060	159.0	1.327	9.926	15	8.2	12.0
1.064	170.2	1.421	10.63	16	8.7	12.8
1.069	181.7	1.517	11.35	17	9.4	13.8
1.073	193.1	1.612	12.06	18	9.9	14.6
1.077	204.6	1.708	12.78	19	10.4	15.4
1.082	216.4	1.806	13.51	20	11.0	16.4
1.086	228.1	1.903	14.24	21	11.5	17.2
1.090	239.8	2.001	14.97	22	12.0	18.0
1.094	251.6	2.100	15.71	23	12.5	18.8
1.098	263.5	2.199	16.45	24	12.9	19.6
1.103	275.8	2.301	17.22	25	13.5	20.6
1.107	287.8	2.402	17.97	26	14.0	21.4
1.111	300.0	2.503	18.73	27	14.5	22.2
1.116	312.5	2.608	19.51	28	15.1	23.2
1.120	324.8	2.711	20.28	29	15.5	24.0
1.125	337.5	2.817	21.07	30	16.1	25.0

SODIUM SULFATE (Continued)

Specific Gravity	Weight of Na_2SO_4 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Na_2SO_4	Degrees: Baumé	Twaddell
1.004	4.426	0.03694	0.2763	0.4408	0.6	0.8
1.008	8.888	0.07417	0.5549	0.8817	1.2	1.6
1.013	13.40	0.1118	0.8364	1.323	1.9	2.6
1.016	17.92	0.1495	1.119	1.763	2.3	3.2
1.020	22.48	0.1876	1.404	2.204	2.8	4.0
1.024	27.09	0.2261	1.691	2.645	3.4	4.8
1.028	31.73	0.2648	1.981	3.086	4.0	5.6
1.032	36.40	0.3038	2.272	3.527	4.5	6.4
1.036	41.11	0.3431	2.566	3.968	5.0	7.2
1.040	45.85	0.3826	2.862	4.408	5.6	8.0
1.044	50.63	0.4225	3.161	4.850	6.1	8.8
1.047	55.39	0.4623	3.458	5.290	6.5	9.4
1.052	60.29	0.5032	3.764	5.731	7.2	10.4
1.056	65.18	0.5439	4.069	6.172	7.7	11.2
1.060	70.10	0.5850	4.376	6.613	8.2	12.0
1.064	75.05	0.6264	4.685	7.054	8.7	12.8
1.069	80.12	0.6686	5.002	7.495	9.4	13.8
1.073	85.15	0.7106	5.316	7.936	9.9	14.6
1.077	90.22	0.7529	5.632	8.377	10.4	15.4
1.082	95.40	0.7962	5.956	8.817	11.0	16.4
1.086	100.5	0.8391	6.277	9.258	11.5	17.2
1.090	105.7	0.8823	6.600	9.699	12.0	18.0
1.094	110.9	0.9258	6.925	10.14	12.5	18.8
1.098	116.2	0.9696	7.253	10.58	12.9	19.6
1.103	121.6	1.015	7.590	11.02	13.5	20.6
1.107	126.9	1.059	7.922	11.46	14.0	21.4
1.111	132.2	1.104	8.256	11.90	14.5	22.2
1.116	137.8	1.150	8.601	12.34	15.1	23.2
1.120	143.2	1.195	8.940	12.79	15.5	24.0
1.125	148.8	1.242	9.289	13.23	16.1	25.0

SODIUM SULFIDE

Density of Aqueous Sodium Sulfide Solutions at 25°/4° C. Computed fro Vlaues Given in the International Critical Tables.

Specific Gravity	Weight of Na_2S in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Na_2S	Degrees: Baumé	Twaddell
1.0098	10.10	0.08427	0.6304	1	1.4	1.96
1.0211	20.42	0.1704	1.275	2	3.0	4.22
1.0440	41.76	0.3485	2.607	4	6.1	8.80
1.0672	64.03	0.5344	3.998	6	9.1	13.44
1.0907	87.26	0.7282	5.447	8	12.1	18.14
1.1146	111.5	0.9302	6.958	10	14.9	22.92
1.1388	136.7	1.140	8.531	12	17.7	27.76
1.1634	162.9	1.359	10.17	14	20.4	32.68
1.1885	190.2	1.587	11.87	16	23.0	37.70
1.2140	218.5	1.824	13.64	18	25.6	42.80

SODIUM ACID SULFITE

Density of Aqueous Sodium Acid Sulfite Solutions at 15° C.

Specific Gravity	Weight of $NaHSO_3$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $NaHSO_3$	Degrees: Baumé	Twaddell
1.008	16.13	0.1346	1.007	1.6	1.2	1.6
1.022	21.46	0.1791	1.340	2.1	3.1	4.4
1.038	37.37	0.3119	2.333	3.6	5.3	7.6
1.052	53.65	0.4477	3.349	5.1	7.2	10.4
1.068	69.42	0.5793	4.334	6.5	9.2	13.6
1.084	86.72	0.7237	5.414	8.0	11.2	16.8
1.100	104.5	0.8721	6.524	9.5	13.2	20.0
1.116	125.0	1.043	7.803	11.2	15.1	23.2
1.134	145.2	1.211	9.062	12.8	17.1	26.8
1.152	168.2	1.404	10.50	14.6	19.1	30.4
1.171	193.2	1.612	12.06	16.5	21.2	34.2
1.190	220.2	1.837	13.74	18.5	23.2	38.0
1.210	252.9	2.110	15.79	20.9	25.2	42.0
1.231	289.3	2.414	18.06	23.5	27.2	46.2
1.252	324.3	2.706	20.24	25.9	29.2	50.4
1.275	368.5	3.075	23.00	28.9	31.3	55.0
1.298	411.5	3.434	25.69	31.7	33.3	59.6
1.321	458.4	3.825	28.62	34.7	35.2	64.2
1.345	511.1	4.265	31.91	38.0	37.2	69.0

Specific Gravity	Weight of SO_2 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent SO_2	Degrees: Baumé	Twaddell
1.008	9.928	0.08285	0.6198	0.9850	1.2	1.6
1.022	13.21	0.1103	0.8248	1.293	3.1	4.4
1.038	22.44	0.1873	1.401	2.162	5.3	7.6
1.052	33.03	0.2756	2.062	3.140	7.2	10.4
1.068	42.74	0.3566	2.668	4.001	9.2	13.6
1.084	53.39	0.4455	3.333	4.925	11.2	16.8
1.100	64.33	0.5369	4.016	5.848	13.2	20.0
1.116	76.95	0.6421	4.804	6.895	15.1	23.2
1.134	89.35	0.7457	5.579	7.880	17.1	26.8
1.152	103.5	0.8641	6.464	8.988	19.1	30.4
1.171	118.9	0.9926	7.426	10.15	21.2	34.2
1.190	135.5	1.131	8.461	11.39	23.2	38.0
1.210	155.7	1.299	9.718	12.87	25.2	42.0
1.231	178.1	1.486	11.12	14.47	27.2	46.2
1.252	199.6	1.666	12.46	15.94	29.2	50.4
1.275	226.8	1.893	14.15	17.79	31.3	55.0
1.298	253.3	2.114	15.81	19.51	33.3	59.6
1.321	282.2	2.355	17.62	21.36	35.2	64.2
1.345	314.6	2.625	19.64	23.39	37.2	69.0

SODIUM SULFITE

ensity of Aqueous Sodium Sulfite Solutions at $\frac{19^{\circ}}{4}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of Na_2SO_3 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Na_2SO_3	Degrees: Baumé	Twaddell
1.0078	10.08	0.08410	0.6292	1	1.1	1.56
1.0172	20.34	0.1698	1.270	2	2.5	3.44
1.0363	41.45	0.3459	2.588	4	5.1	7.26
1.0556	63.34	0.5286	3.954	6	7.6	11.12

SODIUM SULFITE (Continued)

Specific Gravity	Weight of Na_2SO_3 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent Na_2SO_3	Degrees: Baumé	Twaddell
1.0751	86.01	0.7178	5.369	8	10.1	15.02
1.0948	109.5	0.9137	6.835	10	12.6	18.96
1.1146	133.8	1.116	8.350	12	14.9	22.92
1.1346	158.8	1.326	9.917	14	17.2	26.92
1.1549	184.8	1.542	11.54	16	19.4	30.98
1.1755	211.6	1.766	13.21	18	21.7	35.10

SODIUM TARTRATE

Density of Aqueous Sodium Tartrate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Na_2C_4H_4O_6$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2C_4H_4O_6$	Degrees: Baumé	Twaddell
1.0052	10.05	0.08389	0.6275	1	0.8	1.04
1.0123	20.25	0.1690	1.264	2	1.8	2.46
1.0266	41.06	0.3427	2.564	4	3.8	5.32
1.0410	62.46	0.5213	3.899	6	5.7	8.20
1.0555	84.44	0.7047	5.272	8	7.6	11.10
1.0702	107.0	0.8931	6.681	10	9.5	14.04
1.0851	130.2	1.087	8.129	12	11.4	17.02
1.1002	154.0	1.285	9.616	14	13.2	20.04
1.1156	178.5	1.490	11.14	16	15.0	23.12
1.1313	203.6	1.699	12.71	18	16.8	26.26
1.1471	229.4	1.915	14.32	20	18.6	29.42
1.1633	255.9	2.136	15.98	22	20.4	32.66
1.1797	283.1	2.363	17.68	24	22.1	35.94
1.1963	311.0	2.596	19.42	26	23.8	39.26
1.2132	339.7	2.835	21.21	28	25.5	42.64

Specific Gravity	Weight of $Na_2C_4H_4O_6 \cdot 2H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2C_4H_4O_6 + 2H_2O$	Degrees: Baumé	Twaddell
1.0052	11.92	0.09947	0.7441	1.186	0.8	1.04
1.0123	24.01	0.2003	1.499	2.371	1.8	2.46
1.0266	48.69	0.4063	3.040	4.743	3.8	5.32
1.0410	74.06	0.6180	4.623	7.114	5.7	8.20
1.0555	100.1	0.8355	6.250	9.486	7.6	11.10
1.0702	126.9	1.059	7.922	11.86	9.5	14.04
1.0851	154.4	1.288	9.639	14.23	11.4	17.02
1.1002	182.6	1.524	11.40	16.60	13.2	20.04
1.1156	211.6	1.766	13.21	18.97	15.0	23.12
1.1313	241.4	2.015	15.07	21.34	16.8	26.26
1.1471	272.0	2.270	16.98	23.71	18.6	29.42
1.1633	303.4	2.532	18.94	26.09	20.4	32.66
1.1797	335.7	2.802	20.96	28.46	22.1	35.94
1.1963	368.8	3.078	23.02	30.83	23.8	39.26
1.2132	402.8	3.361	25.15	33.20	25.5	42.64

SODIUM THIOSULFATE

nsity of Aqueous Sodium Thiosulfate Solutions at $^{20}_{4}$° C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Na_2S_2O_3$ in solution expressed in			Per Cent $Na_2S_2O_3$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0065	10.07	0.08400	0.6284	1	0.9	1.30
1.0148	20.30	0.1694	1.267	2	2.1	2.96
1.0315	41.26	0.3443	2.576	4	4.4	6.30
1.0483	62.90	0.5249	3.927	6	6.7	9.66
1.0654	85.23	0.7113	5.321	8	8.9	13.08
1.0827	108.3	0.9036	6.759	10	11.1	16.54
1.1003	132.0	1.102	8.243	12	13.2	20.06
1.1182	156.5	1.306	9.773	14	15.3	23.64
1.1365	181.8	1.518	11.35	16	17.4	27.30
1.1551	207.9	1.735	12.98	18	19.5	31.02
1.1740	234.8	1.959	14.66	20	21.5	34.80
1.1932	262.5	2.191	16.39	22	23.5	38.64
1.2128	291.1	2.429	18.17	24	25.4	42.56
1.2328	320.5	2.675	20.01	26	27.4	46.56
1.2532	350.9	2.928	21.91	28	29.3	50.64
1.2739	382.2	3.189	23.86	30	31.2	54.78
1.3273	464.6	3.877	29.00	35	35.8	65.46
1.3827	553.1	4.616	34.53	40	40.1	76.54

Specific Gravity	Weight of $Na_2S_2O_3 \cdot 5H_2O$ in solution expressed in			Per Cent $Na_2S_2O_3 + 5H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0065	15.80	0.1318	0.9863	1.570	0.9	1.30
1.0148	31.86	0.2659	1.989	3.139	2.1	2.96
1.0315	64.77	0.5405	4.043	6.279	4.4	6.30
1.0483	98.73	0.8239	6.164	9.418	6.7	9.66
1.0654	133.8	1.117	8.352	12.56	8.9	13.08
1.0827	170.0	1.418	10.61	15.70	11.1	16.54
1.1003	207.3	1.730	12.94	18.84	13.2	20.06
1.1182	245.7	2.051	15.34	21.98	15.3	23.64
1.1365	285.4	2.382	17.82	25.12	17.4	27.30
1.1551	326.4	2.724	20.38	28.25	19.5	31.02
1.1740	368.6	3.076	23.01	31.39	21.5	34.80
1.1932	412.1	3.439	25.72	34.53	23.5	38.64
1.2128	456.9	3.813	28.52	37.67	25.4	42.56
1.2328	503.1	4.199	31.41	40.81	27.4	46.56
1.2532	550.8	4.597	34.39	43.95	29.3	50.64
1.2739	599.9	5.006	37.45	47.09	31.2	54.78
1.3273	729.2	6.086	45.52	54.94	35.8	65.46
1.3827	868.2	7.245	54.20	62.79	40.1	76.54

Density of Aqueous Sodium Thiosulfate Solutions at 19° C. Computed from the Values of Schiff.

Specific Gravity	Weight of $Na_2S_2O_3$ in solution expressed in			Per Cent $Na_2S_2O_3$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0052	6.404	0.05344	0.3998	0.6371	0.8	1.04
1.0105	12.87	0.1074	0.8038	1.274	1.5	2.10
1.0158	19.41	0.1620	1.212	1.911	2.3	3.16
1.0211	25.02	0.2171	1.624	2.548	3.0	4.22
1.0264	32.69	0.2728	2.041	3.185	3.7	5.28

SODIUM THIOSULFATE (Continued)

Specific Gravity	Weight of $Na_2S_2O_3$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2S_2O_3$	Degrees: Baumé	Twaddell
1.0317	39.44	0.3291	2.462	3.822	4.5	6.34
1.0370	46.24	0.3859	2.887	4.459	5.2	7.40
1.0423	53.12	0.4433	3.316	5.096	5.9	8.46
1.0476	60.06	0.5013	3.750	5.734	6.6	9.52
1.0529	67.08	0.5598	4.188	6.371	7.3	10.58
1.0584	74.17	0.6190	4.630	7.008	8.0	11.68
1.0639	81.33	0.6787	5.078	7.645	8.7	12.78
1.0695	88.57	0.7392	5.530	8.282	9.4	13.90
1.0751	95.89	0.8002	5.986	8.919	10.1	15.02
1.0807	103.3	0.8618	6.447	9.556	10.8	16.14
1.0863	110.7	0.9241	6.913	10.19	11.5	17.26
1.0919	118.3	0.9869	7.383	10.83	12.2	18.38
1.0975	125.9	1.050	7.857	11.47	12.9	19.50
1.1031	133.5	1.114	8.336	12.10	13.6	20.62
1.1087	141.3	1.179	8.819	12.74	14.2	21.74
1.1145	149.1	1.244	9.308	13.38	14.9	22.90
1.1204	157.0	1.310	9.803	14.02	15.6	24.08
1.1263	165.0	1.377	10.30	14.65	16.3	25.26
1.1322	173.1	1.445	10.81	15.29	16.9	26.44
1.1381	181.3	1.513	11.32	15.93	17.6	27.62
1.1440	189.5	1.581	11.83	16.56	18.3	28.80
1.1499	197.8	1.651	12.35	17.20	18.9	29.98
1.1558	206.2	1.721	12.87	17.84	19.5	31.16
1.1617	214.6	1.791	13.40	18.47	20.2	32.34
1.1676	223.1	1.862	13.93	19.11	20.8	33.52
1.1738	231.8	1.935	14.47	19.75	21.5	34.76
1.1800	240.6	2.008	15.02	20.39	22.1	36.00
1.1862	249.4	2.081	15.57	21.02	22.8	37.24
1.1924	258.3	2.155	16.12	21.66	23.4	38.48
1.1986	267.3	2.230	16.68	22.30	24.0	39.72
1.2048	276.3	2.306	17.25	22.93	24.7	40.96
1.2110	285.4	2.382	17.82	23.57	25.3	42.20
1.2172	294.7	2.459	18.40	24.21	25.9	43.44
1.2234	304.0	2.537	18.98	24.85	26.5	44.68
1.2297	313.4	2.615	19.56	25.48	27.1	45.94
1.2362	322.9	2.695	20.16	26.12	27.7	47.24
1.2427	332.5	2.775	20.76	26.76	28.3	48.54
1.2492	342.2	2.856	21.36	27.39	28.9	49.84
1.2558	352.0	2.938	21.98	28.03	29.5	51.16
1.2624	361.9	3.020	22.59	28.67	30.1	52.48
1.2690	371.9	3.103	23.22	29.30	30.7	53.80
1.2756	381.9	3.187	23.84	29.94	31.3	55.12
1.2822	392.1	3.272	24.48	30.58	31.9	56.44
1.2888	402.3	3.357	25.12	31.22	32.5	57.76
1.2954	412.6	3.444	25.76	31.85	33.1	59.08

Density of Aqueous Sodium Thiosulfate Solutions at 19° C Computed from the Values of Schiff.

Specific Gravity	Weight of $Na_2S_2O_3 \cdot 5H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Na_2S_2O_3$ $+5H_2O$	Degrees: Baumé	Twaddell
1.0052	10.05	0.08389	0.6275	1	0.8	1.04
1.0105	20.21	0.1687	1.262	2	1.5	2.10
1.0158	30.47	0.2543	1.902	3	2.3	3.16
1.0211	40.84	0.3409	2.550	4	3.0	4.22

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SODIUM THIOSULFATE (Continued)

Specific Gravity	Weight of $Na_2S_2O_3 \cdot 5H_2O$ in solution expressed in			Per Cent $Na_2S_2O_3$ $+5H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baume	Twaddell
1.0264	51.32	0.4283	3.204	5	3.7	5.28
1.0317	61.90	0.5166	3.865	6	4.5	6.34
1.0370	72.59	0.6058	4.532	7	5.2	7.40
1.0423	83.38	0.6959	5.206	8	5.9	8.46
1.0476	94.28	0.7868	5.886	9	6.6	9.52
1.0529	105.3	0.8787	6.573	10	7.3	10.58
1.0584	116.4	0.9716	7.268	11	8.0	11.68
1.0639	127.7	1.065	7.970	12	8.7	12.78
1.0695	139.0	1.160	8.680	13	9.4	13.90
1.0751	150.5	1.256	9.397	14	10.1	15.02
1.0807	162.1	1.353	10.12	15	10.8	16.14
1.0863	173.8	1.450	10.85	16	11.5	17.26
1.0919	185.6	1.549	11.59	17	12.2	18.38
1.0975	197.6	1.649	12.33	18	12.9	19.50
1.1031	209.6	1.749	13.08	19	13.6	20.62
1.1087	221.7	1.851	13.84	20	14.2	21.74
1.1145	234.0	1.953	14.61	21	14.9	22.90
1.1204	246.5	2.057	15.39	22	15.6	24.08
1.1263	259.0	2.162	16.17	23	16.3	25.26
1.1322	271.7	2.268	16.96	24	16.9	26.44
1.1381	284.5	2.374	17.76	25	17.6	27.62
1.1440	297.4	2.482	18.57	26	18.3	28.80
1.1499	310.5	2.591	19.38	27	18.9	29.98
1.1558	323.6	2.701	20.20	28	19.5	31.16
1.1617	336.9	2.812	21.03	29	20.2	32.34
1.1676	350.3	2.923	21.87	30	20.8	33.52
1.1736	363.9	3.037	22.72	31	21.5	34.76
1.1800	377.6	3.151	23.57	32	22.1	36.00
1.1862	391.4	3.267	24.44	33	22.8	37.24
1.1924	405.4	3.383	25.31	34	23.4	38.48
1.1986	419.5	3.501	26.19	35	24.0	39.72
1.2048	433.7	3.620	27.08	36	24.7	40.96
1.2110	448.1	3.739	27.97	37	25.3	42.20
1.2172	462.5	3.860	28.88	38	25.9	43.44
1.2234	477.1	3.982	29.79	39	26.5	44.68
1.2297	491.9	4.105	30.71	40	27.1	45.94
1.2362	506.8	4.230	31.64	41	27.7	47.24
1.2427	521.9	4.356	32.58	42	28.3	48.54
1.2492	537.2	4.483	33.53	43	28.9	49.84
1.2558	552.6	4.611	34.50	44	29.5	51.16
1.2624	568.1	4.741	35.47	45	30.1	52.48
1.2690	583.7	4.872	36.44	46	30.7	53.80
1.2756	599.5	5.003	37.43	47	31.3	55.12
1.2822	615.5	5.136	38.42	48	31.9	56.44
1.2888	631.5	5.270	39.43	49	32.5	57.76
1.2954	647.7	5.405	40.44	50	33.1	59.08

STANNIC CHLORIDE

Density of Aqueous Stannic Chloride Solutions at $\frac{15^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $SnCl_4$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $SnCl_4$	Degrees: Baumé	Twaddell
1.007	10.07	0.08404	0.6287	1	1.0	1.4
1.015	20.30	0.1694	1.267	2	2.1	3.0
1.031	41.24	0.3442	2.575	4	4.4	6.2
1.047	62.82	0.5243	3.922	6	6.5	9.4
1.064	85.12	0.7104	5.314	8	8.7	12.8
1.081	108.1	0.9021	6.749	10	10.9	16.2
1.099	131.9	1.101	8.233	12	13.1	19.8
1.117	156.4	1.305	9.763	14	15.2	23.4
1.135	181.6	1.516	11.34	16	17.2	27.0
1.154	207.7	1.734	12.97	18	19.4	30.8
1.173	234.6	1.958	14.65	20	21.4	34.6
1.192	262.2	2.188	16.37	22	23.4	38.4
1.212	290.9	2.428	18.16	24	25.4	42.4
1.233	320.6	2.675	20.01	26	27.4	46.6
1.255	351.4	2.933	21.94	28	29.5	51.0
1.278	383.4	3.200	23.94	30	31.5	55.6
1.337	468.0	3.905	29.21	35	36.6	67.4
1.403	561.2	4.683	35.04	40	41.7	80.6
1.475	663.8	5.539	41.44	45	46.7	95.0
1.555	777.5	6.489	48.54	50	51.8	111.0
1.644	904.2	7.546	56.45	55	56.8	128.8
1.742	1045	8.723	65.25	60	61.8	148.4
1.851	1203	10.04	75.11	65	66.7	170.2
1.971	1380	11.51	86.13	70	71.4	194.2

Specific Gravity	Weight of $SnCl_4 \cdot 5H_2O$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $SnCl_4 + 5H_2O$	Degrees: Baumé	Twaddell
1.007	13.55	0.1131	0.8460	1.346	1.0	1.4
1.015	27.32	0.2280	1.706	2.692	2.1	3.0
1.031	55.50	0.4632	3.465	5.383	4.4	6.2
1.047	84.54	0.7055	5.278	8.075	6.5	9.4
1.064	114.6	0.9560	7.151	10.77	8.7	12.8
1.081	145.5	1.214	9.082	13.46	10.9	16.2
1.099	177.5	1.481	11.08	16.15	13.1	19.8
1.117	210.4	1.756	13.14	18.84	15.2	23.4
1.135	244.4	2.040	15.26	21.53	17.2	27.0
1.154	279.5	2.333	17.45	24.22	19.4	30.8
1.173	315.7	2.635	19.71	26.92	21.4	34.6
1.192	352.9	2.945	22.03	29.61	23.4	38.4
1.212	391.5	3.267	24.44	32.30	25.4	42.4
1.233	431.4	3.600	26.93	34.99	27.4	46.6
1.255	472.9	3.947	29.52	37.68	29.5	51.0
1.278	516.0	4.306	32.21	40.37	31.5	55.6
1.337	629.7	5.255	39.31	47.10	36.6	67.4
1.403	755.2	6.303	47.15	53.83	41.7	80.6
1.475	893.2	7.454	55.77	60.56	46.7	95.0
1.555	1046	8.732	65.32	67.29	51.8	111.0
1.644	1217	10.15	75.97	74.02	56.8	128.8
1.742	1407	11.74	87.81	80.75	61.8	148.4
1.851	1619	13.51	101.1	87.47	66.7	170.2
1.971	1857	15.50	115.9	94.20	71.4	194.2

STANNOUS CHLORIDE

Density of Aqueous Stannous Chloride Solutions at $\frac{15^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $SnCl_2$ in solution expressed in			Per Cent $SnCl_2$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0068	10.07	0.08402	0.6285	1	1.0	1.36
1.0146	20.29	0.1693	1.267	2	2.1	2.92
1.0306	41.22	0.3440	2.574	4	4.3	6.12
1.0470	62.82	0.5243	3.922	6	6.5	9.40
1.0638	85.10	0.7102	5.313	8	8.7	12.76
1.0810	108.1	0.9021	6.749	10	10.9	16.20
1.0986	131.8	1.100	8.230	12	13.0	19.72
1.1167	156.3	1.305	9.760	14	15.2	23.34
1.1353	181.6	1.516	11.34	16	17.3	27.06
1.1545	207.8	1.734	12.97	18	19.4	30.90
1.1743	234.9	1.960	14.66	20	21.5	34.86
1.1948	262.9	2.194	16.41	22	23.6	38.96
1.2159	291.8	2.435	18.22	24	25.8	43.18
1.2377	321.8	2.686	20.09	26	27.8	47.54
1.2603	352.9	2.945	22.03	28	29.9	52.06
1.2837	385.1	3.214	24.04	30	32.0	56.74
1.3461	471.1	3.932	29.41	35	37.3	69.22
1.4145	565.8	4.722	35.32	40	42.5	82.90
1.4897	670.4	5.594	41.85	45	47.7	97.94
1.5729	786.5	6.563	49.10	50	52.8	114.58
1.6656	916.1	7.645	57.19	55	57.9	133.12
1.7695	1062	8.860	66.28	60	63.1	153.90
1.8865	1226	10.23	76.55	65	68.1	177.30

Specific Gravity	Weight of $SnCl_2 \cdot 2H_2O$ in solution expressed in			Per Cent $SnCl_4 + 2H_2O$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0068	11.98	0.09999	0.7480	1.190	1.0	1.36
1.0146	24.15	0.2015	1.508	2.380	2.1	2.92
1.0306	49.06	0.4094	3.063	4.760	4.3	6.12
1.0470	74.76	0.6239	4.667	7.140	6.5	9.40
1.0638	101.3	0.8452	6.323	9.521	8.7	12.76
1.0810	128.6	1.074	8.031	11.90	10.9	16.20
1.0986	156.9	1.309	9.795	14.28	13.0	19.72
1.1167	186.1	1.553	11.62	16.66	15.2	23.34
1.1353	216.2	1.804	13.50	19.04	17.3	27.06
1.1545	247.3	2.064	15.44	21.42	19.4	30.90
1.1743	279.5	2.333	17.45	23.80	21.5	34.86
1.1948	312.8	2.611	19.53	26.18	23.6	38.96
1.2159	347.3	2.898	21.68	28.56	25.8	43.18
1.2377	383.0	3.196	23.91	30.94	27.8	47.54
1.2603	420.0	3.505	26.22	33.32	29.9	52.06
1.2837	458.3	3.825	28.61	35.70	32.0	56.74
1.3461	560.7	4.679	35.00	41.65	37.3	69.22
1.4145	673.3	5.619	42.04	47.60	42.5	82.90
1.4897	797.8	6.658	49.81	53.55	47.7	97.94
1.5729	935.9	7.811	58.43	59.50	52.8	114.58
1.6656	1090	9.098	68.06	65.45	57.9	133.12
1.7695	1263	10.54	78.88	71.40	63.1	153.90
1.8865	1459	12.18	91.10	77.35	68.1	177.30

SUCROSE

Density of Aqueous Sucrose Solutions at $\frac{20^{\circ}}{4^{\circ}}$ C. Computed from the Values of Plato.

Specific Gravity	Weight of $C_{12}H_{22}O_{11}$ in solution expressed in			Per Cent $C_{12}H_{22}O_{11}$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
0.9982	.....	......	.....	0	.....	.....
1.0021	10.02	0.08363	0.6256	1	0.3	0.42
1.0060	20.12	0.1679	1.256	2	0.9	1.20
1.0099	30.30	0.2528	1.891	3	1.4	1.98
1.0139	40.56	0.3385	2.532	4	2.0	2.78
1.0179	50.90	0.4247	3.177	5	2.5	3.58
1.0219	61.31	0.5117	3.828	6	3.1	4.38
1.0259	71.81	0.5993	4.483	7	3.7	5.18
1.0299	82.39	0.6876	5.144	8	4.2	5.98
1.0340	93.06	0.7766	5.810	9	4.8	6.80
1.0381	103.8	0.8663	6.481	10	5.3	7.62
1.0423	114.7	0.9568	7.158	11	5.9	8.46
1.0465	125.6	1.048	7.840	12	6.4	9.30
1.0507	136.6	1.140	8.527	13	7.0	10.14
1.0549	147.7	1.232	9.220	14	7.6	10.98
1.0592	158.9	1.326	9.919	15	8.1	11.84
1.0635	170.2	1.420	10.62	16	8.7	12.70
1.0678	181.5	1.515	11.33	17	9.2	13.56
1.0721	193.0	1.610	12.05	18	9.7	14.42
1.0765	204.5	1.707	12.77	19	10.3	15.30
1.0810	216.2	1.804	13.50	20	10.9	16.20
1.0854	227.9	1.902	14.23	21	11.4	17.08
1.0899	239.8	2.001	14.97	22	12.0	17.98
1.0944	251.7	2.101	15.71	23	12.5	18.88
1.0990	263.8	2.201	16.47	24	13.1	19.80
1.1036	275.9	2.302	17.22	25	13.6	20.72
1.1082	288.1	2.405	17.99	26	14.2	21.64
1.1128	300.5	2.507	18.76	27	14.7	22.56
1.1175	312.9	2.611	19.53	28	15.2	23.50
1.1222	325.4	2.716	20.32	29	15.8	24.44
1.1270	338.1	2.822	21.11	30	16.3	25.40
1.1318	350.9	2.928	21.90	31	16.9	26.36
1.1366	363.7	3.035	22.71	32	17.4	27.32
1.1415	376.7	3.144	23.52	33	18.0	28.30
1.1463	389.7	3.253	24.33	34	18.5	29.26
1.1513	403.0	3.363	25.16	35	19.1	30.26
1.1562	416.2	3.474	25.99	36	19.6	31.24
1.1612	429.6	3.586	26.82	37	20.1	32.24
1.1663	443.2	3.699	27.67	38	20.7	33.26
1.1713	456.8	3.812	28.52	39	21.2	34.26
1.1764	470.6	3.927	29.38	40	21.7	35.28
1.1816	484.5	4.043	30.24	41	22.3	36.32
1.1868	498.5	4.160	31.12	42	22.8	37.36
1.1920	512.6	4.278	32.00	43	23.4	38.40
1.1972	526.8	4.396	32.89	44	23.9	39.44
1.2025	541.1	4.516	33.78	45	24.4	40.50
1.2079	555.6	4.637	34.69	46	25.0	41.58
1.2132	570.2	4.759	35.60	47	25.5	42.64
1.2186	584.9	4.881	36.52	48	26.0	43.72
1.2241	599.8	5.006	37.45	49	26.5	44.82
1.2296	614.8	5.131	38.38	50	27.1	45.92
1.2351	629.9	5.257	39.32	51	27.6	47.02
1.2406	645.1	5.384	40.27	52	28.1	48.12
1.2462	660.5	5.512	41.23	53	28.6	49.24
1.2519	676.0	5.642	42.20	54	29.2	50.38
1.2575	691.6	5.772	43.18	55	29.7	51.50

(Completed on following page.)

SUCROSE (Continued)

	Weight of $C_{12}H_{22}O_{11}$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $C_{12}H_{22}O_{11}$	Baumé	Twaddell
1.2632	707.4	5.903	44.16	56	30.2	52.64
1.2690	723.3	6.036	45.16	57	30.7	53.80
1.2748	739.4	6.170	46.16	58	31.3	54.96
1.2806	755.6	6.305	47.17	59	31.8	56.12
1.2865	771.9	6.442	48.19	60	32.3	57.30
1.2924	788.4	6.579	49.22	61	32.8	58.48
1.2983	804.9	6.718	50.25	62	33.3	59.66
1.3043	821.7	6.857	51.30	63	33.8	60.86
1.3103	838.6	6.998	52.35	64	34.3	62.06
1.3163	855.6	7.140	53.41	65	34.8	63.26
1.3224	872.8	7.284	54.49	66	35.3	64.48
1.3286	890.2	7.429	55.57	67	35.9	65.72
1.3347	907.6	7.574	56.66	68	36.4	66.94
1.3409	925.2	7.721	57.76	69	36.9	68.18
1.3472	943.0	7.870	58.87	70	37.4	69.44
1.3535	961.0	8.020	59.99	71	37.9	70.70
1.3598	979.1	8.171	61.12	72	38.4	71.96
1.3661	997.3	8.322	62.26	73	38.9	73.22
1.3725	1016	8.476	63.41	74	39.4	74.50
1.3790	1034	8.631	64.57	75	39.9	75.80
1.3854	1053	8.787	65.73	76	40.3	77.08
1.3920	1072	8.945	66.91	77	40.8	78.40
1.3985	1091	9.103	68.10	78	41.3	79.70
1.4051	1110	9.264	69.30	79	41.8	81.02
1.4117	1129	9.425	70.51	80	42.3	82.34
1.4184	1149	9.588	71.73	81	42.8	83.68
1.4251	1169	9.752	72.95	82	43.2	85.02
1.4318	1188	9.918	74.19	83	43.7	86.36
1.4386	1208	10.08	75.44	84	44.2	87.72
1.4454	1229	10.25	76.70	85	44.7	89.08
1.4522	1249	10.42	77.97	86	45.1	90.44
1.4591	1269	10.59	79.25	87	45.6	91.82
1.4660	1290	10.77	80.54	88	46.1	93.20
1.4730	1311	10.94	81.84	89	46.6	94.60
1.4800	1332	11.12	83.16	90	47.0	96.00
1.4870	1353	11.29	84.48	91	47.5	97.40
1.4941	1375	11.47	85.81	92	48.0	98.82
1.5012	1396	11.65	87.16	93	48.4	100.24
1.5083	1418	11.83	88.51	94	48.9	101.66
1.5155	1440	12.02	89.88	95	49.3	103.10
1.5227	1462	12.20	91.26	96	49.8	104.54
1.5299	1484	12.38	92.65	97	50.2	105.98
1.5372	1506	12.57	94.05	98	50.7	107.44
1.5445	1529	12.76	95.46	99	51.1	108.90
1.5518	1552	12.95	96.88	100	51.6	110.36

SULFURIC ACID

Specific Gravity of Aqueous Sulfuric Acid Solutions Adopted 1904 as Standard by the Manufacturing Chemists' Association of the United States.

Authorities: W. C. Ferguson; H. P. Talbot.

Specific Gravity determinations were made at 60° F., compared with water at 60°F. From the Specific Gravities, the corresponding degrees Baumé were calculated by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}$$

SULFURIC ACID (Continued)

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should always be printed on the scale.

66° Baumé = Sp. Gr. 1.8354.

1 cu. ft. water at 60° F. weighs 62.37 lbs. avoirdupois.

Atomic weights from F. W. Clarke's table of 1901. O = 16.

H_2SO_4 = 100 per cent

	H_2SO_4	O. V.	60°
O. V.	93.19	100.00	119.98
60°	77.67	83.35	100.00
50°	62.18	66.72	80.06

Acids stronger than 66° Bé should have their percentage compositions determined by chemical analysis.

* Calculated from Pickering's results, Journal of London Chemical Society, vol. 57, p. 363.

Be°	Sp. Gr.	Tw.°	Per Cent H_2SO_4	Weight of 1 cu.ft. in lbs. Av.	Per Cent O. V.	Pounds O. V. in 1 cu. ft.	*Freezing (Melting) Point
0	1.0000	0.0	0.00	62.37	0.00	0.00	32.0° F.
1	1.0069	1.4	1.02	62.80	1.09	0.68	31.2° F.
2	1.0140	2.8	2.08	63.24	2.23	1.41	30.5° F.
3	1.0211	4.2	3.13	63.69	3.36	2.14	29.8° F.
4	1.0284	5.7	4.21	64.14	4.52	2.90	28.9° F.
5	1.0357	7.1	5.28	64.60	5.67	3.66	28.1° F.
6	1.0432	8.6	6.37	65.06	6.84	4.45	27.2° F.
7	1.0507	10.1	7.45	65.53	7.99	5.24	26.3° F.
8	1.0584	11.7	8.55	66.01	9.17	6.06	25.1° F.
9	1.0662	13.2	9.66	66.50	10.37	6.89	24.0° F.
10	1.0741	14.8	10.77	66.99	11.56	7.74	22.8° F.
11	1.0821	16.4	11.89	67.49	12.76	8.61	21.5° F.
12	1.0902	18.0	13.01	68.00	13.96	9.49	20.0° F.
13	1.0985	19.7	14.13	68.51	15.16	10.39	18.3° F.
14	1.1069	21.4	15.25	69.04	16.36	11.30	16.6° F.
15	1.1154	23.1	16.38	69.57	17.58	12.23	14.7° F.
16	1.1240	24.8	17.53	70.10	18.81	13.19	12.6° F.
17	1.1328	26.6	18.71	70.65	20.08	14.18	10.2° F.
18	1.1417	28.3	19.89	71.21	21.34	15.20	7.7° F.
19	1.1508	30.2	21.07	71.78	22.61	16.23	4.8° F.
20	1.1600	32.0	22.25	72.35	23.87	17.27	+ 1.6° F.
21	1.1694	33.9	23.43	72.94	25.14	18.34	— 1.8° F.
22	1.1789	35.8	24.61	73.53	26.41	19.42	— 6.0° F.
23	1.1885	37.7	25.81	74.13	27.69	20.53	—11 ° F.
24	1.1983	39.7	27.03	74.74	29.00	21.68	—16 ° F.
25	1.2083	41.7	28.28	75.36	30.34	22.87	—23 ° F.
26	1.2185	43.7	29.53	76.00	31.69	24.08	—30 ° F.
27	1.2288	45.8	30.79	76.64	33.04	25.32	—39 ° F.
28	1.2393	47.9	32.05	77.30	34.39	26.58	—49 ° F.
29	1.2500	50.0	33.33	77.96	35.76	27.88	—61 ° F.
30	1.2609	52.2	34.63	78.64	37.16	29.22	—74 ° F.
31	1.2719	54.4	35.93	79.33	38.55	30.58	—82 ° F.
32	1.2832	56.6	37.26	80.03	39.98	32.00	—96 ° F.
33	1.2946	58.9	38.58	80.74	41.40	33.42	—97 ° F.
34	1.3063	61.3	39.92	81.47	42.83	34.90	—91 ° F.
35	1.3182	63.6	41.27	82.22	44.28	36.41	—81 ° F.
36	1.3303	66.1	42.63	82.97	45.74	37.95	—70 ° F.
37	1.3426	68.5	43.99	83.74	47.20	39.53	—60 ° F.
38	1.3551	71.0	45.35	84.52	48.66	41.13	—53 ° F.
39	1.3679	73.6	46.72	85.32	50.13	42.77	—47 ° F.
40	1.3810	76.2	48.10	86.13	51.61	44.45	—41 ° F.
41	1.3942	78.8	49.47	86.96	53.08	46.16	—35 ° F.
42	1.4078	81.6	50.87	87.80	54.58	47.92	—31 ° F.
43	1.4216	84.3	52.26	88.67	56.07	49.72	—27 ° F.
44	1.4356	87.1	53.66	89.54	57.58	51.56	—23 ° F.

(Continued on following page.)

SULFURIC ACID (Continued)

Be°	Sp. Gr.	Tw.°	Per Cent H_2SO_4	Weight of 1 cu.ft. in lbs. Av.	Per Cent O. V.	Pounds O. V. in 1 cu. ft.	*Freezing (Melting) Point
45	1.4500	90.0	55.07	90.44	59.09	53.44	—20 ° F.
46	1.4646	92.9	56.48	91.35	60.60	55.36	—14 ° F.
47	1.4796	95.9	57.90	92.28	62.13	57.33	—15 ° F.
48	1.4948	99.0	59.32	93.23	63.65	59.34	—18 ° F.
49	1.5104	102.1	60.75	94.20	65.18	61.40	—22 ° F.
50	1.5263	105.3	62.18	95.20	66.72	63.52	—27 ° F.
51	1.5426	108.5	63.66	96.21	68.31	65.72	—33 ° F.
52	1.5591	111.8	65.13	97.24	69.89	67.96	—39 ° F.
53	1.5761	115.2	66.63	98.30	71.50	70.28	—49 ° F.
54	1.5934	118.7	68.13	99.38	73.11	72.66	—59 ° F.
55	1.6111	122.2	69.65	100.48	74.74	75.10	.. Below —40
56	1.6292	125.8	71.17	101.61	76.37	77.60	..
57	1.6477	129.5	72.75	102.77	78.07	80.23	..
58	1.6667	133.3	74.36	103.95	79.79	82.95	..
59	1.6860	137.2	75.99	105.16	81.54	85.75	— 7
60	1.7059	141.2	77.67	106.40	83.35	88.68	+12.6° F.
61	1.7262	145.2	79.43	107.66	85.23	91.76	27.3° F.
62	1.7470	149.4	81.30	108.96	87.24	95.06	39.1° F.
63	1.7683	153.7	83.34	110.29	89.43	98.63	46.1° F.
64	1.7901	158.0	85.66	111.65	91.92	102.63	46.4° F.
64¼	1.7957	159.1	86.33	112.00	92.64	103.75	43.6° F.
64½	1.8012	160.2	87.04	112.34	93.40	104.93	41.1° F.
64¾	1.8068	161.4	87.81	112.69	94.23	106.19	37.9° F.
65	1.8125	162.5	88.65	113.05	95.13	107.54	33.1° F.
65¼	1.8182	163.6	89.55	113.40	96.10	108.97	24.6° F.
65½	1.8239	164.8	90.60	113.76	97.22	110.60	13.4° F.
65¾	1.8297	165.9	91.80	114.12	98.51	112.42	— 1 ° F.
66	1.8354	167.1	93.19	114.47	100.00	114.47	—29 ° F.

APPROXIMATE BOILING POINTS

50° Bé, 295° F.
60° Bé, 386° F.
61° Bé, 400° F.
62° Bé, 415° F.
63° Bé, 432° F.
64° Bé, 451° F.
65° Bé, 485° F.
66° Bé, 538° F.

FIXED POINTS

Sp. Gr.	Per Cent H_2SO_4	Sp. Gr.	Per Cent H_2SO_4
1.0000	.00	1.5281	62.34
1.0048	.71	1.5440	63.79
1.0347	5.14	1.5748	66.51
1.0649	9.48	1.6272	71.00
1.0992	14.22	1.6679	74.46
1.1353	19.04	1.7044	77.54
1.1736	23.94	1.7258	79.40
1.2105	28.55	1.7472	81.32
1.2513	33.49	1.7700	83.47
1.2951	38.64	1.7959	86.36
1.3441	44.15	1.8117	88.53
1.3947	49.52	1.8194	89.75
1.4307	53.17	1.8275	91.32
1.4667	56.68	1.8354	93.19
1.4822	58.14		

ALLOWANCE FOR TEMPERATURE

At 10° Bé, .029° Bé or .00023 Sp. Gr.= 1° F.
At 20° Bé, .036° Bé or .00034 Sp. Gr.= 1° F.
At 30° Bé, .035° Bé or .00039 Sp. Gr.= 1° F.
At 40° Bé, .031° Bé or .00041 Sp. Gr.= 1° F.
At 50° Bé, .028° Bé or .00045 Sp. Gr.= 1° F.
At 60° Bé, .026° Bé or .00053 Sp. Gr.= 1° F.
At 63° Bé. .026° Bé or .00057 Sp. Gr.= 1° F.
At 66° Bé, .0235°Bé or .00054 Sp. Gr.= 1° F.

Per Cent 60°	Pounds 60° in 1 cu. ft.	Per Cent 50°	Pounds 50° in 1 cu. ft.
61.93	53.34	77.36	66.63
63.69	55.39	79.56	69.19
65.50	57.50	81.81	71.83
67.28	59.66	84.05	74.53
69.09	61.86	86.30	77.27
70.90	64.12	88.56	80.10
72.72	66.43	90.83	82.98
74.55	68.79	93.12	85.93
76.37	71.20	95.40	88.94
78.22	73.68	97.70	92.03
80.06	76.21	100.00	95.20
81.96	78.85	102.38	98.50
83.86	81.54	104.74	101.85
85.79	84.33	107.15	105.33
87.72	87.17	109.57	108.89
89.67	90.10	112.01	112.55
91.63	93.11	114.46	116.30
93.67	96.26	117.00	120.24
95.74	99.52	119.59	124.31
97.84	102.89	122.21	128.52
100.00	106.40	124.91	132.91
102.27	110.10	127.74	137.52
104.67	114.05	130.75	142.47
107.30	118.34	134.03	147.82
110.29	123.14	137.76	153.81
111.15	124.49	138.84	155.50
112.06	125.89	139.98	157.25
113.05	127.40	141.22	159.14
114.14	129.03	142.57	161.17
115.30	130.75	144.02	163.32
116.65	132.70	145.71	165.76
118.19	134.88	147.63	168.48
119.98	137.34	149.87	171.56

SULFURIC ACID

Density of Aqueous Sulfuric Acid Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of H_2SO_4 in solution expressed in					Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	N	%	Baumé	Twaddell
1.0051	10.05	0.08388	0.6275	0.205	1	0.7	1.02
1.0118	20.24	0.1689	1.263	0.413	2	1.7	2.36
1.0184	30.55	0.2550	1.907	0.623	3	2.6	3.68
1.0250	41.00	0.3422	2.560	0.836	4	3.5	5.00
1.0317	51.59	0.4305	3.220	1.05	5	4.5	6.34
1.0385	62.31	0.5200	3.890	1.27	6	5.4	7.70
1.0453	73.17	0.6106	4.568	1.49	7	6.3	9.06
1.0522	84.18	0.7025	5.255	1.72	8	7.2	10.44
1.0591	95.32	0.7955	5.951	1.94	9	8.1	11.82
1.0661	106.6	0.8897	6.656	2.17	10	9.0	13.22
1.0731	118.0	0.9851	7.369	2.41	11	9.9	14.62
1.0802	129.6	1.082	8.092	2.64	12	10.8	16.04
1.0874	141.4	1.180	8.825	2.88	13	11.7	17.48
1.0947	153.3	1.279	9.568	3.13	14	12.5	18.94
1.1020	165.3	1.379	10.32	3.37	15	13.4	20.40
1.1094	177.5	1.481	11.08	3.62	16	14.3	21.88
1.1168	189.9	1.584	11.85	3.87	17	15.2	23.36
1.1243	202.4	1.689	12.63	4.13	18	16.0	24.86
1.1318	215.0	1.795	13.43	4.38	19	16.9	26.36
1.1394	227.9	1.902	14.23	4.65	20	17.7	27.88
1.1471	240.9	2.010	15.04	4.91	21	18.6	29.42
1.1548	254.1	2.120	15.86	5.18	22	19.4	30.96
1.1626	267.4	2.232	16.69	5.45	23	20.3	32.52
1.1704	280.9	2.344	17.54	5.73	24	21.1	34.08
1.1783	294.6	2.458	18.39	6.01	25	21.9	35.66
1.1862	308.4	2.574	19.25	6.29	26	22.8	37.24
1.1942	322.4	2.691	20.13	6.57	27	23.6	38.84
1.2023	336.6	2.809	21.02	6.86	28	24.4	40.46
1.2104	351.0	2.929	21.91	7.16	29	25.2	42.08
1.2185	365.6	3.051	22.82	7.46	30	26.0	43.70
1.2267	380.3	3.174	23.74	7.76	31	26.8	45.34
1.2349	395.2	3.298	24.67	8.06	32	27.6	46.98
1.2432	410.3	3.424	25.61	8.37	33	28.4	48.64
1.2515	425.5	3.551	26.56	8.68	34	29.1	50.30
1.2599	441.0	3.680	27.53	8.99	35	29.9	51.98
1.2684	456.6	3.811	28.51	9.31	36	30.7	53.68
1.2769	472.5	3.943	29.50	9.64	37	31.4	55.38
1.2855	488.5	4.077	30.50	9.96	38	32.2	57.10
1.2941	504.7	4.212	31.51	10.3	39	33.0	58.82
1.3028	521.1	4.349	32.53	10.6	40	33.7	60.56
1.3116	537.8	4.488	33.57	11.0	41	34.5	62.32
1.3205	554.6	4.628	34.62	11.3	42	35.2	64.10
1.3294	571.6	4.771	35.69	11.7	43	35.9	65.88
1.3384	588.9	4.915	36.76	12.0	44	36.7	67.68
1.3476	606.4	5.061	37.86	12.4	45	37.4	69.52
1.3569	624.2	5.209	38.97	12.7	46	38.1	71.38
1.3663	642.2	5.359	40.09	13.1	47	38.9	73.26
1.3758	660.4	5.511	41.23	13.5	48	39.6	75.16
1.3854	678.8	5.665	42.38	13.8	49	40.3	77.08
1.3951	697.6	5.821	43.55	14.2	50	41.1	79.02
1.4049	716.5	5.979	44.73	14.6	51	41.8	80.98
1.4148	735.7	6.140	45.93	15.0	52	42.5	82.96
1.4248	755.1	6.302	47.14	15.4	53	43.2	84.96
1.4350	774.9	6.467	48.38	15.8	54	44.0	87.00
1.4453	794.9	6.634	49.63	16.2	55	44.7	89.06

(*Completed on following page.*)

SULFURIC ACID (Continued)

Specific Gravity	Weight of H_2SO_4 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	*N*	%	Degrees: Baumé	Twaddell
1.4557	815.2	6.803	50.89	16.6	56	45.4	91.14
1.4662	835.7	6.975	52.17	17.0	57	46.1	93.24
1.4768	856.5	7.148	53.47	17.5	58	46.8	95.36
1.4875	877.6	7.324	54.79	17.9	59	47.5	97.50
1.4983	899.0	7.502	56.12	18.3	60	48.2	99.66
1.5091	920.6	7.682	57.47	18.8	61	48.9	101.82
1.5200	942.4	7.865	58.83	19.2	62	49.6	104.00
1.5310	964.5	8.049	60.22	19.7	63	50.3	106.20
1.5421	986.9	8.236	61.61	20.1	64	51.0	108.42
1.5533	1010	8.426	63.03	20.6	65	51.7	110.66
1.5646	1033	8.618	64.47	21.1	66	52.3	112.92
1.5760	1056	8.812	65.92	21.5	67	53.0	115.20
1.5874	1079	9.008	67.39	22.0	68	53.7	117.48
1.5989	1103	9.207	68.88	22.5	69	54.3	119.78
1.6105	1127	9.408	70.38	23.0	70	55.0	122.10
1.6221	1152	9.611	71.90	23.5	71	55.6	124.42
1.6338	1176	9.817	73.44	24.0	72	56.3	126.76
1.6456	1201	10.03	75.00	24.5	73	56.9	129.12
1.6574	1226	10.24	76.57	25.0	74	57.5	131.48
1.6692	1252	10.45	78.16	25.5	75	58.1	133.84
1.6810	1278	10.66	79.76	26.1	76	58.7	136.20
1.6927	1303	10.88	81.37	26.6	77	59.3	138.54
1.7043	1329	11.09	82.99	27.1	78	59.9	140.86
1.7158	1355	11.31	84.62	27.6	79	60.5	143.16
1.7272	1382	11.53	86.26	28.2	80	61.1	145.44
1.7383	1408	11.75	87.90	28.7	81	61.6	147.66
1.7491	1434	11.97	89.54	29.2	82	62.1	149.82
1.7594	1460	12.19	91.17	29.8	83	62.6	151.88
1.7693	1486	12.40	92.78	30.3	84	63.0	153.86
1.7786	1512	12.62	94.38	30.8	85	63.5	155.72
1.7872	1537	12.83	95.95	31.3	86	63.9	157.44
1.7951	1562	13.03	97.50	31.9	87	64.2	159.02
1.8022	1586	13.24	99.01	32.3	88	64.5	160.44
1.8087	1610	13.43	100.5	32.8	89	64.8	161.74
1.8144	1633	13.63	101.9	33.3	90	65.1	162.88
1.8195	1656	13.82	103.4	33.8	91	65.3	163.90
1.8240	1678	14.00	104.8	34.2	92	65.5	164.80
1.8279	1700	14.19	106.1	34.7	93	65.7	165.58
1.8312	1721	14.37	107.5	35.1	94	65.8	166.24
1.8337	1742	14.54	108.8	35.5	95	65.9	166.74
1.8355	1762	14.71	110.0	35.9	96	66.0	167.10
1.8364	1781	14.87	111.2	36.3	97	66.0	167.28
1.8361	1799	15.02	112.3	36.7	98	66.0	167.22
1.8342	1816	15.15	113.4	37.0	99	65.9	166.84
1.8305	1831	15.28	114.3	37.3	100	65.8	166.10

FUMING SULFURIC ACID

This table may be used in calculating the quantity of concentrated sulfuric acid to be added to an oleum to obtain an oil of any desired lower strength in free SO_3. Gerster (*Chem. Zeit.* **11**, 3 (1887)) gives the following formula for this purpose: $x = 100(b - a)/(a - c)$, where x represents the quantity of sulfuric acid to be added to 100 parts of the oleum, a the total SO_3 per 100 parts of the acid desired, b the total SO_3 per 100 parts of the original strong oleum, and c the SO_3 per 100 parts of the acid used for dilution. The values for a and b are taken from the table; c is obtained by multiplying the percentage of H_2SO_4 present in the acid used for dilution by 0.816

				Equivalent to			
Sp Gr 35°/15°	°Be	% Free SO_3	%H_2SO_4	Total SO_3	100% H_2SO_4	98% H_2SO_4	93.19% (66° Be) H_2SO_4
1.8186	65.3	0	100	81.63	100.00	102.04	107.31
1.8228	65.5	1	99	81.82	100.23	102.27	107.55
1.8270	65.6	2	98	82.00	100.45	102.50	107.79
1.8315	65.8	3	97	82.18	100.67	102.73	108.03
1.8360	66.0	4	96	82.37	100.90	102.96	108.28
1.8393	66.2	5	95	82.55	101.13	103.19	108.52
1.8425	66.3	6	94	82.73	101.35	103.42	108.76
1.8461	66.5	7	93	82.92	101.58	103.65	109.00
1.8498	66.6	8	92	83.10	101.80	103.88	109.24
1.8531	66.8	9	91	83.29	102.03	104.11	109.48
1.8565	66.9	10	90	83.47	102.25	104.34	109.72
1.8596	67.0	11	89	83.65	102.47	104.57	109.96
1.8627	67.2	12	88	83.84	102.70	104.80	110.21
1.8660	67.3	13	87	84.02	102.92	105.03	110.45
1.8692	67.4	14	86	84.20	103.15	105.26	110.69
1.8724	67.6	15	85	84.39	103.38	105.49	110.93
1.8756	67.7	16	84	84.57	103.60	105.71	111.17
1.8793	67.8	17	83	84.75	103.82	105.94	111.41
1.8830	68.0	18	82	84.94	104.05	106.17	111.65
1.8875	68.2	19	81	85.12	104.27	106.40	111.90
1.8919	68.4	20	80	85.31	104.50	106.63	112.14
1.8969	68.6	21	79	85.49	104.73	106.86	112.38
1.9020	68.8	22	78	85.67	104.95	107.09	112.62
1.9056	68.9	23	77	85.86	105.18	107.32	112.86
1.9092	69.1	24	76	86.04	105.40	107.55	113.10
1.9125	69.2	25	75	86.22	105.62	107.78	113.34
1.9158	69.3	26	74	86.41	105.85	108.01	113.59
1.9189	69.4	27	73	86.59	106.07	108.24	113.83
1.9220	69.6	28	72	86.78	106.30	108.47	114.07
1.9250	69.7	29	71	86.96	106.53	108.70	114.31
1.9280	69.8	30	70	87.14	106.75	108.93	114.55
1.9309	69.9	31	69	87.33	106.98	109.16	114.79
1.9338	70.0	32	68	87.51	107.20	109.39	115.03
1.9372	70.1	33	67	87.69	107.42	109.62	115.28
1.9405	70.3	34	66	87.88	107.65	109.85	115.52
1.9439	70.4	35	65	88.06	107.87	110.08	115.76
1.9474	70.5	36	64	88.24	108.10	110.31	116.00
1.9504	70.7	37	63	88.43	108.33	110.54	116.24
1.9534	70.8	38	62	88.61	108.55	110.76	116.48
1.9559	70.9	39	61	88.80	108.78	110.99	116.73
1.9584	71.0	40	60	88.98	109.00	111.22	116.97
1.9598	71.0	41	59	89.16	109.22	111.45	117.21
1.9612	71.1	42	58	89.35	109.45	111.68	117.45
1.9627	71.1	43	57	89.53	109.67	111.91	117.69
1.9643	71.2	44	56	89.71	109.90	112.14	117.93

(*Completed on following page.*)

FUMING SULFURIC ACID (Continued)

Sp Gr 35°/15°	°Be	% Free SO_3	%H_2SO_4	Equivalent to: Total SO_3	Equivalent to: 100% H_2SO_4	Equivalent to: 98% H_2SO_4	Equivalent to: 93.19% (66° Be) H_2SO_4
1.9658	71.2	45	55	89.90	110.13	112.37	118.17
1.9672	71.3	46	54	90.08	110.35	112.60	118.41
1.9687	71.3	47	53	90.27	110.58	112.83	118.66
1.9702	71.4	48	52	90.45	110.80	113.06	118.90
1.9717	71.5	49	51	90.63	111.02	113.29	119.14
1.9733	71.5	50	50	90.82	111.25	113.52	119.38
1.9741	71.5	51	49	91.00	111.48	113.75	119.62
1.9749	71.6	52	48	91.18	111.70	113.98	119.86
1.9755	71.6	53	47	91.37	111.93	114.21	120.11
1.9760	71.6	54	46	91.55	112.15	114.44	120.35
1.9766	71.6	55	45	91.73	112.37	114.67	120.59
1.9772	71.7	56	44	91.92	112.60	114.90	120.83
1.9763	71.6	57	43	92.10	112.82	115.13	121.07
1.9754	71.6	58	42	92.29	113.05	115.36	121.31
1.9746	71.6	59	41	92.47	113.28	115.59	121.55
1.9738	71.5	60	40	92.65	113.50	115.82	121.79
1.9723	71.5	61	39	92.84	113.73	116.05	122.04
1.9709	71.4	62	38	93.02	113.95	116.28	122.28
1.9691	71.4	63	37	93.20	114.17	116.51	122.52
1.9672	71.3	64	36	93.39	114.40	116.74	122.76
1.9654	71.2	65	35	93.57	114.62	116.96	123.00
1.9636	71.2	66	34	93.76	114.85	117.19	123.24
1.9618	71.1	67	33	93.94	115.08	117.42	123.49
1.9600	71.0	68	32	94.12	115.30	117.65	123.73
1.9582	71.0	69	31	94.31	115.53	117.88	123.97
1.9564	70.9	70	30	94.49	115.75	118.11	124.21
1.9533	70.8	71	29	94.67	115.97	118.34	124.45
1.9502	70.6	72	28	94.86	116.20	118.57	124.69
1.9472	70.6	73	27	95.04	116.42	118.80	124.93
1.9442	70.4	74	26	95.22	116.65	119.03	125.18
1.9411	70.3	75	25	95.41	116.88	119.26	125.42
1.9379	70.2	76	24	95.59	117.10	119.49	125.66
1.9347	70.1	77	23	95.78	117.33	119.72	125.90
1.9315	69.9	78	22	95.96	117.55	119.95	126.14
1.9283	69.8	79	21	96.14	117.77	120.18	126.38
1.9251	69.7	80	20	96.33	118.00	120.41	126.62
1.9217	69.5	81	19	96.51	118.22	120.64	126.86
1.9183	69.4	82	18	96.69	118.45	120.87	127.11
1.9149	69.3	83	17	96.88	118.68	121.10	127.35
1.9115	69.1	84	16	97.06	118.90	121.23	127.59
1.9080	69.0	85	15	97.25	119.13	121.56	127.83
1.9046	68.8	86	14	97.43	119.35	121.79	128.07
1.9013	68.7	87	13	97.61	119.57	122.02	128.31
1.8980	68.6	88	12	97.80	119.80	122.25	128.56
1.8934	68.4	89	11	97.98	120.03	122.48	128.80
1.8888	68.2	90	10	98.16	120.25	122.70	129.04
1.8844	68.1	91	9	98.35	120.48	122.93	129.98
1.8800	68.0	92	8	98.53	120.70	123.16	129.52
1.8756	67.7	93	7	98.71	120.92	123.39	129.76
1.8712	67.5	94	6	98.90	121.15	123.62	130.00
1.8659	67.3	95	5	99.08	121.37	123.85	130.25
1.8605	67.1	96	4	99.27	121.60	124.08	130.49
1.8546	66.8	97	3	99.45	121.83	124.31	130.73
1.8488	66.6	98	2	99.63	122.05	124.54	130.97
1.8429	66.3	99	1	99.82	122.28	124.77	131.21
1.8370	66.1	100	0	100.00	122.50	125.00	131.45

SULFURIC ACID, as SO_3 (Continued)

Specific Gravity	Weight of SO_3 in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent SO_3	Degrees: Baumé	Twaddell
1.0250	33.47	0.2793	2.089	3.265	3.5	5.00
1.0317	42.11	0.3514	2.629	4.082	4.5	6.34
1.0385	50.86	0.4245	3.175	4.898	5.4	7.70
1.0453	59.73	0.4985	3.729	5.714	6.3	9.06
1.0522	68.71	0.5734	4.290	6.530	7.2	10.44
1.0591	77.81	0.6494	4.858	7.347	8.1	11.82
1.0661	87.03	0.7263	5.433	8.163	9.0	13.22
1.0731	96.36	0.8041	6.016	8.979	9.9	14.62
1.0802	105.8	0.8831	6.606	9.796	10.8	16.04
1.0874	115.4	0.9630	7.204	10.61	11.7	17.48
1.0947	125.1	1.044	7.810	11.43	12.5	18.94
1.1020	134.9	1.126	8.424	12.24	13.4	20.40
1.1094	144.9	1.209	9.046	13.06	14.3	21.88
1.1168	155.0	1.293	9.676	13.88	15.2	23.36
1.1243	165.2	1.379	10.31	14.69	16.0	24.86
1.1318	175.5	1.465	10.96	15.51	16.9	26.36
1.1394	186.0	1.552	11.61	16.33	17.7	27.88
1.1471	196.6	1.641	12.28	17.14	18.6	29.42
1.1548	207.4	1.731	12.95	17.96	19.4	30.96
1.1626	218.3	1.822	13.63	18.78	20.3	32.52
1.1704	229.3	1.914	14.32	19.59	21.1	34.08
1.1783	240.5	2.007	15.01	20.41	21.9	35.66
1.1862	251.8	2.101	15.72	21.22	22.8	37.24
1.1942	263.2	2.197	16.43	22.04	23.6	38.84
1.2023	274.8	2.293	17.16	22.86	24.4	40.46
1.2104	286.5	2.391	17.89	23.67	25.2	42.08
1.2185	298.4	2.490	18.63	24.49	26.0	43.70
1.2267	310.4	2.591	19.38	25.31	26.8	45.34
1.2349	322.6	2.692	20.14	26.12	27.6	46.98
1.2432	334.9	2.795	20.91	26.94	28.4	48.64
1.2515	347.3	2.899	21.68	27.75	29.1	50.30
1.2599	360.0	3.004	22.47	28.57	29.9	51.98
1.2684	372.7	3.111	23.27	29.39	30.7	53.68
1.2769	385.7	3.219	24.08	30.20	31.4	55.38
1.2855	398.8	3.328	24.89	31.02	32.2	57.10
1.2941	412.0	3.438	25.72	31.84	33.0	58.82
1.3028	425.4	3.550	26.56	32.65	33.7	60.56
1.3116	439.0	3.663	27.41	33.47	34.5	62.32
1.3205	452.7	3.778	28.26	34.29	35.2	64.10
1.3294	466.6	3.894	29.13	35.10	35.9	65.88
1.3384	480.7	4.012	30.01	35.92	36.7	67.68
1.3476	495.0	4.131	30.90	36.73	37.4	69.52
1.3569	509.5	4.252	31.81	37.55	38.1	71.38
1.3663	524.2	4.375	32.73	38.37	38.9	73.26
1.3758	539.1	4.499	33.65	39.18	39.6	75.16
1.3854	554.1	4.625	34.60	40.00	40.3	77.08
1.3951	569.4	4.752	35.55	40.82	41.1	79.02
1.4049	584.9	4.881	36.51	41.63	41.8	80.98
1.4148	600.6	5.012	37.49	42.45	42.5	82.96
1.4248	616.4	5.144	38.48	43.26	43.2	84.96
1.4350	632.6	5.279	39.49	44.08	44.0	87.00
1.4453	648.9	5.415	40.51	44.90	44.7	89.06
1.4557	665.4	5.553	41.54	45.71	45.4	91.14
1.4662	682.2	5.693	42.59	46.53	46.1	93.24
1.4768	699.2	5.835	43.65	47.35	46.8	95.36
1.4875	716.4	5.979	44.73	48.16	47.5	97.50
1.4983	733.8	6.124	45.81	48.98	48.2	99.66
1.5091	751.5	6.271	46.91	49.80	48.9	101.82
1.5200	769.3	6.420	48.03	50.61	49.6	104.00

(Completed on following page.)

SULFURIC ACID, as SO_3 (Continued)

Specific Gravity	Weight of SO_3 in solution expressed in			Per Cent SO_3	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.5310	787.4	6.571	49.15	51.43	50.3	106.20
1.5421	805.7	6.723	50.30	52.24	51.0	108.42
1.5533	824.2	6.878	51.45	53.06	51.7	110.66
1.5646	843.0	7.035	52.63	53.88	52.3	112.92
1.5760	862.0	7.193	53.81	54.69	53.0	115.20
1.5874	881.2	7.354	55.01	55.51	53.7	117.48
1.5989	900.6	7.516	56.22	56.33	54.3	119.78
1.6105	920.3	7.680	57.45	57.14	55.0	122.10
1.6221	940.1	7.846	58.69	57.96	55.6	124.42
1.6338	960.3	8.014	59.95	58.77	56.3	126.76
1.6456	980.6	8.184	61.22	59.59	56.9	129.12
1.6574	1001	8.355	62.50	60.41	57.5	131.48
1.6692	1022	8.528	63.80	61.22	58.1	133.84
1.6810	1043	8.703	65.11	62.04	58.7	136.20
1.6927	1064	8.879	66.42	62.86	59.3	138.54
1.7043	1085	9.056	67.75	63.67	59.9	140.86
1.7158	1106	9.234	69.08	64.49	60.5	143.16
1.7272	1128	9.413	70.42	65.30	61.1	145.44
1.7383	1149	9.592	71.76	66.12	61.6	147.66
1.7491	1171	9.771	73.09	66.94	62.1	149.82
1.7594	1192	9.948	74.42	67.75	62.6	151.88
1.7693	1213	10.12	75.74	68.57	63.0	153.86
1.7786	1234	10.30	77.05	69.39	63.5	155.72
1.7872	1255	10.47	78.33	70.20	63.9	157.44
1.7951	1275	10.64	79.59	71.02	64.2	159.02
1.8022	1295	10.80	80.82	71.84	64.5	160.44
1.8087	1314	10.97	82.04	72.65	64.8	161.74
1.8144	1333	11.12	83.22	73.47	65.1	162.88
1.8195	1352	11.28	84.38	74.28	65.3	163.90
1.8240	1370	11.43	85.52	75.10	65.5	164.80
1.8279	1388	11.58	86.63	75.92	65.7	165.58
1.8312	1405	11.73	87.72	76.73	65.8	166.24
1.8337	1422	11.87	88.78	77.55	65.9	166.74
1.8355	1438	12.00	89.80	78.37	66.0	167.10
1.8364	1454	12.14	90.78	79.18	66.0	167.28
1.8361	1469	12.26	91.70	80.00	66.0	167.22
1.8342	1482	12.37	92.54	80.81	65.9	166.84
1.8305	1494	12.47	93.29	81.63	65.8	166.10

TANNIC ACID

Density of Aqueous Tannic Acid Solutions at 15° C. Computed from the Values of Trammer.

Specific Gravity	Weight of $C_{14}H_{10}O_9$ in solution expressed in			Per Cent $C_{14}H_{10}O_9$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.0040	10.04	0.08379	0.6268	1.0	0.6	0.80
1.0044	11.05	0.09220	0.6898	1.1	0.6	0.88
1.0048	12.06	0.1006	0.7528	1.2	0.7	0.96
1.0052	13.07	0.1091	0.8158	1.3	0.8	1.04
1.0056	14.08	0.1175	0.8789	1.4	0.8	1.12
1.0060	15.09	0.1259	0.9421	1.5	0.9	1.20
1.0064	16.10	0.1344	1.005	1.6	0.9	1.28
1.0068	17.12	0.1428	1.069	1.7	1.0	1.36
1.0072	18.13	0.1513	1.132	1.8	1.0	1.44
1.0076	19.14	0.1598	1.195	1.9	1.1	1.52

TANNIC ACID (Continued)

Specific Gravity	Weight of $C_{14}H_{10}O_9$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $C_{14}H_{10}O_9$	Degrees Baumé	Twaddell
1.0080	20.16	0.1682	1.259	2.0	1.2	1.60
1.0084	21.18	0.1767	1.322	2.1	1.2	1.68
1.0088	22.19	0.1852	1.386	2.2	1.3	1.76
1.0092	23.21	0.1937	1.449	2.3	1.3	1.84
1.0096	24.23	0.2022	1.513	2.4	1.4	1.92
1.0100	25.25	0.2107	1.576	2.5	1.4	2.00
1.0104	26.27	0.2192	1.640	2.6	1.5	2.08
1.0108	27.29	0.2278	1.704	2.7	1.5	2.16
1.0112	28.31	0.2363	1.768	2.8	1.6	2.24
1.0116	29.34	0.2448	1.831	2.9	1.7	2.32
1.0120	30.36	0.2534	1.895	3.0	1.7	2.40
1.0124	31.38	0.2619	1.959	3.1	1.8	2.48
1.0128	32.41	0.2705	2.023	3.2	1.8	2.56
1.0132	33.44	0.2790	2.087	3.3	1.9	2.64
1.0136	34.46	0.2876	2.151	3.4	1.9	2.72
1.0140	35.49	0.2962	2.216	3.5	2.0	2.80
1.0144	36.52	0.3048	2.280	3.6	2.1	2.88
1.0148	37.55	0.3133	2.344	3.7	2.1	2.96
1.0152	38.58	0.3219	2.408	3.8	2.2	3.04
1.0156	39.61	0.3305	2.473	3.9	2.2	3.12
1.0160	40.64	0.3392	2.537	4.0	2.3	3.20
1.0164	41.67	0.3478	2.602	4.1	2.3	3.28
1.0168	42.71	0.3564	2.666	4.2	2.4	3.36
1.0172	43.74	0.3650	2.731	4.3	2.5	3.44
1.0176	44.77	0.3737	2.795	4.4	2.5	3.52
1.0180	45.81	0.3823	2.860	4.5	2.6	3.60
1.0184	46.85	0.3910	2.925	4.6	2.6	3.68
1.0188	47.88	0.3996	2.989	4.7	2.7	3.76
1.0192	48 92	0.4083	3.054	4.8	2.7	3.84
1.0196	49.96	0.4169	3.119	4.9	2.8	3.92
1.0200	51.00	0.4256	3.184	5.0	2.8	4.00
1.0401	104.0	0.8680	6.493	10.0	5.6	8.02

TARTARIC ACID

Density of Aqueous Tartaric Acid Solutions at 15° C. Computed from the Values of Gerlach.

Specific Gravity	Weight of $H_2C_4H_4O_6$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $H_2C_4H_4O_6$	Degrees Baumé	Twaddell
1.0045	10.05	0.08383	0.6271	1	0.6	0.90
1.0090	20.18	0.1684	1.260	2	1.3	1.80
1.0179	40.72	0.3398	2.542	4	2.6	3.58
1.0273	61.64	0.5144	3.848	6	3.9	5.46
1.0371	82.97	0.6924	5.180	8	5.2	7.42
1.0469	104.7	0.8737	6.536	10	6.5	9.38
1.0565	126.8	1.058	7.915	12	7.8	11.30
1.0661	149.3	1.246	9.318	14	9.0	13.22
1.0761	172.2	1.437	10.75	16	10.3	15.22
1.0865	195.6	1.632	12.21	18	11.5	17.30
1.0969	219.4	1.831	13.70	20	12.8	19.38
1.1072	243.6	2.033	15.21	22	14.0	21.44
1.1175	268.2	2.238	16.74	24	15.2	23.50
1.1282	293.3	2.448	18.31	26	16.5	25.64
1.1393	319.0	2.662	19.92	28	17.7	27.86

(Completed on following page.)

TARTARIC ACID (Continued)

Specific Gravity	Weight of $H_2C_4H_4O_6$ in solution expressed in			Per Cent $H_2C_4H_4O_6$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.1505	345.2	2.880	21.55	30	19.0	30.10
1.1615	371.7	3 102	23.20	32	20.2	32.30
1.1726	398.7	3.327	24.89	34	21.3	34.52
1.1840	426.2	3.557	26.61	36	22.5	36.80
1.1959	454.4	3.793	28.37	38	23.8	39.18
1.2078	483.1	4.032	30.16	40	25.0	41.56
1.2198	512.3	4.275	31.98	42	26.1	43.96
1.2317	541.9	4.523	33.83	44	27.3	46.34
1.2441	572.3	4.776	35.73	46	28.5	48.82
1.2568	603.3	5.034	37.66	48	29.6	51.36
1.2696	634.8	5.298	39.63	50	30.8	53.92
1.2828	667.1	5.567	41.64	52	32.0	56.56
1.2961	699.9	5.841	43.69	54	33.1	59.22
1.3093	733.2	6.119	45.77	56	34.3	61.86

ZINC CHLORIDE

Specific Gravity of Aqueous Zinc Chloride Solutions Adopted 1922 as Standard by the Manufacturing Chemists' Association of the United States.

Authorities: W. H. Whitney, E. H. Hartle, C. H. Sakryd.

Checked by: L. C. Drefahl, R. M. Meiklejohn, R. O. Fernandez.

Specific gravity determinations were made at 60° F., compared with water at 60° F., on solutions of Zinc Chloride made from chemically pure zinc and Hydrochloric Acid, these solutions exhibiting a neutral reaction to methyl orange when diluted below 5° Bé with water.

The corresponding degrees Baumé were calculated from the Specific Gravities by the following formula:

$$\text{Baumé} = 145 - \frac{145}{\text{Sp. Gr.}}$$

Baumé Hydrometers for use with this table must be graduated by the above formula, which formula should always be printed on the scale.

1 cubic foot of water weighs 62.37 lbs. avoirdupois.

Atomic weights used: F. W. Clarke's table of 1912. O=16.

* The percentage composition on all fixed points were determined by actual chemical analysis both Zinc and Chlorine being determined.

Bé°	Sp. Gr.	% $ZnCl_2$	Weight of 1 cu.ft. in lbs.	Lbs. $ZnCl_2$ in 1 cu.ft.	% 50% $ZnCl_2$	Lbs. 50% $ZnCl_2$ in 1 cu. ft.
0	1.0000	0	62.37	0	0	0
1	1.0069	.76	62.80	.4773	1.52	.9546
2	1.0140	1.53	63.24	.9676	3.06	1.9352
3	1.0211	2.29	63.69	1.4585	4.58	2.9170
4	1.0284	3.05	64.14	1.9563	6.10	3.9126
5	1.0357	3.81	64.60	2.4613	7.62	4.9226
6	1.0432	4.63	65.06	3.0123	9.26	6.0246
7	1.0507	5.45	65 53	3.5714	10.90	7.1428
8	1.0584	6.27	66.01	4.1388	12.54	8.2776
9	1.0662	7.09	66.50	4.7149	14.18	9.4298

ZINC CHLORIDE (Continued)

Bé°	Sp. Gr.	% $ZnCl_2$	Weight of 1 cu.ft. in lbs.	Lbs. $ZnCl_2$ in 1 cu. ft.	% 50% $ZnCl_2$	Lbs. 50% $ZnCl_2$ in 1 cu. ft.
10	1.0741	7.91	66.99	5.2989	15.82	10.5978
11	1.0821	8.78	67.49	5.9256	17.56	11.8512
12	1.0902	9.65	68.00	6.5620	19.30	13.1240
13	1.0985	10.52	68.51	7.2073	21.04	14.4146
14	1.1069	11.39	69.04	7.8637	22.78	15.7274
15	1.1154	12.26	69.57	8.5293	24.52	17.0586
16	1.1240	13.21	70.10	9.2602	26.42	18.5204
17	1.1328	14.15	70.65	9.9970	28.30	19.9940
18	1.1417	15.10	71.21	10.7527	30.20	21.5054
19	1.1508	16.04	71.78	11.5135	32.08	23.0270
20	1.1600	16.98	72.35	12.2850	33.96	24.5700
21	1.1694	17.96	72.94	13.1000	35.92	26.2000
22	1.1789	18.94	73.53	13.9266	37.88	27.8532
23	1.1885	19.92	74.13	14.7667	39.84	29.5334
24	1.1983	20.90	74.74	15.6207	41.80	31.2414
25	1.2083	21.88	75.36	16.4888	43.76	32.9776
26	1.2185	22.88	76.00	17.3888	45.76	34.7776
27	1.2288	23.88	76.64	18.3016	47.76	36.6032
28	1.2393	24.89	77.30	19.2400	49.78	38.4800
29	1.2500	25.89	77.96	20.1838	51.78	40.3676
30	1.2609	26.90	78.64	21.1542	53.80	42.3084
31	1.2719	27.91	79.33	22.1410	55.82	44.2820
32	1.2832	28.91	80.03	23.1367	57.82	46.2734
33	1.2946	29.92	80.74	24.1574	59.84	48.3148
34	1.3063	30.93	81.47	25.1987	61.86	50.3974
35	1.3182	31.93	82.22	26.2528	63.86	52.5056
36	1.3303	32.94	82.97	27.3303	65.88	54.6606
37	1.3426	33.95	83.74	28.4297	67.90	56.8594
38	1.3551	34.96	84.52	29.5482	69.92	59.0964
39	1.3679	35.97	85.32	30.6896	71.94	61.3792
40	1.3810	36.98	86.13	31.8509	73.96	63.7018
41	1.3942	38.02	86.96	33.0622	76.04	66.1244
42	1.4078	39.05	87.80	34.2859	78.10	68.5718
43	1.4216	40.09	88.67	35.5478	80.18	71.0956
44	1.4356	41.12	89.54	36.8188	82.24	73.6376
45	1.4500	42.16	90.44	38.1295	84.32	76.2590
46	1.4646	43.21	91.35	39.4723	86.42	78.9446
47	1.4796	44.26	92.28	40.8431	88.52	81.6862
48	1.4948	45.32	93.23	42.2518	90.64	84.5036
49	1.5104	46.37	94.20	43.6805	92.74	87.3610
50	1.5263	47.43	95.20	45.1534	94.86	90.3068
51	1.5426	48.48	96.21	46.6426	96.96	93.2852
52	1.5591	49.54	97.24	48.1727	99.08	96.3454
53	1.5761	50.60	98.30	49.7398	101.20	99.4796
54	1.5934	51.66	99.38	51.3397	103.32	102.6794
55	1.6111	52.72	100.48	52.9731	105.44	105.9462
56	1.6292	53.80	101.61	54.6662	107.60	109.3324
57	1.6477	54.88	102.77	56.4002	109.76	112.8004
58	1.6667	55.97	103.95	58.1808	111.94	116.3616
59	1.6860	57.06	105.16	60.0043	114.12	120.0086
60	1.7059	58.15	106.40	61.8716	116.30	123.7432
61	1.7262	59.23	107.66	63.7670	118.46	127.5340
62	1.7470	60.30	108.96	65.7029	120.60	131.4058
63	1.7683	61.37	110.29	67.6850	122.74	135.3700
64	1.7901	62.44	111.65	69.7143	124.88	139.4286
65	1.8125	63.52	113.05	71.8094	127.04	143.6188
66	1.8354	64.68	114.47	74.0392	129.36	148.0784
67	1.8590	65.85	115.95	76.3531	131.70	152.7062
68	1.8831	67.02	117.45	78.7150	134.04	157.4300
69	1.9079	68.19	119.00	81.1461	136.38	162.2922
70	1.9333	69.36	120.58	83.6343	138.72	167.2686

(Completed on following page.)

ZINC CHLORIDE (Continued)

APPROXIMATE ALLOWANCE FOR TEMPERATURE

At 5° Bé = 0.024° Bé
At 10° Bé = 0.029° Bé
At 15° Bé = 0.029° Bé
At 20° Bé = 0.033° Bé
At 25° Bé = 0.033° Bé
At 30° Bé = 0.033° Bé
At 35° Bé = 0.033° Bé
At 40° Bé = 0.033° Bé
At 45° Bé = 0.033° Bé
At 50° Bé = 0.030° Bé
At 55° Bé = 0.028° Bé
At 60° Bé = 0.027° Bé
At 65° Bé = 0.027° Bé
At 70° Bé = 0.024° Bé

For each 1° Fahrenheit

***FIXED POINTS**

Bé°	Sp. Gr.	Per Cent $ZnCl_2$
5.08	1.0363	3.88
10.16	1.0754	8.05
15.35	1.1184	12.59
20.35	1.1633	17.32
25.14	1.1707	22.02
30.00	1.2609	26.90
35.07	1.3190	32.00
40.15	1.3829	37.14
44.99	1.4499	42.15
50.14	1.5285	47.58
55.05	1.6120	52.77
60.13	1.7085	58.29
65.11	1.8150	63.65
70.05	1.9345	69.42

ZINC CHLORIDE

Density of Aqueous Zinc Chloride Solutions at $\frac{20°}{4°}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $ZnCl_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $ZnCl_2$	Degrees: Baumé	Twaddell
1.0167	20.33	0.1697	1.269	2	2.4	3.34
1.0350	41.40	0.3455	2.585	4	4.9	7.00
1.0532	63.19	0.5274	3.945	6	7.3	10.64
1.0715	85.72	0.7154	5.351	8	9.7	14.30
1.0819	108.2	0.9029	6.754	10	11.0	16.38
1.1085	133.0	1.110	8.304	12	14.2	21.70
1.1275	157.9	1.317	9.855	14	16.4	25.50
1.1468	183.5	1.531	11.46	16	18.6	29.36
1.1665	210.0	1.752	13.11	18	20.7	33.30
1.1866	237.3	1.981	14.82	20	22.8	37.32
1.2380	309.5	2.583	19.32	25	27.9	47.60
1.2928	387.8	3.237	24.21	30	32.8	58.56
1.3522	473.3	3.950	29.55	35	37.8	70.44
1.4173	566.9	4.731	35.39	40	42.7	83.46
1.4890	670.1	5.592	41.83	45	47.6	97.80
1.5681	784.1	6.543	48.95	50	52.5	113.62
1.655	910.3	7.596	56.83	55	57.4	131.0
1.749	1049	8.758	65.51	60	62.1	149.8
1.851	1203	10.04	75.11	65	66.7	170.2
1.962	1373	11.46	85.74	70	71.1	192.4

ZINC NITRATE

Density of Aqueous Zinc Nitrate Solutions at $\frac{18°}{4°}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $Zn(NO_3)_2$ in solution expressed in: Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Zn(NO_3)_2$	Degrees: Baumé	Twaddell
1.0154	20.31	0.1695	1.268	2	2.2	3.08
1.0322	41.29	0.3446	2.578	4	4.5	6.44
1.0496	62.98	0.5256	3.932	6	6.9	9.92
1.0675	85.40	0.7127	5.332	8	9.2	13.50
1.0859	108.6	0.9062	6.779	10	11.5	17.18

ZINC NITRATE (Continued)

	Weight of $Zn(NO_3)_2$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Zn(NO_3)_2$	Baumé	Twaddell
1.1048	132.6	1.106	8.277	12	13.8	20.96
1.1244	157.4	1.314	9.827	14	16.0	24.88
1.1445	183.1	1.528	11.43	16	18.3	28.90
1.1652	209.7	1.750	13.09	18	20.6	33.04
1.1865	237.3	1.980	14.81	20	22.8	37.30
1.2427	310.7	2.593	19.40	25	28.3	48.54
1.3029	390.9	3.262	24.40	30	33.7	60.58
1.3678	478.7	3.995	29.89	35	39.0	73.56
1.4378	575.1	4.800	35.90	40	44.2	87.56
1.5134	681.0	5.683	42.52	45	49.2	102.68
1.5944	797.2	6.653	49.77	50	54.1	118.88

Density of Aqueous Zinc Nitrate Solutions at 17.5° C. Computed from the Values of Franz.

	Weight of $Zn(NO_3)_2$ in solution expressed in				Degrees	
Specific Gravity	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Zn(NO_3)_2$	Baumé	Twaddell
1.0099	10.10	0.08428	0.6305	1	1.4	1.98
1.0198	20.40	0.1702	1.273	2	2.8	3.96
1.0297	30.89	0.2578	1.929	3	4.2	5.94
1.0396	41.58	0.3470	2.596	4	5.5	7.92
1.0496	52.48	0.4380	3.276	5	6.9	9.92
1.0590	63.54	0.5303	3.967	6	8.1	11.80
1.0684	74.79	0.6241	4.669	7	9.3	13.68
1.0778	86.22	0.7196	5.383	8	10.5	15.56
1.0872	97.85	0.8166	6.109	9	11.6	17.44
1.0968	109.7	0.9153	6.847	10	12.8	19.36
1.1070	121.8	1.016	7.602	11	14.0	21.40
1.1172	134.1	1.119	8.370	12	15.2	23.44
1.1274	146.6	1.223	9.150	13	16.4	25.48
1.1376	159.3	1.329	9.943	14	17.5	27.52
1.1476	172.1	1.437	10.75	15	18.6	29.52
1.1586	185.4	1.547	11.57	16	19.9	31.72
1.1696	198.8	1.659	12.41	17	21.0	33.92
1.1806	212.5	1.773	13.27	18	22.2	36.12
1.1916	226.4	1.889	14.13	19	23.3	38.32
1.2024	240.5	2.007	15.01	20	24.4	40.48
1.2147	255.1	2.129	15.93	21	25.6	42.94
1.2270	269.9	2.253	16.85	22	26.8	45.40
1.2393	285.0	2.379	17.79	23	28.0	47.86
1.2516	300.4	2.507	18.75	24	29.1	50.32
1.2640	316.0	2.637	19.73	25	30.3	52.80
1.2766	331.9	2.770	20.72	26	31.4	55.32
1.2892	348.1	2.905	21.73	27	32.5	57.84
1.3018	364.5	3.042	22.76	28	33.6	60.36
1.3144	381.2	3.181	23.80	29	34.7	62.88
1.3268	398.0	3.322	24.85	30	35.7	65.36
1.3396	415.3	3.466	25.93	31	36.8	67.92
1.3524	432.8	3.612	27.02	32	37.8	70.48
1.3652	450.5	3.760	28.13	33	38.8	73.04
1.3780	468.5	3.910	29.25	34	39.8	75.60
1.3906	486.7	4.062	30.39	35	40.7	78.1
1.4039	505.4	4.218	31.55	36	41.7	80.78
1.4172	524.4	4.376	32.74	37	42.7	83.44
1.4305	543.6	4.536	33.94	38	43.6	86.10
1.4438	563.1	4.699	35.15	39	44.6	88.76
1.4572	582.9	4.864	36.39	40	45.5	91.44

ZINC NITRATE (Continued)

Specific Gravity	Weight of $Zn(NO_3)_2$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $Zn(NO_3)_2$	Degrees Baumé	Twaddell
1.4707	603.0	5.032	37.64	41	46.4	94.14
1.4844	623.4	5.203	38.92	42	47.3	96.88
1.4981	644.2	5.376	40.22	43	48.2	99.62
1.5118	665.2	5.551	41.53	44	49.1	102.36
1.5258	686.6	5.730	42.87	45	50.0	105.16
1.5403	708.5	5.913	44.23	46	50.9	108.06
1.5548	730.8	6.098	45.62	47	51.7	110.96
1.5693	753.3	6.286	47.03	48	52.6	113.86
1.5838	776.1	6.477	48.45	49	53.4	116.76
1.5984	799.2	6.670	49.89	50	54.3	119.68

ZINC SULFATE

Density of Aqueous Zinc Sulfate Solutions at $\frac{20^\circ}{4^\circ}$ C. Computed from Values Given in the International Critical Tables.

Specific Gravity	Weight of $ZnSO_4$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $ZnSO_4$	Degrees Baumé	Twaddell
1.0190	20.38	0.1701	1.272	2	2.7	3.80
1.0403	41.61	0.3473	2.598	4	5.6	8.06
1.0620	63.72	0.5318	3.978	6	8.5	12.40
1.0842	86.74	0.7238	5.415	8	11.3	16.84
1.1071	110.7	0.9239	6.912	10	14.0	21.42
1.1308	135.7	1.132	8.472	12	16.8	26.16
1.1553	161.7	1.350	10.10	14	19.5	31.06
1.1806	188.9	1.576	11.79	16	22.2	36.12

Specific Gravity	Weight of $ZnSO_4 \cdot 7H_2O$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $ZnSO_4 + 7H_2O$	Degrees Baumé	Twaddell
1.0190	36.30	0.3029	2.266	3.562	2.7	3.80
1.0403	74.12	0.6185	4.627	7.125	5.6	8.06
1.0620	113.5	0.9472	7.086	10.69	8.5	12.40
1.0842	154.5	1.289	9.645	14.25	11.3	16.84
1.1071	197.2	1.646	12.31	17.81	14.0	21.42
1.1308	241.7	2.017	15.09	21.37	16.8	26.16
1.1533	287.6	2.400	17.95	24.94	19.5	31.06
1.1806	336.5	2.808	21.00	28.50	22.2	36.12

Density of Aqueous Zinc Sulfate Solutions at 15° C. Computed from the Values of Gerlach.

Specific Gravity	Weight of $ZnSO_4 \cdot 7H_2O$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $ZnSO_4 + 7H_2O$	Degrees Baumé	Twaddell
1.006	10.06	0.08395	0.6280	1	0.9	1.2
1.013	20.26	0.1691	1.265	2	1.9	2.6
1.019	30.57	0.2551	1.908	3	2.7	3.8
1.024	40.96	0.3418	2.557	4	3.4	4.8
1.029	51.45	0.4294	3.212	5	4.1	5.8
1.035	62.10	0.5182	3.877	6	4.9	7.0
1.041	72.87	0.6081	4.549	7	5.7	8.2
1.047	83.76	0.6990	5.229	8	6.5	9.4
1.053	94.77	0.7909	5.916	9	7.3	10.6
1.059	105.9	0.8838	6.611	10	8.1	11.8

ZINC SULFATE (Continued)

Specific Gravity	Weight of $ZnSO_4 \cdot 7H_2O$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $ZnSO_4 + 7H_2O$	Degrees Baumé	Twaddell
1.066	117.3	0.9786	7.321	11	9.0	13.2
1.073	128.8	1.075	8.038	12	9.9	14.6
1.079	140.3	1.171	8.757	13	10.6	15.8
1.085	151.9	1.268	9.483	14	11.4	17.0
1.091	163.7	1.366	10.22	15	12.1	18.2
1.097	175.5	1.465	10.96	16	12.8	19.4
1.103	187.5	1.565	11.71	17	13.5	20.6
1.110	199.8	1.667	12.47	18	14.4	22.0
1.116	212.0	1.770	13.24	19	15.1	23.2
1.124	224.8	1.876	14.03	20	16.0	24.8
1.130	237.3	1.980	14.81	21	16.7	26.0
1.137	250.1	2.088	15.62	22	17.5	27.4
1.143	262.9	2.194	16.41	23	18.1	28.6
1.150	276.0	2.303	17.23	24	18.9	30.0
1.157	289.3	2.414	18.06	25	19.7	31.4
1.164	302.6	2.526	18.89	26	20.4	32.8
1.171	316.2	2.639	19.74	27	21.2	34.2
1.179	330.1	2.755	20.61	28	22.0	35.8
1.185	343.7	2.868	21.45	29	22.6	37.0
1.193	357.9	2.987	22.34	30	23.5	38.6
1.200	372.0	3.104	23.22	31	24.2	40.0
1.209	386.9	3.229	24.15	32	25.1	41.8
1.216	401.3	3.349	25.05	33	25.8	43.2
1.224	416.2	3.473	25.98	34	26.5	44.8
1.231	430.9	3.596	26.90	35	27.2	46.2
1.240	446.4	3.725	27.87	36	28.1	48.0
1.246	461.0	3.847	28.78	37	28.6	49.2
1.255	476.9	3.980	29.77	38	29.5	51.0
1.263	492.6	4.111	30.75	39	30.2	52.6
1.271	508.4	4.243	31.74	40	30.9	54.2
1.280	524.8	4.380	32.76	41	31.7	56.0
1.288	541.0	4.515	33.77	42	32.4	57.6
1.295	556.9	4.647	34.76	43	33.0	59.0
1.304	573.8	4.788	35.82	44	33.8	60.8
1.310	589.5	4.920	36.80	45	34.3	62.0
1.320	607.2	5.067	37.91	46	35.2	64.0
1.330	625.1	5.217	39.02	47	36.0	66.0
1.337	641.8	5.356	40.07	48	36.6	67.4
1.346	659.5	5.504	41.18	49	37.3	69.2
1.353	676.5	5.646	42.23	50	37.8	70.6
1.362	694.6	5.797	43.37	51	38.5	72.4
1.370	712.4	5.945	44.48	52	39.2	74.0
1.380	731.4	6.104	45.66	53	39.9	76.0
1.390	750.6	6.264	46.86	54	40.7	78.0
1.399	769.5	6.421	48.04	55	41.4	79.8
1.406	787.4	6.571	49.15	56	41.9	81.2
1.416	807.1	6.736	50.39	57	42.6	83.2
1.425	826.5	6.897	51.60	58	43.2	85.0
1.435	846.7	7.066	52.86	59	44.0	87.0
1.445	867.0	7.235	54.13	60	44.7	89.0

Specific Gravity	Weight of $ZnSO_4$ in solution expressed in Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot	Per Cent $ZnSO_4$	Degrees Baumé	Twaddell
1.006	5.648	0.04713	0.3526	0.5614	0.9	1.2
1.013	11.37	0.09493	0.7101	1.123	1.9	2.6
1.019	17.16	0.1432	1.071	1.684	2.7	3.8
1.024	23.00	0.1919	1.436	2.246	3.4	4.8

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ZINC SULFATE (Continued)

Specific Gravity	Weight of $ZnSO_4$ in solution expressed in			Per Cent $ZnSO_4$	Degrees	
	Grams per Liter	Pounds per U. S. Gallon	Pounds per Cubic Foot		Baumé	Twaddell
1.029	28.89	0.2411	1.803	2.807	4.1	5.8
1.035	34.86	0.2910	2.177	3.369	4.9	7.0
1.041	40.91	0.3414	2.554	3.930	5.7	8.2
1.047	47.03	0.3924	2.936	4.491	6.5	9.4
1.053	53.21	0.4440	3.322	5.053	7.3	10.6
1.059	59.46	0.4962	3.712	5.614	8.1	11.8
1.066	65.83	0.5494	4.110	6.176	9.0	13.2
1.073	72.29	0.6033	4.513	6.737	9.9	14.6
1.079	78.75	0.6572	4.916	7.299	10.6	15.8
1.085	85.28	0.7117	5.324	7.860	11.4	17.0
1.091	91.88	0.7668	5.736	8.421	12.1	18.2
1.097	98.54	0.8224	6.152	8.983	12.8	19.4
1.103	105.3	0.8786	6.572	9.544	13.5	20.6
1.110	112.2	0.9361	7.003	10.11	14.4	22.0
1.116	119.0	0.9935	7.432	10.67	15.1	23.2
1.124	126.2	1.053	7.879	11.23	16.0	24.8
1.130	133.2	1.112	8.317	11.79	16.7	26.0
1.137	140.4	1.172	8.767	12.35	17.5	27.4
1.143	147.6	1.232	9.214	12.91	18.1	28.6
1.150	155.0	1.293	9.674	13.47	18.9	30.0
1.157	162.4	1.355	10.14	14.04	19.7	31.4
1.164	169.9	1.418	10.61	14.60	20.4	32.8
1.171	177.5	1.481	11.08	15.16	21.2	34.2
1.179	185.3	1.547	11.57	15.72	22.0	35.8
1.185	192.9	1.610	12.04	16.28	22.6	37.0
1.193	200.9	1.677	12.54	16.84	23.5	38.6
1.200	208.9	1.743	13.04	17.40	24.2	40.0
1.209	217.2	1.813	13.56	17.97	25.1	41.8
1.216	225.3	1.880	14.06	18.53	25.8	43.2
1.224	233.6	1.950	14.59	19.09	26.5	44.8
1.231	241.9	2.019	15.10	19.65	27.2	46.2
1.240	250.6	2.092	15.65	20.21	28.1	48.0
1.246	258.8	2.160	16.16	20.77	28.6	49.2
1.255	267.7	2.234	16.72	21.33	29.5	51.0
1.263	276.5	2.308	17.26	21.90	30.2	52.6
1.271	285.4	2.382	17.82	22.46	30.9	54.2
1.280	294.6	2.459	18.39	23.02	31.7	56.0
1.288	303.7	2.535	18.96	23.58	32.4	57.6
1.295	312.6	2.609	19.52	24.14	33.0	59.0
1.304	322.1	2.688	20.11	24.70	33.8	60.8
1.310	331.0	2.762	20.66	25.26	34.3	62.0
1.320	340.9	2.845	21.28	25.83	35.2	64.0
1.330	350.9	2.929	21.91	26.39	36.0	66.0
1.337	360.3	3.007	22.49	26.95	36.6	67.4
1.346	370.3	3.090	23.12	27.51	37.3	69.2
1.353	379.8	3.170	23.71	28.07	37.8	70.6
1.362	390.0	3.255	24.35	28.63	38.5	72.4
1.370	400.0	3.338	24.97	29.19	39.2	74.0
1.380	410.6	3.427	25.64	29.76	39.9	76.0
1.390	421.4	3.517	26.31	30.32	40.7	78.0
1.399	432.0	3.605	26.97	30.88	41.4	79.8
1.406	442.0	3.689	27.60	31.44	41.9	81.2
1.416	453.1	3.782	28.29	32.00	42.6	83.2
1.425	464.0	3.872	28.97	32.56	43.2	85.0
1.435	475.3	3.967	29.68	33.12	44.0	87.0
1.445	486.8	4.062	30.39	33.69	44.7	89.0

SPECIFIC GRAVITY OF AUQEOUS SOLUTIONS

% by weight	AgF $d\frac{18^\circ}{4^\circ}$C.	$AgNO_3$ $d\frac{20^\circ}{4^\circ}$C.	$Al(NO_3)_3$ $d\frac{18^\circ}{4^\circ}$C.	$AuCl_3$ $d\frac{15^\circ}{4^\circ}$C.	$Ba(C_2H_3O_2)_2$ $d\frac{18^\circ}{4^\circ}$C.	$BaBr_2$ $d\frac{20^\circ}{4^\circ}$C.	BaI_2 $d\frac{20^\circ}{4^\circ}$C.	$Ba(NO_3)_2$ $d\frac{18^\circ}{4^\circ}$C.	$Be(NO_3)_2$ $d\frac{18^\circ}{4^\circ}$C.	$CaBr_2$ $d\frac{20^\circ}{4^\circ}$C.	$Ca(C_2H_3O_2)_2$ $d\frac{18^\circ}{4^\circ}$C.
1	1.0088	1.0070	1.0065	1.0060	1.0059	......	......	......	......	......	1.0043
2	1.0191	1.0154	1.0144	1.0132	1.0133	1.0156	1.0154	1.0151	1.0108	1.0152	1.0100
3	......	......	......	......	......	......	......	......	......	......	......
4	1.0399	1.0327	1.0305	1.0281	1.0282	1.0335	1.0331	1.0320	1.0233	1.0326	1.0215
5	......	......	......	......	......	......	......	......	......	......	......
6	1.0613	1.0506	1.0469	1.0434	1.0433	1.0519	1.0513	1.0494	1.0361	1.0504	1.0331
7	......	......	......	......	......	......	......	......	......	......	......
8	1.0838	1.0690	1.0638	1.0591	1.0587	1.0710	1.0701	1.0674	1.0491	1.0688	1.0447
9	......	......	......	......	......	......	......	......	......	......	......
10	1.1071	1.0882	1.0811	1.0750	1.0745	1.0907	1.0896	......	1.0624	1.0877	1.0563
11	......	......	......	......	......	......	......	......	......	......	......
12	1.1316	1.1080	1.0989	......	1.0908	1.1111	1.1099	......	1.0761	1.1071	1.0679
13	......	......	......	......	......	......	......	......	......	......	......
14	1.1572	1.1284	1.1171	......	1.1075	1.1323	1.1308	......	1.0902	1.1272	1.0795
15	......	......	......	......	......	......	......	......	......	......	......
16	1.1837	1.1495	1.1357	......	1.1246	1.1543	1.1525	......	1.1046	1.1480	1.0912
17	......	......	......	......	......	......	......	......	......	......	......
18	1.2110	1.1715	1.1549	......	1.1421	1.1770	1.1750	......	1.1193	1.1696	1.1029
19	......	......	......	......	......	......	......	......	......	......	......
20	1.2394	1.1942	1.1745	......	1.1599	1.2006	1.1984	......	1.1344	1.1919	1.1146
21	......	......	......	......	......	......	......	......	......	......	......
22	......	......	1.1946	......	1.1782	......	......	......	1.1499	......	1.1263
23	......	......	......	......	......	......	......	......	......	......	......
24	......	......	1.2153	......	1.1970	......	......	......	1.1657	......	......
25	1.3146	1.2545	......	......	......	1.2634	1.2610	......	......	1.2499	......
30	1.40	1.3205	1.2805	......	1.2554	1.3325	1.3289	......	......	1.3125	......
35	1.48	1.3931	......	......	1.3069	1.4087	1.404	......	......	1.381	......
40	1.58	1.4743	......	......	1.3608	1.4926	1.490	......	......	1.457	......
45	1.70	1.565	......	......	......	......	1.587	......	......	1.541	......
50	1.85	1.668	......	......	......	......	1.698	......	......	1.635	......
60	2.26	1.916	......	......	......	......	1.970	......	......	......	......
70	......	2.2333	......	......	......	......	......	......	......	......	......
80	......	......	......	......	......	......	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

% by weight	CaI_2 $d\frac{20^\circ}{4^\circ}C.$	$Ca(NO-)_2$ $d\frac{18^\circ}{4^\circ}C.$	$CdBr_2$ $d\frac{20^\circ}{4^\circ}C.$	$CdCl_2$ $d\frac{20^\circ}{4^\circ}C.$	CdI_2 $d\frac{20^\circ}{4^\circ}C.$	$CdSO_4$ $d\frac{18^\circ}{4^\circ}C.$	$Ce_2(SO_4)_3$ $d\frac{15^\circ}{4^\circ}C.$	$CoCl_2$ $d\frac{20^\circ}{4^\circ}C.$	$Co(NO_3)_2$ $d\frac{20^\circ}{4^\circ}C.$	$CrBr_3$ $d\frac{18^\circ}{4^\circ}C.$	$CrCl_3$-violet $d\frac{18^\circ}{4^\circ}C.$
1	......	......	......	......	......	1.0086	1.0090	1.0073	1.0064	1.0074	1.0076
2	1.0150	1.0137	1.0158	1.0159	1.0153	1.0182	1.0190	1.0165	1.0145	1.0162	1.0166
3	......	......	......	......	......	......	......	......	......	......	......
4	1.0323	1.0291	1.0339	1.0339	1.0328	1.0383	1.0395	1.0350	1.0315	1.0344	1.0349
5	......	......	......	......	......	......	......	......	......	......	......
6	1.0500	1.0448	1.0524	1.0524	1.0507	1.0590	1.0606	1.0538	1.0485	1.0532	1.0535
7	......	......	......	......	......	......	......	......	......	......	......
8	1.0683	1.0608	1.0714	1.0715	1.0690	1.0803	1.0823	1.0735	1.0660	1.0726	1.0724
9	......	......	......	......	......	......	......	......	......	......	......
10	1.0873	1.0771	1.0910	1.0912	1.0879	1.1023	1.1047	1.0940	1.084	1.0926	1.0917
11	......	......	......	......	......	......	......	......	......	......	......
12	1.1069	1.0937	1.1112	1.1115	1.1075	1.1250	1.1279	1.1150	1.103	1.1132	1.1114
13	......	......	......	......	......	......	......	......	......	......	......
14	1.1273	1.1106	1.1322	1.1324	1.1278	1.1485	1.1520	1.1365	1.122	1.1345	1.1316
15	......	......	......	......	......	......	......	......	......	......	......
16	1.1485	1.1279	1.1540	1.1540	1.1489	1.1729	1.1770	1.1585	1.142	1.1565	......
17	......	......	......	......	......	......	......	......	......	......	......
18	1.1703	1.1455	1.1766	1.1762	1.1709	1.1982	1.2030	1.1815	1.163	1.1794	......
19	......	......	......	......	......	......	......	......	......	......	......
20	1.1928	1.1636	1.2000	1.1992	1.1937	1.2243	1.2300	1.2050	1.184	1.2031	......
21	......	......	......	......	......	......	......	......	......	......	......
22	......	......	......	......	......	......	1.2582	......	......	1.2277	......
23	......	......	......	......	......	......	......	......	......	......	......
24	......	......	......	......	......	......	1.2876	......	......	1.2532	......
25	1.2530	1.2106	1.2605	1.2604	1.2546	1.2940	......	......	1.239	......	......
30	1.3195	1.260	1.3286	1.3273	1.3219	1.3714	......	......	1.299	1.3355	......
35	1.3928	1.311	1.4049	1.4010	1.3967	1.4551	......	......	......	......	......
40	1.4734	1.365	1.4902	1.4833	1.4801	1.5470	......	......	......	......	......
45	......	1.422	......	1.5748	1.5726	......	......	......	......	......	......
50	......	......	......	1.6762	......	......	......	......	......	......	......
60	......	......	......	......	......	......	......	......	......	......	......
70	......	......	......	......	......	......	......	......	......	......	......
80	......	......	......	......	......	......	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

% by weight	CrCl$_3$-green $d\frac{18^\circ}{4^\circ}$C.	CsBr $d\frac{20^\circ}{4^\circ}$C.	CsCl $d\frac{20^\circ}{4^\circ}$C.	CsI $d\frac{20^\circ}{4^\circ}$C.	CsNO$_3$ $d\frac{20^\circ}{4^\circ}$C.	Cs$_2$SO$_4$ $d\frac{20^\circ}{4^\circ}$C.	FeSO$_4$·(NH$_4$)$_2$SO$_4$ $d\frac{25^\circ}{4^\circ}$C.	Fe$_2$(SO$_4$)$_3$·(NH$_4$)$_2$SO$_4$ $d\frac{15^\circ}{4^\circ}$C.	HBr $d\frac{20^\circ}{4^\circ}$C.	HClO$_3$ $d\frac{18^\circ}{4^\circ}$C.	HClO$_4$ $d\frac{15^\circ}{4^\circ}$C.
1	1.0071	1.00612	1.00593	1.00608	1.00566	1.0061	1.005	1.0072	1.0053	1.0044	1.0050
2	1.0157	1.01412	1.01374	1.01402	1.01319	1.0144	1.013	1.0157	1.0124	1.0103	1.0109
3	......	......	......	......	......	......	......	......	......	......	......
4	1.0332	1.03048	1.02969	1.03029	1.02859	1.0316	1.029	1.0324	1.0269	1.0222	1.0228
5	......	......	......	......	......	......	......	......	......	......	......
6	1.0510	1.04734	1.04609	1.04707	1.04443	1.0494	1.045	1.0498	1.0417	1.0344	1.0348
7	......	......	......	......	......	......	......	......	......	......	......
8	1.0691	1.06472	1.06297	1.06438	1.06072	1.0676	1.062	1.0675	1.0568	1.0468	1.0471
9	......	......	......	......	......	......	......	......	......	......	......
10	1.0876	1.08265	1.08036	1.08225	1.07745	1.0870	1.080	1.0856	1.0723	1.0594	1.0597
11	......	......	......	......	......	......	......	......	......	......	......
12	1.1065	1.10116	1.09828	1.10071	1.09463	1.1071	1.098	1.1038	1.0883	1.0723	1.0726
13	......	......	......	......	......	......	......	......	......	......	......
14	......	1.12029	1.11676	1.11979	1.11227	1.1275	1.116	1.1224	1.1048	1.0856	1.0859
15	......	......	......	......	......	......	......	......	......	......	......
16	......	1.14007	1.13582	1.13953	......	1.1484	......	1.1412	1.1219	1.0991	1.0995
17	......	......	......	......	......	......	......	......	......	......	......
18	......	1.16053	1.15549	1.15996	......	1.1696	......	1.1609	1.1396	1.1130	1.1135
19	......	......	......	......	......	......	......	......	......	......	......
20	......	1.18170	1.17580	1.18112	......	1.1913	......	1.1809	1.1579	1.1273	1.1279
21	......	......	......	......	......	......	......	......	......	......	......
22	......	1.20362	1.19679	1.20305	......	1.2137	......	......	1.1767	1.1419	1.1428
23	......	......	......	......	......	......	......	......	......	......	......
24	......	1.22634	1.21849	1.22580	......	1.2375	......	......	1.1961	1.1568	1.1581
25	......	......	......	......	......	......	......	......	......	......	......
30	......	1.29973	1.28817	1.29944	......	......	......	......	1.2580	......	1.2067
35	......	1.36764	1.35218	1.36776	......	......	......	......	1.3150	......	......
40	......	1.44275	1.42245	1.44354	......	......	......	1.3799	1.3772	......	1.2991
45	......	1.52626	1.49993	1.52803	......	......	......	......	1.4446	......	1.3521
50	......	1.61970	1.58575	1.62278	......	......	......	......	1.5173	......	1.4103
60	......	......	1.78859	......	......	......	......	......	1.6787	......	1.5389
70	......	......	......	......	......	......	......	......	......	......	1.6736
80	......	......	......	......	......	......	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

% by weight	HF $d\frac{20^\circ}{4^\circ}C.$	HI $d\frac{20^\circ}{4^\circ}C.$	HIO_3 $d\frac{18^\circ}{4^\circ}C.$	HIO_4 $d\frac{17^\circ}{4^\circ}C.$	H_2O_2 $d\frac{18^\circ}{4^\circ}C.$	H_2SeO_4 $d\frac{20^\circ}{4^\circ}C.$	$HgCl_2$ $d\frac{20^\circ}{4^\circ}C.$	$KC_2H_3O_2$ $d\frac{18^\circ}{4^\circ}C.$	$KBrO_3$ $d\frac{20^\circ}{4^\circ}C.$	KCNS $d\frac{18^\circ}{4^\circ}C.$	$KClO_3$ $d\frac{20^\circ}{4^\circ}C.$
1	......	1.0054	1.0071	1.0076	1.0022	1.0059	1.0065	1.0038	1.0056	1.0035	1.0045
2	......	1.0127	1.0157	1.0165	1.0058	1.0136	1.0150	1.0089	1.0131	1.0085	1.0109
3	......	......	......	......	......	......	1.0236	......	1.0206	......	1.0174
4	......	1.0277	1.0334	1.0349	1.0131	1.0291	1.0323	1.0191	1.0282	1.0186	1.0241
5	1.017	......	......	......	......	......	1.0411	......	1.0359	......	......
6	......	1.0431	1.0517	1.0539	1.0204	1.0447	......	1.0293	......	1.0288	......
7	......	......	......	......	......	......	......	......	......	......	......
8	......	1.0589	1.0706	1.0737	1.0277	1.0605	......	1.0395	......	1.0391	......
9	......	......	......	......	......	......	......	......	......	......	......
10	1.035	1.0751	1.0900	1.0944	1.0351	1.0766	......	1.0497	......	1.0495	......
11	......	......	......	......	......	......	......	......	......	......	......
12	......	1.0918	1.1100	1.1161	1.0425	1.0931	......	1.0599	......	1.0601	......
13	......	......	......	......	......	......	......	......	......	......	......
14	......	1.1091	1.1306	1.1388	1.0499	1.1101	......	1.0703	......	1.0708	......
15	1.053	......	......	......	......	......	......	......	......	......	......
16	......	1.1270	1.1519	1.1623	1.0574	1.1276	......	1.0808	......	1.0817	......
17	......	......	......	......	......	......	......	......	......	......	......
18	......	1.1456	1.1740	1.1865	1.0649	1.1455	......	1.0914	......	1.0927	......
19	......	......	......	......	......	......	......	......	......	......	......
20	1.070	1.1649	1.1969	1.2116	1.0725	1.1639	......	1.1022	......	1.1039	......
21	......	......	......	......	......	......	......	......	......	......	......
22	......	1.1850	1.2206	1.2376	1.0802	1.1829	......	1.1131	......	1.1152	......
23	......	......	......	......	......	......	......	......	......	......	......
24	......	1.2059	1.2450	1.2647	1.0880	1.2026	......	1.1241	......	1.1266	......
25	1.086	......	......	......	......	......	......	......	......	......	......
30	1.101	1.2737	1.3218	1.3545	1.1122	1.2653	......	1.1579	......	1.1618	......
35	1.116	1.3357	1.3900	......	1.1327	......	......	1.1868	......	1.1899	......
40	1.130	1.4029	1.4640	......	1.1536	1.3819	......	1.2162	......	1.2200	......
45	1.143	1.4755	......	......	1.1749	......	......	1.2460	......	1.2517	......
50	1.155	......	......	......	1.1966	1.5186	......	1.2761	......	1.2849	......
60	......	......	......	......	1.2416	1.6850	......	1.3372	......	1.3554	......
70	......	......	......	......	1.2897	1.8870	......	......	......	1.4307	......
80	......	......	......	......	1.3406	2.1220	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

% by weight	KF $d\frac{18°}{4°}C.$	$KHSO_4$ $d\frac{20°}{4°}C.$	$K_3Fe(CN)_6$ $d\frac{20°}{4°}C.$	$K_4Fe(CN)_6$ $d\frac{20°}{4°}C.$	KIO_3 $d\frac{20°}{4°}C.$	KN_3 $d\frac{20°}{4°}C.$	$La(NO_3)_3$ $d\frac{18°}{4°}C.$	LiBr $d\frac{20°}{4°}C.$	LiCl $d\frac{20°}{4°}C.$	LiI $d\frac{20°}{4°}C.$	$LiNO_3$ $d\frac{20°}{4°}C.$
1	1.0072	1.0051	1.0034	1.0051	1.0068	1.0037	1.0076	1.0055	1.0041	1.0056	1.00409
2	1.0159	1.0120	1.0090	1.0119	1.0155	1.0093	1.0167	1.0128	1.0099	1.0131	1.01002
3	......	......	......	......	1.0243	......	......	......	......	......	......
4	1.0334	1.0260	1.0201	1.0256	......	1.0206	1.0353	1.0277	1.0215	1.0284	1.02198
5	......	......	......	......	......	......	......	......	......	......	......
6	1.0512	1.0403	1.0314	1.0395	......	1.0319	1.0545	1.0429	1.0330	1.0442	1.03413
7	......	......	......	......	......	......	......	......	......	......	......
8	1.0693	1.0549	1.0427	1.0536	......	1.0434	1.0742	1.0585	1.0444	1.0604	1.04647
9	......	......	......	......	......	......	......	......	......	......	......
10	1.0877	1.0698	1.0542	1.0678	......	1.0550	1.0945	1.0746	1.0559	1.0771	1.05903
11	......	......	......	......	......	......	......	......	......	......	......
12	1.1064	1.0850	1.0656	1.0823	......	1.0669	1.1153	1.0910	1.0675	1.0943	1.07181
13	......	......	......	......	......	......	......	......	......	......	......
14	1.1254	1.1004	1.0774	1.0971	......	1.0790	1.1368	1.1079	1.0792	1.1120	1.08482
15	......	......	......	......	......	......	......	......	......	......	......
16	1.1448	1.1161	1.0890	1.1120	......	1.0913	1.1589	1.1253	1.0910	1.1303	1.09807
17	......	......	......	......	......	......	......	......	......	......	......
18	1.1646	......	1.1010	......	......	1.1036	1.1817	1.1432	1.1029	1.1492	1.11159
19	......	......	......	......	......	......	......	......	......	......	......
20	1.1847	......	1.1130	......	......	1.1161	1.2052	1.1616	1.1150	1.1688	1.12539
21	......	......	......	......	......	......	......	......	......	......	......
22	1.2052	......	......	......	......	1.1288	1.2295	1.1806	1.1274	1.1890	1.13948
23	......	......	......	......	......	......	......	......	......	......	......
24	1.2260	......	......	......	......	1.1417	1.2547	1.2002	1.1399	1.2099	1.15387
25	......	......	......	......	......	......	......	......	......	......	......
30	......	......	......	......	......	1.1809	1.3360	1.2629	1.1791	1.2772	1.19879
35	......	......	......	......	......	......	......	1.3204	......	1.3393	1.2392
40	......	......	......	......	......	......	......	1.3836	......	1.4078	1.2837
45	......	......	......	......	......	......	......	1.4535	......	1.4840	......
50	......	......	......	......	......	......	......	......	......	1.5692	......
60	......	......	......	......	......	......	......	......	......	1.7748	......
70	......	......	......	......	......	......	......	......	......	......	......
80	......	......	......	......	......	......	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

% by weight	$LiOH$ $d\frac{20^\circ}{4^\circ}C.$	Li_2SO_4 $d\frac{20^\circ}{4^\circ}C.$	$MgBr_2$ $d\frac{20^\circ}{4^\circ}C.$	MgI_2 $d\frac{20^\circ}{4^\circ}C.$	$Mg(NO_3)_2$ $d\frac{20^\circ}{4^\circ}C.$	$MnBr_2$ $d\frac{18^\circ}{4^\circ}C.$	$MnCl_2$ $d\frac{18^\circ}{4^\circ}C.$	$Mn(NO_3)_2$ $d\frac{18^\circ}{4^\circ}C.$	$MnSO_4$ $d\frac{20^\circ}{4^\circ}C.$	N_2H_4 $d\frac{15^\circ}{4^\circ}C.$	NH_4Br $d\frac{25^\circ}{4^\circ}C.$
1	1.0102	1.0068	......	......	......	1.0071	1.0069	1.0063	1.0080	1.0002	1.0027
2	1.0217	1.0155	1.0151	1.0149	1.0132	1.0157	1.0153	1.0140	1.0178	1.0013	1.0084
3	......	......	......	......	......	......	......	......	......	......	......
4	1.0437	1.0329	1.0324	1.0321	1.0285	1.0332	1.0324	1.0298	1.0378	1.0034	1.0198
5	......	......	......	......	......	......	......	......	......	......	......
6	1.0650	1.0505	1.0501	1.0498	1.0441	1.0511	1.0498	1.0459	1.0583	1.0056	1.0314
7	......	......	......	......	......	......	......	......	......	......	......
8	1.0862	1.0684	1.0683	1.0680	1.0600	1.0695	1.0676	1.0624	1.0794	1.0077	1.0432
9	......	......	......	......	......	......	......	......	......	......	......
10	1.1074	1.0863	1.0871	1.0869	1.0762	1.0886	1.0859	1.0794	1.1012	1.0099	1.0552
11	......	......	......	......	......	......	......	......	......	......	......
12	......	1.1044	1.1065	1.1065	1.0928	1.1083	1.1046	1.0969	1.1236	1.0121	1.0674
13	......	......	......	......	......	......	......	......	......	......	......
14	......	1.1228	1.1265	1.1268	1.1098	1.1287	1.1238	1.1149	1.1467	1.0143	1.0799
15	......	......	......	......	......	......	......	......	......	......	......
16	......	1.1411	1.1471	1.1478	1.1272	1.1498	1.1435	1.1333	1.1705	1.0164	1.0927
17	......	......	......	......	......	......	......	......	......	......	......
18	......	1.1599	1.1683	1.1695	1.1449	1.1716	1.1638	1.1522	1.1950	1.0186	1.1058
19	......	......	......	......	......	......	......	......	......	......	......
20	......	1.1789	1.1903	1.1920	1.1630	1.1942	1.1846	1.1717	......	1.0207	1.1191
21	......	......	......	......	......	......	......	......	......	......	......
22	......	1.1984	......	......	1.1815	1.2176	1.2061	1.1918	......	1.0228	1.1327
23	......	......	......	......	......	......	......	......	......	......	......
24	......	1.2182	......	......	1.2004	1.2419	1.2283	1.2125	......	1.0248	1.1466
25	......	......	1.2482	1.2519	......	......	......	......	......	......	......
30	......	......	1.3110	1.3180	......	1.3206	1.2988	1.2781	......	1.0305	1.1901
35	......	......	1.379	1.3914	......	......	......	1.3367	......	1.035	......
40	......	......	1.452	1.4730	......	......	......	1.3993	......	1.038	1.2702
45	......	......	1.532	......	......	......	......	1.4662	......	1.042	......
50	......	......	......	......	......	......	......	1.5378	......	1.044	......
60	......	......	......	......	......	......	......	......	......	1.047	......
70	......	......	......	......	......	......	......	......	......	1.046	......
80	......	......	......	......	......	......	......	......	......	1.040	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

% by weight	$NH_4C_2H_3O_2$ $d\frac{25°}{4°}C.$	$(NH_4)_2CO_3$ $d\frac{15°}{4°}C.$	NH_4F $d\frac{18°}{4°}C.$	NH_4I $d\frac{18°}{4°}C.$	NH_2OH $d\frac{20°}{4°}C.$	$NaBrO_3$ $d\frac{18°}{4°}C.$	$NaClO_4$ $d\frac{18°}{4°}C.$	$NaHCO_3$ $d\frac{18°}{4°}C.$	NaN_3 $d\frac{20°}{4°}C.$	Na_2S $d\frac{18°}{4°}C.$
1	0.9992	1.0026	1.0034	1.0050	1.0002	1.0064	1.0051	1.0059	1.0040	1.0098
2	1.0013	1.0061	1.0085	1.0114	1.0023	1.0143	1.0116	1.0132	1.010	1.0211
3	......	......	......	......	......	......	......	1.0206	......	......
4	1.0055	1.0130	1.0178	1.0244	1.0065	1.0305	1.0247	1.0280	1.022	1.0440
5	......	......	......	......	......	......	......	1.0354	......	......
6	1.0096	1.0199	1.0265	1.0377	1.0107	1.0471	1.0381	1.0429	1.034	1.0672
7	......	......	......	......	......	......	......	1.0505	......	......
8	1.0136	1.0267	1.0346	1.0513	1.0149	1.0641	1.0517	1.0581	1.047	1.0907
9	......	......	......	......	......	......	......	......	......	......
10	1.0176	1.0335	1.0420	1.0652	1.0192	1.0816	1.0656	......	1.059	1.1146
11	......	......	......	......	......	......	......	......	......	......
12	1.0216	1.0403	1.0487	1.0795	1.0235	1.0996	1.0798	......	1.072	1.1388
13	......	......	......	......	......	......	......	......	......	......
14	1.0255	1.0471	1.0547	1.0942	1.0278	1.1182	1.0943	......	1.085	1.1634
15	......	......	......	......	......	......	......	......	......	......
16	1.0294	1.0539	......	1.1093	1.0322	1.1373	1.1090	......	1.099	1.1885
17	......	......	......	......	......	......	......	......	......	......
18	1.0331	1.0607	......	1.1248	1.0366	1.1569	1.1241	......	1.112	1.2140
19	......	......	......	......	......	......	......	......	......	......
20	1.0368	1.0675	......	1.1407	1.0410	1.1771	1.1396	......	1.126	......
21	......	......	......	......	......	......	......	......	......	......
22	1.0404	1.0742	......	1.1570	1.0454	1.1979	1.1554	......	1.140	......
23	......	......	......	......	......	......	......	......	......	......
24	1.0439	1.0808	......	1.1737	1.0499	1.2193	1.1717	......	1.155	......
25	......	......	......	......	......	......	......	......	......	......
30	1.0540	1.1006	......	1.2265	1.0637	1.3565	1.2227	......	1.202	......
35	1.0618	1.1157	......	1.2745	1.0755	......	......	......	......	......
40	1.0691	1.1294	......	1.3264	1.0875	......	......	......	......	......
45	1.0760	1.1417	......	1.3823	1.0997	......	......	......	......	......
50	......	......	......	......	1.1122	......	......	......	......	......
60	......	......	......	......	......	......	......	......	......	......
70	......	......	......	......	......	......	......	......	......	......
80	......	......	......	......	......	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

% by weight	Na_2WO_4 $d\frac{20°}{4°}C.$	$NiBr_2$ $d\frac{18°}{4°}C.$	$Ni(NO_3)_2$ $d\frac{18°}{4°}C.$	$Pb(C_2H_3O_2)_2$ $d\frac{18°}{4°}C.$	$Pb(NO_3)_2$ $d\frac{18°}{4°}C.$	RbBr $d\frac{20°}{4°}C.$	RbCl $d\frac{20°}{4°}C.$	RbI $d\frac{20°}{4°}C.$	$RbNO_3$ $d\frac{20°}{4°}C.$	Rb_2SO_4 $d\frac{20°}{4°}C.$
1	1.0074	1.0078	1.0070	1.0061	1.0074	1.00593	1.00561	1.00591	1.0053	1.0066
2	1.0166	1.0170	1.0155	1.0137	1.0163	1.01372	1.01307	1.01370	1.0125	1.0150
3	......	......	......	......	......	......	......	......	......	......
4	1.0354	1.0359	1.0330	1.0290	1.0344	1.02965	1.02825	1.02963	1.0272	1.0322
5	......	......	......	......	......	......	......	......	......	......
6	1.0546	1.0555	1.0508	1.0446	1.0529	1.04604	1.04379	1.04604	1.0422	1.0499
7	......	......	......	......	......	......	......	......	......	......
8	1.0742	1.0758	1.0693	1.0605	1.0720	1.06291	1.05971	1.06296	1.0575	1.0680
9	......	......	......	......	......	......	......	......	......	......
10	1.0944	1.0969	1.0882	1.0768	1.0918	1.08028	1.07604	1.08041	1.0731	1.0864
11	......	......	......	......	......	......	......	......	......	......
12	1.1154	1.1188	1.1076	1.0936	1.1123	1.09817	1.09281	1.09842	1.0892	1.1052
13	......	......	......	......	......	......	......	......	......	......
14	1.1372	1.1414	1.1277	1.1109	1.1336	1.11661	1.11004	1.11701	1.1057	1.1246
15	......	......	......	......	......	......	......	......	......	......
16	1.1598	1.1648	1.1484	1.1283	1.1557	1.13563	1.12775	1.13621	1.1227	1.1446
17	......	......	......	......	......	......	......	......	......	......
18	1.1833	1.1889	1.1696	1.1473	1.1789	1.15526	1.14596	1.15605	1.1401	1.1652
19	......	......	......	......	......	......	......	......	......	......
20	1.2076	1.2140	1.1914	1.1663	1.2030	1.17554	1.16469	1.17657	1.1580	1.1864
21	......	......	......	......	......	......	......	......	......	......
22	1.2328	......	......	1.1860	1.2277	1.19650	1.18396	1.19781	1.1763	1.2083
23	......	......	......	......	......	......	......	......	......	......
24	1.2590	......	......	1.2063	1.2529	1.21817	1.20379	1.21980	1.1952	1.2309
25	......	1.2615	1.2493	......	......	......	......	......	......	......
30	1.3444	......	1.3114	1.2711	1.3289	1.28784	1.26691	1.29061	1.2552	1.3028
35	......	......	1.3777	1.3304	......	1.35191	1.32407	1.35598	......	......
40	1.5156	......	......	1.3994	......	1.42233	1.38599	1.42806	......	......
45	......	......	......	......	......	1.50010	1.45330	1.50792	......	......
50	......	......	......	......	......	1.58639	1.52675	1.59691	......	......
60	......	......	......	......	......	......	......	1.80924	......	......
70	......	......	......	......	......	......	......	......	......	......
80	......	......	......	......	......	......	......	......	......	......

SPECIFIC GRAVITY OF AQUEOUS SOLUTIONS

% by weight	$Sa(NO_3)_3$ $d\frac{18^\circ}{4^\circ}$C.	SO_2 $d\frac{15.5^\circ}{4^\circ}$C.	$SrBr_2$ $d\frac{20^\circ}{4^\circ}$C.	$SrCl_2$ $d\frac{20^\circ}{4^\circ}$C.	SrI_2 $d\frac{20^\circ}{4^\circ}$C.	$Sr(NO_3)_2$ $d\frac{20^\circ}{4^\circ}$C.	$UO_2(NO_3)_2$ $d\frac{17^\circ}{4^\circ}$C.	WO_3 $d\frac{17.5^\circ}{4^\circ}$C.	$ZnBr_2$ $d\frac{20^\circ}{4^\circ}$C.	ZnI_2 $d\frac{20^\circ}{4^\circ}$C.
1	1.0061	1.0040	......	......	......	......	1.008	1.0078	......	......
2	1.0136	1.0091	1.0157	1.0161	1.0154	1.015	1.017	1.0170	1.0167	1.016
3	......	......	......	......	......	......	......	......	......	......
4	1.0289	1.0191	1.0337	1.0344	1.0331	1.031	1.036	1.0357	1.0354	1.034
5	......	......	......	......	......	......	......	......	......	......
6	1.0445	1.0292	1.0522	1.0532	1.0513	1.048	1.054	1.0550	1.0544	1.053
7	......	......	......	......	......	......	......	......	......	......
8	1.0604	1.0393	1.0712	1.0726	1.0701	1.065	1.072	1.075	1.0738	1.072
9	......	......	......	......	......	......	......	......	......	......
10	1.0766	1.0493	1.0907	1.0925	1.0896	1.083	1.091	1.096	1.0935	1.091
11	......	......	......	......	......	......	......	......	......	......
12	1.0931	......	1.1109	1.1130	1.1099	1.101	1.110	1.118	1.1135	1.111
13	......	......	......	......	......	......	......	......	......	......
14	1.1099	......	1.1317	1.1341	1.1308	1.119	1.129	1.141	1.1338	1.131
15	......	......	......	......	......	......	......	......	......	......
16	1.1271	......	1.1532	1.1558	1.1526	1.138	1.149	1.166	1.1544	1.152
17	......	......	......	......	......	......	......	......	......	......
18	1.1447	......	1.1757	1.1781	1.1753	1.158	1.171	1.191	1.1753	1.174
19	......	......	......	......	......	......	......	......	......	......
20	1.1628	......	1.1992	1.2010	1.1990	1.179	1.194	1.217	1.1965	1.197
21	......	......	......	......	......	......	......	......	......	......
22	1.1814	......	......	......	......	......	1.218	1.244	......	......
23	......	......	......	......	......	......	......	......	......	......
24	1.2005	......	......	......	......	......	1.243	1.272	......	......
25	......	......	1.2620	1.2600	1.2608	1.233	......	......	1.2543	1.258
30	......	......	1.3300	1.3250	1.3295	1.290	1.322	1.363	1.3170	1.325
35	......	......	1.4050	1.3960	1.4058	1.352	......	......	1.3859	1.398
40	......	......	1.4890	......	1.4904	1.419	1.466	1.546	1.4620	1.478
45	......	......	1.5830	......	1.5844	......	......	......	1.5470	1.566
50	......	......	1.6860	......	......	......	1.649	......	1.6430	1.663
60	......	......	......	......	......	......	......	......	1.8690	1.893
70	......	......	......	......	......	......	......	......	......	2.202
80	......	......	......	......	......	......	......	......	......	......

ETHYL ALCOHOL

Specific gravity of aqueous solutions of ethyl alcohol at $\frac{15.56°}{15.56°}$ C. To convert to specific gravity at $\frac{15.56°}{4°}$ C, multiply the specific gravities as given in the table by 0.99908.

(U. S. Dept. of Agriculture.)

Specific gravity $\frac{15.56°}{15.56°}$C.	% Alcohol by volume	% Alcohol by weight	Grams Alcohol per 100 cc
1.00000	0.00	0.00	0.00
0.99984	0.10	0.08	0.08
0.99968	0.20	0.16	0.16
0.99953	0.30	0.24	0.24
0.99937	0.40	0.32	0.32
0.99923	0.50	0.40	0.40
0.99907	0.60	0.48	0.48
0.99892	0.70	0.56	0.56
0.99877	0.80	0.64	0.64
0.99861	0.90	0.71	0.71
0.99849	1.00	0.79	0.79
0.99834	1.10	0.87	0.87
0.99819	1.20	0.95	0.95
0.99805	1.30	1.03	1.03
0.99790	1.40	1.11	1.11
0.99775	1.50	1.19	1.19
0.99760	1.60	1.27	1.27
0.99745	1.70	1.35	1.35
0.99731	1.80	1.43	1.43
0.99716	1.90	1.51	1.51
0.99701	2.00	1.59	1.59
0.99687	2.10	1.67	1.66
0.99672	2.20	1.75	1.74
0.99658	2.30	1.83	1.82
0.99643	2.40	1.91	1.90
0.99629	2.50	1.99	1.98
0.99615	2.60	2.07	2.06
0.99600	2.70	2.15	2.14
0.99586	2.80	2.23	2.22
0.99571	2.90	2.31	2.30
0.99557	3.00	2.39	2.38
0.99543	3.10	2.47	2.46
0.99529	3.20	2.55	2.54
0.99515	3.30	2.64	2.62
0.99501	3.40	2.72	2.70
0.99487	3.50	2.80	2.78
0.99473	3.60	2.88	2.86
0.99459	3.70	2.96	2.94
0.99445	3.80	3.04	3.02
0.99431	3.90	3.12	3.10
0.99417	4.00	3.20	3.18
0.99403	4.10	3.28	3.26
0.99390	4.20	3.36	3.34
0.99376	4.30	3.44	3.42
0.99363	4.40	3.52	3.50
0.99349	4.50	3.60	3.58
0.99335	4.60	3.68	3.66
0.99322	4.70	3.76	3.74
0.99308	4.80	3.84	3.81
0.99295	4.90	3.92	3.89
0.99281	5.00	4.00	3.97
0.99268	5.10	4.08	4.05
0.99255	5.20	4.16	4.13
0.99241	5.30	4.24	4.21
0.99228	5.40	4.32	4.29
0.99215	5.50	4.40	4.37
0.99202	5.60	4.48	4.44
0.99189	5.70	4.56	4.52
0.99175	5.80	4.64	4.60
0.99162	5.90	4.72	4.68
0.99149	6.00	4.80	4.76
0.99136	6.10	4.88	4.84
0.99123	6.20	4.96	4.92
0.99111	6.30	5.05	5.00
0.99098	6.40	5.13	5.08
0.99085	6.50	5.21	5.16
0.99072	6.60	5.29	5.24
0.99059	6.70	5.37	5.32
0.99047	6.80	5.45	5.40
0.99034	6.90	5.53	5.48
0.99021	7.00	5.61	5.56
0.99009	7.10	5.69	5.64
0.98996	7.20	5.77	5.72
0.98984	7.30	5.86	5.80
0.98971	7.40	5.94	5.88
0.98959	7.50	6.02	5.96
0.98947	7.60	6.10	6.04
0.98934	7.70	6.18	6.11
0.98922	7.80	6.26	6.19
0.98909	7.90	6.34	6.27
0.98897	8.00	6.42	6.35
0.98885	8.10	6.50	6.43
0.98873	8.20	6.58	6.51
0.98861	8.30	6.67	6.59
0.98849	8.40	6.75	6.67
0.98837	8.50	6.83	6.75
0.98825	8.60	6.91	6.83
0.98813	8.70	6.99	6.91
0.98801	8.80	7.07	6.99
0.98789	8.90	7.15	7.07
0.98777	9.00	7.23	7.14
0.98765	9.10	7.31	7.22
0.98754	9.20	7.39	7.30
0.98742	9.30	7.48	7.38
0.98730	9.40	7.56	7.46
0.98719	9.50	7.64	7.54
0.98707	9.60	7.72	7.62
0.98695	9.70	7.80	7.70
0.98683	9.80	7.88	7.78
0.98672	9.90	7.96	7.85
0.98660	10.00	8.04	7.93
0.98649	10.10	8.12	8.01
0.98637	10.20	8.20	8.09
0.98626	10.30	8.29	8.17
0.98614	10.40	8.37	8.25
0.98603	10.50	8.45	8.33
0.98592	10.60	8.53	8.41
0.98580	10.70	8.61	8.49
0.98569	10.80	8.70	8.57
0.98557	10.90	8.78	8.65

AQUEOUS ETHYL ALCOHOL AT $\frac{15.56}{15.56}$° C. (Continued)

Specific gravity $\frac{15.56°}{15.56°}$C.	% Alcohol by volume	% Alcohol by weight	Grams alcohol per 100 cc
0.98546	11.00	8.86	8.73
0.98535	11.10	8.94	8.81
0.98524	11.20	9.02	8.89
0.98513	11.30	9.11	8.97
0.98502	11.40	9.19	9.05
0.98491	11.50	9.27	9.13
0.98479	11.60	9.35	9.21
0.98468	11.70	9.43	9.29
0.98457	11.80	9.51	9.36
0.98446	11.90	9.59	9.44
0.98435	12.00	9.67	9.52
0.98424	12.10	9.75	9.60
0.98413	12.20	9.83	9.68
0.98402	12.30	9.92	9.76
0.98391	12.40	10.00	9.84
0.98381	12.50	10.08	9.92
0.98370	12.60	10.16	10.00
0.98359	12.70	10.24	10.07
0.98348	12.80	10.33	10.15
0.98337	12.90	10.41	10.23
0.98326	13.00	10.49	10.31
0.98315	13.10	10.57	10.39
0.98305	13.20	10.65	10.47
0.98294	13.30	10.74	10.55
0.98283	13.40	10.82	10.63
0.98273	13.50	10.90	10.71
0.98262	13.60	10.98	10.79
0.98251	13.70	11.06	10.87
0.98240	13.80	11.15	10.95
0.98230	13.90	11.23	11.03
0.98219	14.00	11.31	11.11
0.98209	14.10	11.39	11.19
0.98198	14.20	11.47	11.27
0.98188	14.30	11.56	11.35
0.98177	14.40	11.64	11.43
0.98167	14.50	11.72	11.51
0.98156	14.60	11.80	11.59
0.98146	14.70	11.88	11.67
0.98135	14.80	11.97	11.75
0.98125	14.90	12.05	11.82
0.98114	15.00	12.13	11.90
0.98104	15.10	12.21	11.98
0.98093	15.20	12.29	12.06
0.98083	15.30	12.38	12.14
0.98073	15.40	12.46	12.22
0.98063	15.50	12.54	12.30
0.98052	15.60	12.62	12.37
0.98042	15.70	12.70	12.45
0.98032	15.80	12.79	12.53
0.98021	15.90	12.87	12.61
0.98011	16.00	12.95	12.69
0.98001	16.10	13.03	12.77
0.97991	16.20	13.12	12.85
0.97980	16.30	13.20	12.93
0.97970	16.40	13.29	13.01
0.97960	16.50	13.37	13.09
0.97950	16.60	13.45	13.17
0.97940	16.70	13.53	13.25
0.97929	16.80	13.62	13.33
0.97917	16.90	13.70	13.41

Specific gravity $\frac{15.56°}{15.56°}$C.	% Alcohol by volume	% Alcohol by weight	Grams alcohol per 100 cc
0.97909	17.00	13.78	13.49
0.97899	17.10	13.86	13.57
0.97889	17.20	13.94	13.65
0.97879	17.30	14.03	13.73
0.97869	17.40	14.11	13.81
0.97859	17.50	14.19	13.89
0.97848	17.60	14.27	13.96
0.97838	17.70	14.35	14.04
0.97828	17.80	14.44	14.12
0.97818	17.90	14.52	14.20
0.97808	18.00	14.60	14.28
0.97798	18.10	14.68	14.36
0.97788	18.20	14.77	14.44
0.97778	18.30	14.85	14.52
0.97768	18.40	14.94	14.60
0.97758	18.50	15.02	14.68
0.97748	18.60	15.10	14.76
0.97738	18.70	15.18	14.84
0.97728	18.80	15.27	14.92
0.97718	18.90	15.38	15.00
0.97708	19.00	15.43	15.08
0.97698	19.10	15.51	15.15
0.97688	19.20	15.59	15.23
0.97678	19.30	15.68	15.31
0.97668	19.40	15.76	15.39
0.97658	19.50	15.84	15.47
0.97648	19.60	15.93	15.55
0.97638	19.70	16.01	15.63
0.97628	19.80	16.09	15.71
0.97618	19.90	16.18	15.79
0.97608	20.00	16.26	15.87
0.97598	20.10	16.34	15.95
0.97588	20.20	16.42	16.03
0.97578	20.30	16.51	16.10
0.97568	20.40	16.59	16.18
0.97558	20.50	16.67	16.26
0.97547	20.60	16.75	16.34
0.97537	20.70	16.84	16.42
0.97527	20.80	16.92	16.50
0.97517	20.90	17.01	16.58
0.97507	21.00	17.09	16.66
0.97497	21.10	17.17	16.74
0.97487	21.20	17.26	16.82
0.97477	21.30	17.34	16.90
0.97467	21.40	17.43	16.98
0.97457	21.50	17.51	17.06
0.97446	21.60	17.59	17.14
0.97436	21.70	17.67	17.22
0.97426	21.80	17.76	17.30
0.97416	21.90	17.84	17.38
0.97406	22.00	17.92	17.46
0.97396	22.10	18.00	17.54
0.97386	22.20	18.09	17.62
0.97375	22.30	18.17	17.70
0.97365	22.40	18.26	17.78
0.97355	22.50	18.34	17.86
0.97345	22.60	18.42	17.94
0.97335	22.70	18.51	18.02
0.97324	22.80	18.59	18.10
0.97314	22.90	18.68	18.18

(Continued on following page.

AQUEOUS ETHYL ALCOHOL AT $\frac{15.56}{15.56}$° C. (Continued)

Specific gravity $\frac{15.56}{15.56}$°C	% Alcohol by volume	% Alcohol by weight	Grams alcohol per 100 cc
0.97304	23.00	18.76	18.25
0.97294	23.10	18.84	18.33
0.97283	23.20	18.92	18.41
0.97273	23.30	19.01	18.49
0.97263	23.40	19.09	18.57
0.97253	23.50	19.17	18.65
0.97242	23.60	19.25	18.73
0.97232	23.70	19.34	18.81
0.97222	23.80	19.42	18.88
0.97211	23.90	19.51	18.96
0.97201	24.00	19.59	19.04
0.97191	24.10	19.67	19.12
0.97180	24.20	19.76	19.20
0.97170	24.30	19.84	19.28
0.97159	24.40	19.93	19.36
0.97149	24.50	20.01	19.44
0.97139	24.60	20.09	19.52
0.97128	24.70	20.18	19.60
0.97118	24.80	20.26	19.68
0.97107	24.90	20.35	19.76
0.97097	25.00	20.43	19.84
0.97086	25.10	20.51	19.92
0.97076	25.20	20.60	20.00
0.97065	25.30	20.68	20.08
0.97055	25.40	20.77	20.16
0.97044	25.50	20.85	20.24
0.97033	25.60	20.93	20.32
0.97023	25.70	21.02	20.40
0.97012	25.80	21.10	20.47
0.97001	25.90	21.19	20.55
0.96991	26.00	21.27	20.63
0.96980	26.10	21.35	20.71
0.96969	26.20	21.44	20.79
0.96959	26.30	21.52	20.87
0.96949	26.40	21.61	20.95
0.96937	26.50	21.69	21.03
0.96926	26.60	21.77	21.11
0.96915	26.70	21.86	21.19
0.96905	26.80	21.94	21.27
0.96894	26.90	22.03	21.35
0.96883	27.00	22.11	21.43
0.96872	27.10	22.20	21.51
0.96861	27.20	22.28	21.59
0.96850	27.30	22.37	21.67
0.96839	27.40	22.45	21.75
0.96828	27.50	22.54	21.83
0.96816	27.60	22.62	21.90
0.96805	27.70	22.71	21.98
0.96794	27.80	22.79	22.06
0.96783	27.90	22.88	22.14
0.96772	28.00	22.96	22.22
0.96761	28.10	23.04	22.30
0.96749	28.20	23.13	22.38
0.96738	28.30	23.21	22.45
0.96726	28.40	23.30	22.53
0.96715	28.50	23.38	22.61
0.96704	28.60	23.47	22.69
0.96692	28.70	23.55	22.77
0.96681	28.80	23.64	22.85
0.96669	28.90	23.72	22.93
0.96658	29.00	23.81	23.01
0.96646	29.10	23.89	23.09
0.96635	29.20	23.98	23.17
0.96623	29.30	24.06	23.25
0.96611	29.40	24.15	23.33
0.96600	29.50	24.23	23.41
0.96587	29.60	24.32	23.49
0.96576	29.70	24.40	23.57
0.96564	29.80	24.49	23.65
0.96553	29.90	24.57	23.73
0.96541	30.00	24.66	23.81
0.96529	30.10	24.74	23.89
0.96517	30.20	24.83	23.97
0.96505	30.30	24.91	24.04
0.96493	30.40	25.00	24.12
0.96481	30.50	25.08	24.20
0.96469	30.60	25.17	24.28
0.96457	30.70	25.25	24.36
0.96445	30.80	25.34	24.44
0.96433	30.90	25.42	24.52
0.96421	31.00	25.51	24.60
0.96409	31.10	25.60	24.68
0.96396	31.20	25.68	24.76
0.96384	31.30	25.77	24.84
0.96372	31.40	25.85	24.92
0.96360	31.50	25.94	25.00
0.96347	31.60	26.03	25.08
0.96335	31.70	26.11	25.16
0.96323	31.80	26.20	25.24
0.96310	31.90	26.28	25.32
0.96298	32.00	26.37	25.40
0.96285	32.10	26.46	25.48
0.96273	32.20	26.54	25.56
0.96260	32.30	26.63	25.64
0.96248	32.40	26.71	25.71
0.96235	32.50	26.80	25.79
0.96222	32.60	26.89	25.87
0.96210	32.70	26.97	25.95
0.96197	32.80	27.06	26.03
0.96185	32.90	27.14	26.11
0.96172	33.00	27.23	26.19
0.96159	33.10	27.32	26.27
0.96146	33.20	27.40	26.35
0.96133	33.30	27.49	26.43
0.96120	33.40	27.57	26.51
0.96108	33.50	27.66	26.59
0.96095	33.60	27.75	26.67
0.96082	33.70	27.83	26.75
0.96069	33.80	27.92	26.82
0.96056	33.90	28.00	26.90
0.96043	34.00	28.09	26.98
0.96030	34.10	28.18	27.06
0.96016	34.20	28.26	27.14
0.96003	34.30	28.35	27.22
0.95990	34.40	28.43	27.30
0.95977	34.50	28.52	27.38
0.95963	34.60	28.61	27.46
0.95950	34.70	28.70	27.54
0.95937	34.80	28.78	27.62
0.95923	34.90	28.87	27.70

AQUEOUS ETHYL ALCOHOL AT $\frac{15.56°}{15.56°}$ C. (Continued)

Specific gravity $\frac{15.56°}{15.56°}$C.	% Alcohol by volume	% Alcohol by weight	Grams alcohol per 100 cc
0.95910	35.00	28.96	27.78
0.95896	35.10	29.05	27.86
0.95883	35.20	29.13	27.94
0.95869	35.30	29.22	28.02
0.95855	35.40	29.30	28.09
0.95842	35.50	29.38	28.17
0.95828	35.60	29.48	28.25
0.95814	35.70	29.57	28.33
0.95800	35.80	29.65	28.41
0.95787	35.90	29.74	28.49
0.95773	36.00	29.83	28.57
0.95759	36.10	29.92	28.65
0.95745	36.20	30.00	28.73
0.95731	36.30	30.09	28.81
0.95717	36.40	30.17	28.88
0.95703	36.50	30.26	28.96
0.95688	36.60	30.35	29.04
0.95674	36.70	30.44	29.12
0.95660	36.80	30.52	29.20
0.95646	36.90	30.61	29.29
0.95632	37.00	30.70	29.36
0.95618	37.10	30.79	29.44
0.95603	37.20	30.88	29.52
0.95589	37.30	30.96	29.60
0.95574	37.40	31.05	29.68
0.95560	37.50	31.14	29.76
0.95545	37.60	31.23	29.84
0.95531	37.70	31.32	29.92
0.95516	37.80	31.40	30.00
0.95502	37.90	31.49	30.08
0.95487	38.00	31.58	30.16
0.95472	38.10	31.67	30.24
0.95457	38.20	31.76	30.32
0.95442	38.30	31.85	30.40
0.95427	38.40	31.94	30.48
0.95413	38.50	32.03	30.56
0.95398	38.60	32.12	30.64
0.95383	38.70	32.20	30.72
0.95368	38.80	32.29	30.79
0.95353	38.90	32.37	30.87
0.95338	39.00	32.46	30.95
0.95323	39.10	32.55	31.03
0.95307	39.20	32.64	31.11
0.95292	39.30	32.72	31.18
0.95277	39.40	32.81	31.26
0.95262	39.50	32.90	31.34
0.95246	39.60	32.99	31.42
0.95231	39.70	33.08	31.50
0.95216	39.80	33.17	31.58
0.95200	39.90	33.27	31.66
0.95185	40.00	33.35	31.74
0.95169	40.10	33.44	31.82
0.95154	40.20	33.53	31.90
0.95138	40.30	33.61	31.98
0.95122	40.40	33.70	32.06
0.95107	40.50	33.79	32.14
0.95091	40.60	33.88	32.22
0.95075	40.70	33.97	32.30
0.95059	40.80	34.06	32.38
0.95044	40.90	34.15	32.46
0.95028	41.00	34.24	32.54
0.95012	41.10	34.33	32.62
0.94996	41.20	34.42	32.70
0.94980	41.30	34.50	32.78
0.94964	41.40	34.59	32.86
0.94948	41.50	34.68	32.93
0.94932	41.60	34.77	33.01
0.94916	41.70	34.86	33.09
0.94900	41.80	34.95	33.17
0.94884	41.90	35.04	33.25
0.94868	42.00	35.13	33.33
0.94852	42.10	35.22	33.41
0.94835	42.20	35.31	33.49
0.94810	42.30	35.40	33.57
0.94802	42.40	35.49	33.65
0.94786	42.50	35.58	33.73
0.94770	42.60	35.67	33.81
0.94753	42.70	35.76	33.89
0.94737	42.80	35.85	33.97
0.94720	42.90	35.94	34.04
0.94704	43.00	36.03	34.12
0.94687	43.10	36.12	34.20
0.94670	43.20	36.21	34.28
0.94654	43.30	36.30	34.36
0.94637	43.40	36.39	34.44
0.94620	43.50	36.48	34.52
0.94603	43.60	36.57	34.60
0.94586	43.70	36.66	34.68
0.94570	43.80	36.75	34.76
0.94553	43.90	36.84	34.84
0.94536	44.00	36.93	34.91
0.94519	44.10	37.02	34.99
0.94502	44.20	37.11	35.07
0.94484	44.30	37.21	35.15
0.94467	44.40	37.30	35.23
0.94450	44.50	37.39	35.31
0.94433	44.60	37.48	35.39
0.94416	44.70	37.57	35.47
0.94398	44.80	37.66	35.55
0.94381	44.90	37.76	35.63
0.94364	45.00	37.84	35.71
0.94346	45.10	37.93	35.79
0.94329	45.20	38.02	35.87
0.94311	45.30	38.12	35.95
0.94294	45.40	38.21	36.03
0.94276	45.50	38.30	36.11
0.94258	45.60	38.39	36.19
0.94241	45.70	38.48	36.26
0.94223	45.80	38.57	36.34
0.94206	45.90	38.66	36.42
0.94188	46.00	38.75	36.50
0.94170	46.10	38.84	36.58
0.94152	46.20	38.93	36.66
0.94134	46.30	39.03	36.74
0.94116	46.40	39.12	36.82
0.94098	46.50	39.21	36.90
0.94080	46.60	39.30	36.98
0.94062	46.70	39.39	37.06
0.94044	46.80	39.49	37.13
0.94026	46.90	39.58	37.21

(Continued on following page.)

AQUEOUS ETHYL ALCOHOL AT $\frac{15.56}{15.56}$°C. (Continued)†

Specific gravity $\frac{15.56°}{15.56°}$C.	% Alcohol by volume	% Alcohol by weight	Grams alcohol per 100 cc
0.94008	47.00	39.67	37.29
0.93990	47.10	39.76	37.37
0.93971	47.20	39.85	37.45
0.93953	47.30	39.95	37.53
0.93934	47.40	40.04	37.61
0.93916	47.50	40.13	37.69
0.93898	47.60	40.22	37.77
0.93879	47.70	40.32	37.85
0.93861	47.80	40.41	37.93
0.93842	47.90	40.51	38.01
0.93824	48.00	40.60	38.09
0.93805	48.10	40.69	38.17
0.93786	48.20	40.78	38.25
0.93768	48.30	40.88	38.33
0.93749	48.40	40.97	38.41
0.93730	48.50	41.06	38.49
0.93711	48.60	41.15	38.57
0.93692	48.70	41.24	38.65
0.93679	48.80	41.34	38.72
0.93655	48.90	41.43	38.80
0.93636	49.00	41.52	38.88
0.93617	49.10	41.61	38.96
0.93598	49.20	41.71	39.04
0.93578	49.30	41.80	39.12
0.93559	49.40	41.90	39.20
0.93540	49.50	41.99	39.28
0.93521	49.60	42.08	39.36
0.93502	49.70	42.18	39.44
0.93482	49.80	42.27	39.52
0.93463	49.90	42.37	39.60
0.9344	50.00	*42.47*	*39.69*
0.9325	51.00	*43.41*	*40.48*
0.9305	52.00	*44.35*	*41.27*
0.9285	53.00	*45.31*	*42.07*
0.9264	54.00	*46.27*	*42.86*
0.9244	55.00	*47.23*	*43.66*
0.9222	56.00	*48.20*	*44.45*
0.9201	57.00	*49.18*	*45.23*
0.9180	58.00	*50.16*	*46.04*
0.9158	59.00	*51.15*	*46.83*
0.9136	60.00	*52.16*	*47.63*
0.9113	61.00	*53.15*	*48.41*
0.9091	62.00	*54.16*	*49.21*
0.9068	63.00	*55.16*	*50.00*
0.9044	64.00	*56.18*	*50.80*
0.9021	65.00	*57.21*	*51.59*
0.8997	66.00	*58.24*	*52.39*
0.8974	67.00	*59.28*	*53.19*
0.8949	68.00	*60.33*	*53.98*
0.8925	69.00	*61.39*	*54.77*
0.8900	70.00	*62.45*	*55.56*
0.8876	71.00	*63.51*	*56.36*
0.8850	72.00	*64.59*	*57.16*
0.8825	73.00	*65.67*	*57.95*
0.8799	74.00	*66.76*	*58.74*
0.8773	75.00	*67.84*	*59.53*
0.8747	76.00	*68.99*	*60.33*
0.8721	77.00	*70.10*	*61.12*
0.8694	78.00	*71.25*	*61.91*
0.8667	79.00	*72.38*	*62.71*
0.8639	80.00	*73.54*	*63.51*
0.8611	81.00	*74.68*	*64.30*
0.8583	82.00	*75.82*	*65.09*
0.8554	83.00	*77.00*	*65.89*
0.8525	84.00	*78.18*	*66.68*
0.8496	85.00	*79.40*	*67.47*
0.8465	86.00	*80.62*	*68.27*
0.8435	87.00	*81.85*	*69.06*
0.8404	88.00	*83.11*	*69.86*
0.8372	89.00	*84.38*	*70.65*
0.8339	90.00	*85.66*	*71.44*
0.8306	91.00	*86.97*	*72.23*
0.8272	92.00	*88.29*	*73.03*
0.8236	93.00	*89.61*	*73.82*
0.8199	94.00	*91.00*	*74.62*
0.8161	95.00	*92.41*	*75.41*
0.8121	96.00	*93.82*	*76.21*
0.8079	97.00	*95.29*	*77.01*
0.8035	98.00	*96.78*	*77.79*
0.7989	99.00	*98.37*	*78.59*
0.7939	100.00	100.00	79.39

AQUEOUS ETHYL ALCOHOL

Density of solutions at $\frac{20°}{4°}$ C. d $\frac{20°}{4°}$ = g/ml in vacuo

% Alcohol by weight	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
0	0.99823	804	785	766	748	729	710	692	673	655
1	636	618	599	581	562	544	525	507	489	471
2	453	435	417	399	381	363	345	327	310	292
3	275	257	240	222	205	188	171	154	137	120
4	103	087	070	053	037	020	003	*987	*971	*954
5	0.98938	922	906	890	874	859	843	827	811	796
6	780	765	749	734	718	703	688	673	658	642
7	627	612	597	582	567	553	538	523	508	493
8	478	463	449	434	419	404	389	374	360	345
9	331	316	301	287	273	258	244	229	215	201
10	187	172	158	144	130	117	103	089	075	061

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† The values printed in italics were interpolated from Hehner's table as given on page 162 of R. F. Herrick's "Denatured or Industrial Alcohol," Wiley, New York (1907).

AQUEOUS ETHYL ALCOHOL AT $\frac{20°}{4°}$ C. (Continued)

% Alcohol by weight	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
11	0.98047	033	019	006	*992	*978	*964	*951	*937	*923
12	0.97910	896	883	869	855	842	828	815	801	788
13	775	761	748	735	722	709	696	683	670	657
14	643	630	617	604	591	578	565	552	539	526
15	514	501	488	475	462	450	438	425	412	400
16	0.97387	374	361	349	336	323	310	297	284	272
17	259	246	233	220	207	194	181	168	155	142
18	129	116	103	089	076	063	050	037	024	010
19	0.96997	984	971	957	944	931	917	904	891	877
20	864	850	837	823	810	796	783	769	756	742
21	0.96729	716	702	688	675	661	647	634	620	606
22	592	578	564	551	537	523	509	495	481	467
23	453	439	425	411	396	382	368	354	340	326
24	312	297	283	269	254	240	225	211	196	182
25	168	153	139	124	109	094	080	065	050	035
26	0.96020	005	*990	*975	*959	*944	*929	*914	*898	*883
27	0.95867	851	836	820	805	789	773	757	742	726
28	710	694	678	662	646	630	613	597	581	565
29	548	532	516	499	483	466	450	433	416	400
30	382	365	349	332	315	298	281	264	247	230
31	0.95212	195	178	161	143	126	108	091	074	056
32	038	020	003	*985	*967	*950	*932	*914	*896	*878
33	0.94860	842	824	806	788	770	752	734	715	697
34	679	660	642	624	605	587	568	550	531	512
35	494	475	456	438	419	400	382	363	344	325
36	0.94306	287	268	249	230	211	192	172	153	134
37	114	095	075	056	036	017	*997	*978	*958	*939
38	0.93919	899	879	859	840	820	800	780	760	740
39	720	700	680	660	640	620	599	579	559	539
40	518	498	478	458	437	417	396	376	356	335
41	0.93314	294	273	253	232	212	191	170	149	129
42	107	086	065	044	023	002	*981	*960	*939	*918
43	0.92897	876	855	834	812	791	770	749	728	707
44	685	664	642	621	600	579	557	536	515	493
45	472	450	429	408	386	365	343	322	300	279
46	0.92257	236	214	193	171	150	128	106	085	063
47	041	019	*997	*976	*954	*932	*910	*889	*867	*845
48	0.91823	801	780	758	736	714	692	670	648	626
49	604	582	560	538	516	494	472	450	428	406
50	384	361	339	317	295	272	250	228	206	183
51	0.91160	138	116	093	071	049	026	004	*981	*959
52	0.90936	914	891	869	846	824	801	779	756	734
53	711	689	666	644	621	598	576	553	531	508
54	485	463	440	417	395	372	349	327	304	281
55	258	236	213	190	167	145	122	099	076	054
56	0.90031	008	*985	*962	*939	*917	*894	*871	*848	*825
57	0.89803	780	757	734	711	688	665	643	620	597
58	574	551	528	505	482	459	436	413	390	367
59	344	321	298	275	252	229	206	183	160	137
60	113	090	067	044	021	*998	*975	*951	*928	*905
61	0.88882	859	836	812	789	766	743	720	696	673
62	650	626	603	580	557	533	510	487	463	440
63	417	393	370	347	323	300	277	253	230	206
64	183	160	136	113	089	066	042	019	*995	*972
65	0.87948	925	901	878	854	831	807	784	760	737
66	0.87713	689	666	642	619	595	572	548	524	501
67	477	454	430	406	383	359	336	312	288	265
68	241	218	194	170	147	123	099	075	052	028
69	004	*981	*957	*933	*909	*885	*862	*838	*814	*790
70	0.86766	742	718	694	671	647	623	599	575	551
71	527	503	479	455	431	407	383	359	335	311

(Continued on following page.)

AQUEOUS ETHYL ALCOHOL AT $\frac{20°}{4°}$ C. (Continued)

% Alcohol by weight	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
72	0.86287	263	239	215	191	167	143	119	095	071
73	047	022	*998	*974	*950	*926	*902	*878	*854	*830
74	0.85806	781	757	733	709	685	661	636	612	588
75	564	540	515	491	467	443	419	394	370	346
76	322	297	273	249	225	200	176	152	128	103
77	0.85079	055	031	006	*982	*958	*933	*909	*884	*860
78	0.84835	811	787	762	738	713	689	664	640	615
79	590	566	541	517	492	467	443	418	393	369
80	344	319	294	270	245	220	196	171	146	121
81	096	072	047	022	*997	*972	*947	*923	*898	*873
82	0.83848	823	798	773	748	723	698	674	649	624
83	599	574	549	523	498	473	448	423	398	373
84	348	323	297	272	247	222	196	171	146	120
85	095	070	044	019	*994	*968	*943	*917	*892	*866
86	0.82840	815	789	763	738	712	686	660	635	609
87	0.82583	557	531	505	479	453	427	401	375	349
88	323	297	271	245	219	193	167	140	114	088
89	062	035	009	*983	*956	*930	*903	*877	*850	*824
90	0.81797	770	744	717	690	664	637	610	583	556
91	529	502	475	448	421	394	366	339	312	285
92	0.81257	230	203	175	148	120	093	066	038	010
93	0.80983	955	928	900	872	844	817	789	761	733
94	705	677	649	621	593	565	537	509	480	452
95	424	395	367	338	310	281	253	224	195	166
96	138	109	080	051	022	*993	*963	*934	*905	*875
97	0.79846	816	787	757	727	698	668	638	608	578
98	547	517	487	456	426	396	365	335	305	274
99	243	213	182	151	120	089	059	028	*997	*966
100	0.78934									

ETHYL ALCOHOL

The table below gives the values for $d_{4°}^{t°}$ = g/ml *in vacuo*.
Osborne-McKelvy-Bearce, *Bull. Bu. Stand.*, Vol 9, p. 424 (1913)

% Alcohol by weight	$d\frac{10°}{4°}C$	$d\frac{20°}{4°}C$	$d\frac{25°}{4°}C$	$d\frac{30°}{4°}C$
0	0.99973	0.99823	0.99708	0.99568
1	0.99785	0.99636	0.99520	0.99379
2	0.99602	0.99453	0.99336	0.99194
3	0.99426	0.99275	0.99157	0.99014
4	0.99258	0.99103	0.98984	0.98839
5	0.99098	0.98938	0.98817	0.98670
6	0.98946	0.98780	0.98656	0.98507
7	0.98801	0.98627	0.98500	0.98347
8	0.98660	0.98478	0.98346	0.98189
9	0.98524	0.98331	0.98193	0.98031
10	0.98393	0.98187	0.98043	0.97875
11	0.98267	0.98047	0.97897	0.97723
12	0.98145	0.97910	0.97753	0.97573
13	0.98026	0.97775	0.97611	0.97424
14	0.97911	0.97643	0.97472	0.97278
15	0.97800	0.97514	0.97334	0.97133
16	0.97692	0.97387	0.97199	0.96990
17	0.97583	0.97259	0.97062	0.96811
18	0.97473	0.97129	0.96923	0.96697
19	0.97363	0.96997	0.96782	0.96517
20	0.97252	0.96864	0.96639	0.96395
21	0.97139	0.96729	0.96495	0.96242

ETHYL ALCOHOL (Continued)

% Alcohol by weight	$d\frac{10°}{4°}C$	$d\frac{20°}{4°}C$	$d\frac{25°}{4°}C$	$d\frac{30°}{4°}C$
22	0.97024	0.96592	0.96348	0.96087
23	0.96907	0.96453	0.96199	0.95929
24	0.96787	0.96312	0.96048	0.95769
25	0.96665	0.96168	0.95895	0.95607
26	0.96539	0.96020	0.95738	0.95442
27	0.96406	0.95867	0.95576	0.95272
28	0.96268	0.95710	0.95410	0.95098
29	0.96125	0.95548	0.95241	0.94922
30	0.95977	0.95382	0.95067	0.94741
31	0.95823	0.95212	0.94890	0.94557
32	0.95665	0.95038	0.94709	0.94370
33	0.95502	0.94860	0.94525	0.94180
34	0.95334	0.94679	0.94337	0.93986
35	0.95162	0.94494	0.94146	0.93790
36	0.94986	0.94306	0.93952	0.93591
37	0.94805	0.94114	0.93756	0.93390
38	0.94620	0.93919	0.93556	0.93186
39	0.94431	0.93720	0.93353	0.92979
40	0.94238	0.93518	0.93148	0.92770
41	0.94042	0.93314	0.92940	0.92558
42	0.93842	0.93107	0.92729	0.92344
43	0.93639	0.92897	0.92516	0.92128
44	0.93433	0.92685	0.92301	0.91910
45	0.93226	0.92472	0.92085	0.91692
46	0.93017	0.92257	0.91868	0.91472
47	0.92806	0.92041	0.91649	0.91250
48	0.92593	0.91823	0.91429	0.91028
49	0.92379	0.91604	0.91208	0.90805
50	0.92162	0.91384	0.90985	0.90580
51	0.91943	0.91160	0.90760	0.90353
52	0.91723	0.90936	0.90534	0.90125
53	0.91502	0.90711	0.90307	0.89896
54	0.91279	0.90485	0.90079	0.89667
55	0.91055	0.90258	0.89850	0.89437
56	0.90831	0.90031	0.89621	0.89206
57	0.90607	0.89803	0.89392	0.88975
58	0.90381	0.89574	0.89162	0.88744
59	0.90154	0.89344	0.88931	0.88512
60	0.89927	0.89113	0.88699	0.88278
61	0.89698	0.88882	0.88466	0.88044
62	0.89468	0.88650	0.88233	0.87809
63	0.89237	0.88417	0.87998	0.87574
64	0.89006	0.88183	0.87763	0.87337
65	0.88774	0.87948	0.87527	0.87100
66	0.88541	0.87713	0.87291	0.86863
67	0.88308	0.87477	0.87054	0.86625
68	0.88074	0.87241	0.86817	0.86387
69	0.87839	0.87004	0.86579	0.86148
70	0.87602	0.86766	0.86340	0.85908
71	0.87365	0.86527	0.86100	0.85667
72	0.87127	0.86287	0.85859	0.85426
73	0.86888	0.86047	0.85618	0.85184
74	0.86648	0.85806	0.85376	0.84941
75	0.86408	0.85564	0.85134	0.84698
76	0.86168	0.85322	0.84891	0.84455
77	0.85927	0.85079	0.84647	0.84211
78	0.85685	0.84835	0.84403	0.83966
79	0.85442	0.84590	0.84158	0.83720
80	0.85197	0.84344	0.83911	0.83473
81	0.84950	0.84096	0.83664	0.83224
82	0.84702	0.83848	0.83415	0.82974

(Continued on following page.)

ETHYL ALCOHOL (Continued)

% Alcohol by weight	$d\frac{10^\circ}{4^\circ}C$	$d\frac{20^\circ}{4^\circ}C$	$d\frac{25^\circ}{4^\circ}C$	$d\frac{30^\circ}{4^\circ}C$
83	0.84453	0.83599	0.83164	0.82724
84	0.84203	0.83348	0.82913	0.82473
85	0.83951	0.83095	0.82660	0.82220
86	0.83697	0.82840	0.82405	0.81965
87	0.83441	0.82583	0.82148	0.81708
88	0.83181	0.82323	0.81888	0.81448
89	0.82919	0.82062	0.81626	0.81186
90	0.82654	0.81797	0.81362	0.80922
91	0.82386	0.81529	0.81094	0.80655
92	0.82114	0.81257	0.80823	0.80384
93	0.81839	0.80983	0.80549	0.80111
94	0.81561	0.80705	0.80272	0.79835
95	0.81278	0.80424	0.79991	0.79555
96	0.80991	0.80138	0.79706	0.79271
97	0.80698	0.79846	0.79415	0.78981
98	0.80399	0.79547	0.79117	0.78684
99	0.80094	0.79243	0.78814	0.78382
100	0.79784	0.78934	0.78506	0.78075

ETHYL ALCOHOL

Specific gravity of aqueous solutions of ethyl alcohol at $\frac{20^\circ}{20^\circ}$ C and at $\frac{25^\circ}{25^\circ}$ C.

% Alcohol by weight	Specific gravity $\frac{20^\circ}{20^\circ}C$	Specific gravity $\frac{25^\circ}{25^\circ}C$
0	1.00000	1.00000
1	0.99813	0.99811
2	0.99629	0.99627
3	0.99451	0.99447
4	0.99279	0.99274
5	0.99113	0.99106
6	0.98955	0.98945
7	0.98802	0.98788
8	0.98653	0.98634
9	0.98505	0.98481
10	0.98361	0.98330
11	0.98221	0.98184
12	0.98084	0.98039
13	0.97948	0.97897
14	0.97816	0.97757
15	0.97687	0.97619
16	0.97560	0.97484
17	0.97431	0.97346
18	0.97301	0.97207
19	0.97169	0.97065
20	0.97036	0.96922
21	0.96901	0.96778
22	0.96763	0.96630
23	0.96624	0.96481
24	0.96483	0.96329
25	0.96339	0.96176
26	0.96190	0.96018
27	0.96037	0.95856
28	0.95880	0.95689
29	0.95717	0.95520
30	0.95551	0.95345
31	0.95381	0.95168

% Alcohol by weight	Specific gravity $\frac{20^\circ}{20^\circ}C$	Specific gravity $\frac{25^\circ}{25^\circ}C$
32	0.95207	0.94986
33	0.95028	0.94802
34	0.94847	0.94613
35	0.94662	0.94422
36	0.94473	0.94227
37	0.94281	0.94031
38	0.94086	0.93830
39	0.93886	0.93626
40	0.93684	0.93421
41	0.93479	0.93212
42	0.93272	0.93001
43	0.93062	0.92787
44	0.92849	0.92571
45	0.92636	0.92355
46	0.92421	0.92137
47	0.92204	0.91917
48	0.91986	0.91697
49	0.91766	0.91475
50	0.91546	0.91251
51	0.91322	0.91026
52	0.91097	0.90799
53	0.90872	0.90571
54	0.90645	0.90343
55	0.90418	0.90113
56	0.90191	0.89883
57	0.89962	0.89654
58	0.89733	0.89423
59	0.89502	0.89191
60	0.89271	0.88959
61	0.89040	0.88725
62	0.88807	0.88491
63	0.88574	0.88256

ETHYL ALCOHOL (Continued)

% Alcohol by weight	Specific gravity $\frac{20^\circ}{20^\circ}$C	Specific gravity $\frac{25^\circ}{25^\circ}$C
64	0.88339	0.88020
65	0.88104	0.87783
66	0.87869	0.87547
67	0.87632	0.87309
68	0.87396	0.87071
69	0.87158	0.86833
70	0.86920	0.86593
71	0.86680	0.86352
72	0.86440	0.86110
73	0.86200	0.85869
74	0.85958	0.85626
75	0.85716	0.85383
76	0.85473	0.85140
77	0.85230	0.84895
78	0.84985	0.84650
79	0.84740	0.84404
80	0.84494	0.84157
81	0.84245	0.83909
82	0.83997	0.83659
83	0.83747	0.83408
84	0.83496	0.83156
85	0.83242	0.82902
86	0.82987	0.82646
87	0.82729	0.82389
88	0.82469	0.82128
89	0.82207	0.81865
90	0.81942	0.81600
91	0.81674	0.81331
92	0.81401	0.81060
93	0.81127	0.80785
94	0.80848	0.80507
95	0.80567	0.80225
96	0.80280	0.79939
97	0.79988	0.79648
98	0.79688	0.79349
99	0.79383	0.79045
100	0.79074	0.78736

DENSITY OF ETHYL ALCOHOL

This table gives the weight in grams of one cubic centimeter of ethyl alcohol as computed from Mendelejeff's formula.

Temp. °C.	Density
0	0.80625
1	0.80541
2	0.80457
3	0.80374
4	0.80290
5	0.80207
6	0.80123
7	0.80039
8	0.79956
9	0.79872
10	0.79788
11	0.79704
12	0.79620
13	0.79535
14	0.79451
15	0.79367
16	0.79283
17	0.79198
18	0.79114
19	0.79029
20	0.78945
21	0.78860
22	0.78775
23	0.78691
24	0.78606
25	0.78522
26	0.78437
27	0.78352
28	0.78267
29	0.78182
30	0.78097
31	0.78012
32	0.77927
33	0.77841
34	0.77756
35	0.77671
36	0.77585
37	0.77500
38	0.77414
39	0.77329

METHYL ALCOHOL

Specific gravity of aqueous solutions of methyl alcohol at $\frac{15.6°}{15.6°}$ C. To convert to specific gravity at $\frac{15.6°}{4°}$ C, multiply the specific gravities as given in the table by 0.99908.

[Arkiv. Kemi Min. Geol. [2] 27, 32 (Stockholm.)]

Specific gravity $\frac{15.6°}{15.6°}$C.	% Alcohol by weight	% Alcohol by volume	Specific gravity $\frac{15.6°}{15.6°}$C.	% Alcohol by weight	% Alcohol by volume	Specific gravity $\frac{15.6°}{15.5°}$C.	% Alcohol by weight	% Alcohol by volume
1.0000	0.00	0.00	0.9944	3.07	3.91	0.9888	6.48	8.05
0.9999	0.06	0.07	0.9943	3.13	3.98	0.9887	6.55	8.13
0.9998	0.11	0.13	0.9942	3.18	4.06	0.9886	6.61	8.21
0.9997	0.17	0.20	0.9941	3.24	4.13	0.9885	6.67	8.29
0.9996	0.22	0.27	0.9940	3.30	4.20	0.9884	6.74	8.36
0.9995	0.28	0.33	0.9939	3.36	4.27	0.9883	6.80	8.44
0.9994	0.33	0.40	0.9938	3.42	4.35	0.9882	6.86	8.52
0.9993	0.39	0.47	0.9937	3.48	4.42	0.9881	6.93	8.59
0.9992	0.44	0.53	0.9936	3.53	4.49	0.9880	6.99	8.67
0.9991	0.50	0.60	0.9935	3.59	4.57	0.9879	7.06	8.75
0.9990	0.55	0.67	0.9934	3.65	4.64	0.9878	7.12	8.83
0.9989	0.61	0.73	0.9933	3.71	4.71	0.9877	7.19	8.90
0.9988	0.66	0.80	0.9932	3.77	4.79	0.9876	7.25	8.98
0.9987	0.72	0.86	0.9931	3.83	4.86	0.9875	7.32	9.06
0.9986	0.77	0.93	0.9930	3.89	4.94	0.9874	7.38	9.14
0.9985	0.83	1.00	0.9929	3.94	5.01	0.9873	7.45	9.22
0.9984	0.88	1.06	0.9928	4.00	5.08	0.9872	7.51	9.29
0.9983	0.94	1.13	0.9927	4.06	5.16	0.9871	7.58	9.37
0.9982	0.99	1.20	0.9926	4.12	5.23	0.9870	7.64	9.45
0.9981	1.05	1.26	0.9925	4.18	5.30	0.9869	7.71	9.53
0.9980	1.10	1.33	0.9924	4.24	5.38	0.9868	7.77	9.61
0.9979	1.15	1.40	0.9923	4.29	5.45	0.9867	7.84	9.68
0.9978	1.20	1.47	0.9922	4.35	5.52	0.9866	7.90	9.76
0.9977	1.26	1.54	0.9921	4.41	5.60	0.9865	7.97	9.84
0.9976	1.31	1.62	0.9920	4.47	5.67	0.9864	8.03	9.92
0.9975	1.36	1.69	0.9919	4.53	5.74	0.9863	8.10	10.00
0.9974	1.41	1.76	0.9918	4.60	5.82	0.9862	8.16	10.07
0.9973	1.46	1.83	0.9917	4.66	5.89	0.9861	8.23	10.15
0.9972	1.52	1.90	0.9916	4.72	5.96	0.9860	8.29	10.23
0.9971	1.57	1.97	0.9915	4.78	6.04	0.9859	8.35	10.31
0.9970	1.62	2.05	0.9914	4.85	6.11	0.9858	8.42	10.38
0.9969	1.67	2.12	0.9913	4.91	6.18	0.9857	8.48	10.47
0.9968	1.72	2.19	0.9912	4.97	6.25	0.9856	8.55	10.55
0.9967	1.78	2.26	0.9911	5.03	6.33	0.9855	8.61	10.63
0.9966	1.83	2.33	0.9910	5.10	6.40	0.9854	8.68	10.71
0.9965	1.88	2.40	0.9909	5.16	6.47	0.9853	8.74	10.79
0.9964	1.93	2.47	0.9908	5.22	6.55	0.9852	8.81	10.87
0.9963	1.98	2.55	0.9907	5.28	6.62	0.9851	8.87	10.95
0.9962	2.04	2.62	0.9906	5.35	6.69	0.9850	8.94	11.03
0.9961	2.09	2.69	0.9905	5.41	6.77	0.9849	9.00	11.10
0.9960	2.14	2.76	0.9904	5.47	6.84	0.9848	9.06	11.18
0.9959	2.20	2.83	0.9903	5.53	6.91	0.9847	9.13	11.26
0.9958	2.26	2.90	0.9902	5.60	6.98	0.9846	9.19	11.34
0.9957	2.31	2.98	0.9901	5.66	7.06	0.9845	9.26	11.42
0.9956	2.37	3.05	0.9900	5.72	7.13	0.9844	9.32	11.50
0.9955	2.43	3.12	0.9899	5.78	7.21	0.9843	9.39	11.58
0.9954	2.49	3.19	0.9898	5.85	7.28	0.9842	9.45	11.66
0.9953	2.55	3.26	0.9897	5.91	7.36	0.9841	9.52	11.74
0.9952	2.60	3.34	0.9896	5.97	7.44	0.9840	9.58	11.82
0.9951	2.66	3.41	0.9895	6.04	7.52	0.9839	9.65	11.90
0.9950	2.72	3.48	0.9894	6.10	7.59	0.9838	9.72	11.98
0.9949	2.78	3.55	0.9893	6.16	7.67	0.9837	9.78	12.06
0.9948	2.84	3.62	0.9892	6.23	7.75	0.9836	9.85	12.14
0.9947	2.89	3.70	0.9891	6.29	7.82	0.9835	9.92	12.23
0.9946	2.95	3.77	0.9890	6.36	7.90	0.9834	9.99	12.31
0.9945	3.01	3.84	0.9889	6.42	7.98	0.9833	10.06	12.39

AQUEOUS METHYL ALCOHOL AT $\frac{15.6°}{15.6°}$ C. (Continued)

Specific gravity $\frac{15.6°}{15.6°}$ C.	% Alcohol by weight	% Alcohol by volume
0.9832	10.12	12.47
0.9831	10.19	12.55
0.9830	10.26	12.63
0.9829	10.33	12.71
0.9828	10.40	12.79
0.9827	10.46	12.87
0.9826	10.53	12.95
0.9825	10.60	13.04
0.9824	10.67	13.12
0.9823	10.74	13.20
0.9822	10.80	13.28
0.9821	10.87	13.36
0.9820	10.94	13.44
0.9819	11.01	13.52
0.9818	11.07	13.61
0.9817	11.14	13.69
0.9816	11.21	13.78
0.9815	11.27	13.86
0.9814	11.34	13.94
0.9813	11.41	14.03
0.9812	11.47	14.11
0.9811	11.54	14.20
0.9810	11.61	14.28
0.9809	11.67	14.36
0.9808	11.74	14.45
0.9807	11.80	14.53
0.9806	11.87	14.62
0.9805	11.94	14.70
0.9804	12.00	14.78
0.9803	12.07	14.87
0.9802	12.14	14.95
0.9801	12.20	15.04
0.9800	12.27	15.12
0.9799	12.34	15.21
0.9798	12.41	15.29
0.9797	12.48	15.38
0.9796	12.55	15.46
0.9795	12.62	15.55
0.9794	12.69	15.63
0.9793	12.76	15.72
0.9792	12.83	15.80
0.9791	12.90	15.89
0.9790	12.97	15.97
0.9789	13.04	16.06
0.9788	13.11	16.14
0.9787	13.18	16.23
0.9786	13.25	16.31
0.9785	13.32	16.40
0.9784	13.39	16.48
0.9783	13.46	16.57
0.9782	13.53	16.65
0.9781	13.60	16.74
0.9780	13.67	16.82
0.9779	13.74	16.91
0.9778	13.82	16.99
0.9777	13.89	17.08
0.9776	13.96	17.16
0.9775	14.03	17.25
0.9774	14.11	17.33
0.9773	14.18	17.42
0.9772	14.25	17.50
0.9771	14.32	17.59
0.9770	14.40	17.68
0.9769	14.47	17.76
0.9768	14.54	17.85
0.9767	14.61	17.93
0.9766	14.69	18.02
0.9765	14.76	18.10
0.9764	14.83	18.19
0.9763	14.90	18.27
0.9762	14.98	18.36
0.9761	15.05	18.44
0.9760	15.12	18.53
0.9759	15.19	18.62
0.9758	15.27	18.70
0.9757	15.34	18.79
0.9756	15.41	18.88
0.9755	15.49	18.96
0.9754	15.56	19.05
0.9753	15.63	19.14
0.9752	15.70	19.22
0.9751	15.78	19.31
0.9750	15.85	19.40
0.9749	15.92	19.48
0.9748	16.00	19.56
0.9747	16.07	19.65
0.9746	16.14	19.74
0.9745	16.22	19.83
0.9744	16.29	19.91
0.9743	16.36	20.00
0.9742	16.43	20.09
0.9741	16.51	20.17
0.9740	16.58	20.26
0.9739	16.65	20.35
0.9738	16.72	20.43
0.9737	16.79	20.52
0.9736	16.86	20.60
0.9735	16.93	20.69
0.9734	17.00	20.77
0.9733	17.07	20.86
0.9732	17.14	20.94
0.9731	17.21	21.03
0.9730	17.28	21.11
0.9729	17.35	21.20
0.9728	17.42	21.28
0.9727	17.49	21.37
0.9726	17.56	21.45
0.9725	17.63	21.54
0.9724	17.70	21.62
0.9723	17.77	21.71
0.9722	17.84	21.79
0.9721	17.91	21.88
0.9720	17.98	21.96
0.9719	18.05	22.05
0.9718	18.12	22.13
0.9717	18.19	22.22
0.9716	18.26	22.30
0.9715	18.33	22.39
0.9714	18.40	22.47
0.9713	18.47	22.56
0.9712	18.54	22.64
0.9711	18.61	22.73
0.9710	18.68	22.82
0.9709	18.75	22.90
0.9708	18.82	22.99
0.9707	18.89	23.07
0.9706	18.96	23.16
0.9705	19.03	23.24
0.9704	19.10	23.33
0.9703	19.17	23.41
0.9702	19.24	23.50
0.9701	19.31	23.58
0.9700	19.38	23.67
0.9699	19.45	23.75
0.9698	19.52	23.84
0.9697	19.59	23.92
0.9696	19.66	24.00
0.9695	19.73	24.09
0.9694	19.80	24.17
0.9693	19.87	24.25
0.9692	19.94	24.34
0.9691	20.01	24.42
0.9690	20.09	24.51
0.9689	20.16	24.59
0.9688	20.23	24.67
0.9687	20.30	24.76
0.9686	20.37	24.84
0.9685	20.44	24.92
0.9684	20.51	25.01
0.9683	20.58	25.09
0.9682	20.65	25.17
0.9681	20.72	25.26
0.9680	20.79	25.34
0.9679	20.86	25.42
0.9678	20.93	25.51
0.9677	21.00	25.59
0.9676	21.07	25.68
0.9675	21.14	25.76
0.9674	21.21	25.84
0.9673	21.28	25.93
0.9672	21.35	26.01
0.9671	21.42	26.10
0.9670	21.49	26.18
0.9669	21.56	26.26
0.9668	21.63	26.35
0.9667	21.70	26.43
0.9666	21.77	26.52
0.9665	21.84	26.60
0.9664	21.91	26.68
0.9663	21.98	26.77
0.9662	22.05	26.85
0.9661	22.12	26.94
0.9660	22.19	27.02
0.9659	22.26	27.10
0.9658	22.33	27.18
0.9657	22.40	27.26
0.9656	22.47	27.34
0.9655	22.54	27.43
0.9654	22.61	27.51
0.9653	22.68	27.59

(Continued on following page.)

AQUEOUS METHYL ALCOHOL AT $\frac{15.6°}{15.6°}$ C. (Continued)

Specific gravity $\frac{15.6°}{15.6°}$C.	% Alcohol by weight	% Alcohol by volume
0.9652	22.75	27.67
0.9651	22.82	27.75
0.9650	22.89	27.83
0.9649	22.96	27.91
0.9648	23.03	27.99
0.9647	23.10	28.07
0.9646	23.17	28.15
0.9645	23.24	28.24
0.9644	23.31	28.32
0.9643	23.38	28.40
0.9642	23.45	28.48
0.9641	23.52	28.56
0.9640	23.59	28.64
0.9639	23.66	28.72
0.9638	23.73	28.80
0.9637	23.80	28.88
0.9636	23.88	28.96
0.9635	23.95	29.04
0.9634	24.02	29.11
0.9633	24.09	29.19
0.9632	24.16	29.27
0.9631	24.23	29.35
0.9630	24.31	29.43
0.9629	24.38	29.51

METHYL ALCOHOL

Specific gravity of aqueous solutions of methyl alcohol by weight.

% Alcohol by weight	$d\frac{0°}{4°}C$	$d\frac{10°}{4°}C$	$d\frac{20°}{4°}C$
0	0.9999	0.9997	0.9982
1	0.9981	0.9980	0.9965
2	0.9963	0.9962	0.9948
3	0.9946	0.9945	0.9931
4	0.9930	0.9929	0.9914
5	0.9914	0.9912	0.9896
6	0.9899	0.9896	0.9880
7	0.9884	0.9881	0.9863
8	0.9870	0.9865	0.9847
9	0.9856	0.9849	0.9831
10	0.9842	0.9834	0.9815
11	0.9829	0.9820	0.9799
12	0.9816	0.9805	0.9784
13	0.9804	0.9791	0.9768
14	0.9792	0.9778	0.9754
15	0.9780	0.9764	0.9740
16	0.9769	0.9751	0.9725
17	0.9758	0.9739	0.9710
18	0.9747	0.9726	0.9696
19	0.9736	0.9713	0.9681
20	0.9725	0.9700	0.9666
21	0.9714	0.9687	0.9651
22	0.9702	0.9673	0.9636
23	0.9690	0.9660	0.9622
24	0.9678	0.9646	0.9607
25	0.9666	0.9632	0.9592
26	0.9654	0.9618	0.9576
27	0.9642	0.9604	0.9562
28	0.9629	0.9590	0.9546
29	0.9616	0.9575	0.9531
30	0.9604	0.9560	0.9515
31	0.9590	0.9546	0.9499
32	0.9576	0.9531	0.9483
33	0.9563	0.9516	0.9466
34	0.9549	0.9500	0.9450
35	0.9534	0.9484	0.9433
36	0.9520	0.9469	0.9416
37	0.9505	0.9453	0.9398
38	0.9490	0.9437	0.9381
39	0.9475	0.9420	0.9363
40	0.9459	0.9403	0.9345
41	0.9443	0.9387	0.9327
42	0.9427	0.9370	0.9309
43	0.9411	0.9352	0.9290
44	0.9395	0.9334	0.9272
45	0.9377	0.9316	0.9252
46	0.9360	0.9298	0.9234
47	0.9342	0.9279	0.9214
48	0.9324	0.9260	0.9196
49	0.9306	0.9240	0.9176
50	0.9287	0.9221	0.9156
51	0.9269	0.9202	0.9135
52	0.9250	0.9182	0.9114
53	0.9230	0.9162	0.9094
54	0.9211	0.9142	0.9073
55	0.9191	0.9122	0.9052
56	0.9172	0.9101	0.9032
57	0.9151	0.9080	0.9010
58	0.9131	0.9060	0.8988
59	0.9111	0.9039	0.8968
60	0.9090	0.9018	0.8946
61	0.9068	0.8998	0.8924
62	0.9046	0.8977	0.8902
63	0.9024	0.8955	0.8879
64	0.9002	0.8933	0.8856
65	0.8980	0.8911	0.8834
66	0.8958	0.8888	0.8811
67	0.8935	0.8865	0.8787
68	0.8913	0.8842	0.8763
69	0.8891	0.8818	0.8738
70	0.8869	0.8794	0.8715
71	0.8847	0.8770	0.8690
72	0.8824	0.8747	0.8665
73	0.8801	0.8724	0.8641
74	0.8778	0.8699	0.8616
75	0.8754	0.8676	0.8592
76	0.8729	0.8651	0.8567
77	0.8705	0.8626	0.8542
78	0.8680	0.8602	0.8518
79	0.8657	0.8577	0.8494
80	0.8634	0.8551	0.8469
81	0.8610	0.8527	0.8446
82	0.8585	0.8501	0.8420
83	0.8560	0.8475	0.8394

METHYL ALCOHOL (Continued)

% Alcohol by weight	$d\frac{0°}{4°}$C	$d\frac{10°}{4°}$C.	$d\frac{20°}{4°}$C
84	0.8535	0.8449	0.8366
85	0.8510	0.8422	0.8340
86	0.8483	0.8394	0.8314
87	0.8456	0.8367	0.8286
88	0.8428	0.8340	0.8258
89	0.8400	0.8314	0.8230
90	0.8374	0.8287	0.8202
91	0.8347	0.8261	0.8174

% Alcohol by weight	$d\frac{0°}{4°}$C.	$d\frac{10°}{4°}$C.	$d\frac{20°}{4°}$C.
92	0.8320	0.8234	0.8146
93	0.8293	0.8208	0.8118
94	0.8266	0.8180	0.8090
95	0.8240	0.8152	0.8062
96	0.8212	0.8124	0.8034
97	0.8186	0.8096	0.8005
98	0.8158	0.8068	0.7976
99	0.8130	0.8040	0.7948
100	0.8102	0.8009	0.7917

IMMERSION REFRACTOMETER READINGS OF METHYL ALCOHOL AND ETHYL ALCOHOL AT 17.5°C.—DETERMINATION OF MIXTURES OF METHYL ALCOHOL AND ETHYL ALCOHOL IN AQUEOUS SOLUTION

The data in the table below are given in the *Official and Tentative Methods of Analysis*, 4th ed. (1935), p. 175; reprinted by permission of the Association of Official Agricultural Chemists, Washington, D. C.

The method for the determination of mixtures of these two alcohols is that of Leach and Lithgoe, *Jour. Amer. Chem. Soc.* 27, 964 (1905) as corrected by Williams, *Ind. Eng. Chem.* 19, 844 (1927).

Example.—To calculate the percentage of methyl and ethyl alcohols in an aqueous mixture, assuming a distillate with an immersion refractometer reading of 35.0 at 17.5°C. and a specific gravity of 0.9793 at 15.56°/15.56°C.

By reference to the table below, an aqueous solution of methyl alcohol of specific gravity 0.9793 at 15.56°/15.56°C. has an immersion reading of 23.2; an aqueous solution of ethyl alcohol of specific gravity 0.9793 at 15.56°/15.56°C. has an immersion reading of 39.4. The difference between these two values is: (39.4 − 23.2), or 16.2; therefore, (39.4 − 35.0) ÷ 16.2, or 27.2% of the alcohols present in the mixture is methyl alcohol.

By reference to tables showing the percentages of these alcohols corresponding to the various specific gravities, an aqueous methyl alcohol solution having a specific gravity of 0.9793 at 15.56°/15.56°C. contains 15.72% by volume of methyl alcohol. An aqueous solution of ethyl alcohol of the same specific gravity contains 16.80% by volume of ethyl alcohol. A distillate of this same specific gravity in which 27.2% of the alcohol is methyl alcohol and 72.8% is ethyl alcohol would contain: 16.80 − [(16.80 − 15.72) ÷ 27.2], or 16.76% by volume of total alcohols. Since 27.2% of this volume is methyl alcohol, 100 cc. of the solution contain 4.56 cc. of methyl alcohol and 12.20 cc. of ethyl alcohol. At 15.56°C., 1 cc. of methyl alcohol weighs 0.7958 g., and 1 cc. of ethyl alcohol weighs 0.7939 g. Therefore, 100 cc. of the distillate contain 4.56 × 0.7958, or 3.63 g. of methyl alcohol; and, 12.20 × 0.7939, or 9.69 g. of ethyl alcohol. As 100 cc. of the distillate weigh 97.93 g., the distillate contains: 3.63 ÷ 97.93, or 3.71% by weight of methyl alcohol; and, 9.69 ÷ 97.93, or 9.89% by weight of ethyl alcohol.

This shows that there is present:	By weight	By volume
Methyl alcohol :	3.71%	4.56%
Ethyl alcohol :	9.89%	12.20%

Sp. Gr. $\frac{15.56°}{15.56°}$C.	Scale Readings		Sp. Gr. $\frac{15.56°}{15.56°}$C.	Scale Readings	
	Methyl Alcohol	Ethyl Alcohol		Methyl Alcohol	Ethyl Alcohol
1.0000	15.0	15.0	.9800	22.8	38.3
.9990	15.3	15.8	.9790	23.4	39.9
.9980	15.6	16.6	.9780	24.0	41.5
.9970	15.9	17.5	.9770	24.5	43.1
.9960	16.2	18.5	.9760	25.0	44.8
.9950	16.5	19.4	.9750	25.5	46.5
.9940	16.9	20.4	.9740	26.0	48.2
.9930	17.2	21.4	.9730	26.5	49.8
.9920	17.5	22.5	.9720	27.0	51.5
.9910	17.9	23.6	.9710	27.5	53.0
.9900	18.2	24.7	.9700	28.1	54.6
.9890	18.6	25.9	.9690	28.7	56.1
.9880	19.0	27.1	.9680	29.2	57.6
.9870	19.5	28.4	.9670	29.6	59.1
.9860	19.9	29.6	.9660	30.1	60.6
.9850	20.4	31.0	.9650	30.6	62.0
.9840	20.8	32.4	.9640	31.0	63.3
.9830	21.3	33.8	.9630	31.5	64.6
.9820	21.8	35.2	.9620	31.9	65.8
.9810	22.3	36.7	.9610	32.4	67.0

(Completed on following page.)

IMMERSION REFRACTOMETER READINGS OF METHYL ALCOHOL AND ETHYL ALCOHOL AT 17.5°C.—DETERMINATION OF MIXTURES OF METHYL ALCOHOL AND ETHYL ALCOHOL IN AQUEOUS SOLUTION (Continued)

Sp. Gr. $\frac{15.56°}{15.56°}$ C.	Scale Readings	
	Methyl Alcohol	Ethyl Alcohol
.9600	32.8	68.1
.9590	33.3	69.2
.9580	33.7	70.2
.9570	34.1	71.2
.9560	34.5	72.1
.9550	34.9	73.0
.9540	35.3	73.8
.9530	35.6	74.6
.9520	35.9	75.4
.9510	36.2	76.2
.9500	36.5	76.9
.9490	36.8	77.6
.9480	37.0	78.3
.9470	37.3	79.0
.9460	37.6	79.7

PROOF AND PERCENTAGE OF ETHYL ALCOHOL

U. S. Proof is double the alcoholic % by vol. at 60° F. Per cent of alcohol by wt. is approximately four-fifths of the % of alcohol by vol. British Proof is approximately 11 parts by vol. of alcohol and 10 parts by vol. of water. It is the equivalent of 114.2 U. S. Proof and has a sp. gr. of 0.9198 at 60° F., with 57.06% by vol. or 49.24% by wt. of absolute alcohol. British Proof has the following relationships between % by wt. (*W*), % by vol. (*V*), % proof spirit (*P*), and sp. gr. (*D*).

$$W = \frac{P}{D \times 2.208} \qquad V = \frac{W \times D}{0.7938} = W \times D \times 1.26 \qquad P = W \times D \times 2.208$$

$$W = \frac{V \times 0.7938}{D} \qquad V = P \times 0.5706 \qquad P = \frac{V}{0.5706} = V \times 1.7525$$

DENSITIES OF VARIOUS SOLIDS AND LIQUIDS

Approximate values at ordinary temperatures.

Name	Grams per cc	Pounds per cu. ft.
Agate	2.5–2.8	156–174
Alabaster	2.3–2.8	143–174
Amber	1.0–1.1	62.3–68.5
Amphoboles	2.9–3.2	181–199
Anthracite	1.4–1.7	87–106
Argillite	2.76–2.88	172–179
Asbestos	2.1–2.8	131–174
Asbestos paper	1.2	75
Asphalt	1.1–1.5	68.5–93.5
Barley	0.51–0.69	31.8–43.0
Basalt	2.7–3.2	168–199
Bone	1.7–2.0	106–125
Brick	1.4–1.6	87–100
Butter	0.94–0.95	58.5–59.2
Calcspar	2.6–2.8	162–174
Caoutchouc	0.92–0.99	57.3–61.4
Cast iron	7.25	452
Celluloid	1.4	87
Cement	0.82–1.95	51–121
Chalk	1.8–2.6	112–162
Charcoal	0.4	25
Charcoal, air free	1.4–1.5	87–93
China, Chinese	2.38	148
China, French	2.24	140
China, German	2.29–2.49	143–155
Cinnabar	8.12	506
Clay	1.8–2.6	112–162
Clinker brick	1.7–2.0	106–125
Coal	1.2–1.5	75–93
Coal, pressed	1.25	77.9
Coke	1.4	87
Concrete	1.80–2.45	112–153
Copal	1.04–1.14	64.8–71.0
Cork	0.24	15
Corkboard, black	0.56	35
Corkboard, white	0.25	15.6
Cotton, air dried	1.47–1.50	91.6–93.5
Diamond	3.01–3.52	187.5–219
Earth, loamy, dry	1.6–1.9	100–118
Earth, loamy, pressed	2.0	125
Ebonite	1.15	71.6
Feldspar	3.25–3.50	202–218
Feldspar	2.5	156
Fire brick	1.85–2.2	115–137
Flax, air dried	1.5	93
Flint	2.6–2.8	162–174
Flour, loose	0.4–0.5	25–31
Flour, pressed	0.7–0.8	44–50

DENSITIES OF VARIOUS SOLIDS AND LIQUIDS (Continued)

Name	Grams per cc	Pounds per cu. ft.
Gamboge	1.2	75
Garnet	3.4–4.3	212–268
Gas carbon	1.88	117
Gasoline	0.66–0.69	41–43
Gelatine	1.27	79.1
Glass, crystal	2.9–3.0	181–187
Glass, flask	2.6	162
Glass, flint	3.15–3.90	196–243
Glass, mirror	2.45–2.72	153–169
Glass, window	2.4–2.6	150–162
Glue	1.27	79.1
Gneiss	2.4–2.7	150–168
Granite	2.51–3.05	156–190
Graphite	2.30–2.72	143–169
Gravel	1.8–2.0	112–125
Gum arabic	1.31–1.45	81.6–90.3
Gunpowder, loose	0.9	56
Gunpowder, pressed	1.75	109
Guttapercha	0.96–0.99	60–61.6
Gypsum, calcined	1.81	113
Gypsum, dry, moulded	0.97	60.4
Gypsum, sifted	1.25	77.9
Hemp, fiber, air dried	1.5	93
Ice	0.88–0.92	54.8–57.3
India rubber	0.91–0.93	56.7–57.9
Ivory	1.83–1.92	114–120
Kaolin	2.2–2.5	137–156
Lava, basaltic	2.8–3.0	174–187
Lava, trachitic	2.0–2.7	125–168
Leather	1.02	63.5
Leather, dried	0.86	53.6
Lignite	1.2–1.5	75–93
Lime mortar, dry	1.60–1.65	99.7–102.8
Lime mortar, fresh	1.75–1.80	109–112
Lime stone	2.46–2.84	153–177
Linoleum	1.15–1.3	71.6–81
Litharge, artificial	9.3–9.4	579–586
Litharge, natural	7.83–7.98	488–497
Loam, dried	1.5–1.6	93–100
Loam, fresh	1.67–1.85	104–115
Marble	2.52–2.85	157–177.5
Marl	2.3–2.5	143–156
Masonry brick, dry	1.42–1.46	88.5–91.0
Masonry brick, fresh	1.57-1.63	97.8-101.5
Meerschaum	0.99–1.28	61.7-79.7
Mica	2.65–3.2	165–199
Milk	1.028–1.035	64.04–64.48
Millstone quartz	1.25–1.60	77.9–99.7
Oats	0.43	26.8

Name	Grams per cc	Pounds per cu. ft.
Ocher	3.5	218
Opal	2.2	137
Paper	0.70–1.15	43.6–71.6
Paraffin	0.87–0.91	54.2–56.7
Peat	0.64	39.9
Petroleum ether	0.665	41.5
Pig iron, gray	6.7–7.6	417–473
Pig iron, white	7.0–7.8	436–486
Pitch	1.07–1.10	66.7–68.5
Pitch peat	0.84	52.5
Polishing slate	2.1	131
Porcelain clay	2.2	137
Porphyry	2.4–2.8	150–174
Potato	1.06–1.13	66.0–70.4
Pumice	0.37–0.9	23–56
Quicklime	2.3–3.2	143–199
Red lead	8.6–9.1	536–567
Rock salt	2.28–2.41	143–150
Rosin	1.07	66.7
Rubber fabric	1.0–2.0	62.3–125
Rubber, gum	0.92–0.96	57.3–59.8
Rubber, raw	0.92–0.96	57.3–59.8
Rye	0.68–0.79	42.4–49.2
Sand, coarse	1.4–1.5	87–93.5
Sand, fine, dry	1.40–1.65	87.2–102.8
Sand, fine, moist	1.90–2.05	118.4–127.7
Sandstone	2.2–2.5	137–156
Sandstone, artificial	2.0–2.1	125–131
Sea water	1.025	63.86
Siderite	3.7–3.9	231–243
Silica	2.66	166
Silk, raw	1.56	97.2
Slag, blast furnace	2.5–3.0	156–187
Slaked lime	1.15–1.25	69.6–77.9
Slate	2.65–2.70	165–168
Snow, loose	0.125	7.79
Soapstone	2.7	168
Starch, lumps	1.53–1.56	95.3–97.2
Steel, ingot	7.87	490
Sugar, white	1.61	100.3
Tallow	0.90–0.97	56.1–60.4
Tar	1.02	63.6
Tufa, lump	1.3	81
Tufa, tile	0.8–0.9	50–56
Verdigris	1.9	118
Wax, sealing	1.8	112
Wheat	0.7–0.8	44–50
White lead	6.7	417
Wood	0.31–1.33	19.3–82.9
Wood naphtha	0.810–0.848	50.5–52.9
Wool, air dried	1.32	82.2

RELATIVE DENSITY AND VOLUME OF WATER* AND OF MERCURY AT VARIOUS TEMPERATURES

These values are based upon the mass of one milliliter of water at 4°C. as unity. To convert to absolute density in C. G. S. units multiply the value for relative density by 0.999973.

WATER		
Temp. Degree C.	Relative Density g/ml	Volume ml/g
−20	....	....
−19	....	....
−18	....	....
−17	....	....
−16	....	....
−15	....	....
−14	....	....
−13	....	....
−12	....	....
−11	....	....
−10	0.99815	1.00186
−9	0.99843	1.00157
−8	0.99869	1.00131
−7	0.99892	1.00108
−6	0.99912	1.00088
−5	0.99930	1.00070
−4	0.99945	1.00055
−3	0.99958	1.00042
−2	0.99970	1.00031
−1	0.99979	1.00021
0	0.99987	1.00013
1	0.99993	1.00007
2	0.99997	1.00003
3	0.99999	1.00001
4	1.00000	1.00000
5	0.99999	1.00001
6	0.99997	1.00003
7	0.99993	1.00007
8	0.99988	1.00012
9	0.99981	1.00019
10	0.99973	1.00027
11	0.99963	1.00037
12	0.99952	1.00048
13	0.99940	1.00060
14	0.99927	1.00073
15	0.99913	1.00087
16	0.99897	1.00103
17	0.99880	1.00120
18	0.99862	1.00138
19	0.99843	1.00157
20	0.99823	1.00177
21	0.99802	1.00198
22	0.99780	1.00221
23	0.99756	1.00244
24	0.99732	1.00268
25	0.99707	1.00294
26	0.99681	1.00320
27	0.99654	1.00347
28	0.99626	1.00375
29	0.99597	1.00405
30	0.99567	1.00435
31	0.99537	1.00466
32	0.99505	1.00497
33	0.99473	1.00530
34	0.99440	1.00563
35	0.99406	1.00598

MERCURY		
Relative Density g/ml	Volume ml/g	Temp. Degree C.
13.6450	0.0732869	−20
13.6425	0.0733002	−19
13.6400	0.0733135	−18
13.6375	0.0733269	−17
13.6350	0.0733402	−16
13.6326	0.0733535	−15
13.6301	0.0733670	−14
13.6276	0.0733805	−13
13.6251	0.0733940	−12
13.6226	0.0734074	−11
13.6202	0.0734205	−10
13.6177	0.0734338	−9
13.6152	0.0734472	−8
13.6127	0.0734608	−7
13.6103	0.0734739	−6
13.6078	0.0734873	−5
13.6053	0.0735006	−4
13.6029	0.0735140	−3
13.6004	0.0735273	−2
13.5979	0.0735407	−1
13.5955	0.0735540	0
13.5930	0.0735674	1
13.5905	0.0735808	2
13.5880	0.0735943	3
13.5856	0.0736075	4
13.5831	0.0736209	5
13.5806	0.0736342	6
13.5782	0.0736476	7
13.5757	0.0736610	8
13.5732	0.0736746	9
13.5708	0.0736877	10
13.5683	0.0737011	11
13.5658	0.0737145	12
13.5634	0.0737278	13
13.5609	0.0737412	14
13.5584	0.0737550	15
13.5560	0.0737680	16
13.5535	0.0737813	17
13.5511	0.0737947	18
13.5486	0.0738081	19
13.5461	0.0738215	20
13.5437	0.0738348	21
13.5412	0.0738487	22
13.5388	0.0738617	23
13.5363	0.0738754	24
13.5339	0.0738888	25
13.5314	0.0739022	26
13.5290	0.0739153	27
13.5265	0.0739289	28
13.5241	0.0739423	29
13.5216	0.0739558	30
13.5191	0.0739691	31
13.5167	0.0739825	32
13.5142	0.0739960	33
13.5118	0.0740094	34
13.5094	0.0740228	35

*See also the table: Properties of Saturated Steam.

RELATIVE DENSITY AND VOLUME OF WATER AND OF MERCURY AT VARIOUS TEMPERATURES

WATER			MERCURY		
Temp. Degree C.	Relative Density g/ml	Volume ml/g	Relative Density g/ml	Volume ml/g	Temp. Degree C.
36	0.99371	1.00633	13.5069	0.0740362	36
37	0.99336	1.00669	13.5045	0.0740496	37
38	0.99299	1.00706	13.5020	0.0740630	38
39	0.99262	1.00743	13.4996	0.0740765	39
40	0.99224	1.00782	13.4971	0.0740898	40
41	0.99186	1.00821	13.4947	0.0741033	41
42	0.99147	1.00861	13.4922	0.0741167	42
43	0.99107	1.00901	13.4898	0.0741301	43
44	0.99066	1.00943	13.4873	0.0741435	44
45	0.99025	1.00985	13.4849	0.0741570	45
46	0.98982	1.01028	13.4825	0.0741704	46
47	0.98940	1.01072	13.4800	0.0741838	47
48	0.98896	1.01116	13.4776	0.0741972	48
49	0.98852	1.01162	13.4751	0.0742107	49
50	0.98807	1.01207	13.4727	0.0742241	50
51	0.98762	1.01254	13.4703	0.0742375	51
52	0.98715	1.01301	13.4678	0.0742510	52
53	0.98669	1.01349	13.4654	0.0742644	53
54	0.98621	1.01398	13.4630	0.0742778	54
55	0.98573	1.01448	13.4605	0.0742913	55
60	0.98324	1.01705	13.4484	0.0743585	60
65	0.98059	1.01979	13.4362	0.0744257	65
70	0.97781	1.02270	13.4241	0.0744930	70
75	0.97489	1.02576	13.4120	0.0745602	75
80	0.97183	1.02899	13.3999	0.0746276	80
85	0.96865	1.03237	13.3878	0.0746949	85
90	0.96534	1.03590	13.3757	0.0747623	90
95	0.96192	1.03959	13.3637	0.0748294	95
100	0.95838	1.04343	13.3516	0.0748971	100
110	0.9510	1.0515	13.328	0.075032	110
120	0.9434	1.0601	13.304	0.075167	120
130	0.9352	1.0693	13.280	0.075303	130
140	0.9264	1.0794	13.256	0.075439	140
150	0.9173	1.0902	13.232	0.075575	150
160	0.9075	1.1019	13.208	0.075712	160
170	0.8973	1.1145	13.184	0.075849	170
180	0.8866	1.1279	13.160	0.075986	180
190	0.8750	1.1429	13.137	0.076124	190
200	0.8628	1.1590	13.113	0.076262	200
210	0.850	1.177	13.089	0.076400	210
220	0.837	1.195	13.065	0.076539	220
230	0.823	1.215	13.042	0.076678	230
240	0.809	1.236	13.018	0.076818	240
250	0.794	1.259	12.994	0.076958	250
260	....	....	12.970	0.077099	260
270	....	....	12.947	0.077239	270
280	....	....	12.923	0.077371	280
290	....	....	12.899	0.077513	290
300	....	....	12.876	0.077666	300
			Under 20 ATM.		
310	....	....	12.853	0.077810	310
320	....	....	12.829	0.077954	320
330	....	....	12.805	0.078099	330
340	....	....	12.781	0.078245	340
350	....	....	12.758	0.078391	350
360	....	....	12.734	0.078538	360
370	....	....	12.710	0.078685	370
380	....	....	12.686	0.078834	380
390	....	....	12.662	0.078993	390
400	....	....	12.638	0.079133	400
450	....	....	12.517	0.079897	450
500	....	....	12.395	0.080686	500

ABSOLUTE DENSITY OF WATER

This table gives the weight in grams of a cubic centimeter of water at temperatures from 0° to 30°C. Water attains its maximum density at 3.98°C. at which temperature the density is 0.999973 (C. G. S.)

Temp. °C.	Density	Temp. °C.	Density	Temp. °C.	Density	Temp. °C.	Density
0.0	0.999841	7.6	0.999872	15.2	0.999069	22.8	0.997585
0.2	9854	7.8	9861	15.4	9038	23.0	7538
0.4	9866	8.0	9849	15.6	9007	23.2	7490
0.6	9878	8.2	9837	15.8	8975	23.4	7442
0.8	9889	8.4	9824	16.0	8943	23.6	7394
1.0	9900	8.6	9810	16.2	8910	23.8	7345
1.2	9909	8.8	9796	16.4	8877	24.0	7296
1.4	9918	9.0	9781	16.6	8843	24.2	7246
1.6	9927	9.2	9766	16.8	8809	24.4	7196
1.8	9934	9.4	9751	17.0	8774	24.6	7146
2.0	9941	9.6	9734	17.2	8739	24.8	7095
2.2	9947	9.8	9717	17.4	8704	25.0	7044
2.4	9953	10.0	9700	17.6	8668	25.2	6992
2.6	9958	10.2	9682	17.8	8632	25.4	6941
2.8	9962	10.4	9664	18.0	8595	25.6	6888
3.0	9965	10.6	9645	18.2	8558	25.8	6836
3.2	9968	10.8	9625	18.4	8520	26.0	6783
3.4	9970	11.0	9605	18.6	8482	26.2	6729
3.6	9972	11.2	9585	18.8	8444	26.4	6676
3.8	9973	11.4	9564	19.0	8405	26.6	6621
4.0	9973	11.6	9542	19.2	8365	26.8	6567
4.2	9973	11.8	9520	19.4	8325	27.0	6512
4.4	9972	12.0	9498	19.6	8285	27.2	6457
4.6	9970	12.2	9475	19.8	8244	27.4	6401
4.8	9968	12.4	9451	20.0	8203	27.6	6345
5.0	9965	12.6	9427	20.2	8162	27.8	6289
5.2	9961	12.8	9402	20.4	8120	28.0	6232
5.4	9957	13.0	9377	20.6	8078	28.2	6175
5.6	9952	13.2	9352	20.8	8035	28.4	6118
5.8	9947	13.4	9326	21.0	7992	28.6	6060
6.0	9941	13.6	9299	21.2	7948	28.8	6002
6.2	9935	13.8	9272	21.4	7904	29.0	5944
6.4	9927	14.0	9244	21.6	7860	29.2	5885
6.6	9920	14.2	9216	21.8	7815	29.4	5826
6.8	9911	14.4	9138	22.0	7770	29.6	5766
7.0	9902	14.6	9159	22.2	7724	29.8	5706
7.2	9893	14.8	9129	22.4	7678	30.0	5646
7.4	9883	15.0	9099	22.6	7632		

FREEZING MIXTURES

The table below gives the percent of the anhydrous material as shown in the column on the left in the eutectic mixture with ice. The eutectic temperature is the lowest temperature which can be obtained from a mixture of the substance with ice. To obtain the maximum cooling effect, the freezing mixture should be prepared with ice rather than with water and the other ingredient should be cooled to 0°C. For most purposes sodium chloride and ice, or calcium chloride and ice, mixtures are most common providing temperatures of -21.2°C. and -55°C. respectively.

Formula of Substance	%	Eutectic Temp. °C.
$BaCl_2$	22.5	−7.8
$CaCl_2$	29.8	−55
$Ca(NO_3)_2$	35	−16
$CuCl_2$	36	−40
$Cu(NO_3)_2$	36	−24
$CuSO_4$	11.9	−1.6
$FeCl_3$	33.1	−55
$FeSO_4$	13.04	−1.824
HCl	24.8	−86
HNO_3	32.7	−43
K_2CO_3	39.5	−36.5
KCl	19.75	−11.1
K_2CrO_4	36.6	−11.3
KOH	31.5	−65
KNO_3	10.9	−2.9
$MgCl_2$	21.6	−33.6
$Mg(NO_3)_2$	34.6	−29
$MgSO_4$	19	−3.9

Formula of Substance	%	Eutectic Temp. °C.
$MnSO_4$	32.2	−10.5
NH_4Cl	18.6	−15.8
NH_4NO_3	41.2	−17.35
$(NH_4)_2SO_4$	38.3	−19.05
$NaBr$	40.3	−28
Na_2CO_3	5.9	−2.1
$NaCl$	23.3	−21.13
$NaOH$	19	−28
$NaNO_3$	37	−18.5
Na_2SO_4	12.7	−3.55
$Na_2S_2O_3$	30	−11
$NiSO_4$	20.6	−4.15
SO_3	32	−75
$SrCl_2$	26	−18.7
$Sr(NO_3)_2$	24.5	−5.75
$ZnCl_2$	51	−62
$Zn(NO_3)_2$	39.4	−29
$ZnSO_4$	27.2	−6.55

NON-AQUEOUS COOLING BATHS

Low temperatures may be produced by mixtures of various substances with carbon dioxide snow or by evaporation of low boiling liquids.*

Substance	Deg. C.
Alcohol-carbon dioxide	−72
Ammonia, boiling point	−33.4
Chloroform-carbon dioxide	−77
Ether-carbon dioxide	−100
Ethyl chloride, boiling point	+12.5
Liquid air, boiling point	−190

Substance	Deg. C.
Nitrogen, boiling point	−196
Oxygen, boiling point	−183
Sulfur dioxide, boiling point	−10

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* The assertion that certain baths with CO_2 snow, especially the acetone bath, give a temperature materially lower than pure dry CO_2 snow is erroneous. Cf. Thiel and Caspar, *Z. physik. Chem.* **86**, *257 93* (*1914*); *C. A.* **8**, *1229* (*1914*). Liquid nitrogen (but not liquid air, which is hazardous) poured into ethyl alcohol until a slush is formed gives a cooling bath −115° to −125°C.

COMPOSITION OF AQUEOUS ANTI-FREEZE SOLUTIONS

FREEZING POINT OF ALCOHOL-WATER MIXTURES

Specific Gravity 20°/4°C. (68°F.)	% alcohol by weight	% alcohol by volume	Freezing Point	
			°C.	°F.
0.99363	2.5	3.13	−1.0	30.2
0.98971	4.8	6.00	−2.0	28.4
0.98658	6.8	8.47	−3.0	26.6
0.98006	11.3	14.0	−5.0	23.0
0.97670	13.8	17.0	−6.1	21.0
0.97336	16.4	20.2	−7.5	18.5
0.97194	17.5	21.5	−8.7	16.3
0.97024	18.8	23.1	−9.4	15.1
0.96823	20.3	24.8	−10.6	12.9
0.96578	22.1	27.0	−12.2	10.0
0.96283	24.2	29.5	−14.0	6.8
0.95914	26.7	32.4	−16.0	3.2
0.95400	29.9	36.1	−18.9	−2.0
0.94715	33.8	40.5	−23.6	−10.5
0.93720	39.0	46.3	−28.7	−19.7
0.92193	46.3	53.8	−33.9	−29.0
0.90008	56.1	63.6	−41.0	−41.8
0.86311	71.9	78.2	−51.3	−60.3

FREEZING POINT OF GLYCEROL (GLYCERINE)—WATER MIXTURES

The values are those reported by Bosart and Snoddy (*Jour. Ind. and Eng. Chem.*, 19, 506 (1927)), and Lane (*Jour. Ind. and Eng. Chem.*, 17, 924 (1925)) but modified by adding 2°F to all temperatures below 0°F in accordance with the suggestion of the Procter and Gamble Co.

% Glycerol by Weight	Specific Gravity 15°/15°C. (59°F.)	Specific Gravity 20°/20°C. (68°F.)	Freezing Point	
			°C.	°F.
10	1.02415	1.02395	−1.6	29.1
20	1.04935	1.04880	−4.8	23.4
30	1.07560	1.07470	−9.5	14.9
40	1.10255	1.10135	−15.4	4.3
50	1.12985	1.12845	−22.0	−7.4
60	1.15770	1.15605	−33.6	−28.5
70	1.18540	1.18355	−37.8	−36.0
80	1.21290	1.21090	−19.2	−2.3
90	1.23950	1.23755	−1.6	29.1
100	1.26557	1.26362	17.0	62.6

FREEZING POINT OF PRESTONE *—WATER MIXTURES

% Prestone		Specific Gravity	Freezing Point	
By Weight	By Volume	15°/15C. (59°F.)	°C.	°F.
10	9.2	1.013	−3.6	25.6
15	13.8	1.019	−5.6	22.0
20	18.3	1.026	−7.9	17.8
25	23.0	1.033	−10.7	12.8
30	28.0	1.040	−14.0	6.8
40	37.8	1.053	−22.3	−8.2
50	47.8	1.067	−33.8	−28.8
60	58.1	1.079	−49.3	−56.7

* Eveready Prestone (manufactured by the National Carbon Co.), marketed for anti-freeze purposes, is 97% ethylene glycol containing fractional percentages of soluble and insoluble ingredients to prevent foaming, creepage and water corrosion in automobile cooling systems.

FREEZING POINT OF MAGNESIUM CHLORIDE BRINES

% $MgCl_2$ by weight	Spec. Grav. 15.6°C. (60°F.)	Freezing Point °C	Freezing Point °F.
5	1.043	−3.11	26.4
6	1.051	−3.89	25.0
7	1.060	−4.72	23.5
8	1.069	−5.67	21.8
9	1.078	−6.67	20.0
10	1.086	−7.83	17.9
11	1.096	−9.05	15.7
12	1.105	−10.5	13.1
13	1.114	−12.1	10.3
14	1.123	−13.7	7.3
15	1.132	−15.6	4.0
16	1.142	−17.6	0.4
17	1.151	−19.7	−3.5

% $MgCl_2$ by weight	Spec. Grav. 15.6°C. (60°F.)	Freezing Point °C	Freezing Point °F
18	1.161	−22.1	−7.7
19	1.170	−25.6	−12.2
20	1.180	−27.4	−17.3
21	1.190	−30.6	−23.0
22	1.200	−32.8	−27.0
23	1.210	−28.9	−20.0
24	1.220	−25.6	−14.0
25	1.230	−23.3	−10.0
26	1.241	−21.1	−6.0
27	1.251	−19.4	−3.0
28	1.262	−18.3	−1.0
29	1.273	−17.2	+1.0
30	1.283	−16.7	2.0

FREEZING POINT OF SODIUM CHLORIDE BRINES

Compiled in collaboration with C. D. Looker, Ph.D., International Salt Co., Inc.

% NaCl by weight	Spec. Grav. 15°C. (59°F.)	Freezing Point °C.	Freezing Point °F.
0	1.000	0.00	32.0
1	1.007	−0.58	31.0
2	1.014	−1.13	30.0
3	1.021	−1.72	28.9
4	1.028	−2.35	27.8
5	1.036	−2.97	26.7
6	1.043	−3.63	25.5
7	1.051	−4.32	24.2
8	1.059	−5.03	22.9
9	1.067	−5.77	21.6
10	1.074	−6.54	20.2
11	1.082	−7.34	18.8
12	1.089	−8.17	17.3
13	1.097	−9.03	15.7
14	1.104	−9.94	14.1

% NaCl by weight	Spec. Grav. 15°C. (59°F.)	Freezing Point °C.	Freezing Point °F.
15	1.112	−10.88	12.4
16	1.119	−11.90	10.6
17	1.127	−12.93	8.7
18	1.135	−14.03	6.7
19	1.143	−15.21	4.6
20	1.152	−16.46	2.4
21	1.159	−17.78	+0.0
22	1.168	−19.19	−2.5
23	1.176	−20.69	−5.2
23.3 (*E*)	1.179	−21.13	−6.0
24	1.184	−17.0*	+1.4*
25	1.193	−10.4*	13.3*
26	1.201	−2.3*	27.9*
26.3	1.203	0.0*	32.0*

* Saturation temperatures of sodium chloride dihydrate: at these temperatures $NaCl{\cdot}2H_2O$ separates leaving the brine of the eutectic composition (*E*).

FREEZING POINT OF CALCIUM CHLORIDE BRINES

Reproduced from "Dow Calcium Chloride for Refrigeration," copyright 1929 The Dow Chemical Co., by permission.

Density of Brine @ 60°F.		Freezing Point °F.	Freezing Point °C.	Ammonia Suction Pressure lbs. gauge Co responding t Freezing Poin	Calcium Chloride Content of Brine in Per Cent		Anhydrous Calcium Chloride Content of Brine†		Weight of Brine @ 60° F.		SPECIFIC HEAT OF BRINE Referred to Water @ 68° F. Temperature °F.					HEAT CAPACITY OF BRINE In BTU's Per Gallon Temperature °F				
Specific Gravity	Baume Scale				Anhydrous CaCl$_2$	Dow 73-75% CaCl$_2$	Pounds Per Gallon	Pounds Per Cu. Ft.	Pounds Per Gallon	Pounds Per Cu. Ft.	−20	−10	0	+10	+20	−20	−10	0	+10	+20
1.00	0.0	+32.0	0.0	47.6	0.0	0.0	0.0	0.0	8.34	62.4	....	....	....	....	....	....	....	....	....	....
1.01	1.4	+31.1	−0.5	46.4	1.1	1.48	0.093	0.69	8.41	63.1	....	....	....	....	....	....	....	....	....	....
1.02	2.8	+30.2	−1.0	45.3	2.3	3.11	0.196	1.46	8.50	63.7	....	....	....	....	....	....	....	....	....	....
1.03	4.2	+29.1	−1.8	43.9	3.5	4.73	0.301	2.25	8.59	64.3	....	....	....	....	....	....	....	....	....	....
1.04	5.6	+28.0	−2.2	42.6	4.7	6.35	0.407	3.04	8.67	64.9	....	....	....	....	....	....	....	....	....	....
1.05	6.9	+27.0	−2.8	41.4	5.8	7.99	0.508	3.80	8.75	65.5	....	....	....	....	....	....	....	....	....	....
1.06	8.2	+25.9	−3.2	40.1	7.0	9.46	0.619	4.62	8.84	66.2	....	....	....	....	....	....	....	....	....	....
1.07	9.5	+24.6	−4.1	38.6	8.1	10.93	0.723	5.40	8.92	66.8	....	....	....	....	....	....	....	....	....	....
1.08	10.7	+23.4	−4.8	37.2	9.2	12.41	0.829	6.19	9.00	67.4	....	....	....	....	....	....	....	....	....	....
1.09	12.0	+21.7	−5.9	35.4	10.4	14.08	0.945	7.06	9.09	68.1	....	....	....	....	....	....	....	....	....	....
1.10	13.2	+20.3	−6.5	33.8	11.4	15.40	1.05	7.81	9.17	68.7	....	....	....	....	0.829	....	....	....	....	7.60
1.11	14.4	+18.5	−7.5	31.9	12.5	16.90	1.16	8.64	9.25	69.3	....	....	....	....	0.815	....	....	....	....	7.55
1.12	15.5	+16.5	−8.6	29.9	13.5	18.25	1.26	9.42	9.34	69.9	....	....	....	....	0.802	....	....	....	....	7.49
1.13	16.7	+14.4	−9.9	27.9	14.6	19.75	1.38	10.28	9.42	70.6	....	....	....	....	0.789	....	....	....	....	7.44
1.14	17.8	+12.0	−11.1	25.6	15.6	21.05	1.48	11.08	9.50	71.2	....	....	....	....	0.776	....	....	....	....	7.38
1.15	18.9	+9.7	−12.4	23.5	16.6	22.41	1.59	11.89	9.58	71.8	....	....	....	0.759	0.764	....	....	....	7.28	7.33
1.16	20.0	+7.0	−13.9	21.2	17.6	23.80	1.70	12.71	9.67	72.4	....	....	....	0.748	0.753	....	....	....	7.24	7.29
1.17	21.1	+4.1	−15.6	18.9	18.6	25.15	1.81	13.56	9.75	73.1	....	....	....	0.737	0.742	....	....	....	7.19	7.24
1.18	22.1	+1.4	−17.0	16.8	19.5	26.38	1.92	14.34	9.83	73.7	....	....	....	0.727	0.732	....	....	....	7.15	7.20
1.19	23.2	−2.2	−19.0	14.2	20.5	27.75	2.02	15.20	9.92	74.3	....	....	0.712	0.717	0.722	....	....	7.07	7.12	7.17
1.20	24.2	−5.8	−21.0	11.7	21.5	29.06	2.13	16.07	10.01	74.9	....	....	0.703	0.707	0.712	....	....	7.03	7.08	7.13
1.21	25.2	−9.4	−23.0	9.4	22.4	30.30	2.25	16.89	10.08	75.5	....	....	0.694	0.699	0.704	....	....	7.00	7.05	7.10
1.22	26.2	−13.2	−25.1	7.3	23.3	31.50	2.37	17.71	10.17	76.2	....	0.681	0.686	0.691	0.696	....	6.93	6.98	7.03	7.08
1.23	27.1	−17.1	−27.2	5.1	24.2	32.70	2.48	18.54	10.25	76.8	....	0.674	0.679	0.683	0.688	....	6.92	6.96	7.01	7.06
1.24	28.1	−21.3	−29.6	3.1	25.1	33.97	2.60	19.39	10.33	77.4	0.663	0.667	0.672	0.676	0.681	6.84	6.89	6.94	6.99	7.04
1.25	29.0	−25.8	−32.1	1.3	26.0	35.13	2.71	20.25	10.41	78.1	0.657	0.661	0.665	0.669	0.674	6.84	6.89	6.93	6.98	7.02
1.26	29.9	−30.8	−34.9	*1.7	26.9	36.40	2.83	21.12	10.50	78.7	0.651	0.655	0.659	0.663	0.667	6.84	6.88	6.92	6.96	7.00
1.27	30.8	−36.4	−38.0	*6.1	27.8	37.60	2.94	21.93	10.58	79.3	0.646	0.650	0.653	0.657	0.660	6.84	6.88	6.91	6.95	6.98
1.28	31.7	−44.1	−42.3	*11.2	28.7	38.80	3.06	22.89	10.66	79.9	0.642	0.645	0.647	0.650	0.654	6.84	6.87	6.90	6.93	6.97
1.29	32.6	−59.8	−51.0	*18.5	29.6	40.00	3.18	23.79	10.75	80.5	0.637	0.640	0.642	0.645	0.648	6.85	6.88	6.90	6.93	6.96
1.30	33.5	−41.8	−41.0	*9.9	30.5	41.20	3.30	24.70	10.84	81.2	0.633	0.635	0.637	0.640	0.643	6.86	6.88	6.91	6.94	6.97

* Inches of mercury below one standard atmosphere (29.92 in.)

† To find equivalent weight of Dow 73-75% Solid multiply by 1.35 and for weight of Dow Flake 77-80% Calcium Chloride multiply by 1.28.

PHYSICAL PROPERTIES OF REFRIGERANTS

Compiled from information contained in a private communication from KINETIC CHEMICALS, INC., Wilmington, Del., U.S.A. and from Cir. No. 2, *Am. Soc. Refrigeration Engineers* (*1926*).

Refrigerant	Ammonia	Carbon Dioxide	Ethyl Chloride	Methyl Chloride	Sulfur Dioxide	Freon*	F—11*	F—21*	F—114*
Chemical symbol	NH_3	CO_2	C_2H_5Cl	CH_3Cl	SO_2	CCl_2F_2	CCl_3F	$CHCl_2F$	$C_2Cl_2F_4$
Molecular weight	17.032	44.00	64.50	50.48	64.06	120.914	137.371	102.922	170.914
Color of liquid	colorless	colorless	colorless	colorless	colorless	colorless	colorless	colorless	colorless
Odor	pungent aromatic	odorless	pungent etherial odor; sweetish taste	similar to chloroform, but less sweet	pungent characteristic	etherial odor	etherial odor	etherial odor	etherial odor
Density of liquid (Water = 1)	0.6818	See Note X	0.9232	0.998	1.4601	1.445	1.568	1.446	1.570
at, deg. C.	−33.35		0.0	−24.09	−10.0	−15.0	−15.0	−15.0	−15.0
Density of gas, grams 1 liter (See Note Y)	0.7708	1.9768		2.3045	2.9267	5.44	6.20	4.60	7.75
(Air = 1)	0.5962	1.5290	2.31	1.7824	2.2636	4.21	4.80	3.56	6.0
Boiling point at 1 atm., deg. C.	−33.35	See Note X	13.1	−24.09	−10.0	−29.8	23.7	8.9	3.5
deg. F.	−28.03		55.6	−11.36	14.0	−21.7	74.67	48.0	38.4
Melting point, deg. C.	−77.70	−78.52	−138.7	−91.5	−75.2	−155.0	−88.0	−127.0	−105.5
deg. F.	−107.86	−109.34	−217.7	−132.7	−103.4	−247.0	−126.4	−196.6	−158.0
Critical temperature, deg. C.	132.9	31.00	182.8	143.12	157.12	111.7	196.6		146.1
deg. F.	271.2	87.80	361.0	289.6	314.82	233.0	386.0		295.0
Critical pressure, atm. abs.	112.3	72.85	53.3	65.93	77.65	39.4	41.7		35.5
lbs. per sq. in. abs.	1651	1071	784	969.2	1141.5	580	612		550
Specific heat of constant pressure (C_p)	0.5202	0.2025	0.273	0.24	0.1511	0.1476	0.147	0.18	
Specific heat of constant volume (C_v)	0.4011	0.1558		0.20		0.1297	0.1296	0.1607	
Ratio of specific heats	1.2969	1.3003	1.1257	1.1991	1.256	1.138	1.135	1.12	1.106
(C_p/C_v) at deg. C.		0.0	73	66—86	16—34				
Latent heat of vaporization at 1 atm., BTU per lb.	589.4	256.3 See Note X	168.6	180.6	172.3	71.95	78.8	101.8	58.3
Suction pressure at 5°F., lb. per sq. in. abs.	34.5	331.8	4.65	20.89	11.82	26.51	2.96	5.5	7.2
Head pressure at 86°F., lb. per sq. in. abs.	168.5	1039.6	27.1	95.53	65.9	107.9	18.3	30.5	35.8

*Trade names for dichlorodifluoromethane, trichloromonofluoromethane, dichloromonofluoromethane, and dichlorotetrafluoroethane.

Note X—Carbon Dioxide not a liquid at atmospheric pressure.

Note Y—Density of gas at 0°C. (32°F.) and 760 mm. (1 atm.), except for Ethyl Chloride for which no temperature has been given.

MOLECULAR DEPRESSION OF THE FREEZING POINT

The constant K_F gives the depression of the freezing point in °C. produced by solution of one gram molecular weight of a substance in 1000 grams of any one of the solvents listed below.

Compound	Freezing Point °C.	K_F	Heat of Fusion gram-cal. per gram
Acetic acid	16.7	3.9	43.2
Aluminum bromide	97.5	26.8	10.47
Barium chloride	962	108	27.8
Benzene	5.5	5.12	30.1
Benzophenone	48.5	9.8	23.5
Bromoform	7.8	14.4	10.9
Camphor*	178.4	37.7	10.74
Cyclohexane	6.5	20.0	7.4
m-Dinitrobenzene	89.8	10.6	24.7
1, 4-Dioxane	10.5	4.9	.....
Diphenyl	70.0	8.0	28.8
Diphenylamine	52.9	8.6	25.2
Ethylene bromide	9.98	12.5	13.5
Formamide	2	3.8	.....
Formic acid	8.6	2.77	58.9
Naphthalene	80.2	6.9	36.0

Compound	Freezing Point °C.	K_F	Heat of Fusion gram-cal. per gram
β-Naphthol	122.5	11.25	31.3
Nitrobenzene	5.7	8.1	22.46
Phenanthrene	99.3	12.0	25.0
Phenol	42	7.27	29.0
Salol	43	12.3	16.13
Stannic bromide	31	28.0	6.49
Stearic acid	69	4.5	47.6
Strontium chloride	873	107	25.6
Sulfuric acid	10.5	6.81	24.03
p-Toluidine	44.5	5.2	39.9
Tribromophenol	96	20.4	13.4
Triphenyl methane	93	12.45	21.1
Triphenyl phosphate	49.9	11.76	17.56
Urethane	49.7	5.14	40.9
Water	0	1.86	79.67
p-Xylene	13.2	4.3	38.1

*According to Rast (*Ber*. 55, 1051, 3727 (1922)) molecular weight determinations may be made with an ordinary thermometer.

MOLECULAR ELEVATION OF THE BOILING POINT

The constant K_B gives the elevation of the boiling point in °C. produced by solution of one gram molecular weight of a substance in 1000 grams of any one of the solvents listed below. In the column headed *Barometric Correction* is given the number of degrees for each mm. of difference between the barometric reading and 760 mm. of mercury to be subtracted from K_B if the pressure is lower, or added if higher, than 760 mm. Cf. Hoyt and Fink, *J. Phys. Chem.* 41, 453 (1937).

Compound	Boiling Point °C.	K_B	Barometric Correction per mm. Hg	Heat of Vaporization gram-cal. per gram.
Acetic Acid	118.5	3.07	0.0008	96.8
Acetone	56.00	1.71	0.0004	124.5
Aniline	184.3	3.52	0.0009	103.7
Benzene	80.15	2.53	0.0007	94.3
Bromobenzene	155.83	6.26	0.0016	57.6
Camphor	208.25	5.95	0.0015	74.23
Carbon disulfide	46.13	2.34	0.0006	84.1
Carbon tetrachloride	76.50	5.03	0.0013	46.4
Chlorobenzene	131.98	4.15	0.0011	77.6
Chloroform	60.19	3.63	0.0009	59.0
Cyclohexane	80.88	2.79	0.0007	85.6
Diphenyl	254.9	7.08	0.0018	78.42
Ethanol	78.26	1.22	0.0003	204
Ethyl acetate	77.13	2.77	0.0007	88.4
Ethyl ether	34.42	2.02	0.0005	83.9
Ethyl iodide	72.5	5.05	0.0013	45.6
Ethylene bromide	131.5	6.44	0.0016	46.2
n-Heptane	98.42	3.43	0.0008	76.3
n-Hexane	68.59	2.75	0.0007	79.3
Iodobenzene	188.47	8.53	0.0021	....
Methanol	64.67	0.83	0.0002	262.8
Methyl acetate	57.1	2.15	0.0005	98.1
Naphthalene	218.0	5.65	0.0014	75.5
Nitrobenzene	210.85	5.24	0.0013	79.1
n-Octane	125.80	4.02	0.0010	70.0
n-Pentane	36.00	2.04	0.0005	....
Phenol	181.2	3.56	0.0009	114.3
Stannic chloride	114.1	9.43	0.0024	30.3
Toluene	110.7	3.33	0.0008	....
Water	100.00	0.512	0.0001	539.6

AZEOTROPIC MIXTURES

These tables give the data for various binary and ternary azeotropic or constant boiling mixtures.

For a very complete listing of azeotropes see Horsley, *Ind. Eng. Chem., Analytical Edition, 19, 508 (1947)*.

For a thorough discussion of Azeotropy, see Lecat, *Traite de Chimie Organique*, V. Grignard, Mason et Cie, Paris, 1935, Tome I, pp. 121 to 267; or Young, *Distillation Principles and Processes*, Macmillan, London, 1922.

The boiling points listed are in °C. at 760 mm.

These data are taken from Lecat, "*L'Azeotropisme*", Brussels, 1918; *Ann. soc. sci. Bruxelles 45B, 169–76, 284–94 (1926); 47B. i, 21–7, 63–71, 108–14, 149–58 (1927); 48B, i, 13–22, 54–62, 113–26; ii, 1–18 (1928); 49B, ii, 17–47, 109–43 (1929); 50B, 21–33 (1930); 55B, 43–7, 253–65 (1935); 56B, 41–54, 221–34 (1936); Rec. trav. chim. Pays-Bas 45, 620–7 (1926); 46, 240–7 (1927); 47, 13–18 (1928)*, unless otherwise designated as follows:

(1) Young and Fortey, *Trans. Chem. Soc., 81, 717, 739, 752 (1902); 83, 45 (1903)*.
(2) Roscoe, *Quart. Jour. Chem. Soc., 13, 146 (1861); 15, 270 (1862)*.
(3) Bogin, *U. S. P. Re. 17, 157*.
(4) Young, "*Distillation Principles and Processes*", Macmillan, London, 1922.
(5) Miller and Bliss, *Ind. Eng. Chem., 32, 123 (1940)*.
(6) Hannotte, *Bull. Soc. Chim. Belg., 35, 85–109 (1926)*.
(7) Wuyts, *ibid., 33, 167–192 (1924)*.
(8) Beduwe, *ibid., 34, 41–55 (1925)*.
(9) Atkins, *Trans. Chem. Soc., 117, 218–20 (1920)*.
(10) Booklet by Shell Chemical Co., "Organic Chemicals Manufactured by Shell Chemical Company", 1939.

TABLE I

BINARY AZEOTROPES CONTAINING WATER

	B.P. 760 mm.		% By weight	
	Other component	Azeotrope	Water	Other component
A—Alcohols				
Ethyl alcohol (1)	78.4	78.1	4.5	95.5
n-Propyl alcohol (1)	97.2	87.7	28.3	71.7
iso-Propyl alcohol (1)	82.5	80.4	12.1	87.9
n-Butyl alcohol	117.8	92.4	38	62
iso-Butyl alcohol	108.0	90.0	33.2	66.8
sec-Butyl alcohol	99.5	88.5	32.1	67.9
tert-Butyl alcohol	82.8	79.9	11.7	88.3
n-Amyl alcohol (Pentanol-1)	137.8	96.0	54.0	46.0
Prim-*iso*-amyl alcohol (Methyl-2-butanol-4)	131.4	95.2	49.6	50.4
tert-Amyl alcohol (Methyl-2-butanol-2)	102.3	87.4	27.5	72.5
sec-Amyl alcohol (Pentanol-3)	115.4	91.7	36.0	64.0
Act.-*sec*-amyl alcohol (Pentanol-2)	119.3	92.5	38.5	61.5
n-Hexyl alcohol	157.9	97.8	75	25
n-Heptyl alcohol	176.2	98.7	83	17
n-Octyl alcohol	195.2	99.4	90	10

AZEOTROPIC MIXTURES

	B.P. 760 mm.		% By weight	
	Other component	Azeotrope	Water	Other component
Allyl alcohol	97.0	88.2	27.1	72.9
Benzyl alcohol	205.2	99.9	91	9
Furfuryl alcohol	169.4	98.5	80	20
B—Hydrocarbons				
Benzene	80.2	69.3	8.9	91.1
Toluene	110.8	84.1	13.5	86.5
C—Substituted Hydrocarbons				
Ethylene chloride	83.7	72	8.3	91.7
Propylene chloride	96.8	78	12	88
D—Ethers				
Diethyl ether	34.5	34.2	1.3	98.7
Di-*iso*-propyl ether	68.4	62.2	4.5	95.5
Ethyl *n*-propyl ether	63.6	59.5	4	96
Di-*iso*-butyl ether	122.2	88.6	23	77
Di-*iso*-amyl ether	172.6	97.4	54	46
Diphenyl ether	259.3	99.3	96.8	3.2
Phenetole	170.4	97.3	59	41
Anisole	153.9	95.5	40.5	59.5
Resorcinol diethyl ether	235.0	99.7	91	9
E—Esters				
n-Propyl formate	80.9	71.9	3.6	96.4
n-Butyl formate	106.8	83.8	15	85
iso-Butyl formate	98.4	80.4	7.8	92.2
n-Amyl formate	132.0	91.6	28.4	71.6
iso-Amyl formate	123.9	89.7	23.5	76.5
Benzyl formate	202.3	99.2	80	20
Ethyl acetate	77.1	70.4	6.1	93.9
n-Propyl acetate	101.6	82.4	14	86
iso-Propyl acetate	91.0	77.4	6.2	93.8
n-Butyl acetate	126.2	90.2	28.7	71.3
iso-Butyl acetate	117.2	87.5	19.5	80.5
n-Amyl acetate	148.8	95.2	41	59
iso-Amyl acetate	142.1	93.8	36.2	63.8
Benzyl acetate	214.9	99.6	87.5	12.5
Phenyl acetate	195.7	98.9	75.1	24.9
Methyl propionate	79.9	71.4	3.9	96.1
Ethyl propionate	99.2	81.2	10	90
n-Propyl propionate	122.1	88.9	23	77
iso-Butyl propionate	136.9	92.8	32.2	67.8
iso-Amyl propionate	160.3	96.6	48.5	51.5
Methyl butyrate	102.7	82.7	11.5	88.5
Ethyl butyrate	120.1	87.9	21.5	78.5
n-Propyl butyrate	142.8	94.1	36.4	63.6
n-Butyl butyrate	165.7	97.2	53	47
iso-Butyl butyrate	156.8	96.3	46	54
iso-Amyl butyrate	178.5	98.1	63.5	36.5
Methyl *iso*-butyrate	92.3	77.7	6.8	93.2
Ethyl *iso*-butyrate	110.1	85.2	15.2	84.8
n-Propyl *iso*-butyrate	133.9	92.2	30.8	69.2

AZEOTROPIC MIXTURES

	B.P. 760 mm.		% By weight	
	Other component	Azeotrope	Water	Other component
iso-Butyl *iso*-butyrate	147.3	95.5	39.4	60.6
iso-Amyl *iso*-butyrate	168.9	97.4	56.0	44.0
Methyl *iso*-valerate	116.3	87.2	19.2	80.8
Ethyl *iso*-valerate	134.7	92.2	30.2	69.8
n-Propyl *iso*-valerate	155.8	96.2	45.2	54.8
iso-Butyl *iso*-valerate	168.7	97.4	55.8	44.2
iso-Amyl *iso*-valerate	193.5	98.8	74.1	25.9
Ethyl caproate	166.8	97.2	54	46
Methyl cinnamate	261.9	99.9	95.5	4.5
Methyl benzoate	199.5	99.1	79.2	20.8
Ethyl benzoate	212.4	99.4	84.0	16.0
n-Propyl benzoate	230.9	99.7	90.9	9.1
n-Butyl benzoate	249.8	99.9	94	6
iso-Butyl benzoate	242.2	99.8	92.6	7.4
iso-Amyl benzoate	262.3	99.9	95.6	4.4
Ethyl phenylacetate	228.8	99.7	91.3	8.7
Ethyl nitrate	87.7	74.4	22	78
n-Propyl nitrate	110.5	84.8	20	80
iso-Butyl nitrate	122.9	89.0	25	75
F—Organic Acids				
Formic acid (Max.)	100.8	107.3	22.5	77.5
Acetic acid	118.1	No	Azeotrope	
Propionic acid	141.1	99.98	82.3	17.7
Butyric acid	163.5	99.4	81.6	18.4
iso-Butyric acid	154.5	99.3	79	21
G—Inorganic Acids (2)				
Nitric acid (Max.)	86.0	120.5	32	68
Perchloric acid (Max.)	110.0	203	28.4	71.6
Hydrofluoric acid (Max.)	19.4	120	63	37
Hydrochloric acid (Max.)	−84	110	79.76	20.24
Hydrobromic acid (Max.)	−73	126	52.5	47.5
Hydriodic acid (Max.)	−34	127	43	57
H—Ketones				
Methyl ethyl ketone	79.6	73.5	11	89
Methyl *n*-propyl ketone (10)	102.0	83.3	19.5	80.5
Methyl *iso*-butyl ketone (10)	115.9	87.9	24.3	75.7
Mesityl oxide (10)	129.5	91.8	34.8	65.2
Diacetone alcohol (10)	166	98.8	87.3	12.7
I—Aldehydes				
Furfural	161.5	97.5	65	35
Butyraldehyde (3)	75.7	68	6	94
J—Amines				
Pyridine	115.5	92.6	43	57

TABLE II

BINARY AZEOTROPES CONTAINING ALCOHOLS

	B.P. 760 mm.		% By weight	
	Other component	Azeotrope	Alcohol	Other component
A—Methyl Alcohol (B.P. 64.7°)				
Methylal	42.3	41.9	8.2	91.8
Dimethyl sulfide	37.3	34.0	15	85
Methyl borate	68.7	54.6	32	68
Dimethyl carbonate	90.4	62.7	70	30
Methyl acetate	57.0	53.8	18.7	81.3
Methyl propionate	79.8	62.5	47.5	52.5
Ethyl formate	54.1	51.0	16	84
Ethyl acetate	77.1	62.3	44	56
iso-Propyl acetate	91.0	64.5	80	20
n-Pentane	36.2	30.8	9	91
n-Hexane	68.9	50.6	28	72
n-Heptane	98.5	59.1	51.5	48.5
Benzene	80.2	58.3	39.6	60.4
Toluene	110.8	63.8	69	31
Cyclohexane	80.8	54.2	37.2	62.8
Nitromethane	101.2	64.6	91	9
Methyl iodide	42.6	38.0	6.5	93.5
Chloroform	61.1	53.5	12.6	87.4
Carbon tetrachloride (4)	76.8	55.7	20.6	79.4
Ethyl bromide	38.4	35.0	4.5	95.5
Ethylene chloride	83.7	61.0	32	68
n-Propyl chloride	46.6	40.5	9.5	90.5
n-Propyl bromide	71.0	54.5	21	79
iso-Propyl chloride	36.3	33.4	6	94
iso-Propyl bromide	59.8	48.6	15.0	85.0
iso-Propyl iodide	89.4	61.0	38	62
n-Butyl chloride	78.1	57.0	27	73
iso-Butyl bromide	91.0	61.3	41.7	58.3
Di-*n*-propyl ether	90.4	63.8	72	28
Acetone	56.5	55.7	12.1	87.9
B—Ethyl Alcohol (B.P. 78.3°)				
Methyl acetate	57.0	56.9	3	97
Methyl propionate	79.7	72.0	33	67
Ethyl nitrate	87.7	71.9	44	56
Ethyl acetate	77.1	71.8	30.8	69.2
Ethyl propionate	99.2	78.0	75	25
n-Propyl formate	80.8	71.8	38	62
n-Propyl acetate	101.6	78.2	85	15
iso-Propyl acetate	91.0	76.8	57	43
Benzene	80.2	68.2	32.4	67.6
Toluene	110.8	76.7	68	32
n-Pentane	36.2	34.3	5	95
n-Hexane	68.9	58.7	21	79
n-Heptane	98.5	70.9	49	51
n-Octane	125.6	77.0	78	22
Methyl iodide	42.6	41.2	3.2	96.8
Ethylene chloride	83.7	70.5	37	63
Carbon tetrachloride	76.8	65.1	15.8	84.2
Allyl chloride	45.7	44	5	95

AZEOTROPIC MIXTURES

	B.P. 760 mm.		% By weight	
	Other component	Azeotrope	Alcohol	Other component
Chloroform	61.1	59.4	7	93
n-Propyl chloride	46.7	45.0	6	94
n-Propyl bromide	71.0	62.8	20.5	79.5
n-Propyl iodide	102.4	75.4	44	56
iso-Propyl chloride	36.3	35.6	2.8	97.2
iso-Propyl bromide	59.8	55.6	10.5	89.5
iso-Propyl iodide	89.4	71.5	27	73
n-Butyl chloride	78.1	65.7	20.3	79.7
n-Butyl bromide	100.3	75.0	43	57
iso-Butyl bromide	91.0	72.5	31	69
Acetal	103.6	78.0	76	24
Di-*n*-propyl ether	90.4	74.5	44	56
Methyl ethyl ketone	79.6	74.8	40	60
C—iso-Propyl Alcohol (B.P. 82.5°)				
Methyl propionate	79.8	76.4	37	63
Ethyl acetate	77.1	75.3	25	75
iso-Propyl acetate	91.0	81.3	60	40
Benzene	80.2	71.9	33.3	66.7
Toluene	110.8	81.3	79	21
n-Pentane	36.2	35.5	6	94
n-Hexane	68.9	62.7	23	77
n-Heptane	98.5	76.3	54	46
Carbon tetrachloride	76.8	69.0	18	82
Chloroform	61.1	60.8	4.2	95.8
Allyl bromide	70.8	66.5	20	80
Ethyl iodide	72.3	67.1	15	85
Ethylene chloride	83.7	74.7	43.5	56.5
iso-Propyl bromide	59.8	57.8	12	88
iso-Propyl iodide	89.4	76.0	32	68
n-Propyl chloride	46.7	46.4	2.8	97.2
n-Propyl bromide	71.0	66.8	20.5	79.5
n-Propyl iodide	102.4	79.8	42	58
n-Butyl chloride	78.1	70.8	23	77
Acetal	103.6	81.3	63	37
Ethyl *n*-propyl ether	63.6	62.0	10	90
Di-*iso*-propyl ether (5)	82.3	66.2	14.1	85.9
Methyl ethyl ketone	79.0	77.5	32	68
D—n-Propyl Alcohol (B.P. 97.2°)				
Methyl butyrate	102.7	94.4	49	51
Ethyl propionate	99.2	93.4	48	52
n-Propyl formate	80.8	80.65	3	97
n-Propyl acetate	101.6	94.7	51	49
Benzene	80.2	77.1	16.9	83.1
Toluene	110.8	92.4	52.5	47.5
n-Hexane	68.9	65.7	4	96
Carbon tetrachloride	76.8	73.1	11.5	88.5
Chlorobenzene	132.0	96.9	83	17
Ethylene chloride	83.7	80.7	19	81
n-Propyl bromide	71.0	69.7	9	91
n-Butyl chloride	78.1	74.8	18	82
Acetal	103.6	92.4	37	63
Di-*n*-propyl ether	90.4	85.7	30	70

AZEOTROPIC MIXTURES

	B.P. 760 mm.		% By weight	
	Other component	Azeotrope	Alcohol	Other component
E—iso-Butyl Alcohol (B.P. 107.9°)				
Methyl butyrate	102.7	101.3	25	75
iso-Butyl formate	97.9	97.4	12	88
iso-Butyl acetate	117.5	107.6	92	8
Benzene	80.2	79.8	9.3	90.7
Toluene	110.8	100.9	44.5	55.5
m-Xylene	139.0	107.7	87	13
Cyclohexane	80.8	78.1	14	86
n-Hexane	68.9	68.3	2.5	97.5
Chlorobenzene	132.0	107.1	63	37
Ethylene chloride	83.7	83.5	6.5	93.5
n-Butyl chloride	78.1	77.7	4	96
n-Butyl bromide	100.3	95.0	21	79
iso-Butyl bromide	91.0	88.8	12	88
iso-Butyl iodide	120.4	104.0	36	64
iso-Amyl chloride	99.8	94.5	22	78
Acetal	103.6	98.2	20	80
F—n-Butyl Alcohol (B.P. 117.8°)				
Ethyl butyrate	120.0	115.7	64	36
n-Butyl formate	106.6	105.8	23.7	76.3
n-Butyl acetate	126.2	117.2	47	53
Toluene	110.8	105.7	27	73
m-Xylene	139.0	116.0	80	20
Cyclohexane	80.8	79.8	4	96
n-Heptane	98.5	94.4	18	82
Carbon tetrachloride	76.8	76.6	2.5	97.5
Chlorobenzene	132.0	115.3	56	44
iso-Butyl bromide	91.0	90.2	7	93
iso-Butyl iodide	120.4	110.5	30	70
Acetal	103.6	101	13	87
G—iso-Amyl Alcohol (B.P. 131.4°)				
iso-Amyl formate	123.8	123.7	10	90
iso-Amyl acetate	142.1	131.3	98.5	1.5
Toluene	110.8	110.0	14	86
m-Xylene	139.0	127.0	53.3	46.7
Chlorobenzene	132.0	124.3	35	65
iso-Amyl bromide	120.3	116.8	21	79
iso-Amyl iodide	147.7	129.2	54	46
Paraldehyde	124.0	122.9	22	78
H—n-Amyl Alcohol (B.P. 137.8°)				
n-Amyl formate	132.0	130.4	43	57
Di-*n*-butyl ether	142.1	134.0	52	48
I—Cyclohexyl Alcohol (B.P. 160.7°)				
o-Xylene	143.6	143.0	14	86
iso-Amyl iodide	147.5	147.0	10	90
Furfural	161.4	155.6	45	55
Di-*iso*-amyl ether	172.6	158.8	78	22
Phenetole	170.4	159.2	72	28

AZEOTROPIC MIXTURES

	B.P. 760 mm.		% By weight	
	Other component	Azeotrope	Alcohol	Other component
J—Allyl Alcohol (B.P. 97.0°)				
Methyl butyrate	102.7	93.8	55	45
n-Propyl acetate	101.6	94.2	53	47
Benzene	80.2	76.8	17.4	82.6
Toluene	110.8	92.4	50	50
Cyclohexane	80.8	74	20	80
Allyl iodide	102.0	89.4	28	72
Chlorobenzene	132.0	96.2	85	15
Ethylene chloride	83.7	79.9	18	82
K—Benzyl Alcohol (B.P. 205.2°)				
Nitrobenzene	210.8	204.0	58	42
Iodobenzene	188.6	187.8	12	88
o-Bromotoluene	181.4	181.25	7	93
Naphthalene	218.1	204.1	60	40
m-Cresol (Max.)	202.2	207.1	61	39
Dimethyl aniline	194.1	193.9	6.5	93.5
L—Ethylene Glycol (B.P. 197.4°)				
Ethyl benzoate	212.6	186.1	46.5	53.5
iso-Amyl acetate	142.1	141.95	3	97
Diphenyl	254.9	192.0	64	36
Mesitylene	164.6	156.0	13	87
Naphthalene	218.1	183.9	51	49
Toluene	110.8	110.2	6.5	93.5
m-Xylene	139.0	135.6	15	85
Ethylene bromide	131.7	129.8	4	96
Nitrobenzene	210.9	185.9	59	41
Chlorobenzene	132.0	130.1	94.4	5.6
Benzyl chloride	179.3	167.0	30	70
Benzyl alcohol	205.1	193.1	56	44
Di-*n*-butyl ether	142.1	140.0	10	90
Diphenyl ether	259.3	193.1	60	40
Anisole	153.9	150.5	10.5	89.5
β-Phenylethyl alcohol	219.4	194.4	69	31
Acetophenone	202.1	185.7	52	48
Aniline	184.4	180.6	24	76
Dimethyl aniline	194.1	175.9	33.5	66.5
o-Cresol	191.1	189.6	27	73
M—Glycerol (B.P. 291.0°)				
n-Propyl benzoate	230.9	228.8	8	92
n-Butyl benzoate	249.8	243.0	17	83
Diphenyl	254.9	243.8	55	45
Naphthalene	218.1	215.2	10	90
p-Dibromobenzene	220.3	217.1	10	90
Diphenyl ether	257.7	246.3	22	78

TABLE III

BINARY AZEOTROPES CONTAINING ORGANIC ACIDS

	B.P. 760 mm.		% By weight	
	Other component	Azeotrope	Acid	Other component
A—Formic Acid (B.P. 100.8°)				
Benzene	80.2	71.7	31	69
Toluene	110.8	85.8	50	50
m-Xylene	139.0	94.2	70.2	29.8
n-Pentane	36.2	34.2	10	90
n-Hexane	68.9	60.6	28	72
n-Heptane	98.5	78.2	43.5	56.5
n-Octane	125.8	90.5	63	37
Chloroform	61.2	59.2	15	85
Carbon tetrachloride	76.8	66.7	18.5	81.5
Carbon disulfide	46.3	42.6	17	83
Methyl iodide	42.6	42.1	6	94
Ethyl bromide	38.4	38.2	3	97
Ethylene chloride	83.6	77.4	14	86
Ethylene bromide	131.7	94.7	51.5	48.5
n-Propyl chloride	46.7	45.6	8	92
n-Propyl bromide	71.0	64.7	27	73
iso-Propyl chloride	34.8	34.7	1.5	98.5
iso-Propyl bromide	59.4	56.0	14	86
iso-Butyl chloride	68.9	63.0	19	81
iso-Amyl chloride	99.8	80.0	33.5	66.5
Chlorobenzene	132.0	95.0	55	45
Diethyl ketone (Max.)	102.2	105.4	33	67
Methyl *n*-propyl ketone (Max.)	102.3	105.3	32	68
B—Acetic Acid (B.P. 118.5°)				
Benzene	80.2	80.05	2	98
Toluene	110.8	105.0	34	66
m-Xylene	139.0	115.4	72.5	27.5
n-Heptane	98.5	92.3	30	70
n-Octane	125.8	109.0	50	50
Carbon tetrachloride	76.8	76.6	3	97
Ethylene bromide	131.7	114.4	55	45
iso-Propyl iodide	89.2	88.3	9	91
n-Butyl bromide	100.4	97.6	18	82
iso-Butyl bromide	91.3	90.2	12	88
iso-Amyl chloride	99.8	97.2	18.5	81.5
Chlorobenzene	132.0	114.7	58.5	41.5
C—Propionic Acid (B.P. 140.9°)				
m-Xylene	139.0	132.7	35.5	64.5
Ethylene bromide	131.7	127.8	17.5	82.5
iso-Butyl iodide	120.4	119.5	9	91
iso-Amyl bromide	120.3	119.2	10	90
Chlorobenzene	132.0	128.9	18	82
Anisole	153.9	140.8	96	4
D—Butyric Acid (B.P. 162.5°)				
m-Xylene	139.0	138.3	6	94
Ethylene bromide	131.7	131.1	3.5	96.5
Chlorobenzene	132.0	131.8	2.8	97.2

AZEOTROPIC MIXTURES

	B.P. 760 mm.		% By weight	
	Other component	Azeotrope	Acid	Other component
Benzyl chloride	179.3	160.8	65	35
Anisole	153.9	152.9	12	88
Furfural	161.5	159.4	42.5	57.5
E—Iso-Butyric Acid (B.P. 154.4°)				
m-Xylene	139.0	136.8	14	86
Ethylene bromide	131.7	130.5	6.5	93.5
Chlorobenzene	132.0	131.2	8	92
Benzyl chloride	179.3	153.5	80	20
Anisole	153.9	148.5	42	58
F—iso-Valeric Acid (B.P. 176.5°)				
Mesitylene	164.6	162.8	20	80
Benzyl chloride	179.3	171.2	36	64
Benzaldehyde	179.2	174.5	68	32
iso-Amyl butyrate	178.5	176.1	70	30
Phenetole	170.5	168.5	20	80
G—Caproic Acid (B.P. 205.2°)				
Naphthalene	218.1	202.0	70	30
Benzyl chloride	179.3	179.0	3	97
Nitrobenzene	210.8	202.0	70	30
H—Caprylic Acid (B.P. 237.5°)				
Naphthalene	218.1	216.2	6	94
p-Dibromobenzene	220.3	218.8	10	90
I—Chloroacetic Acid (B.P. 189.4°)				
Mesitylene	164.6	162	17	83
Naphthalene	218.1	187.1	78	22
Benzyl chloride	179.3	173.8	25	75
p-Dichlorobenzene	174.1	167.6	24.5	75.5
o-Cresol	191.1	187.5	54	46
J—Phenylacetic Acid (B.P. 266.5°)				
α-Chloronaphthalene	262.7	255.9	30	70
Diphenyl	255.9	252.2	23.3	76.7
iso-Amyl benzoate	262.0	259.9	26	74
Methyl cinnamate	261.9	261.8	3	97
Diphenyl ether	259.3	255.4	27.8	72.2
K—Benzoic Acid (B.P. 250.5°)				
Diphenyl	255.9	245.9	50.5	49.5
Naphthalene	218.1	217.7	5	95
p-Dibromobenzene	220.3	219.5	3.8	96.2
p-Nitrotoluene	239.0	237.4	11	89
Ethyl salicylate	234.0	233.85	6	94
iso-Butyl benzoate	241.9	241.2	12	88
Diphenyl ether	259.3	247.0	59	41

TABLE IV

TERNARY AZEOTROPES CONTAINING WATER AND ALCOHOLS

	B.P. 760 mm.		% By weight		
	Other component	Azeotrope	Water	Alcohol	Other component
A—Ethyl Alcohol (B.P. 78.3°)					
Ethyl acetate (6)	77.1	70.3	7.8	9.0	83.2
Diethyl formal (7)	87.5	73.2	12.1	18.4	69.5
Diethyl acetal (8)	103.6	77.8	11.4	27.6	61.0
Cyclohexane	80.8	62.1	7	17	76
Benzene (4)	80.2	64.9	7.4	18.5	74.1
Chloroform	61.2	55.5	3.5	4.0	92.5
Carbon tetrachloride	76.8	61.8	4.3	9.7	86.0
Ethyl iodide	72.3	61	5	9	86
Ethylene chloride	83.7	66.7	5	17	78
B—n-Propyl Alcohol (B.P. 97.2°)					
n-Propyl formate (6)	80.9	70.8	13	5	82
n-Propyl acetate (6)	101.6	82.2	21.0	19.5	59.5
Di-*n*-propyl formal (7)	137.4	86.4	8.0	44.8	47.2
Di-*n*-propyl acetal (8)	147.7	87.6	27.4	51.6	21.0
Di-*n*-propyl ether (7)	91.0	74.8	11.7	20.2	68.1
Cyclohexane	80.8	66.6	8.5	10.0	81.5
Benzene (4)	80.2	68.5	8.6	9.0	82.4
Carbon tetrachloride	76.8	65.4	5	11	84
Diethyl ketone	102.2	81.2	20	20	60
C—iso-Propyl Alcohol (B.P. 82.5°)					
Cyclohexane	80.8	64.3	7.5	18.5	74.0
Benzene (4)	80.2	66.5	7.5	18.7	73.8
D—n-Butyl Alcohol (B.P. 117.8°)					
n-Butyl formate (6)	106.6	83.6	21.3	10.0	68.7
n-Butyl acetate (6)	126.2	89.4	37.3	27.4	35.3
Di-*n*-butyl ether (7)	141.9	91	29.3	42.9	27.7
E—iso-Butyl Alcohol (B.P. 108.0°)					
iso-Butyl formate (6)	94.4	80.2	17.3	6.7	76.0
iso-Butyl acetate	117.2	86.8	30.4	23.1	46.5
F—tert-Butyl Alcohol (B.P. 82.6°)					
Benzene (4)	80.2	67.3	8.1	21.4	70.5
Carbon tetrachloride (9)	76.8	64.7	3.1	11.9	85.0
G—n-Amyl Alcohol (B.P. 137.8°)					
n-Amyl formate (6)	131.0	91.4	37.6	21.2	41.2
n-Amyl acetate (6)	148.8	94.8	56.2	33.3	10.5
H—iso-Amyl Alcohol (B.P. 131.4°)					
iso-Amyl formate (6)	124.2	89.8	32.4	19.6	48.0
iso-Amyl acetate (6)	142.0	93.6	44.8	31.2	24.0
I—Allyl Alcohol (B.P. 97.0°)					
n-Hexane	69.0	59.7	5	5	90
Cyclohexane	80.8	66.2	8	11	81
Benzene	80.2	68.2	8.6	9.2	82.2
Carbon tetrachloride	76.8	65.2	5	11	84

IONIZATION CONSTANTS OF ACIDS AND BASES AT 25° C.

Figures in italics are activity constants (ionic strength zero).

Values in the table have been collected from various sources including among others:

Kolthoff and Stenger: *Volumetric Analysis*, 2d ed. 1942, Vol. I, Table II, Published by Interscience Publishers, New York, by permission of the publishers.

Mac Innes: *Principles of Electrochemistry* (1939), Table VIII. Published by Reinhold Publishing Corp., New York, by permission of the publishers.

Dippy: *Chem. Reviews* 25, *203-11* (*1939*).

ACIDS

Acid	Formula	K	—log K
Acetic	$HC_2H_3O_2$	*1.753×10^{-5}*	*4.76*
Acrylic	$HC_3H_3O_2$	*5.50×10^{-5}*	*4.26*
Adipic	$H_2C_6H_8O_4$	*3.72×10^{-5}*	*4.43*
Alanine	$HC_3H_6O_2N$	1.9×10^{-10}	9.72
Allylacetic	$HC_5H_7O_2$	2.10×10^{-5}	4.68
β-Allylpropionic	$HC_6H_9O_2$	1.90×10^{-5}	4.72
Aluminum hydroxide	$Al(OH)_3$	6.3×10^{-13}	12.20
Anisic, *see methoxybenzoic*			
Arsenic	H_3AsO_4	K_1 5×10^{-3}	2.30
		K_2 8.3×10^{-8}	7.08
		K_3 6×10^{-10}	9.22
Arsenious	H_3AsO_3	K_1 6×10^{-10}	9.22
Barbituric	$HC_4H_3O_3N_2$	1.05×10^{-4}	3.98
Benzoic	$HC_7H_5O_2$	6.30×10^{-5}	4.20
Boric	H_3BO_3	*5.8×10^{-10}*	*9.24*
Bromoacetic	$HC_2H_2O_2Br$	1.35×10^{-3}	2.87
o-Bromobenzoic	$HC_7H_4O_2Br$	1.40×10^{-3}	2.85
m-Bromobenzoic	$HC_7H_4O_2Br$	1.54×10^{-4}	3.81
p-Bromobenzoic	$HC_7H_4O_2Br$	1.07×10^{-4}	3.97
o-Bromophenylacetic	$HC_8H_6O_2Br$	8.84×10^{-5}	4.05
p-Bromophenylacetic	$HC_8H_6O_2Br$	6.49×10^{-5}	4.19
α-Bromopropionic	$HC_3H_4O_2Br$	1.06×10^{-3}	2.97
β-Bromopropionic	$HC_3H_4O_2Br$	9.5×10^{-5}	4.02
β-(*iso*-Butenyl)-propionic	$HC_7H_{11}O_2$	1.59×10^{-5}	4.80
tert-Butylbenzoic (*p*)	$HC_{11}H_{13}O_2$	3.98×10^{-5}	4.40
p-*tert*-Butyl-phenylacetic	$HC_{12}H_{15}O_2$	3.82×10^{-5}	4.42
n-Butyric	$HC_4H_7O_2$	*1.506×10^{-5}*	*4.82*
iso-Butyric	$HC_4H_7O_2$	1.55×10^{-5}	4.81
Caffeine	$C_8H_{10}O_2N_4$	$< 1 \times 10^{-14}$	.....
Camphoric	$H_2C_{10}H_{14}O_4$	K_1 2.7×10^{-5}	4.57
		K_2 8×10^{-6}	5.10
n-Caproic	$HC_6H_{11}O_2$	1.32×10^{-5}	4.88
n-Caprylic	$HC_8H_{15}O_2$	1.27×10^{-5}	4.90
Carbonic	H_2CO_3	K_1 *4.31×10^{-7}*	*6.37*
		K_2 *5.6×10^{-11}*	*10.25*
Chloroacetic	$HC_2H_2O_2Cl$	*1.396×10^{-3}*	*2.86*
o-Chlorobenzoic	$HC_7H_4O_2Cl$	*1.197×10^{-3}*	*2.92*
m-Chlorobenzoic	$HC_7H_4O_2Cl$	*1.506×10^{-4}*	*3.82*
p-Chlorobenzoic	$HC_7H_4O_2Cl$	*1.04×10^{-4}*	*3.98*
o-Chlorocinnamic (*trans*)	$HC_9H_6O_2Cl$	5.83×10^{-5}	4.23
m-Chlorocinnamic (*trans*)	$HC_9H_6O_2Cl$	5.08×10^{-5}	4.29
p-Chlorocinnamic (*trans*)	$HC_9H_6O_2Cl$	3.86×10^{-5}	4.41
o-Chlorophenylacetic	$HC_8H_6O_2Cl$	*8.60×10^{-5}*	*4.07*
m-Chlorophenylacetic	$HC_8H_6O_2Cl$	*7.24×10^{-5}*	*4.14*

IONIZATION CONSTANTS OF ACIDS AND BASES AT 25° C.

Acid	Formula	*K*	—log *K*
p-Chlorophenylacetic	$HC_8H_6O_2Cl$	6.45×10^{-5}	*4.19*
o-Chloro-β-phenylpropionic	$HC_9H_8O_2Cl$	2.65×10^{-5}	4.58
m-Chloro-β-phenylpropionic	$HC_9H_8O_2Cl$	2.60×10^{-5}	4.59
p-Chloro-β-phenylpropionic	$HC_9H_8O_2Cl$	2.47×10^{-5}	4.61
α-Chloropropionic	$HC_3H_4O_2Cl$	1.6×10^{-3}	2.80
β-Chloropropionic	$HC_3H_4O_2Cl$	8.4×10^{-5}	4.08
Chromic	H_2CrO_4	K_2 3.2×10^{-7}	*6.49*
Cinnamic (*cis*)	$HC_9H_7O_2$	1.32×10^{-4}	3.88
Cinnamic (*trans*)	$HC_9H_7O_2$	3.7×10^{-5}	4.43
Cinnamylideneacetic	$HC_{11}H_9O_2$	3.75×10^{-5}	4.43
Citraconic	$H_2C_5H_4O_4$	3.33×10^{-3}	2.48
Citric	$H_3C_6H_5O_7$	K_1 8.7×10^{-4}	*3.06*
		K_2 1.8×10^{-5}	*4.74*
		K_3 4.0×10^{-6}	*5.40*
Crotonic (*trans*)	$HC_4H_5O_2$	2.00×10^{-5}	4.70
Crotonic (*iso*)	$HC_4H_5O_2$	3.5×10^{-5}	4.46
Cuminic	$HC_{10}H_{11}O_2$	4.43×10^{-5}	4.35
Cyanuric	$C_3H_3O_3N_3$	1.8×10^{-7}	6.74
Cyclobutane-1, 1-dicarboxylic	$H_2C_6H_6O_4$	7.55×10^{-5}	*4.12*
Cyclohexane-1,1-dicarboxylic	$H_2C_8H_{10}O_4$	3.54×10^{-5}	*4.45*
Cyclopentane-1, 1-dicarboxylic	$H_2C_7H_8O_4$	5.96×10^{-5}	*4.22*
Cyclopropane-1, 1-dicarboxylic	$H_2C_5H_4O_4$	1.50×10^{-5}	*4.82*
Dichloroacetic	$HC_2HO_2Cl_2$	5×10^{-2}	1.30
Diethylacetic	$HC_6H_{11}O_2$	1.78×10^{-5}	4.75
Diethylbarbituric	$HC_8H_{11}O_3N_2$	3.7×10^{-8}	7.43
Diethylmalonic	$H_2C_7H_{10}O_4$	7.08×10^{-4}	*3.15*
3, 4-Dimethoxy-phenylacetic	$HC_{10}H_{11}O_4$	4.64×10^{-5}	4.33
β,β-Dimethylacrylic	$HC_5H_7O_2$	7.6×10^{-6}	5.12
Dimethylmalonic	$H_2C_5H_6O_4$	7.06×10^{-5}	*4.15*
Dinitro-*o*-cresol	$HC_7H_5O_5N_2$	4.5×10^{-5}	4.35
2, 4-Dinitrophenylacetic	$HC_8H_5O_6N_2$	3.15×10^{-4}	3.50
Diphenylacetic	$HC_{14}H_{11}O_2$	1.15×10^{-4}	3.94
Di-*n*-propylmalonic	$H_2C_9H_{14}O_4$	9.20×10^{-4}	*3.04*
Ethylacrylic	$HC_5H_7O_2$	2.02×10^{-5}	4.69
p-Ethylbenzoic	$HC_9H_9O_4$	4.43×10^{-5}	4.35
Ethylmalonic	$H_2C_5H_6O_4$	1.09×10^{-4}	*3.96*
p-Ethyl-phenylacetic	$HC_{10}H_{11}O_2$	4.24×10^{-5}	4.37
Ethyl-*n*-propylmalonic	$H_2C_8H_{12}O_4$	7.84×10^{-4}	*3.11*
o-Fluorobenzoic	$HC_7H_4O_2F$	5.41×10^{-4}	3.27
m-Fluorobenzoic	$HC_7H_4O_2F$	1.37×10^{-4}	3.86
p-Fluorobenzoic	$HC_7H_4O_2F$	7.22×10^{-5}	*4.14*
p-Fluorophenylacetic	$HC_8H_6O_2F$	5.68×10^{-5}	4.25
Formic	$HCHO_2$	1.77×10^{-4}	3.75
Fumaric	$H_2C_4H_2O_4$	K_1 9.3×10^{-4}	*3.03*
		K_2 3.4×10^{-5}	4.47
Gallic	$HC_7H_5O_5$	4×10^{-5}	4.40
Glutaric	$H_2C_5H_6O_4$	4.54×10^{-5}	4.34
Glycerophosphoric	$H_2C_3H_7O_6P$	K_1 3.4×10^{-2}	1.47
		K_2 6.4×10^{-7}	6.19
Glycine	$HC_2H_4O_2N$	1.67×10^{-10}	*9.78*
Glycolic	$HC_2H_3O_3$	1.52×10^{-4}	3.82
n-Heptoic	$HC_7H_{13}O_2$	1.28×10^{-5}	4.89
Hexahydrobenzoic	$HC_7H_{11}O_2$	1.28×10^{-5}	4.89
Hippuric	$HC_9H_8O_3N$	2.3×10^{-4}	3.64
Hydrazoic	HN_3	2.6×10^{-5}	4.59

IONIZATION CONSTANTS OF ACIDS AND BASES AT 25° C.

Acid	Formula		K	—log K
Hydrocyanic	HCN		7.2×10^{-10}	9.14
Hydrofluoric	HF		*7.2×10^{-4}*	*3.14*
Hydrosulfuric	H_2S	K_1	5.7×10^{-8}	7.24
		K_2	1.2×10^{-15}	14.92
Hydroquinone	$HC_6H_5O_2$	(18°)	1.1×10^{-10}	9.96
o-Hydroxybenzoic, *see salicylic*				
m-Hydroxybenzoic	$HC_7H_5O_3$		8.3×10^{-5}	4.08
p-Hydroxybenzoic	$H_2C_7H_4O_3$	K_1	*3.3×10^{-5}*	*4.48*
		K_2	4.0×10^{-10}	9.40
o-Hydroxycinnamic (*trans*)	$HC_9H_7O_3$		2.44×10^{-5}	4.61
m-Hydroxycinnamic (*trans*)	$HC_9H_7O_3$		4.00×10^{-5}	4.40
Hypochlorous	$HClO$		3.5×10^{-8}	7.46
Iodic	HIO_3		*1.67×10^{-1}*	*0.78*
o-Iodobenzoic	$HC_7H_4O_2I$		1.37×10^{-3}	2.86
m-Iodobenzoic	$HC_7H_4O_2I$		1.41×10^{-4}	3.85
o-Iodophenylacetic	$HC_8H_6O_2I$		9.16×10^{-5}	4.04
m-Iodophenylacetic	$HC_8H_6O_2I$		6.93×10^{-5}	4.16
p-Iodophenylacetic	$HC_8H_6O_2I$		*6.64×10^{-5}*	*4.18*
Itaconic	$H_2C_5H_4O_4$	K_1	1.46×10^{-4}	3.84
		K_2	2.8×10^{-6}	5.55
Lactic	$HC_3H_5O_3$		*1.387×10^{-4}*	*3.86*
Maleic	$H_2C_4H_2O_4$	K_1	*1.0×10^{-2}*	*2.00*
		K_2	5.5×10^{-7}	6.26
Malic	$H_2C_4H_4O_5$	K_1	4×10^{-4}	3.40
		K_2	9×10^{-6}	5.05
Malonic	$H_2C_3H_2O_4$	K_1	*1.397×10^{-3}*	*2.85*
		K_2	8.0×10^{-7}	6.10
Mandelic	$HC_8H_7O_3$		4.29×10^{-4}	3.37
Mesaconic	$H_2C_5H_4O_4$		7.75×10^{-4}	3.11
o-Methoxybenzoic	$HC_8H_7O_3$		8.06×10^{-5}	4.09
m-Methoxybenzoic	$HC_8H_7O_3$		8.17×10^{-5}	4.09
p-Methoxybenzoic	$HC_8H_7O_3$		3.38×10^{-5}	4.47
o-Methoxycinnamic (*trans*)	$HC_{10}H_9O_3$		3.45×10^{-5}	4.46
m-Methoxycinnamic (*trans*)	$HC_{10}H_9O_3$		4.21×10^{-5}	4.38
p-Methoxycinnamic (*trans*)	$HC_{10}H_9O_3$		2.89×10^{-5}	4.54
p-Methoxyphenylacetic	$HC_9H_9O_3$		*4.36×10^{-5}*	*4.36*
o-Methoxy-β-phenylpropionic	$HC_{10}H_{11}O_3$		1.57×10^{-5}	4.80
m-Methoxy-β-phenylpropionic	$HC_{10}H_{11}O_3$		2.22×10^{-5}	4.65
p-Methoxy-β-phenylpropionic	$HC_{10}H_{11}O_3$		2.04×10^{-5}	4.69
o-Methylcinnamic (*trans*)	$HC_{10}H_9O_2$		3.16×10^{-5}	4.50
m-Methylcinnamic (*trans*)	$HC_{10}H_9O_2$		3.61×10^{-5}	4.44
p-Methylcinnamic (*trans*)	$HC_{10}H_9O_2$		2.73×10^{-5}	4.56
Methylethylacrylic (*cis*)	$HC_6H_9O_2$		7.1×10^{-6}	5.15
Methylethylacrylic (*trans*)	$HC_6H_9O_2$		7.4×10^{-6}	5.13
Methylethylmalonic	$H_2C_6H_8O_4$		*1.54×10^{-4}*	*3.81*
Methylmalonic	$H_2C_4H_4O_4$		*8.47×10^{-5}*	*4.07*
2-Methyl-6-nitrobenzoic	$HC_8H_6O_4N$		1.34×10^{-2}	1.87
p-Methyl-phenylacetic	$HC_9H_9O_2$		4.27×10^{-5}	4.37
o-Methyl-β-phenylpropionic	$HC_{10}H_{11}O_2$		2.17×10^{-5}	4.66
m-Methyl-β-phenylpropionic	$HC_{10}H_{11}O_2$		2.10×10^{-5}	4.68
p-Methyl-β-phenylpropionic	$HC_{10}H_{11}O_2$		2.07×10^{-5}	4.68
Mucic	$H_2C_6H_8O_8$		6.1×10^{-4}	3.21
α-Naphthoic	$HC_{11}H_7O_2$		2.0×10^{-4}	3.70
β-Naphthoic	$HC_{11}H_7O_2$		6.9×10^{-5}	4.16
o-Nitrobenzoic	$HC_7H_4O_4N$		6.71×10^{-3}	2.17

IONIZATION CONSTANTS OF ACIDS AND BASES AT 25° C.

Acid	Formula		K	$-\log K$
m-Nitrobenzoic	$HC_7H_4O_4N$		3.21×10^{-4}	3.49
p-Nitrobenzoic	$HC_7H_4O_4N$		3.76×10^{-4}	3.42
o-Nitrocinnamic (*trans*)	$HC_9H_6O_4N$		7.07×10^{-5}	4.15
m-Nitrocinnamic (*trans*)	$HC_9H_6O_4N$		7.58×10^{-5}	4.12
p-Nitrocinnamic (*trans*)	$HC_9H_6O_4N$		8.99×10^{-5}	4.05
o-Nitrophenylacetic	$HC_8H_6O_4N$		9.90×10^{-5}	4.00
m-Nitrophenylacetic	$HC_8H_6O_4N$		1.08×10^{-4}	3.97
p-Nitrophenylacetic	$HC_8H_6O_4N$		1.41×10^{-4}	3.85
o-Nitro-β-phenylpropionic	$HC_9H_8O_4N$		3.13×10^{-5}	4.50
p-Nitro-β-phenylpropionic	$HC_9H_8O_4N$		3.36×10^{-5}	4.47
Nitrous	HNO_2		4×10^{-4}	3.40
Oxalic	$H_2C_2O_4$	K_1	*6.5×10^{-2}*	*1.19*
		K_2	*6.1×10^{-5}*	*4.21*
n-Pelargonic	$HC_9H_{17}O_2$		1.11×10^{-5}	4.95
Periodic	HIO_4		2.3×10^{-2}	1.64
Phenol	HC_6H_5O		1.3×10^{-10}	9.89
o-Phenoxybenzoic	$HC_{13}H_9O_3$		2.97×10^{-4}	3.53
m-Phenoxybenzoic	$HC_{13}H_9O_3$		1.12×10^{-4}	3.95
p-Phenoxybenzoic	$HC_{13}H_9O_3$		3.00×10^{-5}	4.52
Phenylacetic	$HC_8H_7O_2$		*4.88×10^{-5}*	*4.31*
o-Phenylbenzoic	$HC_{13}H_9O_2$		3.47×10^{-4}	3.46
γ-Phenylbutyric	$HC_{10}H_{11}O_2$		1.75×10^{-5}	4.76
Phenylmalonic	$H_2C_9H_6O_4$		*2.77×10^{-3}*	*2.56*
β-Phenylpropionic	$HC_9H_9O_2$		2.19×10^{-5}	4.66
Phosphoric	H_3PO_4	K_1	*7.5×10^{-3}*	*2.12*
		K_2	*6.2×10^{-8}*	*7.21*
		K_3	4.8×10^{-13}	*12.32*
Phosphorous	H_3PO_3	K_1	1.6×10^{-2}	1.80
		K_2	7×10^{-7}	6.15
Phenolphthalein	$C_{20}H_{14}O_4$		2×10^{-10}	9.70
o-Phthalic	$H_2C_8H_4O_4$	K_1	1.3×10^{-3}	*2.89*
		K_2	*3.9×10^{-6}*	*5.41*
Picric	$HC_6H_2O_7N_3$		*4.2×10^{-1}*	*0.38*
Pimelic	$H_2C_7H_{10}O_4$		*3.10×10^{-5}*	*4.31*
Propenylacetic	$HC_5H_7O_2$		3.11×10^{-5}	4.51
β-Propenylpropionic	$HC_6H_9O_2$		1.91×10^{-5}	4.72
Propionic	$HC_3H_5O_2$		*1.343×10^{-5}*	*4.87*
n-Propylacrylic	$HC_6H_9O_2$		1.98×10^{-5}	4.70
iso-Propylacrylic	$HC_6H_9O_2$		1.99×10^{-5}	4.70
β-Propylidenepropionic	$HC_6H_9O_2$		3.05×10^{-5}	4.52
β-(*iso*-Propylidene)-propionic	$HC_5H_9O_2$		2.51×10^{-5}	4.60
n-Propylmalonic	$H_2C_6H_8O_4$		*1.03×10^{-4}*	*3.99*
p-*iso*-Proypl-phenylacetic	$HC_{11}H_{13}O_2$		4.06×10^{-5}	4.39
Pyridine-2-carboxylic (Picolinic)	$HC_6H_4O_2N$		5×10^{-6}	5.30
Pyridine-3-carboxylic (Nicotinic)	$HC_6H_4O_2N$		1.34×10^{-5}	4.87
Pyridine-4-carboxylic (*iso*-Nicotinic)	$HC_6H_4O_2N$		1.07×10^{-5}	4.97
Pyromucic	$HC_5H_3O_3$		7.01×10^{-6}	5.15
Pyrophosphoric	$H_4P_2O_7$	K_1	1.4×10^{-1}	0.85
		K_2	1.1×10^{-2}	1.96
		K_3	*2.1×10^{-7}*	*6.68*
		K_4	*4.06×10^{-10}*	*9.39*
Pyrotartaric	$H_2C_5H_6O_4$		8.5×10^{-5}	4.07
Saccharin	$HC_7H_4O_3NS$	K_1	2.5×10^{-2}	1.60

IONIZATION CONSTANTS OF ACIDS AND BASES AT 25° C.

Acid	Formula		K	$-\log K$
Salicylic	$H_2C_7H_4O_3$	K_1	1.06×10^{-3}	2.97
		K_2	3.6×10^{-14}	13.44
Selenious	H_2SeO_3	K_1	3×10^{-3}	2.52
		K_2	5×10^{-8}	7.30
Silicic	H_4SiO_4	K_1	2×10^{-10}	*ca.* 9.7
Stannic	H_2SnO_3		4×10^{-10}	9.40
Suberic	$H_2C_8H_{12}O_4$		*2.99×10^{-5}*	*4.52*
Succinic	$H_2C_4H_4O_4$	K_1	*6.4×10^{-5}*	*4.19*
		K_2	*2.7×10^{-6}*	*5.57*
Sulfanilic	$HC_6H_6O_3NS$		6.5×10^{-4}	3.19
Sulfuric	H_2SO_4	K_1	4×10^{-1}(?)	0.40
		K_2	1.2×10^{-2}	1.92
Sulfurous	H_2SO_3	K_1	*1.72×10^{-2}*	*1.76*
		K_2	*6.24×10^{-8}*	*7.20*
Tartaric	$H_2C_4H_4O_6$	K_1	*9.6×10^{-4}*	*3.02*
		K_2	*2.9×10^{-5}*	*4.54*
Tartronic	$H_2C_3H_2O_5$		1.05×10^{-3}	2.98
Telluric	H_2TeO_4	K_1	6×10^{-7}	6.22
		K_2	2×10^{-8}	7.70
Tetrolic	$HC_4H_3O_2$		2.41×10^{-3}	2.62
Thiosulfuric	$H_2S_2O_3$		1×10^{-2}	2.00
o-Toluic	$HC_8H_7O_2$		1.23×10^{-4}	3.91
m-Toluic	$HC_8H_7O_2$		5.35×10^{-5}	4.27
p-Toluic	$HC_8H_7O_2$		4.24×10^{-5}	4.37
Trichloroacetic	$HC_2O_2Cl_3$		1.3×10^{-1}	0.89
Trimethylacetic	$HC_5H_9O_2$		8.91×10^{-6}	5.05
Uric	$C_5H_4O_3N_4$		1.3×10^{-4}	3.89
Valeric	$HC_5H_9O_2$		1.56×10^{-5}	4.81
iso-Valeric	$HC_5H_9O_2$		1.68×10^{-5}	4.77
Vanillic	$HC_8H_7O_4$		3.0×10^{-5}	4.52
Vinylacetic	$HC_4H_5O_2$		4.48×10^{-5}	4.35

BASES

Base	Formula		K	$-\log K$
Acetanilide	$CH_3CO{\cdot}NH{\cdot}C_6H_5$	(40°)	4.1×10^{-14}	13.39
Aconitine	$C_{34}H_{47}O_{11}N$		1.3×10^{-6}	5.89
α-Alanine	$NH_2{\cdot}C_3H_5O_2$		5.1×10^{-12}	11.29
Ammonium hydroxide	NH_4OH	(25°)	1.8×10^{-5}	4.74
		(0°)	1.4×10^{-5}	4.85
		(10°)	1.6×10^{-5}	4.80
		(40°)	2×10^{-5}	4.70
		(75°)	1.6×10^{-5}	4.80
		(100°)	1.4×10^{-5}	4.85
iso-Amylamine	$NH_2{\cdot}C_5H_{11}$		4.0×10^{-4}	3.40
Aniline	$NH_2{\cdot}C_6H_5$		3.83×10^{-10}	9.42
Anthranilic acid	$NH_2{\cdot}C_7H_5O_2$		1.4×10^{-12}	11.85
Apomorphine	$C_{17}H_{17}O_2N$		1.0×10^{-7}	7.00
Arsenous oxide	As_2O_3		1.1×10^{-4}	3.96
Benzylamine	$NH_2{\cdot}C_7H_7$		2.0×10^{-5}	4.70
Benzidine	$(NH_2)_2C_{12}H_8$	K_1	9.3×10^{-10}	9.03
		K_2	5.6×10^{-11}	10.25
Beryllium hydroxide	$Be(OH)_2$	K_2	5×10^{-11}	10.30
Brucine	$C_{23}H_{26}O_4N_2$	K_1	9×10^{-7}	6.05
		K_2	2×10^{-12}	11.7

IONIZATION CONSTANTS OF ACIDS AND BASES AT 25° C.

Base	Formula		*K*	—log *K*
n-Butylamine	$NH_2 \cdot C_4H_9$		4.1×10^{-4}	3.39
iso-Butylamine	$NH_2 \cdot C_4H_9$		2.6×10^{-4}	3.59
sec-Butylamine	$NH_2 \cdot C_4H_9$		3.6×10^{-4}	3.44
tert-Butylamine	$NH_2 \cdot C_4H_9$		2.8×10^{-4}	3.55
Caffeine	$C_8H_{10}O_2N_4$	(40°)	4.1×10^{-4}	3.39
Cinchonidine	$C_{19}H_{22}ON_2$	K_1	1.6×10^{-6}	5.80
		K_2	8.4×10^{-11}	10.08
Cinchonine	$C_{19}H_{22}ON_2$	K_1	1.4×10^{-6}	5.85
		K_2	1.1×10^{-10}	9.96
Cocaine	$C_{17}H_{21}O_4N$		2.6×10^{-6}	5.59
Codeine	$C_{18}H_{21}O_3N$		9×10^{-7}	6.05
Colchicine	$C_{22}H_{25}O_6N$		4.5×10^{-13}	12.35
Coniine	$C_8H_{17}N$		1×10^{-3}	3.0
Creatine (anhydrous)	$C_4H_9O_2N_3$	(40°)	1.9×10^{-11}	10.72
Creatinine	$C_4H_7ON_3$	(40°)	3.7×10^{-11}	10.43
Di-*iso*-amylamine	$HN(C_5H_{11})_2$		7.7×10^{-4}	3.11
Di-*iso*-butylamine	$HN(C_4H_9)_2$		3.9×10^{-4}	3.41
Diethylamine	$HN(C_2H_5)_2$		1.26×10^{-3}	2.90
Diethylbenzylamine	$(C_2H_5)_2N \cdot C_7H_7$		3.0×10^{-5}	4.52
Dimethylamine	$HN(CH_3)_2$		*5.12×10^{-4}*	*3.29*
Dimethylaminoantipyrine	$(CH_3)_2N \cdot C_{10}H_9ON_2$		*6.9×10^{-10}*	*9.16*
Dimethylbenzylamine	$(CH_3)_2N \cdot C_7H_7$		8.5×10^{-6}	5.07
Dipropylamine	$HN(C_3H_7)_2$		8.2×10^{-4}	3.09
Emetine	$C_{29}H_{40}O_4N_2$	K_1	1.7×10^{-6}	5.77
		K_2	2.3×10^{-7}	6.64
Ethanolamine	$H_2N \cdot C_2H_5O$		*2.77×10^{-5}*	*4.56*
Ethylamine	$C_2H_5 \cdot NH_2$		5.6×10^{-4}	3.25
Ethylenediamine	$(CH_2NH_2)_2$		8.5×10^{-5}	4.07
Glycine	$H_2N \cdot CH_2CO_2H$		*2.26×10^{-12}*	*11.65*
Guanine	$C_5H_5ON_5$	(40°)	8.4×10^{-12}	11.08
Hydrastine	$C_{21}H_{21}O_6N$		1.7×10^{-8}	7.77
Hydrazine	$(NH_2)_2$		3×10^{-6}	5.52
Hydroquinine	$C_{20}H_{26}O_2N_2$		4.7×10^{-6}	5.33
Hydroxylamine	NH_2OH		1.07×10^{-8}	7.97
Lead hydroxide	$Pb(OH)_2$		9.6×10^{-4}	3.02
Leucine	$H_2N \cdot C_6H_{11}O_2$		2.3×10^{-12}	11.64
o-Methoxybenzylamine	$NH_2 \cdot C_8H_9O$		5.56×10^{-5}	4.25
m-Methoxybenzylamine	$NH_2 \cdot C_8H_9O$		1.56×10^{-5}	4.81
p-Methoxybenzylamine	$NH_2 \cdot C_8H_9O$		3.22×10^{-5}	4.49
N,N-Methoxybenzylamine	$CH_3ONH \cdot C_7H_7$		4.75×10^{-5}	4.32
Methylamine	CH_3NH_2		*4.38×10^{-4}*	*3.36*
o-Methylbenzylamine	$NH_2 \cdot C_8H_9$		1.70×10^{-5}	4.77
m-Methylbenzylamine	$NH_2 \cdot C_8H_9$		2.40×10^{-5}	4.62
p-Methylbenzylamine	$NH_2 \cdot C_8H_9$		2.55×10^{-5}	4.59
N,N-Methylbenzylamine	$CH_3NH \cdot C_7H_7$		3.80×10^{-5}	4.42
Methyldiethylamine	$CH_3N(C_2H_5)_2$		2.7×10^{-4}	3.66
Methyl red	$(CH_3)_2N \cdot C_{13}H_9O_2N_2$	(18°)	3×10^{-12}	11.52
Morphine	$C_{17}H_{19}O_3N$		7.4×10^{-7}	6.13
α-Naphthylamine	$C_{10}H_7NH_2$		*8.36×10^{-11}*	*10.08*
β-Naphthylamine	$C_{10}H_7NH_2$		1.29×10^{-10}	9.89
Narceine	$C_{23}H_{27}O_8N$		2×10^{-11}	10.7
Narcotine	$C_{22}H_{23}O_7N$		1.5×10^{-8}	7.82
Nicotine	$C_{10}H_{14}N_2$	K_1	7×10^{-7}	6.15
		K_2	1.4×10^{-11}	10.85
Novocain	$C_{13}H_{20}O_2N_2$		7×10^{-6}	5.15

IONIZATION CONSTANTS OF ACIDS AND BASES AT 25° C.

Base	Formula		K	$-\log K$
Papaverine	$C_{20}H_{21}O_4N$		8×10^{-9}	8.10
p-Phenetidine	$H_2N{\cdot}C_8H_9O$		2.2×10^{-9}	8.66
ε-Phenylamylamine	$NH_2{\cdot}C_{11}H_{15}$		3.06×10^{-4}	3.51
δ-Phenylbutylamine	$NH_2{\cdot}C_{10}H_{13}$		1.59×10^{-4}	3.80
o-Phenylenediamine	$(H_2N)_2C_6H_4$		3.3×10^{-10}	9.48
p-Phenylenediamine	$(H_2N)_2C_6H_4$	K_1	*1.1×10^{-8}*	*7.96*
		K_2	3.5×10^{-12}	*11.46*
β-Phenylethylamine	$NH_2{\cdot}C_8H_9$		6.75×10^{-5}	4.17
β-Phenylethyl-methylamine	$CH_3NH{\cdot}C_8H_9$		1.39×10^{-4}	3.86
Phenylhydrazine	$C_6H_5NH{\cdot}NH_2$	(40°)	1.6×10^{-9}	8.80
γ-Phenylpropylamine	$NH_2{\cdot}C_9H_{11}$		2.48×10^{-4}	3.61
N, N-iso-Propylbenzylamine	$C_3H_7NH{\cdot}C_7H_7$		4.18×10^{-5}	4.38
Physostigmine	$C_{15}H_{21}O_2N_3$	K_1	7.6×10^{-7}	6.12
		K_2	5.7×10^{-13}	12.24
Pilocarpine	$C_{11}H_{16}O_2N_2$	K_1	7×10^{-8}	7.15
		K_2	2×10^{-13}	12.7
Piperazine	$C_4H_{10}N_2$	K_1	6.4×10^{-5}	4.19
		K_2	3.7×10^{-9}	8.43
Piperidine	$C_5H_{11}N$		1.6×10^{-3}	2.80
Piperine	$C_{17}H_{19}O_3N$		1.0×10^{-14}	14.0
n-Propylamine	$C_3H_7NH_2$		3.9×10^{-4}	3.41
iso-Propylamine	$C_3H_7NH_2$		4.3×10^{-4}	3.37
Propyl cyanide	C_3H_7CN		1.8×10^{-15}	14.74
Pyridine	C_5H_5N		*1.4×10^{-9}*	*8.85*
Quinidine	$C_{20}H_{24}O_2N_2$	K_1	3.5×10^{-6}	5.46
		K_2	1×10^{-10}	10.0
Quinine	$C_{20}H_{20}O_2N_2$	K_1	1×10^{-6}	6.0
		K_2	1.3×10^{-10}	9.89
Quinoline	C_9H_7N		6.3×10^{-10}	9.20
Sarcosine	$CH_3NH{\cdot}C_2H_3O_2$		1.8×10^{-12}	11.74
Semicarbazide	$H_2N{\cdot}CH_3ON_2$	(40°)	2.7×10^{-11}	10.57
Silver hydroxide	$AgOH$		1.1×10^{-4}	3.96
Solanine	$C_{44}H_{71}O_{15}N$		2.2×10^{-7}	6.66
Sparteine	$C_{15}H_{26}N_2$	K_1	5.7×10^{-3}	2.24
		K_2	1×10^{-6}	6.0
Strychnine	$C_{21}H_{22}O_2N_2$	K_1	1×10^{-6}	6.0
		K_2	2×10^{-12}	11.7
Tetramethylenediamine	$(NH_2)_2C_4H_8$		4.1×10^{-4}	3.39
Thebaine	$C_{19}H_{21}O_3N$		9×10^{-7}	6.05
Theobromine	$C_7H_8O_2N_4$	(40°)	4.8×10^{-14}	13.32
Thiazole	C_3H_3NS		3.3×10^{-12}	11.48
Thiourea	CH_4N_2S		1.1×10^{-15}	14.96
o-Toluidine	$H_2N{\cdot}C_7H_7$		3.3×10^{-10}	9.48
m-Toluidine	$H_2N{\cdot}C_7H_7$		5.5×10^{-10}	9.26
p-Toluidine	$H_2N{\cdot}C_7H_7$		2×10^{-9}	8.70
Tri-*iso*-butylamine	$(C_4H_9)_3N$		2.1×10^{-4}	3.68
Triethylamine	$(C_2H_5)_3N$		*5.65×10^{-4}*	*3.25*
Trimethylamine	$(CH_3)_3N$		*5.27×10^{-5}*	*4.28*
Trimethylenediamine	$(NH_2)_2C_3H_6$		2.8×10^{-4}	3.55
Tripropylamine	$(C_3H_7)_3N$		5×10^{-4}	3.30
Urea	CH_4ON_2		1.5×10^{-14}	13.82
Veratrine	$C_{32}H_{49}O_9N$		7×10^{-6}	5.15
Xanthine	$C_5H_4O_2N_4$	(40°)	4.8×10^{-14}	13.32
Zinc hydroxide	$Zn(OH)_2$	K_2	4.4×10^{-5}	4.36

ELECTRICAL CONDUCTIVITY OF AQUEOUS SOLUTIONS

In the table below are given values for the conductivity and the equivalent conductivity of various aqueous solutions. The percent by weight is that of the anhydrous substance. The conductivity in mhos/cm. divided by the conductivity in gram-equivalents per cubic centimeter is the equivalent conductivity.

Formula	Temp. °C.	% by Weight	Cond. mho/cm $\times 10^4$	Equiv. Cond.
$AgNO_3$	18	5	256	83.4
		10	476	74.3
		20	872	62.0
		40	1565	45.0
		60	2101	31.1
$BaCl_2$	18	5	389	77.7
		10	733	69.8
		15	1051	63.6
		24	1534	53.0
$Ba(NO_3)_2$	18	4.2	209	63.0
		8.4	352	51.2
$Ba(OH)_2$	18	1.25	250	169.4
		2.5	479	160.2
CH_3CO_2H	18	0.3	3.18	6.36
		1	5.84	3.50
		5	12.25	1.464
		10	15.26	0.904
		20	16.05	0.470
		30	14.01	0.2698
		40	10.81	0.1546
		50	7.40	0.0838
		60	4.56	0.0428
		70	2.35	0.0189
		99.7	0.0004	0.00023
$C_2H_5CO_2H$	18	1.00	4.79	3.549
		5.01	9.25	1.364
		10.08	11.13	0.809
		20.02	10.42	0.379
		30.03	8.18	0.1970
		50.09	3.77	0.0541
		69.99	0.85	0.0088
		100	0.0007	0.00052
$C_3H_7CO_2H$	18	1.00	4.55	3.99
		5.02	8.63	1.51
		10.07	9.86	0.857
		15.03	9.55	0.555
		20.01	8.88	0.388
		50.04	2.96	0.0519
		70.01	0.56	0.0071
		100	0.0006	....
$(CO_2H)_2$	18	3.5	508	64.3
		7.0	783	48.8
$CaCl_2$	18	5	643	68.6
		10	1141	58.3
		20	1728	40.6
		25	1781	32.12
		30	1658	23.87
		35	1366	16.13
$Ca(NO_3)_2$	18	6.25	491	61.5
		12.5	804	47.9

Formula	Temp. °C.	% by Weight	Cond. mho/cm $\times 10^4$	Equiv. Cond.
$Ca(NO_3)_2$	18	25	1048	28.2
		37.5	876	14.15
		50	469	5.10
$CdBr_2$	18	0.0324	2.31	96.7
		0.0748	4.70	85.1
		0.154	8.44	74.7
		0.506	21.3	57.0
		1	35.7	48.2
		5	109	28.4
		10	164	20.4
		20	236	14.3
		30	273	9.30
		43	261	5.34
$CdCl_2$	18	0.0503	4.95	90.0
		0.200	15.6	71.2
		0.599	36.4	55.2
		1	55.1	50.1
		5	167	29.2
		10	241	20.2
		15	282	15.0
		20	299	11.39
		30	282	6.47
		40	221	3.40
		50	137	1.49
CdI_2	18	1	21.2	38.5
		5	60.9	21.4
		10	103.9	17.5
		15	146	15.6
		20	186	14.2
		30	254	11.7
		40	303	9.35
		45	314	8.11
$Cd(NO_3)_2$	18	1	69.4	81.6
		5	289	65.5
		10	513	55.7
		20	827	41.0
		30	956	28.7
		40	903	18.35
		48	755	11.62
$CdSO_4$	18	0.0289	2.47	88.8
		0.0999	6.92	72.0
		0.495	23.93	49.9
		1	41.6	42.9
		5	146	29.0
		10	247	23.3
		25	430	13.82
		36	421	8.25
$CuCl_2$	18	1.35	187	936
		9	716	493
		18.2	924	316

ELECTRICAL CONDUCTIVITY OF AQUEOUS SOLUTIONS

Formula	Temp. °C.	% by Weight	Cond. mho/cm $\times 10^4$	Equiv. Cond.
$CuCl_2$	18	28.75	897	155
		35.2	699	92
$Cu(NO_3)_2$	15	5	365	65.6
		10	635	54.7
		15	858	47.1
		20	1018	40.0
		25	1089	32.8
		35	1062	20.7
$CuSO_4$	18	2.5	109	34.0
		5	189	28.7
		10	320	23.1
		15	421	19.19
		17.5	458	17.41
HBr	15	5	1908	299.5
		10	3549	269.3
		15	4940	241.5
HCO_2H	18	4.94	55.0	5.03
		9.55	75.6	3.55
		20.34	98.4	2.12
		29.83	103.8	1.491
		39.95	98.4	1.033
		50.02	86.4	0.709
		70.06	52.3	0.294
		89.02	18.7	0.0803
		100	2.8	0.0105
HCl	15	5	3948	281.0
		10	6302	219.1
		20	7615	126.2
		30	6620	69.8
		40	5152	39.1
HF	18	0.004	2.5	131.8
		0.007	3.8	100.2
		0.015	5.0	65.9
		0.030	8.0	52.7
		0.060	12.3	40.5
		0.121	21.0	34.6
		0.242	36.3	29.9
		0.484	67.3	27.7
		1.50	198	26.2
		2.48	315	25.1
		4.80	593	24.3
		7.75	963	24.2
		15.85	1853	22.1
		24.5	2832	21.3
		29.8	3411	20.7
HI	15	5	1332	328.9
HNO_3	18	6.2	3123	307.1
		12.4	5418	257.0
		24.8	7676	169.3
		31.0	7819	133.1
		37.2	7545	103.4
		49.6	6341	61.1
		62.0	4964	36.4
H_3PO_4	15	10	566	17.54
H_3PO_4	15	20	1129	16.56
		30	1654	15.26
		35	1858	14.27
		50	2073	10.17
		70	1436	4.42
		80	979	2.47
		85	780	1.749
		87	709	1.566
H_2SO_4	18	5	2085	198.0
		10	3915	179.9
		15	5432	160.9
		20	6527	140.2
		25	7171	119.2
		30	7388	98.9
		35	7243	80.4
		40	6800	63.8
		50	5405	37.9
		60	3726	20.27
		65	2905	14.40
		70	2157	9.36
		75	1522	5.95
		80	1105	3.91
		85	980	3.172
		86	992	3.161
		87	1010	3.169
		88	1033	3.193
		89	1055	3.212
		90	1075	3.224
		91	1093	3.236
		92	1102	3.220
		93	1096	3.160
		94	1071	3.049
		95	1025	2.881
		96	944	2.624
		97	800	2.199
		99.4	85	0.228
$HgBr_2$	18	0.223	0.16	1.29
		0.422	0.26	1.10
$HgCl_2$	18	0.229	0.44	2.59
		1.013	1.14	1.51
		5.08	4.21	1.07
KBr	15	5	465	106.9
		10	928	102.9
		20	1907	98.1
		30	2923	92.4
		36	3507	87.9
$K \cdot CH_3CO_2$	15	4.67	347	71.4
		9.33	625	62.8
		28	1256	38.3
		46.67	1122	18.75
		65.33	479	5.25
KCN	15	3.25	527	104.2
		6.5	1026	99.7
K_2CO_3	15	5	561	74.2

ELECTRICAL CONDUCTIVITY OF AQUEOUS SOLUTIONS

Formula	Temp. °C.	% by Weight	Cond. mho/cm $\times 10^4$	Equiv. Cond.
K_2CO_3	15	10	1038	65.7
		20	1806	52.4
		30	2222	39.4
		40	2168	26.45
		50	1469	13.16
$K_2C_2O_4$	18	5	488	78.3
		10	915	70.8
KCl	18	5	690	99.9
		10	1359	95.2
		15	2020	91.5
		20	2677	88.9
		21	2810	87.5
KF	18	5	652	72.9
		10	1209	64.9
		20	2080	51.5
		30	2561	39.1
		40	2522	26.6
KI	18	5	338	108.3
		10	680	104.9
		20	1455	103.4
		30	2303	100.1
		40	3168	94.1
		55	4226	78.2
KNO_3	18	5	454	89.2
		10	839	79.8
		15	1186	72.9
		20	1505	67.2
		22	1625	65.1
KOH	15	4.2	1464	188.4
		8.4	2723	168.9
		16.8	4558	131.5
		25.2	5403	96.8
		33.6	5221	65.4
		42.0	4212	39.4
K_2S	18	3.18	845	139.7
		4.98	1284	136.5
		9.93	2343	120.3
		19.96	4020	94.7
		29.97	4563	66.2
		38.08	4106	44.1
		47.26	2579	20.63
K_2SO_4	18	5	458	76.8
		10	860	69.4
Li_2CO_3	18	0.20	34.3	63.5
		0.63	88.5	51.9
$LiCl$	18	2.5	410	68.7
		5	733	60.6
		10	1218	49.0
		20	1676	31.9
		30	1399	16.78
		40	844	7.14
LiI	18	5	296	76.5
		10	573	71.4
		20	1094	62.9
LiI	18	25	1346	59.4
$LiOH$	18	1.25	781	148.2
		2.5	1416	132.5
		5	2396	109.2
		7.5	2999	89.0
Li_2SO_4	15	5	400	42.2
		10	610	30.9
$MgCl_2$	18	5	683	62.4
		10	1128	49.5
		20	1402	28.37
		30	1061	13.18
		34	768	8.14
$Mg(NO_3)_2$	18	5	438	62.7
		10	770	53.1
		17	1102	42.3
$MgSO_4$	15	5	263	30.1
		10	414	22.55
		15	480	16.60
		25	415	7.77
$MnCl_2$	15	5	526	63.3
		10	844	48.8
		15	1055	38.9
		20	1134	30.0
		25	1090	22.00
		28	1016	17.80
$Na\cdot CH_3CO_2$	18	5	295	47.3
		20	651	24.20
		32	569	12.47
Na_2CO_3	18	5	451	45.5
		10	705	33.9
		15	836	25.51
$NaCl$	18	5	672	76.0
		10	1211	66.2
		15	1642	57.8
		20	1957	49.9
		25	2135	42.0
		26	2151	40.4
NaI	18	5	298	86.1
		10	581	81.6
		20	1144	73.1
		40	2111	55.9
$NaNO_3$	18	5	436	71.8
		10	782	62.3
		20	1303	48.5
		30	1606	37.1
$NaOH$	18	1	465	184.5
		2	887	173.7
		4	1628	156.3
		6	2242	140.5
		8	2729	125.6
		10	3093	111.7
		15	3490	80.0
		20	3284	53.95
		25	2717	34.22

ELECTRICAL CONDUCTIVITY OF AQUEOUS SOLUTIONS

Formula	Temp. °C.	% by Weight	Cond. mho/cm ×10⁴	Equiv. Cond.
NaOH	18	27.5	2386	26.69
		30	2074	20.83
		32.5	1798	16.35
		35	1560	12.93
		37.5	1361	10.34
		40	1206	8.44
		45	977	5.88
		50	820	4.30
Na_2S	18	2.02	612	115.7
		5.03	1321	97.2
		9.64	2017	73.7
		14.02	2359	56.7
		16.12	2243	46.0
		18.15	2184	38.7
Na_2SO_4	18	5	409	55.6
		10	687	44.7
		15	886	36.7
NH_3	15	0.10	2.51	4.25
		0.40	4.92	2.103
		0.80	6.57	1.408
		1.60	8.67	0.929
		4.01	10.95	0.475
		8.03	10.38	0.228
		16.15	6.32	0.0713
		30.5	1.93	0.0121
NH_4Cl	18	5	918	96.8
		10	1776	92.4
		15	2586	88.4
		20	3365	85.0
		25	4025	80.5
NH_4I	18	10	772	105.1
		20	1599	101.7
		50	4200	84.5
NH_4NO_3	15	5	590	92.6
		10	1117	85.9

Formula	Temp. °C.	% by Weight	Cond. mho/cm ×10⁴	Equiv. Cond.
NH_4NO_3	15	30	2841	67.1
		50	3633	47.4
$(NH_4)_2SO_4$	15	5	552	71.0
		10	1010	63.1
		20	1779	52.7
		30	2292	43.1
		31	2321	42.0
$Pb(NO_3)_2$	15	5	191	60.4
		10	322	48.7
		15	429	41.4
		20	521	35.8
		25	600	31.3
		30	668	27.6
$SrCl_2$	18	5	483	73.3
		10	886	64.3
		15	1231	56.8
		22	1583	46.5
$Sr(NO_3)_2$	15	5	309	62.8
		10	527	51.4
		15	690	43.0
		20	802	35.9
		25	866	29.66
		35	861	19.23
$ZnCl_2$	15	2.5	276	73.6
		5	483	62.8
		10	727	45.3
		20	912	26.1
		30	926	16.19
		40	845	10.12
		60	369	2.40
$ZnSO_4$	18	5	191	29.3
		10	321	23.42
		15	415	19.13
		25	480	11.88
		30	444	8.66

ELECTRICAL CONDUCTIVITY OF VARIOUS PURE LIQUIDS

Liquid	Temp. °C.	mhos/cm or $ohm^{-1} cm^{-1}$
Acetaldehyde	15	1.7×10^{-6}
Acetamide	100	$<4.3 \times 10^{-5}$
Acetic acid	0	5×10^{-9}
" "	25	1.12×10^{-8}
Acetic anhydride	0	1×10^{-6}
" "	25	4.8×10^{-7}
Acetone	18	2×10^{-8}
"	25	6×10^{-8}
Acetonitrile	20	7×10^{-6}
Acetophenone	25	6×10^{-9}
Acetyl bromide	25	2.4×10^{-6}
Acetyl chloride	25	4×10^{-7}
Alizarin	233	99×10^{-4}

Liquid	Temp. °C.	mhos/cm or $ohm^{-1} cm^{-1}$
Allyl alcohol	25	7×10^{-6}
Ammonia	−79	1.3×10^{-7}
Aniline	25	2.4×10^{-8}
Anthracene	230	3×10^{-10}
Arsenic tribromide	35	1.5×10^{-6}
Arsenic trichloride	25	1.2×10^{-6}
Benzaldehyde	25	1.5×10^{-7}
Benzene	. . .	7.6×10^{-8}
Benzoic acid	125	3×10^{-9}
Benzonitrile	25	5×10^{-8}
Benzyl alcohol	25	1.8×10^{-6}
Benzyl benzoate	25	$<1 \times 10^{-9}$
Benzylamine	25	$<1.7 \times 10^{-8}$

ELECTRICAL CONDUCTIVITY OF VARIOUS PURE LIQUIDS

Liquid	Temp. °C.	mhos/cm or $ohm^{-1} cm^{-1}$
Bromine	17.2	1.3×10^{-13}
Bromobenzene	25	$<2\times10^{-11}$
Bromoform	25	$<2\times10^{-8}$
iso-Butyl alcohol	25	8×10^{-8}
Capronitrile	25	3.7×10^{-6}
Carbon disulfide	1	7.8×10^{-18}
Carbon tetrachloride	18	4×10^{-18}
Chlorine	−70	$<1\times10^{-16}$
Chloroacetic acid	60	1.4×10^{-6}
m-Chloroaniline	25	5×10^{-8}
Chloroform	25	$<2\times10^{-8}$
Chlorohydrin	25	5×10^{-7}
m-Cresol	25	$<1.7\times10^{-8}$
Cyanogen	...	$<7\times10^{-9}$
Cymene	25	$<2\times10^{-8}$
Dichloroacetic acid	25	7×10^{-8}
Dichlorohydrin	25	1.2×10^{-5}
Diethyl carbonate	25	1.7×10^{-8}
Diethyl oxalate	25	7.6×10^{-7}
Diethyl sulfate	25	2.6×10^{-7}
Diethylamine	−33.5	2.2×10^{-9}
Dimethyl sulfate	0	1.6×10^{-7}
Epichlorohydrin	25	3.4×10^{-8}
Ethyl acetate	25	$<1\times10^{-9}$
Ethyl acetoacetate	25	4×10^{-8}
Ethyl alcohol	25	1.35×10^{-9}
Ethyl benzoate	25	$<1\times10^{-9}$
Ethyl bromide	25	$<2\times10^{-8}$
Ethyl ether	25	$<4\times10^{-13}$
Ethyl iodide	25	$<2\times10^{-8}$
Ethyl isothiocyanate	25	1.26×10^{-7}
Ethyl nitrate	25	5.3×10^{-7}
Ethyl thiocyanate	25	1.2×10^{-6}
Ethylamine	0	4×10^{-7}
Ethylene bromide	19	$<2\times10^{-10}$
Ethylene chloride	25	3×10^{-8}
Ethylidene chloride	25	$<1.7\times10^{-8}$
Eugenol	25	$<1.7\times10^{-8}$
Formamide	25	4×10^{-6}
Formic acid	18	5.6×10^{-5}
Formic acid	25	6.4×10^{-5}
Furfural	25	1.5×10^{-6}
Gallium	30	36,800
Germanium tetrabromide	30	7.8×10^{-5}
Glycerol	25	6.4×10^{-8}
Glycol	25	3×10^{-7}
Guaiacol	25	2.8×10^{-7}
Heptane	....	$<1\times10^{-13}$
Hexane	18	$<1\times10^{-18}$
Hydrogen bromide	−80	8×10^{-9}
Hydrogen chloride	−96	1×10^{-8}
Hydrogen cyanide	0	3.3×10^{-6}
Hydrogen iodide	B.P.	2×10^{-7}
Hydrogen sulfide	B.P.	1×10^{-11}
Iodine	110	1.3×10^{-10}
Kerosene	25	$<1.7\times10^{-8}$
Mercury	0	10,629.6
Methyl acetate	25	3.4×10^{-6}
Methyl alcohol	18	4.4×10^{-7}
Methyl ethyl ketone	25	1×10^{-7}
Methyl iodide	25	$<2\times10^{-8}$
Methyl nitrate	25	4.5×10^{-6}
Methyl thiocyanate	25	1.5×10^{-6}
Naphthalene	82	4×10^{-10}
Nitrobenzene	0	5×10^{-9}
Nitromethane	18	6×10^{-7}
o-or *m*-Nitrotoluene	25	$<2\times10^{-7}$
Nonane	25	$<1.7\times10^{-8}$
Oleic acid	15	$<2\times10^{-10}$
Pentane	19.5	$<2\times10^{-10}$
Petroleum	...	3×10^{-13}
Phenetole	25	$<1.7\times10^{-8}$
Phenol	25	$<1.7\times10^{-8}$
Phenyl isothiocyanate	25	1.4×10^{-6}
Phosgene	25	7×10^{-9}
Phosphorus	25	4×10^{-7}
Phosphorus oxychloride	25	2.2×10^{-6}
Pinene	23	$<2\times10^{-10}$
Piperidine	25	$<2\times10^{-7}$
Propionaldehyde	25	8.5×10^{-7}
Propionic acid	25	$<1\times10^{-9}$
Propionitrile	25	$<1\times10^{-7}$
n-Propyl alcohol	18	5×10^{-8}
" " "	25	2×10^{-8}
iso-Propyl alcohol	25	3.5×10^{-6}
n-Propyl bromide	25	$<2\times10^{-8}$
Pyridine	18	5.3×10^{-8}
Quinoline	25	2.2×10^{-8}
Salicylaldehyde	25	1.6×10^{-7}
Stearic acid	80	$<4\times10^{-13}$
Sulfonyl chloride, $SOCl_2$	25	2×10^{-6}
Sulfur	115	1×10^{-12}
"	130	5×10^{-11}
"	440	1.2×10^{-7}
Sulfur dioxide	35	1.5×10^{-8}
Sulfuric acid	25	1×10^{-2}
Sulfuryl chloride, SO_2Cl_2	25	3×10^{-8}
Toluene	...	$<1\times10^{-14}$
o-Toluidine	25	$<2\times10^{-6}$
p-Toluidine	100	6.2×10^{-8}
Trichloroacetic acid	25	3×10^{-9}
Trimethylamine	−33.5	2.2×10^{-10}
Turpentine	...	2×10^{-13}
iso-Valeric acid	80	$<4\times10^{-13}$
Water	18	4×10^{-8}
Xylene	...	$<1\times10^{-15}$

ELECTRICAL CONDUCTIVITY OF STANDARD SOLUTIONS

In the table below, the normal KCl solution was prepared by dissolving 74.59g of KCl in water and diluting to one liter at 18°C. The specific gravity of such a solution is 1.0449 at 18°C.

The concentrations of H_2SO_4 and of $MgSO_4$ are those of maximum conductivity at 18°C.

The NaCl solution is saturated at all the temperatures given, and has a specific gravity of 1.2014 at 18°C.

	Conductivity in mhos/centimeter, or $ohm^{-1}cm^{-1}$.						
Temp. °C.	KCl Normal	KCl 0.1 Normal	KCl 0.02 Normal	KCl 0.01 Normal	H_2SO_4 Sp. G. $1.223^{18°}$	NaCl Saturated	$MgSO_4$ Sp. G. $1.190^{18°}$
0	0.06541	0.00715	0.001521	0.000776	0.5184	0.1345	0.02877
1	0.06713	0.00736	0.001566	0.000800	0.5304	0.1386	0.02979
2	0.06886	0.00757	0.001612	0.000824	0.5425	0.1427	0.03083
3	0.07061	0.00779	0.001659	0.000848	0.5547	0.1469	0.03188
4	0.07237	0.00800	0.001705	0.000872	0.5669	0.1512	0.03294
5	0.07414	0.00822	0.001752	0.000896	0.5792	0.1555	0.03402
6	0.07593	0.00844	0.001800	0.000921	0.5915	0.1599	0.03512
7	0.07773	0.00866	0.001848	0.000945	0.6038	0.1643	0.03623
8	0.07954	0.00888	0.001896	0.000970	0.6161	0.1688	0.03735
9	0.08136	0.00911	0.001945	0.000995	0.6285	0.1734	0.03849
10	0.08319	0.00933	0.001994	0.001020	0.6408	0.1779	0.03963
11	0.08504	0.00956	0.002043	0.001045	0.6532	0.1826	0.04079
12	0.08689	0.00979	0.002093	0.001070	0.6656	0.1872	0.04197
13	0.08876	0.01002	0.002142	0.001095	0.6780	0.1919	0.04315
14	0.09063	0.01025	0.002193	0.001121	0.6904	0.1967	0.04434
15	0.09252	0.01048	0.002243	0.001147	0.7028	0.2015	0.04555
16	0.09441	0.01072	0.002294	0.001173	0.7151	0.2063	0.04676
17	0.09631	0.01095	0.002345	0.001199	0.7275	0.2112	0.04799
18	0.09822	0.01119	0.002397	0.001225	0.7398	0.2161	0.04922
19	0.10014	0.01143	0.002449	0.001251	0.7522	0.2210	0.05046
20	0.10207	0.01167	0.002501	0.001278	0.7645	0.2260	0.05171
21	0.10400	0.01191	0.002553	0.001305	0.7768	0.2310	0.05297
22	0.10594	0.01215	0.002606	0.001332	0.7890	0.2360	0.05424
23	0.10789	0.01239	0.002659	0.001359	0.8013	0.2411	0.05551
24	0.10984	0.01264	0.002712	0.001386	0.8135	0.2462	0.05679
25	0.11180	0.01288	0.002765	0.001413	0.8257	0.2513	0.05808
26	0.11377	0.01313	0.002819	0.001441	0.8378	0.2565	0.05937
27	0.11574	0.01337	0.002873	0.001468	0.8499	0.2616	0.06067
28	....	0.01362	0.002927	0.001496	0.8620	0.2669	0.06197
29	....	0.01387	0.002981	0.001524	0.8740	0.2721	0.06328
30	....	0.01412	0.003036	0.001552	0.8860	0.2774	0.06459
31	....	0.01437	0.003091	0.001581	0.8980	0.2827	0.06591
32	....	0.01462	0.003146	0.001609	0.9099	0.2880	0.06723
33	....	0.01488	0.003201	0.001638	0.9217	0.2933	0.06855
34	....	0.01513	0.003256	0.001667	0.9335	0.2987	0.06988
35	....	0.01539	0.003312	....	0.9453	0.3041	0.07121
36	....	0.01564	0.003368	....	0.9570	0.3095	0.07254

EQUIVALENT CONDUCTANCE OF THE SEPARATE IONS

Johnston, *Jour. Am. Chem. Soc.*, *31*, *1010* (*1909*).

The equivalent conductivity at infinite dilution of a salt may be obtained by adding the equivalent conductivity of the separate ions as given below. Thus Λ_o or KCl at 18° C. is 64.6 + 65.5 = 130.1.

Ion	Λ_o in cm^{-1}ohm^{-1} / gram equivalents per cm^3							
	0°C.	18°C.	25°C.	50°C.	75°C.	100°C.	128°C.	156°C.
Ag	32.9	54.3	63.5	101	143	188	245	299
½Ba	33	55	65	104	149	200	262	322
$C_2H_3O_2$	20.3	34.6	40.8	67	96	130	171	211
⅓$C_6H_5O_7$ (citrate)	36	60	70	113	161	214	...	...
½C_2O_4	39	63	73	115	163	213	275	336
½Ca	30	51	60	98	142	191	252	312
Cl	41.1	65.5	75.5	116	160	207	264	318
¼Fe(CN)$_6$	58	95	111	173	244	321	....	....
H	240	314	350	465	565	644	722	777
K	40.4	64.6	74.5	115	159	206	263	317
⅓La	35	61	72	119	173	235	312	388
NH_4	40.2	64.5	74.5	115	159	207	264	319
NO_3	40.4	61.7	70.6	104	140	178	222	263
Na	26	43.5	50.9	82	116	155	203	249
OH	105	172	192	284	360	439	525	592
½SO_4	41	68	79	125	177	234	303	370

DIELECTRIC CONSTANTS

The dielectric constant (ϵ) of a material, sometimes called the specific inductive capacity, is a measure of the ratio of electric displacement to electric field intensity. The dielectric constant of a vacuum is unity. The frequency in cycles per second is given in the column headed *f*.

GASES

Gas	t °C	f	ϵ	Gas	t °C	f	ϵ
Acetaldehyde	20	<3 ¶	1.0213	*n*-Heptane	100	<3 ¶	1.0035
Acetone	100	<3 ¶	1.0159	Hydrogen	0	2 ¶	1.000272
Acetyl chloride	20	<3 ¶	1.0217	Hydrogen bromide	0	<3 ¶	1.00313
Acetylene	0	<3 ¶	1.00134	Hydrogen chloride	0	<3 ¶	1.0046
Air[a]	0	<3 ¶	1.000567	Hydrogen iodide	0	<3 ¶	1.00234
Ammonia	0	1 ¶	1.0072	Hydrogen sulfide	0	1 ¶	1.0040
β-Amylene	100	<3 ¶	1.0028	Mercury	400	3*	1.00074
Argon	0	1 ¶	1.000545	Methane	0	<3 ¶	1.00094
Benzene	100	<3 ¶	1.0028	Methyl alcohol	100	<3 ¶	1.0057
Bromine	180	<3 ¶	1.0128	Methyl bromide	100	<3 ¶	1.0068
Butylene	0	<3 ¶	1.00319	Methyl chloride	100	<3 ¶	1.0069
Carbon dioxide	0	1 ¶	1.00098	Methyl iodide	100	<3 ¶	1.0063
Carbon disulfide	0	<3 ¶	1.0029	Methylamine	100	<3 ¶	1.0038
Carbon monoxide	0	[b]	1.00070	Methylene chloride	100	<3 ¶	1.0065
Carbon tetrachloride	110	<3 ¶	1.0030	Neon	0	<3 ¶	1.000127
Chloroform	120	<3 ¶	1.0042	Nitrogen	0	<3 ¶	1.000580
Dimethylamine	100	<3 ¶	1.0033	Nitromethane	100	<3 ¶	1.0247
Ethane	0	<3 ¶	1.00150	Nitrous oxide (N_2O)	0	2 ¶	1.00113
Ethyl alcohol	100	<3 ¶	1.0061	Oxygen	0	<3 ¶	1.000523
Ethyl bromide	20	<3 ¶	1.0139	*n*-Pentane	100	<3 ¶	1.0025
Ethyl chloride	20	<3 ¶	1.0132	*n*-Propyl chloride	20	<3 ¶	1.0143
Ethyl ether	100	<3 ¶	1.0049	*iso*-Propyl chloride	20	<3 ¶	1.0152
Ethyl formate	100	<3 ¶	1.0083	Sulfur dioxide	0	<3 ¶	1.0093
Ethyl iodide	20	<3 ¶	1.0140	Toluene	126	<3 ¶	1.0043
Ethyl iodide	100	<3 ¶	1.0089	Vinyl bromide	20	<3 ¶	1.0081
Ethylene	0	<3 ¶	1.00144	Water (steam)	110	<3 ¶	1.0126
Helium	0	<3 ¶	1.0000684	Water (steam)	140	<3 ¶	1.00785

* $\times 10^8$. ¶ $\times 10^6$.

[a] Free from carbon dioxide.

[b] Frequency of 50 cycles per second.

(*Continued on following page.*)

LIQUIDS

The frequency in cycles per second is given in the column headed *f*. The symbol *A* stands for "audio frequency" and signifies that the condenser frequency lies between 20 and 20,000 vibrations or cycles per second and is audible to the average person. Acetone, aniline, benzene, nitrobenzene, *o*-nitrotoluene, ethyl ether, *m*-xylene and others have been used as standard liquids for calibrating apparatus used for measuring dielectric constants (ϵ) but of these benzene is probably best.

Liquid	t °C	f	ϵ
Acetaldehyde	10	4*	22.2
Acetic acid	17	A	7.14
Acetic anhydride	20	A	20.5
Acetone	−80	. . .	31.0
"	20	A	21.4
"	50	. . .	18.7
Acetonitrile	20	A	38.8
Acetyl chloride	20	4*	15.8
Allyl chloride	20	A	8.2
Ammonia	−34	4*	22
"	20.5	4*	15.5
Amyl acetate	20	A	5.07
Amyl alcohol	−117	A	35.5
" "	20	A	15.8
" "	60	A	11.2
Amylene	16	A	2.23
Aniline	0	. . .	7.78
"	20	A	7.25
"	100	. . .	5.46
Antimony pentachloride	21.5	1*	3.78
Arsenic trichloride	21	1*	12.35
Arsine	−50	4*	2.74
Benzaldehyde	20	A	18.0
"	20	44*	17.5
Benzene	−80	. . .	2.322
Benzene	20	A	2.283
"	20	5†	3.1
"	25	. . .	2.274
"	60	. . .	2.228
Benzonitrile	0	. . .	27.60
"	25	. . .	25.21
Benzoyl chloride	70	. . .	22.10
" chloride	24	4*	19.0
Benzyl alcohol	20	A	13.0
" chloride	13	A	7.0
n-Butyl acetate	−20	. . .	5.54
" "	0	. . .	5.34
" "	19	A	5.14
iso-Butyl acetate	20	A	5.60
n-Butyl alcohol	19	4*	7.8
iso-Butyl alcohol	−80	A	31.7
" "	0	A	20.5
" "	20	A	18.7
Butyraldehyde	26	A	13.4
n-Butyric acid	20	4*	2.85
iso-Butyric acid	20	4*	2.65
Carbon dioxide	0	. . .	1.585
" disulfide	20	9‡	2.647
" tetrachloride	20	1*	2.24
Chloral	15	3§	5.5
Chlorine	0	A	2.0
Chlorobenzene	20	A	5.94
"	100	A	4.70
Chloroform	0	A	5.48
"	20	A	5.05
o-Cresol	24	4*	5.8
m- "	24	4*	5.0
p- "	24	4*	5.6
Cyanogen	23	4*	2.57
Cyclohexane	20	A	2.052
Cyclohexanol	25	A	15.0
Cyclohexanone	20	A	18.2
p-Cymene	17	A	2.26
o-Dichlorobenzene	25	1¶	7.47
p- "	53	A	2.86
Diethyl oxalate	21	4*	8.2
Dimethylaniline	20	A	4.48
Dimethyl sulfate	20	A	55.0
Ethyl acetate	20	A	6.4
" ether	−100	A	8.143

† $\times 10^{10}$. * $\times 10^{8}$. § $\times 10^{7}$. ¶ $\times 10^{6}$. ‡ $\times 10^{5}$.

(*Continued on following page.*)

DIELECTRIC CONSTANTS (Continued)

Liquid	t °C	f	ϵ
Ethyl ether	−40	A	5.72
" "	20	A	4.335
" mercaptan	20	4*	8.0
" silicate	20	4*	4.10
" *iso*-thiocyanate	20	4*	19.7
Ethylene bromide	18	A	4.865
" chloride	20	1¶	10.5
" diamine	18	4*	16.0
Formic acid	16	4*	58.5
Furfuraldehyde	20	A	41.9
Glycerol (98%)	0	3‡	47.2
"	20	3‡	43
Glycol	20	A	41.2
"	50	A	35.6
Heptane	20	5*	4.3
Hexane	20	A	1.874
Helium	−268.9	6‡	1.048
Hydrogen	−253	1‡	1.22
" cyanide	21	4*	95.4
" sulfide	10	A	5.75
Iodobenzene	20	5*	4.6
Lactic acid	19	4*	19.4
Mesityl oxide	20	4*	15.4
Mesitylene	20	A	2.353
Methyl alcohol	−80	. . .	56.6
Methyl alcohol	0	. . .	37.5
" "	20	4*	33.1
" salicylate	20	4*	9.0
Naphthalene	100	. . .	2.30
Nitrobenzene	20	A	36.1
"	25	. . .	34.89
"	80	. . .	26.28
Nitroethane	20	A	19.7
Nitrous oxide	0	A	1.607
Octane	20	A	1.960
Octyl alcohol	18	3*	3.4
Oil, almond	20	<3¶	2.83
" , castor	11	<3¶	4.67
" , cottonseed	14	<3¶	3.10
" , lemon	21	<3¶	2.25
" , linseed	13	<3¶	3.35
" , olive	20	<3¶	3.11
Oil, peanut	11.4	<3¶	3.03
" , petroleum	. . .	2§	2.13
" , rapeseed	16	<3¶	2.85
" , sesame	13.4	<3¶	3.02
" , turpentine	20	<3¶	2.23
Oleic acid	20	<4*	2.45
Oxygen	−182	<1‡	1.46
Paraldehyde	20	A	14.5
Phenol	48	4*	9.9
Phenyl *iso*-thiocyanate	20	4*	10.7
Phosphorus oxychloride	22	1*	14
Phosphorus trichloride	18	1*	3.72
iso-Propyl alcohol	20	4*	15.7
Pyridine	20	A	12.5
Quinoline	25	A	9.00
Silicon tetrachloride	16	1*	2.4
Stannic chloride	22	A	3.2
Sulfur	400	A	3.42
" dioxide	0	A	15.6
" trioxide	21	1*	3.56
Sulfuric acid	20	1*	>84
" oxychloride	22	1*	9.15
Sulfurous oxychloride	22	1*	9.05
Tetrabromoethane	20	A	7.1
Tetrachloroethylene	21	4*	2.46
Toluene	−100	. . .	2.600
"	0	. . .	2.435
"	20	A	2.387
"	20	5*	2.402
p-Toluidine	44	A	5.48
Trichloroacetic acid	61	A	4.55
Trichloroethylene	16	7§	3.42
Triethylamine	21	A	3.15
Vanadyl trichloride	0	4*	3.4
Water	0	1*	88
"	20	1*	80
"	100	1*	48
m-Xylene	20	. . .	2.420
"	20	A	2.374

† $\times 10^{10}$. * $\times 10^{8}$. § $\times 10^{7}$. ¶ $\times 10^{6}$. ‡ $\times 10^{5}$.

(*Continued on following page.*)

DIELECTRIC CONSTANTS (*Continued*)

SOLIDS

The frequency in cycles per second is given in the column headed f. The symbol *A* tands for "audio frequency" and signifies that the condenser frequency lies between :0 and 20,000 vibrations or cycles per second and is audible to the average person. /alues for the dielectric constant (ϵ) in the following table are at ordinary room emperatures (17 to 22° C) unless otherwise given after the name of the solid. The ymbols ⊥ and ∥ signify that the determinations were made perpendicular and parallel respectively to the optical axes in the case of crystals, and to the fibers in the case of voods. The word "mean" in parentheses following the name shows that the mean alue of the three different axes in monoclinic and rhombic crystals is given.

Solid	f	ϵ
Acetamide	4*	4.0
Acetanilide	...	2.9
Acetic acid (2° C)	4*	4.1
Aluminum oleate	4*	2.40
Ammonium bromide	1¶	7.1
" chloride	1¶	7.0
Antimony trichloride	1*	5.34
Apatite ⊥	3*	9.50
" ∥	3*	7.41
Asphalt	<3¶	2.68
Barium chloride (anhyd.)	6§	11.4
" " ($2\ H_2O$)	6§	9.4
" nitrate	6§	5.9
" sulfate (15° C)	1*	11.4
Beryl ⊥	A	7.02
" ∥	A	6.08
Calcite ⊥	A	8.5
" ∥	A	8.0
Calcium carbonate	1¶	6.14
" fluoride	A	7.36
Calcium sulfate ($2\ H_2O$)	A	5.66
Cassiterite ⊥	100†	23.4
" ∥	100†	24
d-Cocaine	5*	3.10
Cupric oleate	4*	2.80
" oxide (15° C)	1*	18.1
" sulfate (anhyd.)	6§	10.3
" " ($5\ H_2O$)	6§	7.8
Diamond	A	16.5
"	1*	5.5
Diphenylmethane	4*	2.7
Dolomite ⊥	1*	8.0
" ∥	1*	6.8
Ferrous oxide (15° C)	1*	14.2
Glass, borosilicate	<3¶	6.4–7.7
" , flint	<3¶	6.6–9.9
" , lead	<3¶	5.4–8.0
Iodine	1*	4
Lead acetate	1¶	2.6
" carbonate (15° C)	1*	18.6
Lead chloride	1¶	4.2
" monoxide (15° C)	1*	25.9
" nitrate	6§	37.7
" oleate	4*	3.27
" sulfate	1¶	14.3
" sulfide (15° C)	1*	17.9
Malachite (mean)	100†	7.2
Mercuric chloride	1¶	3.2
Mercurous chloride	1¶	9.4
Mica	<3¶	5.6–6.6
Naphthalene	4*	2.52
Ozokerite	<3¶	2.21
Paper	<3¶	2.0
Paraffin	<3¶	2.10
Phenanthrene	4*	2.80
Phenol (10° C)	4*	4.3
Phosphorus, red	1*	4.1
" , yellow	1*	3.6
Porcelain	<3¶	5.7–6.8
Potassium aluminum sulfate	1¶	3.8

× 10^{10}. * × 10^8. § × 10^7. ¶ × 10^6. ‡ × 10^5.

(*Continued on following page.*)

DIELECTRIC CONSTANTS (*Continued*)

Solid	f	ε	Solid	f	ε
Potassium carbonate (15° C)	1*	5.6	Sodium carbonate (10 H_2O)	6§	5.3
" chlorate	6§	5.1	" chloride	A	6.12
" chloride	A	5.03	" nitrate	. . .	5.2
" chromate	6§	7.3	" oleate	4*	2.75
" iodide	6§	5.6	" perchlorate	6§	5.4
" nitrate	6§	5.0	Sucrose (mean)	3*	3.32
" sulfate	6§	5.9	Sulfur (mean)	. . .	4.0
Quartz ⊥	3§	4.34	Thallium chloride	1¶	46.9
" ‖	3§	4.27	*p*-Toluidine	4*	3.0
Resorcinol	4*	3.2	Tourmaline ⊥	A	7.10
Ruby ⊥	A	13.27	" ‖	A	6.3
" ‖	A	11.28	Urea	4*	3.5
Rutile ⊥	1*	86	Water (ice) (−5° C)	40#	4.6
" ‖	1*	170	" " (−5° C)	3#	40
Selenium	1*	6.6	" " (−5° C)	1#	73
Shellac	<3¶	2.9–3.7	" " (−22° C)	40#	2.2
Silver bromide	1¶	12.2	" " (−22° C)	500	40
" chloride	1¶	11.2	Wood, beech ‖	<3¶	2.5–4.8
" cyanide	1¶	5.6	" , " ⊥	<3¶	3.6–7.7
Smithsonite ⊥	100†	9.3	" , oak ‖	<3¶	2.4–4.2
" ‖	1†	9.4	" , " ⊥	<3¶	3.6–6.8
Sodium carbonate (anhyd.)	6§	8.4	Zircon ⊥ and ‖	1*	12

† $\times 10^{10}$. * $\times 10^{8}$. § $\times 10^{7}$. ¶ $\times 10^{6}$. ‡ $\times 10^{5}$.

DIPOLE MOMENTS OF VARIOUS SUBSTANCES

In this table and in the following table of *GROUP MOMENTS* the dipole moments are expressed in Debye units, usually represented by the symbol λ, which are equal to 10^{-18} electrostatic units. A dipole consists of two equal electrical charges, very close together and opposite in sign. Its magnitude is measured by its moment which is the product of either charge by the distance between the two charges.

Substance	λ	Substance	λ
Acetone	2.7	Diphenyl ether	1.15
Ammonia	1.46	Hydrogen	0
iso-Amyl cyanide	3.53	Hydrogen bromide	0.78
n-Amyl fluoride	1.85	Hydrogen chloride	1.03
tert-Amyl fluoride	1.92	Hydrogen cyanide	2.93
Benzene	0	Hydrogen iodide	0.38
Benzophenone	2.95	Hydrogen peroxide	2.1
Boron trichloride	0	Hydrogen sulfide	1.10
Bromine	0	Iodine	0
Butylamine	1.40	Nitrogen	0
Carbon dioxide	0	Paraffin	0
Carbon disulfide	0	*iso*-Propyl cyanide	3.61
Carbon tetrachloride	0	Rosin	8.8
Chlorine	0	Stannic chloride	0
p-Chloronitrobenzene	2.78	Stannic iodide	0
Cyclohexane	0	Sulfur dioxide	1.6
o-Dichlorobenzene	2.51	Water	1.84
Dioxane	0		

GROUP MOMENTS

The following data are taken by permission of the Publishers from "Dipole Moments" by C. P. Smyth in *PHYSICAL METHODS OF ORGANIC CHEMISTRY*, A. Weissberger, ed.; copyright, Interscience Publishers, New York (1946). For further information concerning dipole moments and their applications reference can be made to the afore-mentioned work, Volume II.

Each moment value given is that which is to be found when a group listed in the first column is attached to one of the groups listed across the top of the table. For example, the moment listed for C_6H_5-Cl is that of chlorobenzene.

Group	C_6H_5-		CH_3-		C_2H_5-		Degrees Angle
	Gas	Soln.	Gas	Soln.	Gas	Soln.	
$-CH_3$	0.36	0.4	0	....	0	....	180
$-OCH_3$	1.35	1.25	1.30	....	....	....	55
$-SCH_3$	....	1.27	....	1.40	....	....	52
$-NH_2$	1.48	1.53	1.23	....	1.2	1.38	..
-I	1.6	1.30	1.64	1.5	1.87	1.8	0
-Br	1.75	1.52	1.80	1.8	2.01	1.9	0
-Cl	1.72	1.55	1.87	1.7	2.05	1.8	0
-F	1.57	1.43	1.81	....	1.92	....	0
-OH	1.4	1.6	1.69	1.66	1.69	1.7	62
$-CO_2H$	....	1.7	1.73	1.6	1.73	1.7	74
$-CO_2CH_3$	....	1.9	1.67	1.75	1.76	1.9	70
-CHO	3.1	2.8	2.72	2.5	2.73	2.5	58
$-COCH_3$	3.00	2.9	2.84	2.74	2.78	....	59
-CN	4.39	4.0	3.94	3.4	4.00	3.57	0
$-NO_2$	4.21	3.98	3.50	3.1	3.68	3.3	0

MASS OF WATER VAPOR IN SATURATED AIR

The values in this table have been selected from those in the 1947 American Society of Refrigeration Engineer's Brochure on Psychrometry and are reprinted by permission.

To convert grains per cubic foot to pounds per cubic foot multiply by 0.0001429.

°F	°C	grains/ft³	grams/m³	°F	°C	grains/ft³	grams/m³
....	......	.....	.....	42	5.6	3.080	7.048
....	......	.....	.....	44	6.7	3.313	7.581
−24	−31.1	0.132	0.302	46	7.8	3.561	8.149
−22	−30.0	0.149	0.341	48	8.9	3.826	8.755
−20	−28.9	0.165	0.378	50	10.0	4.108	9.401
−18	−27.8	0.184	0.421	52	11.1	4.407	10.08
−16	−26.7	0.205	0.469	54	12.2	4.723	10.81
−14	−25.6	0.229	0.524	56	13.3	5.063	11.59
−12	−24.4	0.255	0.584	58	14.4	5.419	12.40
−10	−23.3	0.283	0.648	60	15.6	5.798	13.27
−8	−22.2	0.314	0.719	62	16.7	6.201	14.19
−6	−21.1	0.348	0.796	64	17.8	6.627	15.17
−4	−20.0	0.386	0.883	66	18.9	7.080	16.20
−2	−18.9	0.427	0.977	68	20.0	7.561	17.30
0	−17.8	0.473	1.229	70	21.1	8.064	18.45
2	−16.7	0.522	1.318	72	22.2	8.605	19.69
4	−15.6	0.576	1.439	74	23.3	9.169	20.98
6	−14.4	0.636	1.574	76	24.4	9.763	22.34
8	−13.3	0.702	1.698	78	25.6	10.39	23.78
10	−12.2	0.772	1.860	80	26.7	11.06	25.31
12	−11.1	0.851	2.046	82	27.8	11.76	26.91
14	−10.0	0.935	2.231	84	28.9	12.50	28.60
16	−8.9	1.027	2.439	86	30.0	13.28	30.39
18	−7.8	1.128	2 668	88	31.1	14.10	32.27
20	−6.7	1.236	2.938	90	32.2	14.96	34.23
22	−5.6	1.356	3.224	92	33.3	15.86	36.29
24	−4.4	1.484	3.517	94	34.4	16.82	38.49
26	−3.3	1.624	3.824	96	35.6	17.82	40.78
28	−2.2	1.775	4.147	98	36.7	18.88	43.21
30	−1.1	1.940	4.488	100	37.8	19.99	45.74
32	0.0	2.119	4.849	102	38.9	21.15	48.40
34	1.1	2.287	5.234	104	40.0	22.38	51.21
36	2.2	2.466	5.643	106	41.1	23.65	54.12
38	3.3	2.657	6.080	108	42.2	24.98	57.16
40	4.4	2.861	6.547	110	43.3	26.39	60.39

MASS OF WATER VAPOR IN SATURATED AIR (Continued)

°F	°C	grains/ft³	grams/m³	°F	°C	grains/ft³	grams/m³
112	44.4	27.86	63.75	162	72.2	94.72	216.8
114	45.6	29.40	67.28	164	73.3	98.97	226.5
116	46.7	31.00	70.94	166	74.4	103.4	236.7
118	47.8	32.70	74.83	168	75.6	108.0	247.2
120	48.9	34.46	78.86	170	76.7	112.8	258.1
122	50.0	36.29	83.05	172	77.8	117.8	269.5
124	51.1	38.21	87.44	174	78.9	122.9	281.2
126	52.2	40.23	92.06	176	80.0	128.2	293.4
128	53.3	42.33	96.87	178	81.1	133.7	305.9
130	54.4	44.50	101.8	180	82.2	139.4	319.0
132	55.6	46.79	107.1	182	83.3	145.3	332.4
134	56.7	49.18	112.5	184	84.4	151.3	346.3
136	57.8	51.66	118.2	186	85.6	157.7	360.8
138	58.9	54.23	124.1	188	86.7	164.2	375.7
140	60.0	56.91	130.2	190	87.8	170.9	391.2
142	61.1	59.75	136.7	192	88.9	177.9	407.1
144	62.2	62.67	143.4	194	90.0	185.1	423.5
146	63.3	65.67	150.3	196	91.1	192.5	440.5
148	64.4	68.83	157.5	198	92.2	200.2	458.0
150	65.6	72.16	165.1	200	93.3	208.1	476.2
152	66.7	75.54	172.9				
154	67.8	79.12	181.1				
156	68.9	82.79	189.5				
158	70.0	86.62	198.2				
160	71.1	90.59	207.3				

HUMIDITY AND DEW POINT FROM WET AND DRY BULB READINGS

In the table below *d−w* is the difference between the dry and the wet bulb thermometer readings, *r.h.* is the relative humidity, and *a.h.* is the absolute humidity.

	d − w = 0°C.			d − w = 1°C.			d − w = 2°C.			d − w = 3°C.		
Temp. °C.	r. h. %	dew point °C.	a. h. mm of Hg	r. h. %	dew point °C.	a. h. mm of Hg	r. h. %	dew point °C.	a. h. mm of Hg	r. h. %	dew point °C.	a. h. mm of Hg
−20	100	−20	0.8	..	......	....	..	......	....	..	......	....
−10	100	−10	1.9	66	−14.6	1.3	32	−22.1	0.6	..	......	....
− 5	100	− 5	3.0	75	− 8.3	2.3	51	−12.7	1.5	27	−19.4	0.8
0	100	0	4.6	81	− 2.5	3.7	63	− 5.5	2.9	45	− 9.3	2.1
+ 5	100	+ 5	6.5	86	+ 2.8	5.6	72	+ 0.3	4.7	58	− 2.3	3.8
10	100	10	9.2	88	8.1	8.1	76	6.1	7.0	65	+ 3.8	6.0
15	100	15	12.8	90	13.4	11.5	80	11.6	10.2	71	9.7	9.0
16	100	16	13.6	90	14.4	12.3	81	12.7	11.0	71	10.8	9.7
17	100	17	14.5	90	15.4	13.1	81	13.7	11.8	72	12.0	10.5
18	100	18	15.5	91	16.5	14.0	82	14.8	12.6	73	13.1	11.3
19	100	19	16.5	91	17.5	15.0	82	15.9	13.5	74	14.2	12.1
20	100	20	17.5	91	18.5	16.0	83	16.9	14.5	74	15.3	13.0
21	100	21	18.7	91	19.5	17.0	83	18.0	15.5	75	16.4	14.0
22	100	22	19.8	92	20.6	18.2	83	19.1	16.5	76	17.5	15.0
23	100	23	21.1	92	21.6	19.3	84	20.1	17.6	76	18.6	16.0
25	100	25	23.8	92	23.6	21.9	84	22.2	20.1	77	20.7	18.3
30	100	30	31.8	93	28.7	29.5	86	27.4	27.3	79	26.0	25.2

	d − w = 4°C.			d − w = 5°C.			d − w = 6°C.			d − w = 7°C.		
Temp. C.	r. h. %	dew point °C	a. h. mm of Hg	r. h. %	dew point °C.	a. h. mm of Hg	r. h. %	dew point °C.	a. h. mm of Hg	r. h. %	dew point °C.	a. h. mm of Hg
0	28	−14.6	1.3	11	−24.2	0.5	..	......	....	..	......	....
5	45	− 5.3	2.9	32	− 9.3	2.1	19	−15.2	1.2	6	−27.1	0.4
10	54	+ 1.2	5.0	44	− 1.5	4.0	34	− 4.6	3.1	24	− 8.7	2.2
12	57	3.9	6.0	48	+ 1.2	5.0	38	− 1.6	4.0	29	− 4.9	3.0
14	60	6.4	7.2	51	4.0	6.1	42	+ 1.3	5.0	34	− 1.6	4.0
15	61	7.6	7.8	52	5.4	6.7	44	2.8	5.6	36	− 0.1	4.5
16	62	8.8	8.5	54	6.7	7.3	46	4.3	6.2	37	+ 1.5	5.1
17	64	10.0	9.2	55	8.0	8.0	47	5.6	6.8	39	3.1	5.7
18	65	11.2	10.0	56	9.2	8.7	49	7.0	7.5	41	4.6	6.3
19	65	12.4	10.8	58	10.5	9.5	50	8.3	8.2	43	6.0	7.0
20	66	13.5	11.6	59	11.7	10.3	51	9.6	9.0	44	7.4	7.7
21	67	14.7	12.5	60	12.9	11.1	52	10.9	9.8	46	8.8	8.5
22	68	15.8	13.5	61	14.1	12.0	54	12.2	10.6	47	10.1	9.3
23	69	16.9	14.5	61	15.2	13.0	55	13.4	11.5	48	11.4	10.1
25	70	19.2	16.7	63	17.5	15.0	57	15.8	13.5	50	14.0	12.0
30	73	24.6	23.3	67	23.2	21.3	61	21.6	19.4	55	20.0	17.6

HUMIDITY AND DEW POINT FROM WET AND DRY BULB READINGS

	d − w = 8°C.			d − w = 9°C.			d − w = 10°C.			d − w = 11°C.		
Temp. °C.	r.h. %	dew point °C.	a.h. mm of Hg	r.h. %	dew point °C.	a.h. mm of Hg	r.h. %	dew point °C.	a.h. mm of Hg	r.h. %	dew point °C.	a.h. mm of Hg
8	7	−22.9	0.6	..	......	....	..	.....	....	..	......	....
10	14	−14.5	1.3	5	−26.0	0.4	..	.....	....	..	......	....
12	20	− 9.1	2.1	11	−15.5	1.2	..	.....	....	..	......	....
14	25	− 5.0	3.0	17	− 9.5	2.0	9	−16.3	1.1	..	......	....
15	27	− 3.2	3.5	20	− 7.1	2.5	12	−12.6	1.5	5	−22.6	0.6
16	30	− 1.5	4.0	22	− 5.0	3.0	15	− 9.6	2.0	8	−16.8	1.0
17	32	+ 0.1	4.6	24	− 3.1	3.5	17	− 7.1	2.5	10	−12.8	1.5
18	34	1.8	5.2	27	− 1.3	4.1	20	− 4.9	3.0	13	− 9.6	2.0
19	35	3.4	5.8	29	+ 0.4	4.7	22	− 2.9	3.6	15	− 6.9	2.5
20	37	5.0	6.5	30	2.1	5.3	24	− 1.0	4.2	18	− 4.6	3.1
21	39	6.4	7.2	32	3.8	6.0	26	+ 0.8	4.8	20	− 2.5	3.7
22	40	7.9	8.0	34	5.4	6.7	28	2.6	5.5	22	− 0.6	4.3
23	42	9.3	8.8	36	6.9	7.5	30	4.3	6.2	24	+ 1.3	5.0
24	43	10.7	9.6	37	8.4	8.3	31	5.9	7.0	26	3.1	5.7
25	44	12.0	10.5	38	9.9	9.1	33	7.5	7.8	27	4.9	6.5
26	46	13.3	11.5	40	11.3	10.0	34	9.0	8.6	29	6.6	7.3
28	48	15.9	13.5	42	14.0	12.0	37	11.9	10.5	32	9.7	9.0
30	50	18.4	15.8	44	16.6	14.1	39	14.7	12.5	34	12.7	11.0

RELATIVE HUMIDITY TABLES

For Use with Hygrometer

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The following tables are computed from data supplied by the U. S. Bureau of Standards, and are correct at a barometric pressure of 29.92 inches or 760 mm. of mercury. The values above 140° dry-bulb are extrapolated. Complete tables covering barometric pressures may be obtained by applying to the Superintendent of Documents, Government Printing Office, Washington, D. C. for psychrometric tables WB No. 235.

Use of Tables.—Locate at either the top or bottom margin the reading corresponding to the dry-bulb indication. Locate at either side margin the reading corresponding to wet-bulb indication. At the intersection of these two columns can be read the relative humidity. For example—given dry-bulb temperature 144°F. and wet-bulb temperature 112° F., relative humidity is 36%.

Precautions.—When the wick of an hygrometer becomes hard the bulb will not be thoroughly wet and inaccurate readings will result. Care should be taken to keep the wick clean. It should not be handled unless the fingers are perfectly clean, and the water should be pure and soft; distilled water is preferable. If the wick surrounding the bulb becomes hard (which can be easily detected by feeling of it) it should be discarded and replaced by a new one.

Accurate Readings.—Accuracy with fixed position hygrometers can be obtained only by creating free circulation around the bulb. When taking observations, fan the bulb vigorously for a full minute or more, then immediately take the reading.

Use of Sling Psychrometer.—Saturate the wicking covering the bulb with water at room temperature, then whirl the instrument for 15 or 20 seconds, holding it away from the body. Stop and note the indication of wet-bulb thermometer; then repeat the operation until two or more readings agree at the lowest indication obtainable. The wicking must be kept perfectly clean and thoroughly saturated to secure accurate indication.

Humidity Below the Freezing Point.—At temperatures below freezing apply water to the bare wet bulb sparingly, a thin coat of ice will then be formed on the bulb, and evaporation from the frozen surface will go on as before. In the case of desk-type and wall-type hygrometers the capillary effect of the wicking is lost when frozen so that water will have to be applied directly to the bare bulb.

DRY BULB TEMPERATURE °F

These values are correct for air velocity of not less than 600 ft. per minute and a barometric pressure of 29.92 inches or 760 mm. of mercury.

WET BULB TEMPERATURE °F

	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	
14	1																																								14
15	15	4																																							15
16	28	17	7																																						16
17	42	31	20	10	1																																				17
18	56	44	33	22	13	4																																			18
19	71	58	46	35	25	16	7																																		19
20	85	71	59	47	37	27	18	10	3																																20
21	100	86	72	60	49	39	29	21	13	6																															21
22		100	86	73	62	51	41	32	23	16	8	2																													22
23			100	87	74	63	52	43	34	26	18	11	5																												23
24				100	87	75	64	54	44	36	28	20	14	8	2																										24
25					100	87	76	65	55	46	37	30	23	16	10	5																									25
26						100	88	76	66	56	47	39	32	25	19	13	7	2																							26
27							100	88	77	67	58	49	41	34	27	21	15	10	5																						27
28								100	88	78	68	59	51	43	36	29	23	17	12	7	3																				28
29									100	89	78	69	60	52	45	38	31	25	20	15	10	5																			29
30										100	89	79	70	62	54	46	40	33	27	22	17	12	8	4																	30
31											100	89	80	71	63	55	48	42	35	29	24	19	14	10	6																31
32												100	90	81	72	64	57	50	43	37	31	26	21	16	12	8	5	1													32
33													100	90	81	73	65	58	51	45	39	33	28	23	18	14	10	7	3												33
34														100	91	82	74	66	59	52	46	40	35	30	25	20	16	12	9	5											34
35															100	91	83	75	67	60	54	47	42	36	31	26	22	18	14	10	7	4	1								35
36																100	91	83	75	68	61	55	48	43	38	32	28	23	19	16	12	9	6	3							36
37																	100	91	83	75	69	62	55	49	44	39	34	29	25	21	17	14	10	8	5	2					37
38																		100	92	83	76	69	63	56	51	45	40	35	31	27	23	19	16	12	9	7	4	1			38
39																			100	92	84	77	70	63	57	52	46	41	36	32	28	24	20	17	14	11	8	6	3	1	39
40																				100	92	85	77	71	64	58	52	47	42	38	34	29	26	22	19	16	13	10	7	5	40
41																					100	92	85	78	71	65	59	54	48	43	39	35	31	27	23	20	17	14	11	9	41
42																						100	92	85	78	72	66	60	54	49	45	40	36	32	28	25	22	18	16	13	42
43																							100	93	86	79	72	66	61	55	50	46	41	37	33	30	26	23	20	17	43
44																								100	93	86	79	73	67	61	56	51	47	42	38	34	31	27	24	21	44
45																									100	93	86	79	73	67	62	57	52	48	43	39	35	32	29	26	45
46																										100	93	86	80	74	68	63	58	53	49	44	40	37	33	30	46
47																											100	93	86	80	75	69	63	59	54	50	45	41	38	34	47
48																												100	93	87	81	75	69	64	59	55	50	46	42	39	48
49																													100	93	87	81	75	70	65	60	55	51	47	43	49
50																														100	94	87	81	76	70	65	61	56	52	48	50
51																															100	94	87	82	76	71	66	61	57	53	51
52																																100	94	88	82	76	71	66	62	58	52
63																																	100	94	88	82	77	72	67	63	53
54																																		100	94	88	82	77	72	68	54
	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	

DRY BULB TEMPERATURE °F

WET BULB TEMPERATURE °F

	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	
41	100	92	85	78	71	65	59	54	48	43	39	35	31	27	23	20	17	14	11	9	7	4	2																		41
42		100	92	85	78	72	66	60	54	49	45	40	36	32	28	25	22	18	16	13	10	8	6	4	2																42
43			100	93	86	79	72	66	61	55	50	46	41	37	33	30	26	23	20	17	14	12	10	7	5	3	2														43
44				100	93	86	79	73	67	61	56	51	47	42	38	34	31	27	24	21	18	16	13	11	9	7	5	3	1												44
45					100	93	86	79	73	67	62	57	52	48	43	39	35	32	29	26	22	20	17	15	12	10	8	6	5	3	1										45
46						100	93	86	80	74	68	63	58	53	49	44	40	37	33	30	27	24	21	18	16	14	12	10	8	6	4	3	1								46
47							100	93	86	80	75	69	63	59	54	50	45	41	38	34	31	28	25	22	20	17	15	13	11	9	7	6	4	3	1						47
48								100	93	87	81	75	69	64	59	55	50	46	42	39	35	32	29	26	24	21	19	16	14	12	10	9	7	5	4	3	1				48
49									100	93	87	81	75	70	65	60	55	51	47	43	40	36	33	30	27	25	22	20	18	15	13	12	10	8	7	5	4	3	1		49
50										100	94	87	81	76	70	65	61	56	52	48	44	41	37	34	31	29	26	23	21	19	17	15	13	11	9	8	6	5	4	3	50
51											100	94	87	82	76	71	66	61	57	53	49	45	42	38	35	32	30	25	24	22	20	18	16	14	12	11	9	8	6	5	51
52												100	94	88	82	76	71	66	62	58	54	50	46	43	39	36	33	31	28	25	23	21	19	17	15	13	12	10	9	7	52
53													100	94	88	82	77	72	67	63	58	54	50	47	44	40	37	34	32	29	27	24	22	20	18	16	14	13	11	10	53
54														100	94	88	82	77	72	68	63	59	55	51	48	44	41	38	35	33	30	28	25	23	21	19	17	16	14	12	54
55															100	94	88	83	78	73	68	64	60	56	52	48	45	42	39	36	33	31	29	26	24	22	20	18	17	15	55
56																100	94	88	83	78	73	69	64	60	56	53	49	46	43	40	37	34	32	29	27	25	23	21	19	18	56
57																	100	94	89	83	78	74	69	65	61	57	53	50	47	44	41	38	35	33	30	28	26	24	22	20	57
58																		100	94	89	84	79	74	70	66	61	58	54	51	48	45	42	39	36	34	31	29	27	25	23	58
59																			100	94	89	84	79	74	70	66	62	58	55	51	48	45	42	39	37	34	32	30	28	26	59
60																				100	94	89	84	79	75	71	66	62	59	55	52	49	46	43	40	38	35	33	31	29	60
61																					100	94	89	84	80	75	71	67	63	59	56	53	50	47	44	41	39	36	34	32	61
62																						100	95	90	85	80	75	71	67	64	60	57	53	50	47	44	42	39	37	35	62
63																							100	95	90	85	80	76	72	68	64	61	57	54	51	48	45	43	40	38	63
64																								100	95	90	85	80	76	72	68	65	61	58	54	51	48	46	43	41	64
65																									100	95	90	85	81	77	72	69	65	61	58	55	52	49	46	44	65
66																										100	95	90	85	81	77	73	69	65	62	59	56	53	50	47	66
67																											100	95	90	86	81	77	73	69	66	62	59	56	53	50	67
68																												100	95	90	86	82	78	74	70	66	63	60	57	54	68
69																													100	95	90	86	82	78	74	70	67	63	60	57	69
70																														100	95	91	86	82	78	74	71	67	64	61	70
71																															100	95	91	86	82	78	74	71	68	64	71
72																																100	95	91	86	82	79	75	71	68	72
73																																	100	95	91	87	83	79	75	72	73
74																																		100	96	91	87	83	79	75	74
75																																			100	96	91	87	83	79	75
76																																				100	96	91	87	83	76
77																																					100	96	91	87	77
78																																						100	96	91	78
79																																							100	96	79
80																																								100	80
	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	

DRY BULB TEMPERATURE °F

WET BULB TEMPERATURE °F

	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136	138	140	142	144	146	148	150	152	154	156	158	160	
54	10	7	5	3	1																																				54
56	14	12	9	7	5	3																																			56
58	20	16	14	11	9	7	5	3																																	58
60	25	21	18	15	13	11	9	7	5																																60
62	30	26	23	20	17	15	12	10	8	7	5																														62
64	36	32	28	25	22	19	16	14	12	10	8	7	5																												64
66	42	37	33	30	26	23	20	18	15	13	11	10	8	7																											66
68	48	43	39	35	31	28	24	22	19	17	15	13	11	10	8	7	6																								68
70	55	49	44	40	36	32	29	26	23	21	18	16	14	12	11	9	8																								70
72	61	56	50	46	41	37	33	30	27	24	22	20	17	16	14	12	11	9	8																						72
74	69	62	57	51	47	42	38	35	32	28	26	23	21	19	17	15	13	12	11	9	8																				74
76	76	69	63	57	52	48	43	39	36	33	30	27	24	22	20	18	16	14	13	12	10	9	8																		76
78	84	76	70	64	58	53	49	44	40	37	34	31	28	25	23	21	19	17	16	14	13	11	10	9																	78
80	92	84	77	70	65	59	54	50	45	41	38	35	32	29	26	24	22	20	18	17	15	14	12	11	10																80
82	100	92	84	77	71	65	60	55	50	46	42	39	36	33	30	27	25	23	21	19	18	16	15	13	12	11															82
84		100	92	85	78	72	66	61	55	51	47	43	40	37	34	31	28	26	24	22	20	18	17	16	14	13	12														84
86			100	92	85	78	72	66	61	56	52	48	44	41	38	35	32	29	27	25	23	21	19	18	16	15	14	13													86
88				100	92	85	79	73	67	62	57	53	49	45	42	38	35	33	30	28	26	24	22	20	19	17	16	15	14												88
90					100	92	85	79	73	68	62	58	53	49	46	42	39	36	34	31	29	27	25	23	21	20	18	17	15	14											90
92						100	93	86	79	73	68	63	58	54	50	47	43	40	37	34	32	30	27	25	24	21	20	19	17	16	15										92
94							100	93	86	80	74	69	64	59	55	51	47	44	41	38	35	33	30	28	26	24	22	21	20	18	18	16									94
96								100	93	86	80	74	69	64	60	55	52	48	45	41	39	36	33	31	29	26	25	23	22	21	20	19	16								96
98									100	93	86	80	75	70	65	60	56	52	49	45	42	39	37	34	32	30	27	26	24	23	22	21	19	17							98
100										100	93	87	81	75	70	65	61	57	53	49	46	43	40	37	35	33	30	28	27	25	24	23	21	20	18						100
102											100	93	87	81	75	70	66	61	57	53	50	47	44	41	38	36	33	31	29	27	26	25	23	22	21	18					102
104												100	93	87	81	76	71	66	62	58	54	50	47	44	41	39	36	34	32	30	28	27	25	24	23	21	19				104
106													100	93	87	81	76	71	67	62	58	54	51	48	45	42	39	37	34	32	31	29	27	26	25	23	22	19			106
108														100	93	87	82	76	72	67	63	59	55	52	48	45	43	40	37	35	33	31	29	28	27	25	24	22	20		108
110															100	94	88	82	77	72	67	63	59	56	52	49	46	43	40	38	36	34	32	30	28	27	26	24	23		110
112																100	94	88	82	77	72	68	64	60	56	53	49	46	44	41	39	36	34	32	30	29	28	26	25	23	112
114																	100	94	88	82	77	73	68	64	60	56	53	50	47	44	42	39	37	35	33	31	30	28	27	25	114
116																		100	94	88	83	78	73	68	64	61	57	54	50	47	45	42	40	37	35	34	32	30	29	27	116
118																			100	94	88	83	78	73	69	65	61	57	54	51	48	45	43	40	38	36	34	32	31	29	118
120																				100	94	88	83	78	73	69	65	61	58	54	52	48	46	43	41	38	36	35	33	31	120
122																					100	94	88	83	78	74	69	65	62	58	55	52	49	46	43	41	39	37	35	33	122
124																						100	94	89	83	79	74	70	66	62	59	55	53	49	46	44	42	39	38	35	124
126																							100	94	89	84	79	74	70	66	63	59	55	53	49	47	44	42	40	38	126
128																								100	94	89	84	79	75	70	67	63	59	56	53	50	47	45	43	40	128
130																									100	94	89	84	79	75	71	67	63	60	56	54	50	47	45	43	130
132																										100	94	89	84	79	75	71	67	64	60	57	54	50	48	46	132
	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136	138	140	142	144	146	148	150	152	154	156	158	160	

These values are correct for air velocity of not less than 600 ft. per minute. The values above 140° (Dry Bulb) are extrapolated.

DRY BULB TEMPERATURE °F

WET BULB TEMPERATURE °F

	134	136	138	140	142	144	146	148	150	152	154	156	158	160	162	164	166	168	170	172	174	176	178	180	182	184	186	188	190	192	194	196	198	200	202	204	206	208	210	212	
112	49	46	44	41	39	36	34	33	30	29	28	26	25	23	22															100	96	92	88	84	81	78	76	73	70	67	192
114	53	50	47	44	42	39	37	35	33	31	30	28	27	25	24	22															100	96	92	88	85	81	79	76	73	70	194
116	57	54	50	47	45	42	40	37	35	34	32	30	29	27	26	24	23															100	96	92	89	86	82	79	76	73	196
118	61	57	54	51	48	45	43	40	38	36	34	32	31	29	28	27	25	23															100	96	92	89	86	82	79	77	198
120	65	61	58	54	52	48	46	43	41	38	36	35	33	31	30	29	27	25	23															100	96	92	90	86	82	79	200
122	69	65	62	58	55	52	49	46	43	41	39	37	35	33	32	31	29	27	25	24															100	96	93	90	86	83	202
124	74	70	66	62	59	55	53	49	46	44	42	39	38	35	34	32	31	29	27	26	24															100	96	93	90	86	204
126	79	74	70	66	63	59	55	53	49	47	44	42	40	38	36	34	33	31	29	28	26	25															100	96	93	90	206
128	84	79	75	70	67	63	59	56	53	50	47	45	43	40	39	37	35	33	31	30	28	27	25															100	96	93	208
130	89	84	79	75	71	67	63	60	56	54	50	47	45	43	41	39	37	35	33	32	30	29	27	26															100	96	210
132	94	89	84	79	75	71	67	64	60	57	54	50	48	46	44	41	40	38	35	34	32	31	29	28	26															100	212
134	100	94	89	84	80	75	71	68	64	60	57	54	51	48	47	44	42	40	38	36	34	33	31	30	28	26															
136		100	94	89	84	80	76	71	68	64	61	57	55	51	49	47	45	42	40	39	36	35	33	31	30	28	27														
138			100	95	90	84	80	76	71	68	65	61	57	55	51	49	48	45	42	41	39	37	35	33	32	30	28	27													
140				100	95	90	85	80	76	72	69	65	61	58	55	52	50	48	45	43	41	40	37	35	34	32	30	29	28												
142					100	95	90	85	80	76	72	69	65	62	58	56	53	50	48	46	43	42	40	37	36	34	32	31	30	28											
144						100	95	90	85	81	76	72	69	65	62	58	56	53	50	49	46	44	42	40	38	36	34	33	32	30	29										
146							100	95	90	85	81	77	72	69	66	62	59	57	53	51	49	47	44	42	41	38	37	35	33	32	31	29									
148								100	95	90	85	81	77	73	70	66	63	59	57	54	51	50	47	44	43	41	39	37	35	34	33	31	30								
150									100	95	90	85	81	77	73	70	66	63	60	58	54	52	50	47	45	43	42	39	37	36	34	33	32	30							
152										100	95	90	85	81	77	73	70	67	63	60	58	55	52	50	48	45	44	42	39	38	36	35	34	32	30						
154											100	95	90	85	82	78	74	70	67	63	61	58	55	52	50	48	46	44	42	40	38	37	35	34	32	30	29				
156												100	95	90	86	82	78	74	70	67	64	61	58	55	53	50	48	46	44	42	40	39	37	36	34	32	31	30			
158													100	95	91	86	82	78	74	71	67	64	61	58	56	53	51	48	46	44	42	40	39	38	36	34	33	32	30		
160														100	95	91	86	82	78	74	71	68	64	61	59	56	54	51	49	47	45	43	41	40	38	36	35	33	32	31	160
162															100	95	91	86	82	79	74	71	68	64	62	59	57	54	51	49	47	45	43	42	40	38	37	35	34	33	162
164																100	96	91	86	83	79	75	72	68	65	62	60	57	54	52	50	47	45	44	42	40	39	37	36	34	164
166																	100	96	91	87	83	79	75	72	69	65	63	60	57	55	52	50	48	46	45	42	41	39	38	36	166
168																		100	96	92	87	83	79	75	72	69	66	63	60	58	55	53	50	48	47	45	43	42	40	38	168
170																			100	96	92	87	83	79	76	72	69	66	63	61	58	55	53	51	49	47	45	44	42	40	170
172																				100	96	92	87	83	79	76	73	69	66	63	61	58	55	53	52	49	48	46	44	42	172
174																					100	96	92	87	83	79	76	73	69	67	63	61	58	56	54	52	50	48	46	44	174
176																						100	96	92	87	83	80	76	73	70	67	64	61	59	57	55	53	50	48	46	176
178																							100	96	92	87	83	80	76	73	70	67	64	62	60	58	55	53	50	48	178
180																								100	96	92	87	83	80	76	73	70	67	65	63	60	58	55	53	51	180
182																									100	96	92	87	83	80	76	74	70	68	66	63	60	58	56	54	182
184																										100	96	92	87	84	80	77	74	72	69	66	63	61	58	56	184
186																											100	96	92	88	84	80	77	75	72	69	66	64	61	58	186
188																												100	96	92	88	84	80	78	75	72	70	67	64	61	188
190																													100	96	92	88	84	80	78	75	73	70	67	64	190
	134	136	138	140	142	144	146	148	150	152	154	156	158	160	162	164	166	168	170	172	174	176	178	180	182	184	186	188	190	192	194	196	198	200	202	204	206	208	210	212	

SOLUTIONS FOR MAINTAINING CONSTANT HUMIDITY

A saturated aqueous solution in contact with an excess of a definite solid phase at a given temperature will maintain constant humidity in an enclosed space. The table below gives a number of salts suitable for this purpose listed in order of decreasing humidity. The aqueous tensions were obtained by multiplying the percent humidity by the vapor pressure of pure water (mm. of Hg) at the same temperature.

Solid Phase	Temp. °C.	% Humidity	Aqueous Tension
$TlCl$	100.097	99.7	760.5
$TlNO_3$	100.317	98.7	758.6
$Pb(NO_3)_2$	20	98	17.2
$CaSO_4 \cdot 5H_2O$	20	98	17.2
NaF	100.0	96.6	734
$Na_2SO_3 \cdot 7H_2O$	20	95	16.7
$Na_2HPO_4 \cdot 12H_2O$	20	95	16.7
$ZnSO_4 \cdot 7H_2O$	5	94.7	6.11
$NH_4H_2PO_4$	20.0	93.1	16.3
$NH_4H_2PO_4$	25.0	93.0	22.1
$Na_2SO_4 \cdot 10H_2O$	20	93	16.3
$NH_4H_2PO_4$	30.0	92.9	29.6
$NaBrO_3$	20	92	16.1
K_2HPO_4	20	92	16.1
$Na_2CO_3 \cdot 10H_2O$	18.5	92	14.7
$ZnSO_4 \cdot 7H_2O$	20	90	15.8
$Pb(NO_3)_2$	103.5	88.4	759
$BaCl_2 \cdot 2H_2O$	24.5	88	20.3
K_2CrO_4	20	88	15.4
$Na_2CO_3 \cdot 10H_2O$	24.5	87	20.1
$KHSO_4$	20	86	15.1
Tl_2SO_4	104.7	84.8	760.5
KBr	20	84	14.7
$(NH_4)_2SO_4$	30.0	81.1	25.8
$(NH_4)_2SO_4$	25.0	81.1	19.3
$(NH_4)_2SO_4$	20.0	81.0	14.2
NH_4Cl	30.0	79.5	25.3
NH_4Cl	25.0	79.3	18.8
NH_4Cl	20.0	79.2	13.9
$Na_2S_2O_3 \cdot 5H_2O$	20	78	13.7
$NaC_2H_3O_2 \cdot 3H_2O$	20	76	13.3
$H_2C_2O_4 \cdot 2H_2O$	20	76	13.3
$(NH_4)_2SO_4$	108.2	75	758.5
$NaClO_3$	20	75	13.2
$NH_4Cl + KNO_3$	20.0	72.6	12.7
$NH_4Cl + KNO_3$	25.0	71.2	16.9
KBr	100	69.2	526
$NH_4Cl + KNO_3$	30.0	68.6	21.8
$NaNO_2$	20	66	11.6
$Mg(C_2H_3O_2)_2 \cdot 4H_2O$	20	65	11.4
$NaBr \cdot 2H_2O$	20	58	10.2
KI	100.0	56.2	427
$Ca(NO_3)_2 \cdot 4H_2O$	18.5	56	8.94
$Mg(NO_3)_2 \cdot 6H_2O$	18.5	56	8.94
$NaClO_3$	100.0	54	410
$Mg(NO_3)_2 \cdot 6H_2O$	24.5	52	12.0
$NaHSO_4 \cdot H_2O$	20	52	9.12
$Na_2Cr_2O_7 \cdot 2H_2O$	20	52	9.12
$Ca(NO_3)_2 \cdot 4H_2O$	24.5	51	11.8
NaI	100.0	50.4	383
$KCNS$	20	47	8.24

SOLUTIONS FOR MAINTAINING CONSTANT HUMIDITY

Solid Phase	Temp. °C.	% Humidity	Aqueous Tension
KNO_2	20	45	7.36
$K_2CO_3 \cdot 2H_2O$	18.5	44	7.03
$K_2CO_3 \cdot 2H_2O$	24.5	43	9.92
$Zn(NO_3)_2 \cdot 6H_2O$	20	42	7.36
$CaCl_2 \cdot 6H_2O$	5	39.8	2.60
$CaCl_2 \cdot 6H_2O$	10	38	3.50
$NaCl + KClO_3$	16.39	36.58	5.114
CrO_3	20	35	6.14
$CaCl_2 \cdot 6H_2O$	18.5	35	5.59
$NaCl + KNO_3$	16.39	32.57	4.553
$CaCl_2 \cdot 6H_2O$	20.0	32.3	5.66
$CaCl_2 \cdot 6H_2O$	24.5	31	7.15
$NaCl + KNO_3 + NaNO_3$	16.39	30.49	4.263
KF	100.0	22.9	174
$NaBr$	100.0	22.9	174
$KC_2H_3O_2$	20	20	3.51
$LiCl \cdot H_2O$	20	15	2.63
$KC_2H_3O_2$	168	13	736
$ZnCl_2 \cdot 1\frac{1}{2}H_2O$	20	10	1.74
$H_3PO_4 \cdot \frac{1}{2}H_2O$	24.5	9	2.08

VAPOR PRESSURES OF VARIOUS SUBSTANCES

The following table gives the values of A and B in the equation:

$$(1)\ \log_{10} P = \frac{-52.23\,A}{T} + B$$

where P is the vapor pressure of the substance in mm of mercury and where T is the absolute temperature (t°C$+273.1$). The values obtained by the use of this equation are valid within the temperature ranges indicated for each of the compounds.

For many of the hydrocarbons listed in this table the values of A, B, and C are to be used in *equation* 2 (Antoine's equation) which is

$$(2)\ \log_{10} P = A - B/(C + t)$$

where P is the vapor pressure of the substance in mm of mercury and where t is the temperature in degrees centigrade.

Abbreviations: *l*, liquid; *s*, solid.

Name	Formula	Range, °C	A	B	C
Acenaphthene	$C_{12}H_{10}$	147 to 288	54.279	8.033	....
Acetaldehyde	C_2H_4O	−24.3 to +27.5	27.707	7.8206	....
Acetic acid	$C_2H_4O_2$	−35 to +10	41.689	8.502	....
Acetic anhydride	$C_4H_6O_3$	100 to 140	45.585	8.688	....
Acetophenone	C_8H_8O	30 to 100	55.117	9.1352	....
		100 to 194	49.141	8.3170	....
Acetylene	C_2H_2	−140 to −82	21.914	8.933	....
Allylene	C_3H_4	−73 to −13	23.893	7.877	....
Aluminum chloride	$AlCl_3$	70 to 190	115	16.24	....
Aluminum oxide	Al_2O_3	1840 to 2200	540	14.22	....
Ammonia*	NH_3	−127 to −78	31.211	9.9974	....
Ammonium bromide	NH_4Br	250 to 400	90.208	9.9404	....
Ammonium chloride	NH_4Cl	100 to 400	83.486	10.0164	....
Ammonium cyanide	NH_4CN	7 to 17	41.484	9.978	....
Ammonium iodide	NH_4I	300 to 400	95.730	10.2700	....
Ammonium thiohydrate	NH_4SH	6 to 40	46.025	10.7500	....
Aniline	C_6H_7N	145 to 185	45.9516	8.1278	....
Anthracene	$C_{14}H_{10}$	100 to 160	72	8.91	....
		223 to 342	59.219	7.910	....
Anthraquinone	$C_{14}H_8O_2$	224 to 286	110.04	12.305	....
		285 to 370	63.985	8.002	....
Antimony	Sb	1070 to 1325	189	9.051	....
Antimony tribromide	$SbBr_3$	235 to 324	55	8.005	....
Antimony trichloride	$SbCl_3$	170 to 253	49.44	8.090	....
Antimony tri-iodide	SbI_3	330 to 445	64.15	7.831	....
Argon	A	−207.62 to −189.19	7.8145	7.5741	....
Arsenic	As	440 to 815	133	10.800	....
		800 to 860	47.1	6.692	....
Arsenic trichloride	$AsCl_3$	50 to 100	39.11	7.953	....
Arsenic trioxide	As_2O_3	100 to 310	111.35	12.127	....
		315 to 490	52.12	6.513	....
Barium	Ba	930 to 1130	350	15.765	....
Benzene†	C_6H_6	*Equation 2*	6.89745(*l*)	1206.350(*l*)	220.237(*l*)
		Equation 2	9.0963(*s*)	1882.0(*s*)	244.0(*s*)
Benzoic acid	$C_7H_6O_2$	60 to 110	63.82	9.033	....
Benzophenone	$C_{13}H_{10}O$	260 to 308	58.221	8.137	....
Benzoyl chloride	C_7H_5OCl	140 to 200	45.416	7.9245	....

* See also special tables.

† Triple point, 5.53°C.; 35.8 mm.

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Name	Formula	Range, °C	A	B	C
Benzyl alcohol	C_7H_8O	100 to 135	59.491	9.5152	....
		135 to 205	53.118	8.6977	....
Bismuth	Bi	1210 to 1420	200	8.876	....
Bismuth trichloride	$BiCl_3$	91 to 213	13.125	2.681	....
Boron tribromide	BBr_3	−40 to +90	33.32	7.655	....
Boron trimethyl	$B(CH_3)_3$	−118 to −20	22.171	7.4595	....
Bromobenzene	C_6H_5Br	−26 to −15	42.5	8.075	....
n-Butane	C_4H_{10}	***Equation 2***	6.83029	945.90	240.00
iso-Butane	C_4H_{10}	***Equation 2***	6.74808	882.80	240.00
Butenes:					
Butene-1	C_4H_8	***Equation 2***	6.84290	926.10	240.00
Butene-2 (*cis*)	C_4H_8	***Equation 2***	6.86926	960.10	237.000
Butene-2 (*trans*)	C_4H_8	***Equation 2***	6.86952	960.80	240.00
Butene (*iso*)	C_4H_8	***Equation 2***	6.84134	923.20	240.000
n-Butyl alcohol	$C_4H_{10}O$	75 to 117.5	46.774	9.1362	....
iso-Butyl valerate	$C_9H_{18}O_2$	90 to 170	44.482	8.143	....
n-Butyric acid	$C_4H_8O_2$	80 to 165	51.103	9.010	....
iso-Butyric acid	$C_4H_8O_2$	30 to 155	48.498	8.8193	....
Cadmium	Cd	150 to 320.9	109	8.564	....
		500 to 840	99.9	7.897	....
Cadmium iodide	CdI_2	385 to 450	122.2	9.269	....
Calcium	Ca	500 to 700	195	9.697	....
		960 to 1110	370	16.240	....
Camphor	$C_{10}H_{16}O$	0 to 180	53.559	8.799	....
Carbazole	$C_{12}H_9N$	244 to 352	64.715	8.280	....
Carbon	C	3880 to 4430	540	9.596	....
Carbon dioxide	CO_2	−135 to −56.7	26.1793	9.9082	....
Carbon monoxide	CO	−290 to −206	6.354	6.976	....
Carbon oxysulfide	COS	−80 to −50	19.22	7.383	....
Carbon suboxide	C_3O_2	−100 to +6	25.46	7.640	....
Carbon tetrachloride	CCl_4	−70 to −19	36.585	8.540	....
		−19 to +20	33.914	8.004	....
Cesium	Cs	200 to 350	73.4	6.949	....
Cesium bromide	CsBr	978 to 1305	153.6	7.990	....
Cesium chloride	CsCl	986 to 1295	163.2	8.340	....
Cesium fluoride	CsF	1033 to 1255	140.9	7.703	....
Cesium iodide	CsI	1052 to 1280	185.7	9.124	....
Chlorine	Cl_2	−154 to −103	29.293	9.950	....
Chlorine dioxide	ClO_2	−59 to +11	27.26	7.893	....
Chlorobenzene	C_6H_5Cl	−35 to −15	42.25	8.500	....
p-Chlorobromobenzene	C_6H_4ClBr	23 to 63	69.755	11.629	....
Cobalt	Co	2375	309	7.571	....
Copper	Cu	2100 to 2310	468	12.344	....
Cuprous bromide	Cu_2Br_2	997 to 1351	79.9	5.460	....
Cuprous chloride	Cu_2Cl_2	878 to 1369	80.7	5.454	....
Cuprous iodide	Cu_2I_2	991 to 1154	80.7	5.570	....
Cyanogen	C_2N_2	−72 to −28	32.437	9.6539	....
		−32 to −6	23.75	7.808	.....
Cyanogen bromide	CNBr	−17 to +35	47.051	10.328	....
Cyanogen chloride	CNCl	−5 to +40	27.1	7.840	....
Cyclohexane*	C_6H_{12}	***Equation 2***	6.84498	1203.526	222.863
Cyclopentane	C_5H_{10}	***Equation 2***	6.88673	1124.162	231.361
Dibenzyl ketone	$C_{15}H_{14}O$	285 to 325	62.118	8.257	....
p-Dichlorobenzene	$C_6H_4Cl_2$	30 to 50	72.218	12.480	....

* Triple point, 6.56°C; 39.7 mm.

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Name	Formula	Range, °C	A	B	C
Dimethylcyclohexane (1,1)	C_8H_{16}	*Equation 2*	6.80225	1323.861	218.053
Dimethylcyclohexane (1,2) (*cis*)	C_8H_{16}	*Equation 2*	6.84164	1369.525	216.040
Dimethylcyclohexane (1,2) (*trans*)	C_8H_{16}	*Equation 2*	6.83722	1356.100	219.342
Dimethylcyclohexane (1,3) (*cis*)	C_8H_{16}	*Equation 2*	6.84293	1340.658	218.281
Dimethylcyclohexane (1,3) (*trans*)	C_8H_{16}	*Equation 2*	6.83866	1345.859	215.598
Dimethylcyclohexane (1,4) (*cis*)	C_8H_{16}	*Equation 2*	6.83699	1347.794	216.360
Dimethylcyclohexane (1,4) (*trans*)	C_8H_{16}	*Equation 2*	6.82180	1332.613	218.791
Diphenylamine	$C_{12}H_{11}N$	278 to 284	57.35	8.088	....
Diphenylmethane	$C_{13}H_{12}$	217 to 283	52.36	7.967	....
Dipropyl ether	$C_6H_{14}O$	8 to 90	34.295	7.821	....
Ethane	C_2H_6	*Equation 2*	6.80266	656.40	256.00
Ethylbenzene	C_8H_{10}	*Equation 2*	6.95366	1421.914	212.931
Ethyl butyrate	$C_6H_{12}O_2$	45 to 121	39.318	8.093	....
Ethyl chloride	C_2H_5Cl	−30 to +30	26.319	7.691	....
Ethylcyclohexane	C_8H_{16}	*Equation 2*	6.87041	1384.036	215.128
Ethylcyclopentane	C_7H_{14}	*Equation 2*	6.86472	1286.60	219.50
Ethylmercaptan	C_2H_6S	8 to 45	28.210	7.672	....
o-Ethyltoluene	C_9H_{12}	*Equation 2*	7.03460	1566.60	212.00
m-Ethyltoluene	C_9H_{12}	*Equation 2*	7.05428	1566.30	214.00
p-Ethyltoluene	C_9H_{12}	*Equation 2*	7.06730	1582.70	216.00
Ethylene	C_2H_4	*Equation 2*	6.74756	585.00	255.00
Ethylene bromide	$C_2H_4Br_2$	10 to 150	38.082	7.792	....
Ethylene chloride	$C_2H_4Cl_2$	0 to 30	35.598	8.126	....
		64 to 86	32.996	7.705	....
Ethylidene chloride	$C_2H_4Cl_2$	0 to 30	31.706	7.909	....
		40 to 70	30.625	7.7165	....
Ferrous chloride	$FeCl_2$	700 to 930	135.2	8.33	....
Fluorene	$C_{13}H_{10}$	161 to 300	56.615	8.059	....
Germanium tetrachloride	$GeCl_4$	10.4 to 86	38.5	7.340	....
Gold	Au	2315 to 2500	385	9.853	....
Heptanes:					
Heptane (*n*)	C_7H_{16}	*Equation 2*	6.90319	1268.586	216.954
2-Methylhexane	C_7H_{16}	*Equation 2*	6.88017	1240	220
3-Methylhexane	C_7H_{16}	*Equation 2*	6.86216	1238	219
3-Ethylpentane	C_7H_{16}	*Equation 2*	6.87306	1249.825	219.595
2,2-Dimethylpentane	C_7H_{16}	*Equation 2*	6.81506	1190.298	223.343
2,3-Dimethylpentane	C_7H_{16}	*Equation 2*	6.85785	1240	222
2,4-Dimethylpentane	C_7H_{16}	*Equation 2*	6.84773	1204	223
3,3-Dimethylpentane	C_7H_{16}	*Equation 2*	6.81810	1223.543	224.687
2,2,3-Trimethylbutane	C_7H_{16}	*Equation 2*	6.79968	1204.997	226.615
Hexanes:					
Hexane (*n*)	C_6H_{14}	*Equation 2*	6.87773	1171.530	224.366

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Name	Formula	Range, °C	A	B	C
Hexanes (cont.):					
2-Methylpentane	C_6H_{14}	*Equation 2*	6.83907	1135.410	226.572
3-Methylpentane	C_6H_{14}	*Equation 2*	6.84884	1152.368	227.129
2,2-Dimethylbutane	C_6H_{14}	*Equation 2*	6.75480	1081.176	229.343
2,3-Dimethylbutane	C_6H_{14}	*Equation 2*	6.80980	1127.187	228.900
Hydrogen bromide	HBr	−114 to −86	22.420	8.734	....
		−86 to −66	17.96	7.427	....
Hydrogen chloride	HCl	−158 to −110	19.588	8.4430	....
Hydrogen cyanide	HCN	−8 to +27	27.83	7.7446	....
		0 to 46	27.875	7.7526	....
Hydrogen fluoride	HF	−83 to +48	25.18	7.370	....
Hydrogen iodide	HI	−97 to −51	24.16	8.259	....
		−50 to −34	21.58	7.630	....
Hydrogen peroxide	H_2O_2	10 to 90	48.53	8.853	....
Hydrogen selenide	H_2Se	−66 to −26	20.21	7.431	....
Hydrogen selenite	H_2SeO_3	70 to 110	43	8.150	....
Hydrogen sulfide	H_2S	−110 to −83	20.69	7.880	....
Hydrogen telluride	H_2Te	−46 to 0	22.76	7.260	....
Iodobenzene	C_6H_5I	−30 to +18	43	7.500	....
Iron	Fe	2220 to 2450	309	7.482	....
Krypton	Kr	−188.7 to −169	10.065	7.1770	....
Lauric acid	$C_{12}H_{24}O_2$	164 to 205	74.386	9.768	....
Lead	Pb	525 to 1325	188.5	7.827	....
Lead bromide	$PbBr_2$	735 to 918	118	8.064	....
Lead chloride	$PbCl_2$	500 to 950	141.9	8.961	....
Lead fluoride	PbF_2	1078 to 1289	165.1	8.391	....
Lithium bromide	LiBr	1010 to 1265	152.7	8.068	....
Lithium chloride	LiCl	1045 to 1325	155.9	7.939	....
Lithium fluoride	LiF	1398 to 1666	218.4	8.753	....
Lithium iodide	LiI	940 to 1140	143.6	8.011	....
Magnesium	Mg	900 to 1070	260	12.993	....
Maleic anhydride	$C_4H_2O_3$	60 to 160	46.34	7.825	....
Manganese	Mn	1510 to 1900	267	9.300	....
Mercuric bromide	$HgBr_2$	130 to 270	79.8	10.094	....
Mercuric chloride	$HgCl_2$	60 to 130	85.03	10.888	....
		130 to 270	78.85	10.094	....
		275 to 309	61.02	8.409	....
Mercuric iodide	HgI_2	100 to 250	82.34	10.057	....
		266 to 360	62.77	8.115	....
Mercury	Hg	−80 to −38.87	73.0	10.383	....
		400 to 1300	58.7	7.752	....
Methane*	CH_4	*Equation 2*	6.61184 (*l*)	389.93 (*l*)	266.00 (*l*)
		Equation 2	7.69540 (*s*)	532.20 (*s*)	275.00 (*s*)
Methyl alcohol	CH_4O	−62 to −44	39.234	8.9547	....
		−10 to +80	38.324	8.8017	....
Methyl chloride	CH_3Cl	−47 to −10	21.988	7.481	....
Methylcyclopentane	C_6H_{12}	*Equation 2*	6.86280	1186.059	226.042
Methylcyclohexane	C_7H_{14}	*Equation 2*	6.82689	1272.864	221.630
Methyl ether	C_2H_6O	−70 to −20	23.025	7.720	....
Methylethyl ether	C_3H_8O	0 to 25	26.262	7.769	....
Methyl fluoride	CH_3F	−102 to −76	17.053	7.445	....
Methylpropyl ether	$C_4H_{10}O$	−0.5 to +40	28.952	7.729	....

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* Triple point, −182.48°C.; 87.7 mm.

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Name	Formula	Range, °C	A	B	C
Methyl salicylate	$C_8H_8O_3$	175 to 215	48.67	8.008	....
Methylarsine dichloride	CH_3Cl_2As	−17 to +35	43.686	8.6944	....
Molybdenum	Mo	1800 to 2240	680	10.844	....
Myristic acid	$C_{14}H_{28}O_2$	190 to 224	75.783	9.541	....
Naphthalene	$C_{10}H_8$	0 to 80	71.401	11.450	....
		120 to 200	47.362	7.927	....
Nickel	Ni	2360	309	7.600	....
Nickel carbonyl	$Ni(CO)_4$	2 to 40	29.8	7.780	....
Nitric oxide	NO	−200 to −161	16.423	10.048	....
		−163.7 to −148	13.04	8.440	....
o-Nitroaniline	$C_6H_6O_2N_2$	150 to 260	63.881	8.8684	....
m-Nitroaniline	$C_6H_6O_2N_2$	170 to 260	65.88	8.8188	....
p-Nitroaniline	$C_6H_6O_2N_2$	190 to 260	77.345	9.5595	....
Nitrobenzene	$C_6H_5O_2N$	112 to 209	48.955	8.192	....
Nitrogen	N_2	−215.2 to −209.86	6.8813	7.66558	....
Nitrogen pentoxide	N_2O_5	−30 to +30	57.18	12.647	....
Nitrogen tetroxide	N_2O_4	−100 to −40	55.16	13.400	....
		−40 to −10	45.44	11.214	....
		−8 to +43.2	33.43	8.814	....
Nitrogen trioxide	N_2O_3	−25 to 0	39.4	10.30	....
Nitromethane	CH_3O_2N	47 to 100	36.914	8.033	....
o-Nitrotoluene	$C_7H_7O_2N$	50 to 225	48.114	7.9728	....
m-Nitrotoluene	$C_7H_7O_2N$	55 to 235	50.128	8.0655	....
p-Nitrotoluene	$C_7H_7O_2N$	80 to 240	49.95	7.9815	....
Nitrosyl chloride	NOCl	−61.5 to −5.4	25.5	7.870	....
Nitrous oxide	N_2O	−144 to −90	23.59	9.579	....
		−90.1 to −88.7	16.44	7.535	....
Octanes:					
Octane (*n*)	C_8H_{18}	*Equation 2*	6.92374	1355.126	209.517
2-Me-heptane	C_8H_{18}	*Equation 2*	6.91733	1337.468	213.693
3-Me-heptane	C_8H_{18}	*Equation 2*	6.89942	1331.530	212.414
4-Me-heptane	C_8H_{18}	*Equation 2*	6.90061	1327.661	212.568
3-Et-hexane	C_8H_{18}	*Equation 2*	6.89095	1327.884	212.595
2,2-DiMe-hexane	C_8H_{18}	*Equation 2*	6.83712	1273.594	215.072
2,3-DiMe-hexane	C_8H_{18}	*Equation 2*	6.87000	1315.503	214.157
2,4-DiMe-hexane	C_8H_{18}	*Equation 2*	6.85302	1287.876	214.790
2,5-DiMe-hexane	C_8H_{18}	*Equation 2*	6.85980	1287.274	214.412
3,3-DiMe-hexane	C_8H_{18}	*Equation 2*	6.85118	1307.882	217.439
3,4-DiMe-hexane	C_8H_{18}	*Equation 2*	6.87982	1330.035	214.863
2-Me-3-Et-pentane	C_8H_{18}	*Equation 2*	6.86354	1318.120	215.306
3-Me-3-Et-pentane	C_8H_{18}	*Equation 2*	6.86727	1347.209	219.684
2,2,3-TriMe-pentane	C_8H_{18}	*Equation 2*	6.82542	1294.875	218.420
2,2,4-TriMe-pentane	C_8H_{18}	*Equation 2*	6.81984	1262.490	221.271
2,3,3-TriMe-pentane	C_8H_{18}	*Equation 2*	6.84349	1328.046	220.375
2,3,4-TriMe-pentane	C_8H_{18}	*Equation 2*	6.85392	1315.084	217.526
2,2,3,3-TetraMe-butane*	C_8H_{18}	*Equation 2*	6.87665 (*l*)	1327.8 (*l*)	226 (*l*)
		Equation 2	7.78882 (*s*)	1625.7 (*s*)	226 (*s*)

* Triple point, 100.58°C.; 647.0 mm.

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Name	Formula	Range, °C	A	B	C
Osmium octafluoride	OsF_8	38 to 47.3	29.2	7.650	....
Osmium tetroxide	OsO_4	−38 to +40.1	56.5	10.7100	....
Oxalic acid	$H_2C_2O_4$	55 to 105	90.5026	12.2229	....
Pentanes:					
Pentane (*n*)	C_5H_{12}	***Equation 2***	6.85221	1064.63	232.000
Pentane (*iso*)	C_5H_{12}	***Equation 2***	6.80380	1027.25	234.000
2,2-DiMe-propane*	C_5H_{12}	***Equation 2***	6.73812	950.84	237.00
Phenanthrene	$C_{14}H_{10}$	203 to 347	57.247	7.771	....
Phenol	C_6H_6O	116 to 180	49.644	8.587	....
Phosgene	$COCl_2$	−90 to +25	24.684	7.460	....
Phosphonium bromide	PH_4Br	−80 to +40	48.115	10.9561	....
Phosphonium iodide	PH_4I	10 to 60	51.854	10.9500	....
Phosphorus (white)	P	20 to 44.1	63.123	9.6511	....
Phosphorus (violet)	P	380 to 590	108.51	11.0842	....
Phosphorus trichloride	PCl_3	0 to 70	31.86	7.681	....
Phthalic anhydride	$C_8H_4O_3$	160 to 285	54.92	8.022	....
Platinum	Pt	1425 to 1765	486	7.786	....
Potassium	K	260 to 760	84.9	7.183	....
Potassium bromide	KBr	906 to 1063	168.1	8.2470	....
		1095 to 1375	163.8	7.936	....
Potassium chloride	KCl	906 to 1105	174.5	8.3526	....
		1116 to 1418	169.7	8.130	....
Potassium fluoride	KF	1278 to 1500	207.5	9.000	....
Potassium hydroxide.	KOH	1170 to 1327	136	7.330	....
Potassium iodide	KI	843 to 1028	157.6	8.0957	....
		1063 to 1333	155.7	7.949	....
Propane	C_3H_8	***Equation 2***	6.82973	813.20	248.00
Propionic acid	$C_3H_6O_2$	20 to 140	46.15	8.715	....
n-Propyl alcohol	C_3H_8O	−45 to −10	47.274	9.5180	....
n-Propylbenzene	C_9H_{12}	***Equation 2***	6.95175	1491.548	207.171
iso-Propylbenzene	C_9H_{12}	***Equation 2***	6.92926	1455.811	207.202
iso-Propyl bromide	C_3H_7Br	0 to 30	30.76	7.722	....
n-Propyl chloride	C_3H_7Cl	0 to 50	28.894	7.593	...
iso-Propyl chloride	C_3H_7Cl	0 to 30	27.242	7.493	
n-Propyl iodide	C_3H_7I	0 to 30	35.334	7.826	.
iso-Propyl iodide	C_3H_7I	0 to 30	32.978	7.629	.
Propyl propionate	$C_6H_{12}O_2$	45 to 125	39.221	8.0525	....
Propylene	C_3H_6	***Equation 2***	6.81960	785.00	247.00
Quinoline	C_9H_7N	180 to 240	49.72	7.969	....
Rubidium	Rb	250 to 370	76	6.976	....
Rubidium bromide	RbBr	1050 to 1365	165	8.223	....
Rubidium chloride	RbCl	1142 to 1395	198.6	9.111	....
Rubidium fluoride	RbF	1142 to 1400	183.2	8.570	....
Rubidium iodide	RbI	1075 to 1325	156.6	8.067	....
Selenic acid	H_2SeO_4	25 to 56	82.4	14.130	....
Silver	Ag	1650 to 1950	250	8.762	....
Silver chloride	AgCl	1255 to 1442	185.5	8.179	....
Silica	SiO_2	1860 to 2230	506	13.43	....
Silicon	Si	1200 to 1320	170	5.950	....
Silicon hexahydride	Si_2H_6	−115 to −14.6	21.7	7.258	....
Silicon octahydride	Si_3H_8	−70 to +52	29.85	7.676	....
Silicon tetrachloride	$SiCl_4$	−70 to +5	30.1	7.644	...

* Triple point, −16.6°C.; 265.4 mm.

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Name	Formula	Range, °C	A	B	C
Silicon tetrahydride	SiH_4	−160 to −112	12.69	6.996	....
Sodium	Na	180 to 883	103.3	7.553	....
Sodium bromide	NaBr	1138 to 1394	161.6	7.948	....
Sodium chloride	NaCl	976 to 1155	180.3	8.3297	....
		1156 to 1430	185.8	8.548	....
Sodium cyanide	NaCN	800 to 1360	155.52	7.472	....
Sodium fluoride	NaF	1562 to 1701	218.2	8.640	....
Sodium hydroxide	NaOH	1010 to 1402	132	7.030	....
Sodium iodide	NaI	1063 to 1307	165.1	8.371	....
Stannic chloride	$SnCl_4$	−52 to −38	46.74	9.824	....
Stannic hydride	SnH_4	−148 to −49	19.14	7.400	....
Strontium	Sr	940 to 1140	360	16.056	....
Sulfur chloride	S_2Cl_2	0 to 138	35.99	7.455	....
Sulfur dioxide	SO_2	−95 to −75	35.827	10.5916	....
Sulfur trioxide	SO_3	24 to 48	43.45	10.022	....
Thallium	Tl	950 to 1200	120	6.140	....
Thallium bromide	TlBr	634 to 817	105.4	7.940	....
Thallium chloride	TlCl	665 to 807	105.2	7.974	....
Thallium fluoride	TlF	282 to 298	105	12.52	....
Thallium iodide	TlI	693 to 822	105.4	7.902	....
Tin	Sn	1950 to 2270	328	9.643	....
Toluene	C_7H_8	*Equation 2*	6.95334	1343.943	219.377
TriMe-benzene (1,2,3)	C_9H_{12}	*Equation 2*	7.10175	1646.80	214.00
TriMe-benzene (1,2,4)	C_9H_{12}	*Equation 2*	7.07938	1609.10	214.00
TriMe-benzene (1,3,5)	C_9H_{12}	*Equation 2*	7.04089	1567.10	212.00
Tungsten	W	2230 to 2770	897	9.920	....
Uranium hexafluoride	UF_6	0 to 69	41.73	9.521	....
o-Xylene	C_8H_{10}	*Equation 2*	7.00289	1477.519	214.024
m-Xylene	C_8H_{10}	*Equation 2*	7.00659	1460.498	214.889
p-Xylene	C_8H_{10}	*Equation 2*	6.99099	1453.840	215.367
Zinc	Zn	250 to 419.4	133	9.200	....
		600 to 985	118	8.108	....

VAPOR PRESSURES OF VARIOUS SUBSTANCES

In the table below, the vapor pressures are given in millimeters of mercury or in atmospheres (1 atmosphere 760 mm Hg) as indicated. Data on some compounds which are not listed in this table may be found in the International Critical Tables, vol. 3, pp 199-246; the Landolt-Bornstein Physikalisch-Chemische Tabellen, 5th ed., vol. 2 pp 1332-1381; Stull, *Ind. Eng. Chem.* **39**, 517 (1947).

The following abbreviations are used: c.p., critical point; t.p., triple point; m.p., melting point.

See also special tables for mercury, ammonia, and water.

Acetic Acid CH_3CO_2H

t°C.	mm of Hg
20	11.7
30	20.6
40	34.8
50	56.6
60	88.9
62.5	100
70	136
72.3	150
80	202.3
85.5	250
90	293.7
95.1	350
100	417.1
105.4	500
110	580.8
118	760
120	794
130	1067.6
140	1414

Acetone CH_3COCH_3

t°C.	mm of Hg
−90	0.021
−70	0.34
−50	2.4
−30	11.2
−10	38.7
+ 5	89.1
10	115.6
15	147.1
20	184.8
25	229.2
30	282.7
35	346.4
40	421.5
45	510.5
50	612.6
56.30	760
60	860.6
70	1190
80	1611
90	2142
100	2797
110	3594
120	4547
130	5670
140	6974

Acetylene C_2H_2

t°C.	mm of Hg
−143.2	1
−140.6	2.5
−134.6	6
−126.1	15
−119.9	30
−115.1	50
−108.2	100
−104.0	150
−100.6	200
− 95.8	300
− 92.3	400
− 89.5	500
− 87.0	600
− 85.9	650
− 85.1	700
− 84.5	730
− 84.0	760

Ammonia NH_3
See Special Table

Ammonium Chloride NH_4Cl

t°C.	mm of Hg	p in atm
250	49.5	
270	97.5	
290	185.3	
310	341.3	
330	610.6	
337.8	760.0	
340		1.062
350		1.40
387		3
427		6
459		11
490		20
520		34.5

Aniline $C_6H_5NH_2$

t°C.	mm of Hg
50	2.4
60	5.7
70	10.6
80	18.0
90	29.2
100	45.7
110	69.2
120	96.6
130	144.5
140	204.0
146.5	250
152.1	300
157.0	350
161.4	400
165.3	450
169.3	500
172.5	550
175.6	600
178.5	650
181.2	700
184.3	760

Antimony Sb

t°C.	mm of Hg
1075	54
1175	206
1265	403
1325	745
1440	760

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Argon A

t°C.	mm of Hg
−205.3	38.3
−200	84.56
−195.6	208.8
−189.3	515.6 (m.p.)
−186.1	672.7
−185.9	760.0
−185.3	802.0
−183.0	1015.3
	p in atm
−161.2	7.43
−140.8	22.185
−135.1	29.0
−129.8	35.85
−125.5	42.46
−122.4	48.00 (c.p.)

Arsenic As

t°C.	mm of Hg
400	6
470	28
500	61
526	130
568.9	334.1

Benzene C_6H_6

t°C.	mm of Hg
−36.7	1
−11.5	10
+3.0	30
21.3	80
35.3	150
52.7	300
72.6	600
78.4	720
80.1	760
81.8	800
89.3	1000
95.7	1200
103.9	1500
110	1748.2
120	2238.1
130	2824.9
140	3520.0
150	4334.8
160	5281.9
170	6374.1
180	7625.2
190	9049.4
	p in atm
200	14.03
220	19.11
240	25.49
260	33.39
280	43.12
284.3	45.52
288.5	47.90(c.p.)

Benzoic Acid $C_6H_5CO_2H$

t°C.	mm of Hg
60	0.11
70	0.16
80	0.30
90	0.60
100	1.40
110	3.74
140	14.6
150	23.6
160	36.3
170	55.8
180	81.6
190	119.1
200	171.3
210	239
220	331.5
230	451
240	597
250	780

Benzonitrile C_6H_5CN

t°C.	mm of Hg
38.4	1
56.9	5
60	6.3
70	10.5
77.1	15
80	17.0
83.0	20
88.0	25
90	27.2
92.1	30
95.5	35
98.5	40
100	42.7
103.9	50
110	65
113.7	75
120	94.2
121.3	100
130	135.5
132.8	150
140	187.3
141.4	200
148.6	250
150	254.7
155.3	300
160	338.8
165.8	400
170	445.7
174.4	500
178.1	550
180	582.1
184.8	650
187.7	700
190	748.2
190.6	760

Benzophenone $(C_6H_5)_2CO$

t°C.	mm of Hg
257.2	250
260.1	270
262.9	290
265.6	310
268.2	330
270.7	350
273.0	370
275.2	390
277.4	410
279.4	430
281.4	450
283.3	470
285.1	490
286.9	510
288.6	530
290.3	550
291.9	570
293.5	590
295.0	610
296.5	630
298.0	650
299.4	670
300.8	690
302.2	710
303.5	730
304.2	740
304.8	750
305.4	760
306.1	770
306.7	780
307.3	790
307.9	800

Benzoyl Chloride C_6H_5COCl

t°C.	mm of Hg
38.6	1
40	1.1
46.8	2
50	2.4
56.7	4
60	4.8
70	8.2
73.8	10
80	13.6
82.1	15
88.2	20
90	21.8
93.1	25
97.2	30
100	33.9
106.7	45
110	51.4
120	75.1
128.0	100
130	107.8
140	152.0

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Benzoyl Chloride (Cont.)

t°C.	mm of Hg
148.9	200
156.2	250
162.5	300
167.7	350
172.7	400
177.0	450
180.9	500
184.5	550
187.8	600
191.0	650
193.8	700
197.1	760

Benzyl Alcohol $C_6H_5CH_2OH$

t°C.	mm of Hg
60.9	1
67.8	2
72.9	3
77.2	4
80.8	5
92.6	10
99.9	15
105.3	20
109.7	25
113.4	30
116.7	35
119.6	40
122.2	45
124.4	50
133.9	75
141.3	100
152.1	150
160.8	200
167.1	250
172.6	300
177.7	350
182.0	400
185.7	450
189.0	500
192.6	550
195.6	600
198.9	650
201.7	700
205.0	760

Bismuth

t°C.	mm of Hg
1200	102
1290	126
1310	257
1385	300
1490	760
	p in atm
1740	6.3
1950	11.7
2060	16.5

Boron Trichloride BCl_3

t°C.	mm of Hg
−80	4
−60	18
−40	67
−20	197
0	477
+12.4	753
20	807.5
40	1535.2
60	2658.5
80	4248.3

Bromine Br_2

t°C.	mm of Hg
−95	0.0022
−90	0.0052
−85	0.0117
−80	0.0251
−75	0.0513
−70	0.102
−65	0.192
−60	0.357
−55	0.628
−50	1.09
−45	1.83
−40	2.98
−35	4.77
−30	7.45
−25	11.4
−20	17.1
−15	25.2
−10	36.6
− 7.3	44.4 (m.p.)
− 5	50.5
0	65.9
+ 5	85.3
10	109
15	138
20	173
25	214
30	264
35	324
40	392
45	472
50	564
55	670
58.78	760
60	793

Bromobenzene C_6H_5Br

t°C.	mm of Hg
30	5.67
40	9.99
50	16.96
60	27.61
70	43.55
80	66.22

Bromobenzene C_6H_5Br (Cont.)

t°C.	mm of Hg
90	97.72
100	141.1
110	198.7
120	274.9
130	372.7
140	495.8
150	649.1
156.15	760
160	846.0
170	1077
180	1351
190	1685
200	2075
210	2525
220	3055
230	3660
240	4360
250	5160
260	6080
270	7105
397	33900 (c.p.)

α-Bromonaphthalene $C_{10}H_7Br$

t°C.	mm of Hg
110	3.55
120	5.55
130	8.5
140	12.8
150	18.9
160	27.4
180	54.95
200	102.4
220	178.7
230	232.6
240	300.3
250	381.5
260	482.0
270	604.0
280	743.0
281.1	760

n-Butane C_4H_{10}

t°C.	mm of Hg
−101.5	1
− 77.8	10
− 68.9	20
− 52.8	60
− 44.2	100
− 31.2	200
− 16.3	400
− 2.7	700
− 0.5	760
+ 0.9	800
7.0	1000
18.9	1500

VAPOR PRESSURES OF VARIOUS SUBSTANCES

n-Butyric Acid $C_3H_7CO_2H$

t°C.	mm of Hg
10	0.36
20	0.76
30	1.5
40	3.0
50	5.4
60	9.8
70	17.0
80	28.6
90	46.6
100	73.8
110	114.0
120	171.3
130	251.6
140	361.4
150	508.5
160	701.2
162.4	760

Camphor $C_{10}H_{16}O$

t°C.	mm of Hg
18.9	0.46
23.4	0.55
28.4	0.94
30.8	1.04
40.2	1.70
52.5	2.72
55.0	3.12
62.0	4.22
66.6	5.61
78.0	6.4
92.4	15.4
101.0	27.2
109.4	35.0
116.7	46.0
127.4	66.3
134.2	88.6
136.3	92.8
140.3	105.0
141.7	109.4
147.0	155.1
154.3	197.6
157.9	218.5
160.1	240.7
168.0	297.8
176.7	350.6
178.9	370.3
180.3	385.9
182.0	400.8
182.6	405.3
184.5	421.1
194.8	555.2
198.7	593.2
201.8	646.1
206.7	731.0
207.3	746.3
208.25	760

Carbon C (Graphite)

t°C.	p in atm
3752	0.40
3844	0.68
3917	1.00
4090	2.00
4249	4.00
4422	8.00

Carbon Dioxide CO_2

t°C.	mm of Hg
−168.8	0.0006
−163.2	0.00282
−148.3	0.0882
−134.7	1.073
−127.2	3.50
−117.8	13.09
−109.7	35.7
−103.0	76.7
− 95.9	158.7
− 87.9	338.5
− 80.8	630.3
− 80.0	669.9
− 79.1	724.3
− 78.5	760
	p in atm
− 70.0	1.88
− 60.0	3.95
− 56.6	5.115 (m.p.)
− 56	5.249
− 54	5.716
− 52	6.214
− 50	6.745
− 48	7.309
− 46	7.908
− 44	8.543
− 42	9.215
− 40	9.925
− 38	10.675
− 36	11.466
− 34	12.299
− 32	13.176
− 30	14.099
− 28	15.067
− 26	16.084
− 24	17.150
− 22	18.267
− 20	19.437
− 18	20.661
− 16	21.940
− 14	23.277
− 12	24.673
− 10	26.129
− 8	27.648
− 6	29.231
− 4	30.879
− 2	32.595
0	34.379
+ 2	36.235
4	38.163
6	40.166
8	42.247
10	44.406
12	46.648
14	48.974
16	51.388
18	53.895
20	56.495
22	59.197
24	62.006
26	64.928
28	67.971
30	71.143
31.1	72.947 (c.p.)

Carbon Disulfide CS_2

t°C.	mm of Hg
−78.19	0.68
−42.59	11.81
−25.35	34.3
−21.52	42.69
0	127.0
+11.54	211.3
19.67	294.27
46.25	760.0
	p in atm
50	1.13
60	1.54
70	2.05
80	2.69
90	3.47
100	4.42
110	5.55
120	6.90
130	8.47
140	10.3
150	12.4
160	14.9
170	17.6
180	20.8
190	24.3
200	28.3
210	32.8
220	37.8
230	43.4
240	49.6
250	56.5
260	64.1
270	72.5
273	76 (c.p.)

Carbon Monoxide CO

t°C.	mm of Hg
−220.6	4

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Carbon Monoxide CO (Cont.)

t°C.	mm of Hg
−207	100
−205	114
−191	760
	p in atm
−180	3.2
−170	6.7
−160	12.4
−150	20.9
−140	33.2
−139	35 (c.p.)

Carbon Tetrachloride CCl_4

t°C.	mm of Hg
−69.7	0.145
−65.3	0.224
−59.6	0.384
−56.8	0.504
−54.8	0.595
−50.1	0.925
−40	2.208
−30	4.745
−20	9.708
−10	18.47
0	32.95
+10	55.97
20	90.99
25	114.5
30	143.0
35	176.2
40	215.8
45	262.5
50	317.1
55	379.3
60	450.8
65	530.9
70	622.3
76.75	760
80	843
90	1122
100	1463
	p in atm
110	2.483
120	3.149
130	3.904
140	4.880
150	5.994
160	7.288
170	8.738
180	10.39
190	12.25
200	14.39
210	16.79
220	19.47
230	22.44
240	25.83

Carbon Tetrachloride (Cont.)

t°C.	p in atm
250	29.49
260	33.59
270	38.15
280	43.16
283.15	45 (c.p.)

Cesium Cs

t°C.	mm of Hg
244	0.29
249.5	0.31
272	0.99
278.4	1.01
315	3.18
350	6.72
397	15.88
670	760

Cesium Chloride CsCl

t°C.	mm of Hg
1062	87.8
1078	95
1150	223
1180	271
1260	535.4
1295	760

Chlorine Cl_2

t°C.	mm of Hg
−153.9	0.0015
−147	0.0067
−126.5	0.26
−112	2.64
−103.1	8.9 (m.p.)
−100	11.8
−95.5	17.4
−90	27.8
−80	58.7
−75	82
−70	115
−60	211
−55	278
−50	363
−40	594
−34.6	760
	p in atm
−30	1.23
−20	1.84
−10	2.63
0	3.66
+10	4.95
20	6.62
30	8.75
50	14.70
70	23.00
90	34.50
110	50.80

Chlorine Cl_2 (Cont.)

t°C.	p in atm
130	71.60
146	93.50 (c.p.)

Chorobenzene C_6H_5Cl

t°C.	mm of Hg
−35	0.169
−15	0.885
0	2.52
+10	4.86
20	8.76
30	15.45
40	26.00
50	41.98
60	65.54
70	97.90
80	144.75
90	208.35
100	292.75
110	402.55
120	542.80
130	718.95
132	760
140	939.4
150	1206
160	1534
170	1913
180	2367
190	2899
200	3518
210	4233
220	5054
230	5992
240	7060
250	8271
270	11185
280	12925
359.2	33926 (c.p.)

Chloroform $CHCl_3$

t°C.	mm of Hg
−60	0.81
−50	2.06
−40	4.7
−30	10.0
−20	19.6
−10	34.75
0	61.0
+10	100.5
20	159.6
25	199.1
30	246.0
35	301.3
40	366.4
45	439.0
50	526.0
55	625.2

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Chloroform (Cont.)

t°C.	mm of Hg
60	739.6
61.2	760
70	1019
80	1403
100	2429
120	3926
140	6000
160	8734

Chloropicrin CCl_3NO_2

t°C.	mm of Hg
−20	1.50
−19	1.70
−18	1.90
−10	3.0
0	5.71
+10	10.37
15	13.82
20	18.31
25	23.81
30	31.10
35	40.14

Copper Cu

t°C.	mm of Hg
1875	20
1980	100
2175	209
2215	300
2300	752
2310	760

o-Cresol C_7H_8O

t°C.	mm of Hg
36.6	1
50	1.87
57.3	3
60	3.55
65.5	5
70	6.5
77.6	10
80	11.5
85.0	15
90	19.4
95.1	25
100	31.6
105.2	40
110	49.2
120	74.1
127.4	100
130	109.4
138.4	150
140	158.1
146.7	200
150	222.9
153.5	250

o-Cresol (Cont.)

t°C.	mm of Hg
160	308.3
164.2	350
170	421.2
175.8	500
180	566.9
182.0	600
184.8	650
187.5	700
190.1	760

m-Cresol C_7H_8O

t°C.	mm of Hg
55.9	1
60	1.76
62.8	2
68.4	3
70	3.4
76.0	5
80	6.37
87.8	10
90	11.3
95.7	15
100	19.05
105.7	25
110	31.0
115.9	40
120	48.6
130	72.5
138.0	100
140	106.9
149.0	150
150	154.2
157.3	200
160	219.3
164.1	250
170	302.7
174.8	350
180	411.2
182.9	450
186.3	500
190	549.6
192.5	600
195.3	650
198.0	700
200.5	760

p-Cresol C_7H_8O

t°C.	mm of Hg
55.7	1
60	1.7
64.4	2
70	3.3
73.3	4
76.5	5
80	6.17
88.6	10

p-Cresol (Cont.)

t°C.	mm of Hg
90	10.8
96.2	15
100	18.3
106.2	25
110	30.1
113.4	35
116.4	40
120	47.4
121.3	50
130	71.0
138.4	100
140	105.0
149.4	150
150	152.1
157.7	200
160	216.8
164.5	250
170	300.0
175.2	350
180	407.4
183.4	450
186.8	500
190	548.3
193.0	600
195.8	650
198.5	700
201.1	760

Cyanogen Chloride CNCl

t°C.	mm of Hg
−30	68.3
−20	148.2
−10	270.5
− 7.04	......(m.p.)
− 5	350.2
0	444.1
+20	1001.9
40	1988
60	3664
75	5595

Cyclohexane C_6H_{12}

t°C.	mm of Hg
− 45.3	1
− 5.0	20
+ 6.7	40
20.7	80
34.9	150
42.0	200
60.8	400
78.0	700
80.7	760
82.5	800
90.2	1000
105.2	1500

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Cyclohexane (Cont.)

t°C.	mm of Hg
120	2152
130	2703
140	3362
150	4123
160	5028
170	6041
180	7194
190	8482
200	9977
	p in atm
210	15.33
220	17.77
230	20.53
240	23.65
250	27.01
270	35.09
281	40.57(c.p.)

Cymene $C_{10}H_{14}$

t°C.	mm of Hg
0	4.65
10	5.2
20	6.3
30	8.15
40	10.95
50	15.15
60	21.4
70	30.45
80	43.55
90	62.1
100	87.85
110	122.85
120	169.25
130	229.45
140	304.65
150	398.0
160	519.6
170	672.7
175	760

Decane $C_{10}H_{22}$

t°C.	mm of Hg
0	0.6
5	0.9
10	1.3
15	1.9
20	2.7
25	3.8
30	5.0
35	6.7
40	8.9
45	11.7
50	15.2
55	19.5
60	24.7
65	31.1

Decane (Cont.)

t°C.	mm of Hg
70	38.8
75	48.0
80	59.0
85	71.9
90	87.3
95	105.1
100	125.9
105	150.1
110	178.0
115	210.1
120	247.0
125	289.0
130	336.9
140	453.2
150	601.7
160	789.8

Diethylaniline $C_{10}H_{15}N$

t°C.	mm of Hg
50	1.6
60	2.7
70	4.2
80	6.8
90	10.0
100	16.2
107.2	20
110	25.1
116.4	30
120	38.2.
126.0	45
130	56.2
140	80.6
147.3	100
150	113.5
160	158.0
168.2	200
170	216.0
175.3	250
180	291.7
187.0	350
190	386.9
195.6	450
200	504.0
202.8	550
206.0	600
210	651.0
212.4	700
215.5	760
220	837.0

Dimethylaniline $C_8H_{11}N$

t°C.	mm of Hg
40	2.5
50	4.1
60	6.8
70	10.0

Dimethylaniline (Cont.)

t°C.	mm of Hg
80	15.4
87.5	20
90	24.3
96.3	30
100	37.9
105.6	45
110	56.8
118.3	75
120	81.8
125.7	100
130	116.2
137.1	150
140	163.9
146.0	200
150	227.1
153.4	250
160	307.0
164.5	350
170	408.1
173.6	450
177.4	500
180	536.0
183.9	600
187.0	650
190	695.4
193.1	760
195	787.5

Ethane C_2H_6

t°C.	mm of Hg
−159.5	1
−142.9	10
−129.8	40
−122.0	80
−119.3	100
−110.2	200
−104.3	300
−96.1	500
−92.9	600
−90.1	700
−89.4	730
−88.6	760
−87.7	800
−83.4	1000
−79.7	1200
−75.0	1500
	p in atm
−70	2.58
−65	3.10
−60	3.79
−55	4.61
−50	5.60
−45	6.67
−40	7.80
−35	9.05

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Ethane (Cont.)

t°C.	p in atm
−30	10.5
−25	12.2
−20	14.05
−15	16.0
−10	18.2
− 5	20.7
0	23.6
+15	32.3
32.3	48.2 (c.p.)

Ethyl Acetate $CH_3CO_2C_2H_5$

t°C.	mm of Hg
−20	6.55
−10	12.95
0	24.3
+10	42.7
20	72.8
30	118.7
40	186.2
50	282.2
60	415.4
70	596.3
77.15	760
80	832.7
90	1130
100	1515
110	1995
120	2585
130	3300
140	4164
150	5176
160	6368
170	7736
180	9322
	p in atm
190	14.64
200	17.34
210	20.47
220	24.03
230	28.11
240	32.71
250.1	37.80(c.p.)

Ethyl Alcohol C_2H_5OH

t°C.	mm of Hg
−65	0.021
−60	0.045
−55	0.087
−50	0.12
−45	0.24
−40	0.39
−35	0.63
−30	1.04
−25	1.63
−20	2.5
−15	3.65

Ethyl Alcohol (Cont.)

t°C.	mm of Hg
−10	5.6
− 5	8.3
0	12.2
+ 5	17.3
10	23.6
15	32.2
20	43.9
25	59.0
30	78.8
35	103.7
40	135.3
45	174.0
50	222.2
55	280.6
60	352.7
65	448.8
70	542.5
75	666.1
78.32	760
80	812.6
85	986.3
	p in atm
90	1.562
100	2.228
110	3.107
120	4.243
130	5.685
140	7.486
150	9.700
160	12.39
170	15.61
180	19.44
190	23.94
200	29.20
210	35.31
220	42.38
230	50.53
240	59.92
243.1	63.11 (c.p.)

Ethylaniline $C_6H_5NHC_2H_5$

t°C.	mm of Hg
40	1.1
50	2.4
60	4.0
70	6.1
80	10.0
90	16.0
100	24.0
110	36.4
120	54.5
130	79.0
140	112.0
150	158.0
160	218.8
170	296.0

Ethylaniline (Cont.)

t°C.	mm of Hg
180	394.2
190	518.0
200	674.4
204.7	760
210	867

Ethylbenzene $C_6H_5C_2H_5$

t°C.	mm of Hg.
−9.8	1
+25.9	10
68.6	80
84.7	150
104.7	300
113.8	400
121.3	500
127.6	600
133.2	700
134.7	730
136.2	760
138.1	800
146.7	1000
154.1	1200
163.5	1500

Ethyl Bromide C_2H_5Br

t°C.	mm of Hg
−20	59.2
−10	101.5
0	165.6
+10	257.4
20	387.0
30	564.5
38.4	760
40	801.9
50	1113
60	1512
70	2015
80	2639
90	3399
100	4312
110	5394
120	6658
130	8116
140	9780

Ethyl Chloride C_2H_5Cl

t°C.	mm of Hg
−30	110.2
−20	187.6
−10	302.1
0	465.2
+10	691.1
12.7	760
20	996.2
30	139.9
40	1920

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Ethyl Chloride (Cont.)

t°C.	mm of Hg
50	2579
60	3401
70	4405
80	5614
90	7048
100	8723

Ethylene C_2H_4

t°C.	mm of Hg
−168.3	1
−153.2	10
−137.3	60
−131.8	100
−123.4	200
−113.9	400
−107.6	600
−105.1	700
−104.4	730
−103.7	760
−102.8	800
	p in atm
− 98.9	1.32
− 91.2	1.97
− 80	3.35
− 70	5.07
− 60	7.38
− 50	10.4
− 40	14.2
− 30	18.9
− 20	24.8
− 10	31.9
0	40.6
+ 9.6	50.6 (c.p.)

Ethyl Ether $(C_2H_5)_2O$

t°C.	mm of Hg
−100	0.05
− 80	0.6
− 60	4.1
− 53.5	7.01
− 44.2	14.17
− 40	19.0
− 32.4	31.93
− 30	37.6
− 10	112.3
0	185.3
+ 5	233.2
10	291.7
15	360.7
20	442.2
25	537.0
30	647.3
34.6	760
35	775.5
40	921.3
45	1090
	p in atm
50	1.680
60	2.275
70	3.021
80	3.939
90	5.054
100	6.394
110	7.987
120	9.861
130	12.05
140	14.58
150	17.48
160	20.80
170	24.57
180	28.81
185	31.12
190	33.57
193.8	35.52 (c.p.)

Ethyl Formate $HCO_2C_2H_5$

t°C.	mm of Hg
−20	22.5
−10	41.5
0	72.4
+10	120.3
20	192.5
30	297.5
40	446.7
50	649.4
54.35	760
	p in atm
60	1.208
70	1.667
80	2.251
90	2.983
100	3.883
110	4.978
120	6.290
130	7.846
140	9.674
150	11.80
160	14.26
170	17.07
180	20.28
190	23.91
200	28.00
210	32.59
220	37.70
225	40.47
230	43.39
235.3	46.65 (c.p.)

Ethyl Propionate $C_2H_5CO_2C_2H_5$

t°C.	mm of Hg
−10	4.05
0	8.30
+10	15.55
20	27.75
30	47.75
40	77.9
50	123
60	188
70	280
80	403.6
90	569.5
99.1	760
	p in atm
100	1.027
110	1.383
120	1.828
130	2.376
140	3.042
150	3.840
160	4.788
170	5.904
180	7.206
190	8.727
200	10.45
210	12.45
220	14.73
230	17.33
240	20.28
250	23.62
260	27.40
265	29.48
270	31.69
272.9	33.03 (c.p.)

Formic Acid HCO_2H

t°C.	mm of Hg
10	18.9
20	33.1
30	52.2
40	82.6
50	125.9
60	189.7
70	279.6
80	398.1
90	552.1
100	753.4
100.5	760

Germanium Tetrachloride $GeCl_4$

t°C.	mm of Hg
10.4	0.073
30.0	0.151
50.0	0.33
70.7	0.67
86.0	1.00
185.0	7.00
215.0	15.0
276.9	38.0

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Glycol $C_2H_4(OH)_2$

t°C.	mm of Hg
120	39
130	62
136.7	83
140	96.8
150	147.9
160	218.8
170	316.2
173.2	357.3
180	446.2
186.5	544.3
190	615.9
197.0	760

Gold Au

t°C.	mm of Hg
2315	130
2450	296
2500	400
2610	760

Helium He

t°C.	mm of Hg
−271.655	4.15
−269.614	359.5
−268.925	757.5
−268.23	1329
−267.97	1668
−267.93	1718(c.p.)

n-Heptane C_7H_{16}

t°C.	mm of Hg
−34.0	1
−2.1	10
+22.4	40
36.8	80
41.8	100
58.7	200
69.7	300
84.8	500
90.6	600
95.7	700
97.1	730
98.4	760
100.2	800
108.1	1000
123.4	1500
	p in atm
140	2.933
150	3.663
160	4.539
170	5.542
180	6.699
190	8.020
200	9.554
210	11.31
220	13.30

n-Heptane (Cont.)

t°C.	*p* in atm
230	15.54
240	18.14
250	21.03
260	24.30
266.85	26.84(c.p.)

n-Hexane C_6H_{14}

t°C.	mm of Hg
−53.9	1
−25.0	10
−14.3	20
−7.4	30
−2.3	40
+11.1	80
15.8	100
31.6	200
41.9	300
49.6	400
56.0	500
61.4	600
66.1	700
67.5	730
68.7	760
70.4	800
77.8	1000
84.1	1200
92.1	1500
100	1836
110	2358
120	2982
130	3719
140	4606
150	5610
160	6795
170	8126
180	9650
	p in atm
190	14.99
200	17.57
210	20.50
220	23.82
230	27.57
234.8	29.61(c.p.)

Hydrogen H_2

t°C.	mm of Hg
−259.14	51.4(t.p.)
−258.93	61.8
−258.46	79.9
−257.99	100
−257.77	114.0
−257.21	149.7
−256.61	191.9
−256.19	232.5
−255.16	350.0
−254.73	397.6

Hydrogen (Cont.)

t°C.	mm of Hg
−252.92	728.8
−252.74	760.0
−252.45	823.7
	p in atm
−248.54	2.894
−245.91	4.877
−243.26	7.915
−240.53	11.75
−239.91	12.80(c.p.)

Hydrogen Bromide HBr

t°C.	mm of Hg
−104.2	96
− 96.3	185
− 87.1	284
− 83.0	357
− 76.0	517
− 74.0	575
− 68.6	739
− 68.4	775
	p in atm
− 42.4	3.0
− 21	6.63
+ 5	17.04
36	30.01
70	59.15
84	75.9
90	84.44(c.p.)

Hydrogen Chloride HCl

t°C.	mm of Hg
−117.6	75.6
−108.8	159.3
−100.5	289.9
− 90.69	545.5
− 87.12	674.1
− 85.03	760
	p in atm
− 73.3	1.80
− 70.0	2.03
− 55.0	4.26
− 36.1	8.53
− 35	8.73
− 20.0	14.35
0.0	25.94
+ 25	46.42
50	78.49
51.4	81.55(c.p.)

Hydrogen Cyanide HCN

t°C.	*p* in atm
25.65	1.00
30	1.14
40	1.67
50	2.31
60	3.15

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Hydrogen Cyanide (Cont.)

t°C.	p in atm
70	4.20
80	5.52
90	7.16
100	9.16
110	11.6
120	14.5
130	18.0
140	22.1
150	27.0
160	32.7
170	39.3
180	47.1
183.5	50(c.p.)

Hydrogen Iodide HI

t°C.	mm of Hg
−77.9	74
−68.4	126
−59.5	224
−49.2	450
−43.0	638
−39.5	743
	p in atm
−32.7	1.28
− 6.5	3.1
0	3.97
+ 5.5	4.49
56.5	16.43
100	37.68
138.6	68.34
150.8	82(c.p.)

Hydrogen Selenide H_2Se

t°C.	p in atm
−42	1
+ 0.2	4.5
18	8.6
30.8	12
52	21.5
100	47.1
137	91.0

Hydrogen Sulfide H_2S

t°C.	mm of Hg
−84	193
−81.7	220
−75.1	353
−62.2	676
−59.5	760
	p in atm
−50	1.60
−40	2.50
−30	3.74
−20	5.39
−10	7.53
0	10.2

Hydrogen Sulfide (Cont.)

t°C.	p in atm
+10	13.6
20	17.7
30	22.6
40	28.3
50	35.1
60	43.0
70	52.1
80	62.6
90	74.5
100.4	88.9(c.p.)

Iodine I

t°C.	mm of Hg
−50	0.0_437
−40	0.0_319
−30	0.0_380
−20	0.0030
−10	0.0099
0	0.0299
+10	0.0808
20	0.202
30	0.471
40	1.03
50	2.16
60	4.31
70	8.22
80	15.1
90	26.8
100	45.5
110	74.9
114.15	90.1 (m.p.)
115	92.9
120	111
130	157
140	217
150	294
160	394
170	521
180	679
184.35	760
190	869
553.4	. . . (c.p.)

Iodobenzene C_6H_5I

t°C.	mm of Hg
−30	0.0182
−20	0.0422
−10	0.0920
0	0.189
+10	0.369
+18	0.610
30	1.48
40	2.24
50	4.85
60	8.30
70	13.65

Iodobenzene (Cont.)

t°C.	mm of Hg
80	21.78
90	33.50
100	50.23
110	73.88
120	105.4
130	148.3
140	204.9
150	276.7
160	367.3
170	479.7
180	618.7
188.45	760.0
190	793.0
200	991.0
210	1232
220	1520
230	1855
240	2245
250	2700
260	3220
270	3815
448	33900(c.p.)

Krypton Kr

t°C.	p in atm
−151.8	1.000
−150	1.175
−130	4.315
−110	11.32
− 90	24.27
− 70	41.12
− 62.6	54 24(c.p.)

Lead Pb

t°C.	mm of Hg
808	0.08
996	1.75
1178	16.8
1275	73
1315	105
1365	166
1410	266
1415	289
1525	760
	p in atm
1870	6.3
2100	11.7

Lead Chloride $PbCl_2$

°C.	mm of Hg
400	0.00174
425	0.0058
450	0.0178
475	0.051
500	0.141
925	600
945	754

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Lithium Bromide LiBr

t°C.	mm of Hg
1010	55
1110	140
1114	148
1176	400
1265	763

Magnesium Mg

t°C.	mm of Hg
772	1
1070	760

Manganese Mn

t°C.	mm of Hg
1227	1
1900	760

Mercuric Bromide $HgBr_2$

t°C.	mm of Hg
110	0.18
140	1.33
170	6.30
200	24.1
206	29
229	73
230	78.2
255	174
260	199.9
266	255
290	411.8
320	761.2
331	947

Mercuric Chloride $HgCl_2$

t°C.	mm of Hg
60	0.003
90	0.05
120	0.38
150	2.37
180	9.80
195	20
200	23.8
231	82
260	235.5
280	447.0
283	481
286.1	505
302	723
308	821

Mercuric Iodide HgI_2

t°C.	mm of Hg
100	0.061
140	0.45
170	2.30
177	3
200	9.4
203	10
230	32.4
260	97.9
266	108
300	256.4
320	392.9
353.6	758
360.5	861

Mercurous Chloride Hg_2Cl_2

t°C.	mm of Hg
140	0.038
160	0.15
180	0.45
300	74.4
320	140.5
340	251.4
360	428.0
380	696.8
383.7	760.0

Mercury

(see special table)

Methane CH_4

t°C.	mm of Hg
−205.9	1
−195.5	10
−191.8	20
−189.4	30
−187.7	40
−186.3	50
−185.1	60
−183.1	80
−181.5	100
−178.1	150
−175.6	200
−173.5	250
−171.7	300
−168.8	400
−166.4	500
−164.3	600
−162.5	700
−162.3	710
−162.1	720
−162.0	730
−161.8	740
−161.7	750
−161.5	760
−161.3	770
−161.2	780
−161.0	790
−160.9	800
−159.4	900
−158.0	1000
−155.6	1200
−152.5	1500

t°C.	p in atm
−150	2.35
−140	4.38
−130	7.45
−120	11.84
−110	17.83
−100	25.7
−90	35.9
−82.1	45.8 (c.p.)

Methyl Acetate $CH_3CO_2CH_3$

t°C.	mm of Hg
−20	19
−10	35.1
0	62.1
+10	104.8
20	169.8
30	265.8
40	400.4
50	588.2
57.1	760
60	837.5
70	1.537
80	2.092
90	2.791
100	3.659
110	4.719
120	5.998
130	7.523
140	9.325
150	11.43
160	13.88
170	16.71
180	19.95
190	23.64
200	27.84
210	32.56
220	37.92
230	43.92
233.7	46.31 (c.p.)

Methyl Alcohol CH_3OH

t°C.	mm of Hg
−67.4	0.102
−60.4	0.212
−54.5	0.379
−48.1	0.702
−44.4	0.986
−10	15.5
0	29.6
+10	54.7
20	96.0
30	160
40	260.5
50	406
60	625
64.7	760

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Methyl Alcohol (Cont.)

t°C.	p in atm
70	1.22
80	1.764
90	2.494
100	3.452
110	4.688
120	6.255
130	8.213
140	10.63
150	13.57
160	17.11
170	21.34
180	26.35
190	32.23
200	39.08
210	47.03
220	56.18
225	61.25
230	66.67
235	72.47
240.0	78.67 (c.p.)

Methylamine CH_3NH_2

t°C.	p in atm
−7.55	0.947
−6.6	1.000
0	1.33
+10	2.00
20	2.92
30	4.16
40	5.93
50	7.70
60	10.15
70	13.12
80	16.7
90	20.9
100	25.9
110	31.9
120	38.5
130	46.3
140	55.1
150	65.5
156.9	73.6 (c.p.)

Methylaniline $C_6H_5NHCH_3$

t°C.	mm of Hg
40	1.0
50	2.5
60	4.4
70	7.5
80	12.1
90	19.6
100	31.5
110	49.3
120	72.8
130	104.0
140	147.6

Methylaniline (Cont.)

t°C.	mm of Hg
150	207.1
160	286.0
170	380.9
180	502.6
190	654.5
195.7	760.0
200	843.5

Methyl n-Butyrate $C_3H_7CO_2CH_3$

t°C.	mm of Hg
−10	3.55
0	7.3
+10	13.8
20	24.55
30	41.95
40	69.2
50	109.7
60	167.5
70	250.3
80	361.4
90	507.0
100	700.7
102.7	760
110	941.0
120	1247
130	1624
	p in atm
140	2.749
160	4.378
180	6.603
200	9.587
220	13.53
240	18.67
260	25.18
270	29.36
280	33.62
281.3	34.19 (c.p.)

Methyl *iso*-Butyrate $C_3H_7CO_2CH_3$

t°C.	mm of Hg
−10	6.22
0	12.15
+10	22.4
20	38.9
30	65.45
40	104.7
50	162.0
60	243.8
70	355.2
80	505.0
90	707.0
92.2	760
100	956.0
110	1269
120	1660

Methyl *iso*-Butyrate (Cont.)

t°C.	p in atm
130	2.820
140	3.591
150	4.500
160	5.580
170	6.826
180	8.264
190	9.924
200	11.85
210	14.05
220	16.53
230	19.37
240	22.61
250	26.25
260	30.42
267.55	33.72 (c.p.)

Methyl Chloride CH_3Cl

t°C.	p in atm
−47.29	0.3173
−39.28	0.4869
−30	0.762
−23.47	1.000
−20	1.16
−10	1.72
0	2.49
+10	3.50
20	4.82
30	6.50
35	7.50
40	8.75
50	11.20
60	14.30
70	18.87
80	22.15
90	27.65
100	33.90
110	41.00
130.1	52.60
143.1	65.8 (c.p.)

Methyl Ether $(CH_3)_2O$

t°C.	p in atm
−30	0.759
−25	0.942
−23.7	1.000
−20	1.17
−10	1.74
0	2.54
+10	3.59
20	4.95
30	6.62
40	8.69
50	11.25
60	14.27
70	17.90
80	22.10

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Methyl Ether (Cont.)

t°C.	p in atm
90	26.9
100	32.6
110	39.0
115	42.5
120	46.3
125	50.3
126.9	52.0 (c.p.)

Methyl Ethyl Ether $CH_3OC_2H_5$

t°C.	p in atm
7.5	1.000
10	1.10
20	1.61
30	2.29
40	3.14
50	4.24
60	5.56
70	7.21
80	9.16
90	11.4
100	14.2
110	17.3
120	20.9
130	25.0
140	29.6
150	34.7
160	40.5
164.7	43.4 (c.p.)

Methyl Formate HCO_2CH_3

t°C.	mm of Hg
−20	67.7
−10	117.6
0	195.0
+10	309.4
20	476.4
30	707.9
31.75	760
40	1029
50	1451
	p in atm
60	2.608
70	3.500
80	4.610
90	5.969
100	7.614
110	9.582
120	11.91
130	14.64
140	17.83
150	21.46
160	25.64
170	30.40
180	35.76
190	41.78

Methyl Formate (Cont.)

t°C.	p in atm
200	48.50
210	55.95
214.0	59.15 (c.p.)

Methyl Propionate $C_2H_5CO_2CH_3$

t°C.	mm of Hg
−20	5.6
−10	11.5
0	21.9
+10	38.8
20	66.2
30	107.8
40	169.3
50	256.7
60	380.3
70	548.0
79.75	760
80	771
90	1048
100	1408
	p in atm
110	2.440
120	3.165
130	4.043
140	5.096
150	6.345
160	7.812
170	9.523
180	11.50
190	13.78
200	16.38
210	19.33
220	22.68
230	26.46
240	30.70
245	33.01
250	35.46
255	38.04
257.4	39.34 (c.p.)

Methyl Salicylate $HOC_6H_4CO_2CH_3$

t°C.	mm of Hg
175	215.1
180	249.4
185	287.8
190	330.9
195	378.9
200	432.4
205	491.7
210	557.5
215	630.2
220	710.2
222.9	760
225	798.1

Methyl Sulfide $(CH_3)_2S$

t°C.	mm of Hg
0	172
10	275.4
20	418.8
30	616.6
35.9	760
40	873
	p in atm
50	1.60
60	2.15
70	2.84
80	3.68
90	4.70
100	5.97
110	7.45
120	9.14
130	11.1
140	13.4
150	16.0
160	19.1
170	22.4
180	26.2
190	30.6
200	35.6
210	41.5
220	47.0
229.9	54.6 (c.p.)

Molybdenum Mo

t°C.	mm of Hg
1727	7.89×10^{-7}
1827	6.12×10^{-6}
1927	3.96×10^{-5}
2027	2.14×10^{-4}
2127	1.03×10^{-3}
2293	0.001

Naphthalene $C_{10}H_8$

t°C.	mm of Hg
0	0.006
5	0.010
10	0.021
15	0.035
20	0.054
25	0.082
30	0.133
35	0.210
40	0.320
45	0.518
50	0.815
55	1.26
60	1.83
65	2.65
70	3.95
75	5.43
80	7.4 (m.p.)
85	9.8

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Naphthalene (Cont.)

t°C.	mm of Hg
90	12.6
95	15.5
100	18.5
110	27.3
120	40.2
130	61.9
140	87.37
145	103.0
150	121.0
155	141.8
160	165.5
165	192.4
170	222.7
175	256.9
180	295.2
185	337.9
190	385.5
195	438.2
200	496.5
205	560.8
210	631.6
212	661.8
214	693.1
216	725.3
218	759.3
220	794.2
222	830.3
224	867.8
226	906.6
228	946.7
230	988.2
235	1098
240	1218
245	1347
250	1487
255	1639
260	1802
265	1977
270	2166
275	2368
280	2585
290	3065
300	3613

α-Naphthol $C_{10}H_8O$

t°C.	mm of Hg
110	1.7
120	2.8
130	4.6
140	7.4
150	11.5
160	17.9
170	25.8
180	37.5
190	53.5
200	74.7

α-Naphthol (Cont.)

t°C.	mm of Hg
210	102.9
220	139.0
230	185.2
240	243.2
250	315.4
260	403.7
270	511.3
280	639.5
288	760
290	797.3
295	879.1

β-Naphthol $C_{10}H_8O$

t°C.	mm of Hg
130	3.6
140	5.8
150	9.0
160	13.6
170	20.2
180	29.5
190	42.1
200	59.2
210	81.9
220	111.5
230	149.8
240	198.5
250	259.9
260	336.2
270	430.0
280	544.3
290	685.1
294.85	760
300	848.7

Neon Ne

t°C.	mm of Hg
−257.48	2.4
−252.7	12.8
−248.71	323.5
−247.53	451.6
−246.70	605.2
−245.96	760
	p in atm
−243.73	1.888
−241.81	2.98
−236.86	7.970
−231.75	17.43
−228.70	25.9(c.p.)

Nitric Oxide NO

t°C.	mm of Hg
−198.8	0.059
−190.6	0.460
−186.9	1.224
−176.5	18

Nitric Oxide (Cont.)

t°C.	mm of Hg
−174.4	23
−160.6	168(m.p.)
−157.3	356
−150.2	760
	p in atm
−125.9	9.8
−109.2	27.7
−96.3	55.6
−94	65(c.p.)

Nitrogen N_2

t°C.	mm of Hg
−216.13	21.8
−215.24	28.8
−213.18	46.95
−211.11	71.9
−210.90	96.4(m.p.)
−208.62	120.9
−206.20	177.6
−202.16	329.4
−198.30	561.3
−197.27	631.3
−195.82	760.0
−193.95	938.6
−192.65	1086
	p in atm
−188.92	2.092
−186.92	2.507
−182.47	3.725
−173.62	7.370
−161.31	15.949
−155.51	21.82
−152.11	25.889
−147.17	33.46(c.p.)

Nitrogen Dioxide NO_2

t°C.	mm of Hg
−90	0.0051
−78	0.040
−60	0.500
−45.2	4.84
−36	12.7
−23	53
−15	102
−14	114
−10.8	146(m.p.)
−10	151.6
0	257.5
+12.1	483
21.5	752
	p in atm
39.0	2.20
54.25	4.10
72.7	8.00
93.7	16.1
115.6	31.45
142.75	66.5

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Nitrogen Dioxide NO_2 (Cont.)

	p in atm
157.4	97.2
158.2	100(c.p.)

Nitrous Oxide N_2O

t°C.	mm of Hg
−144.1	1.2
−131.3	7
−117.2	50
− 99.5	300
− 90.6	660
− 90.1	700
− 88.7	760
	p in atm
− 60	5.05
− 34	13.19
0	30.75
+20	49.4
36.5	71.7

n-Octane C_8H_{18}

t°C.	mm of Hg
−14.0	1
+19.2	10
31.5	20
53.8	60
65.7	100
83.6	200
95.2	300
104.0	400
111.2	500
117.4	600
122.7	700
124.2	730
125.7	760
126.1	770
126.6	780
127.1	790
127.5	800
131.9	900
135.9	1000
143.0	1100
152.1	1200
160	1805
170	2255
180	2776
190	3382
200	4099
210	4927
220	5873
230	6948
240	8219
250	9612
	p in atm
260	14.72
270	17.08
280	19.76

n-Octane C_8H_{18} (Cont.)

	p in atm
290	22.54
296.2	24.61(c.p.)

Oxygen O_2

t°C.	mm of Hg
−215.73	2.68
−210.76	9.59
−209.97	11.52
−205.82	28.07
−204.56	36.11
−201.42	64.01
−200.39	75.7
−196.39	129.5
−195.54	162.15
−192.73	239.5
−192.05	263.2
−189.47	366.2
−187.61	457.6
−186.95	493.3
−183.95	687.8
−183.00	760.0
−182.44	807.18
	p in atm
−154.91	9.096
−149.29	12.506
−138.99	21.328
−135.96	24.528
−130.68	30.914
−125.32	38.571
−121.37	45.142
−118.82	49.713(c.p.)

Ozone O_3

t°C.	mm of Hg
−193.1	0.015
−183.1	0.17
−173.1	1.3
−163.1	6.87
−153.1	25.4
−143.1	74.6
−133.1	182.8
−123.1	387.7
−112.4	760
	p in atm
−5	67(c.p.)

Phenol C_6H_5OH

t°C.	mm of Hg
44.8	1
55.8	3
62.5	5
73.5	10
80.5	15
85.8	20
90.2	25
93.8	30

Phenol (Cont.)

t°C.	mm of Hg
97.0	35
99.8	40
102.3	45
104.7	50
113.7	75
120.2	100
131.0	150
139.0	200
145.5	250
151.0	300
155.8	350
160.0	400
163.8	450
167.0	500
170.1	550
173	600
176	650
179	700
181.4	760

Phosgene CCl_2O

t°C.	*p* in atm
7.95	1.00
10	1.08
20	1.55
30	2.17
40	2.97
50	3.99
60	5.25
70	6.81
80	8.68
90	10.94
100	13.6
110	16.7
120	20.3
130	24.4
140	29.1
150	34.4
160	40.4
170	47.0
180	54.4
182	56(c.p.)

Phosphine PH_3

t°C.	mm of Hg
−132.7	30.2
−115.15	135.3
−111.6	174.8
−95.86	481.7
−89.71	673.9
	p in atm
+25	38.5
35	46.5
45	57
51.3	64.5(c.p.)

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Phosphonium Bromide PH_4Br

t°C.	mm of Hg
−80	1
−50	3
−24	8
− 9.8	25
0	56
+ 7.5	101
19.0	222
19.8	266.8
34.3	602
38.8	794

Phosphonium Chloride PH_4Cl

t°C.	mm of Hg
−80	9.6
−60	62.0
−45	186.4
−40	284
−30	603
−20	1260
	p in atm
0	8.9
+12.8	17.4
18.2	22.6
22.8	32.0
28.2	48.7 (m.p.)
30.0	50.2
40 3	60.5
49.1	72.7 (c.p.)

Phosphorus P

t°C.	mm of Hg
(white)	
20	0.0253
30	0.0724
40	0.1221
44.1	0.173 (m.p.)
69.92	0.823
100.11	3.66
119.85	8.60
150.0	27.20
200	110
210	152
252	410
280.5	760
	p in atm
331.8	2.47
355.7	3.88
504	23.2
550	33.0
581	41.1
(solid violet)	
308.5	0.07
379.5	0.35
433.5	1.49
486.5	5.46
522.5	11.61

Phosphorus P (Cont.)

t°C.	*p* in atm
578	34.35
589.5	43.1 (m.p.)
593	44.2
608	49.0
634	58.6
695	82.2 (c.p.)

Phosphorus Pentachloride PCl_5

t°C.	mm of Hg
98.08	31
101.4	37.58
108.31	60
122.2	133.4
126.1	158
136.7	266.1
143.68	347
157.63	608
162.58	748
166.89	915

Platinum Pt

t°C.	mm of Hg
1427	4.65×10^{-7}
1527	3.5×10^{-6}
1627	2.13×10^{-5}
1727	1.07×10^{-4}

Potassium K

t°C.	mm of Hg
162	0.001
249.5	0.05
268.8	0.11
317.3	0.57
344	1.0
364	1.86
398.6	4.01
758	760

Potassium Chloride KCl

t°C.	mm of Hg
1123	71
1202	130.7
1225	157
1279	256
1364	526
1414	756

Propane C_3H_8

t°C.	mm of Hg
−128.9	1
−108.5	10
−92.4	40
−87.0	60
−79.6	100
−61.2	300
−47.3	600

Propane (Cont.)

t°C.	mm of Hg
−43.9	700
−42.1	760
−40.9	800
−35.7	1000
−31.2	1200
−25.4	1500
	p in atm
−15	3.1
−11	3.6
−5	4.1
−2	4.8
+1	5.1
5.5	5.9
12.5	7.1
22	9.0
53	17
85	35
96.85	42.1 (c.p.)

n-Propyl Alcohol C_3H_7OH

t°C.	mm of Hg
−43.3	0.068
−38.2	0.134
−32.8	0.219
−29.7	0.295
−26.2	0.403
−23.1	0.549
−18.4	0.815
−15.7	1.036
−12.9	1.310
0	3.44
+10	7.26
20	14.5
30	27.6
40	50.2
50	87.2
55	113.6
60	147.0
65	186.8
70	239.0
75	301.0
80	376
85	466
90	574
95	697
97.19	760
100	842.5
105	1097
110	1206
115	1428
120	1683
130	2293
	p in atm
140	4.045
150	5.332
160	6.916

VAPOR PRESSURES OF VARIOUS SUBSTANCES

n-Propyl Alcohol (Cont.)

t°C.	p in atm
170	8.809
180	11.03
190	13.77
200	16.84
210	20.49
220	24.58
230	29.15
240	34.47
250	40.51
260	47.50
263.7	49.95(c.p.)

n-Propylbenzene $C_6H_5C_3H_7$

t°C.	mm of Hg
6.3	1
43.4	10
65.3	30
81.1	60
94.0	100
113.5	200
126.2	300
135.7	400
143.6	500
150.2	600
156.0	700
157.7	730
159.2	760
161.2	800
170.3	1000
178.0	1200
187.9	1500

Propyl Formate $HCO_2C_3H_7$

t°C.	mm of Hg
−10	11.4
0	21.4
+10	37.85
20	63.9
30	104.1
40	163.6
50	249.4
60	364.9
70	523.9
80	734.5
81.1	760
90	1003
100	1343
110	1772
120	2288
130	2914
140	3673
150	4560
160	5617
180	8175
	p in atm
200	15.16

Propyl Formate (Cont.)

t°C.	p in atm
220	20.88
230	24.24
240	28.23
250	32.60
260	37.43
264.85	40.06 (c.p.)

Quinoline C_9H_7N

t°C.	mm of Hg
80	3.1
90	5.2
100	8.5
110	13.4
120	20.7
130	31.0
140	45.3
150	65.3
160	91.4
170	127.0
180	172.4
190	230.4
200	303.4
210	394.2
220	505.7
222	530.8
224	556.9
226	584.0
228	612.1
230	641.3
232	671.6
234	703.1
236	735.7
237.2	760
238	769.5
240	804.6

Radon (Niton) Rn

t°C.	p in atm
−70.5	0.658
−61.8	1.000
−50	2.065
−38.6	2.64
−20	5.26
−10.3	6.59
+17.2	13.2
48.6	26.4
70	37.67
91.3	52.8
100	59.43
104.4	62.44 (c.p.)

Rubidium Rb

t°C.	mm of Hg
250	0.06
292	0.98
331.5	2.80

Rubidium Rb (Cont.)

t°C.	mm of Hg
366	5.82
698	760

Rubidium Bromide RbBr

t°C.	mm of Hg
1050	55
1100	94.9
1117	104
1147	140
1223	268.8
1295	545
1358	767.5
1365	785

Rubidium Chloride RbCl

t°C.	mm of Hg
1142	55
1162	130.1
1241	262.8
1300	390
1327	530.2
1395	758

Rubidium Iodide RbI

t°C.	mm of Hg
1035	66.2
1080	125.4
1144	221
1169	246.9
1261	522.0
1325	760

Selenium Se

t°C.	mm of Hg
193.6	0.00084
200	0.0015
205	0.0022
210	0.0032
215	0.0047
217.4	0.0055 (m.p.)
219	0.0059
238	0.0138
390	3.0
440	11.0
500	42.0
620	313
660	550
688	760
710	970

Selenium Dioxide SeO_2

t°C.	mm of Hg
70	12.5
72	13.43
112.5	21.28

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Selenium Dioxide (Cont.)

t°C.	mm of Hg
180.9	39.0
199	40.6
213.5	50.12
232	67.8
260	112.7
299	450.6
311	610.9
317	760.0
319.9	849.0

Silane SiH_4

t°C.	mm of Hg
−160	11
−150	41
−140	102
−130	230
−120	470
−115	630
−112	750

Silicon Si

t°C.	mm of Hg
719	0.001
1205	0.87
1219	1.0
1315	2.3
2620	760

Silicon Tetrachloride $SiCl_4$

t°C.	mm of Hg
−50	4
−40	7.5
−30	14
−20	26.5
−10	46.5
0	78.0
+10	125.9
20	195.9
30	294.5
40	429.1
50	607.5
56.8	760
60	837.2

Silver Ag

t°C.	mm of Hg
1178	0.144
1316	0.82
1435	3.9
1660	102
1758	200
1780	263
1940	744
1955	760

Sodium Na

t°C.	mm of Hg
238	0.001
350	0.08
355	0.12
397	0.26
441	1.0
473	2.01
500	3.59
540	7.90
565	12.41
882	760

Sodium Chloride NaCl

t°C.	mm of Hg
1156	50.3
1189	82.5
1298	206.9
1331	335
1346	385
1439	760

Stannic Chloride $SnCl_4$

t°C.	mm of Hg
−69.7	0.145
−65.3	0.224
−56.8	0.504
−50.1	0.925
−10	2.78
0	5.53
+10	10.33
20	18.58
30	31.3
40	50.82
60	122.2
80	256.7
90	360.5
100	496.0
120	895.4
	p in atm
150	2.49
200	6.77
250	11.55
280	22.96
318.7	36.95(c.p.)

Strontium Sr

t°C.	mm of Hg
713.4	0.001
899	1
1154	760

Sulfur S

t°C.	mm of Hg
50	0.0002
60	0.0004
70	0.0010
80	0.0023

Sulfur S (Cont.)

t°C.	mm of Hg
90	0.0049
100	0.010
110	0.021
114.5	0.028(m.p.)
120	0.040
130	0.074
140	0.13
150	0.22
160	0.37
170	0.59
180	0.91
190	1.4
200	2.1
210	3.1
220	4.4
230	6.3
240	8.7
250	12
260	16
270	21
280	28
290	37
300	48
310	60
320	76
330	95
340	118
350	146
360	179
370	218
380	263
390	325
400	376
410	446
420	525
430	613
440	711
444.6	760
450	821
460	948
470	1093
480	1257
490	1441
500	1647
510	1876
520	2130
530	2410
540	2718
550	3055
560	3423
570	3824
1040	. . (c.p.)

Sulfur Dioxide SO_2

t°C.	*p* in atm
−72.5	0.02145

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Sulfur Dioxide (Cont.)

t°C.	p in atm
−70	0.02635
−68	0.03095
−66	0.03623
−64	0.04227
−62	0.04916
−60	0.05699
−58	0.06586
−56	0.07589
−54	0.08719
−52	0.09989
−50	0.11411
−48	0.1300
−46	0.1477
−44	0.1674
−42	0.1893
−40	0.2135
−38	0.2401
−36	0.2695
−34	0.3018
−32	0.3371
−30	0.3759
−28	0.4181
−26	0.4641
−24	0.5142
−22	0.5686
−20	0.6274
−18	0.6911
−16	0.7599
−14	0.8340
−12	0.9138
−10	0.9995
− 8	1.091
− 6	1.190
− 4	1.295
− 2	1.408
0	1.529
+ 2	1.657
4	1.793
6	1.938
8	2.092
10	2.256
12	2.429
14	2.613
16	2.807
18	3.012
20	3.228
22	3.456
24	3.697
26	3.951
28	4.217
30	4.498
32	4.793
34	5.102
36	5.427
38	5.768
40	6.125

Sulfur Dioxide (Cont.)

t°C.	p in atm
42	6.499
44	6.890
46	7.300
48	7.729
50	8.176
55	9.385
60	10.729
65	12.219
70	13.867
75	15.684
80	17.682
85	19.872
90	22.268
95	24.878
100	27.714
105	30.784
110	34.091
115	37.641
120	41.432
125	45.457
130	49.705
135	54.157
140	58.783
145	63.549
150	68.405
155	73.296
157	75.245
157.2	77.7 (c.p.)

Sulfur Trioxide SO_3

t°C.	mm of Hg
24	240
36	476
44.6	760
	p in atm
60	2.0
80	4.3
100	8.0
110	10.4
120	13.3
130	15.7
140	20.6
150	25.1
160	30.3
170	36.4
180	43.4
190	51.5
200	61.1
210	72.5
218.3	83.6 (c.p.)

Tellurium Hydride TeH_2

t°C.	mm of Hg
−60	34
−50	79
−45.4	102 (m.p.)
−40	139
−30	234
−20	370
−10	555
0	808

Thallium Tl

t°C.	mm of Hg
413	0.001
634	0.056
748	1.0
783	1.3
950	10.5
1000	17.5
1100	37.0
1200	78.0
1650	760

Tin Sn

t°C.	mm of Hg
1130	0.13
1360	1.5
1970	101
2005	126
2100	262
2160	372
2270	760

Toluene $C_6H_5CH_3$

t°C.	mm of Hg
−26.7	1
+6.4	10
18.4	20
31.8	40
40.3	60
46.7	80
51.9	100
61.9	150
69.5	200
75.6	250
80.9	300
89.5	400
96.5	500
102.5	600
107.8	700
108.7	720
109.2	730
109.7	740
110.2	750
110.6	760
111.1	770
111.5	780
112.0	790

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Toluene (Cont.)

t°C.	mm of Hg
112.4	800
116.7	900
120.6	1000
127.5	1200
136.4	1500

o-Toluidine $H_2NC_6H_4CH_3$

t°C.	mm of Hg
40	1.1
50	2.1
60	3.7
70	6.4
80	10.5
90	17.3
100	27.2
110	41.7
120	62.3
130	91.2
140	129.9
150	180.5
154.0	200
160	250.2
166.2	300
170	338.0
176.2	400
180	450.2
183.9	500
187.3	550
190	590.7
193.2	650
196.2	700
199.84	760
200	762.9
205	863.9

m-Toluidine $H_2NC_6H_4CH_3$

t°C.	mm of Hg
45	1.3
50	1.9
60	3.4
70	5.7
80	9.4
90	15.2
100	23.9
110	36.7
120	54.8
130	80.4
140	115.5
150	162.6
157.6	200
160	224.9
164.1	250
170	305.9
175.1	350
180	410.6
183.8	450

m-Toluidine (Cont.)

t°C.	mm of Hg
187.5	500
190	541.9
194.0	600
196.8	650
200	706.7
202.86	760
205	803.4

p-Toluidine $H_2NC_6H_4CH_3$

t°C.	mm of Hg
40	1.1
50	2.0
60	3.7
70	6.3
80	10.5
90	16.9
100	26.6
110	40.6
120	60.6
130	88.4
140	126.3
150	177.2
154.7	200
160	244.0
166.9	300
170	330.6
176.9	400
180	441.3
184.6	500
188.0	550
190	580.4
191.1	600
193.9	650
196.9	700
200.35	760
205	854.2

Trinitrotoluene
$C_6H_2CH_3(NO_2)_3$

t°C.	mm of Hg
80	0.042
85	0.053
90	0.067
95	0.085
100	0.106

Tungsten W

t°C.	mm of Hg
2500	2.94×10^{-7}
2700	6.95×10^{-6}
2900	1.06×10^{-4}
3100	1.14×10^{-3}
4450	1.0
6383	760

Urethane $H_2NCO_2C_2H_5$

t°C.	mm of Hg
103	54
120	103
130	146
140	203
150	283
160	392
170	551
176.8	697

n-Valeric Acid $C_4H_9CO_2H$

t°C.	mm of Hg
45	0.1
50	0.5
60	2.07
70	4.8
80	9.3
90	17.0
100	28.2
110	48.6
120	70.5
130	106.9
140	159.6
150	234.5
160	336.1
165.0	400
170	475.3
174.5	550
177.0	600
180	660.7
181.8	700
184.4	760

iso-Valeric Acid $C_4H_9CO_2H$

t°C.	mm of Hg
10	0.17
20	0.37
30	0.76
40	1.5
50	2.9
60	5.3
70	9.4
80	16.4
90	27.3
100	44.2
110	69.8
120	107.4
130	159.8
140	236.0
150	338.3
160	654.9

Water H_2O
See Special Table

Xenon Xe

t°C.	p in atm
−109.1	1.000

VAPOR PRESSURES OF VARIOUS SUBSTANCES

Xenon Xe (Cont.)

t°C.	p in atm
−100	1.629
−80	4.064
−60	8.570
−40	15.85
−20	26.73
0.0	41.24
+16.6	58.22 (c.p.)

o-Xylene $C_6H_4(CH_3)_2$

t°C.	mm of Hg
−3.8	1
+32.1	10
64.5	50
81.3	100
100.2	200
112.4	300
121.7	400
129.3	500
135.7	600
141.3	700
142.9	730
144.4	760
146.4	800
155.1	1000
162.5	1200
172.1	1500

m-Xylene $C_6H_4(CH_3)_2$

t°C.	mm of Hg
−6.9	1
+28.3	10
60.3	50
76.8	100
95.5	200
107.6	300
116.7	400
124.2	500
130.5	600
136.1	700
137.6	730
139.1	760
141.0	800
149.6	1000
157.0	1200
166.4	1500

p-Xylene $C_6H_4(CH_3)_2$

t°C.	mm of Hg
−8.1	1
+27.3	10
59.4	50
75.9	100
94.6	200
106.7	300
115.9	400
123.4	500
129.7	600
135.3	700
136.9	730
138.4	760
140.3	800
148.9	1000
156.3	1200
165.7	1500

Zinc Zn

t°C.	mm of Hg
256.8	0.00012
291.4	0.00084
296.3	0.001
363.0	0.0182
419.4	0.143 (m.p.)
490.7	1.069
544.5	3.687
588.8	9.051
632.3	20
641.1	23.02
720.4	81.42
836.0	356.2
905.7	760
	p in atm
950	1.515
980	2.0
1120	6.3
1280	21.5
1510	53.0

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Acetic Acid CH_3CO_2H

°C	atm	*d liq*, g/cc	*d vap*, g/cc
118.5(*l*)	1.000	0.9380	0.003150
120	1.058	0.9362	0.003271
130	1.426	0.9235	0.004275
140	1.884	0.9091	0.005515
150	2.452	0.8963	0.00703
160	3.149	0.8829	0.00887
170	3.994	0.8694	0.01084
180	5.014	0.8555	0.01370
190	6.233	0.8413	0.01681
200	7.682	0.8265	0.02052
210	9.391	0.8109	0.02488
220	11.39	0.7941	0.03021
230	13.73	0.7764	0.03626
240	16.42	0.7571	0.04327
250	19.52	0.7364	0.05163
260	23.07	0.7136	0.06165
270	27.11	0.6900	0.07365
280	31.67	0.6629	0.0883
290	36.79	0.6334	0.1073
300	42.54	0.5950	0.1331
310	48.93	0.5423	0.1718
320	56.01	0.4615	0.2417
321.6	57.21	0.3506	0.3506

Acetone CH_3COCH_3

°C	atm	*d liq*, g/cc	*d vap*, g/cc
56.1(*l*)	1.000	0.750	0.002
60	1.14	0.746	0.003
70	1.58	0.734	0.003
80	2.12	0.719	0.004
90	2.81	0.706	0.005
100	3.67	0.693	0.007
110	4.74	0.679	0.009
120	6.01	0.665	0.011
130	7.53	0.650	0.013
140	9.33	0.634	0.016
150	11.5	0.618	0.020
160	13.9	0.601	0.024
170	16.6	0.588	0.030
180	20.0	0.568	0.039
190	23.8	0.540	0.050
200	28.0	0.514	0.065
210	32.7	0.482	0.085
220	38.1	0.443	0.110
230	44.1	0.393	0.152
235	47.0	0.268	0.268

Acetonitrile CH_3CN

°C	atm	*d liq*, g/cc	*d vap* , g/cc
80(*l*)	......	0.717	0.001
90	......	0.706	0.002
100	......	0.694	0.002
110	......	0.682	0.003
120	......	0.670	0.004
130	......	0.658	0.005
140	......	0.646	0.007
150	......	0.633	0.009
160	......	0.620	0.011
170	......	0.605	0.013
180	......	0.590	0.015
190	......	0.573	0.018
200	......	0.555	0.022
210	......	0.536	0.027
220	......	0.514	0.034
230	......	0.492	0.042
240	......	0.467	0.053
250	......	0.439	0.068
260	......	0.399	0.091
270	......	0.342	0.139
274.7	47.7	0.240	0.240

Acetylene C_2H_2

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−84.0(s)	1.00	....	....
−81.5(t.p)	1.20	0.618	0.0021
−70(*l*)	2.20	0.601	0.0036
−60	3.48	0.585	0.0056
−50	5.3	0.568	0.0085
−40	7.7	0.551	0.012
−30	10.9	0.532	0.017
−20	14.9	0.512	0.024
−10	20.0	0.490	0.033
0	26.3	0.464	0.045
+10	33.9	0.435	0.060
20	43.1	0.400	0.082
30	54.1	0.346	0.122
36.0	61.7	0.230	0.230

Ammonia NH_3

°C	atm	*V liq*, cc/g	*V vap*, cc/g
−75(*l*)	0.0738	1.3681	12781
−70	0.1078	1.3788	8976.2
−65	0.1541	1.3898	6429.9
−60	0.2161	1.4010	4690.3
−55	0.2977	1.4126	3479.0
−50	0.4034	1.4245	2620.7
−45	0.5383	1.4367	2002.4
−40	0.7083	1.4493	1550.2
−35	0.9197	1.4623	1214.8
−30	1.1799	1.4757	962.82
−25	1.4963	1.4895	771.06
−20	1.8774	1.5037	623.48
−15	2.3322	1.5185	508.68
−10	2.8703	1.5338	418.46
− 5	3.5020	1.5496	346.90
0	4.2380	1.5660	289.62
+ 5	5.0895	1.5831	243.39
10	6.0685	1.6008	205.79
15	7.1875	1.6193	174.97
20	8.4585	1.6386	149.53

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Ammonia (Cont.)

°C	atm	*V liq*, cc/g	*V vap*, cc/g
25	9.8955	1.6588	128.40
30	11.512	1.6800	110.73
35	13.321	1.7023	95.865
40	15.339	1.7257	83.290
45	17.580	1.7504	72.594
50	20.059	1.7766	63.448
55	22.793	1.8044	....
60	25.797	1.8341	48.8
65	29.089	1.8658	....
70	32.687	1.9000	37.7
75	36.626	1.9370	....
80	40.902	1.9774	29.3
85	45.539	2.0217	....
90	50.558	2.0708	22.8
95	55.977	2.1258	....
100	61.816	2.1885	17.6
105	68.096	2.2612	....
110	74.837	2.3478	....
115	82.064	2.4548	....
120	89.802	2.5948	....
125	98.075	2.7979	....
130	106.913	3.1769	....
132.9	112.3	4.2830	4.2830

Argon A

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−183.15(*l*)	....	1.37396	0.00801
−175.39	....	1.32482	0.01457
−161.23	7.4332	1.22414	0.03723
−150.76	....	1.13851	0.06785
−135.51	....	0.97385	0.15994
−125.17	....	0.77289	0.29534
−122.44	47.996	0.53078	0.53078

Benzene C_6H_6

°C	atm	*d liq*, g/cc	*d vap*, g/cc
80.2(*l*)	1.000	......	......
90	1.326	0.8041	0.0036
100	1.757	0.7927	0.0047
110	2.290	0.7809	0.0060
120	2.934	0.7692	0.0077
130	3.71	0.7568	0.0096
140	4.63	0.7440	0.0118
150	5.70	0.7310	0.0144
160	6.97	0.7185	0.0173
170	8.40	0.7043	0.0209
180	10.03	0.6906	0.0249
190	11.90	0.6758	0.0298
200	14.01	0.6605	0.0355
210	16.38	0.6432	0.0421
220	19.11	0.6255	0.0502
230	22.13	0.6065	0.0598
240	25.46	0.5851	0.0714
250	29.21	0.5609	0.0855
260	33.36	0.5328	0.1038
270	37.96	0.4984	0.1287
280	43.16	0.4514	0.1660
288.5	47.90	0.3045	0.3045

Bromobenzene C_6H_5Br

°C	atm	*d liq*, g/cc	*d vap*, g/cc
156.15(*l*)	1.000	......	......
160	1.11	1.2994	0.0052
170	1.42	1.2847	0.0066
180	1.78	1.2697	0.0081
190	2.22	1.2534	0.0099
200	2.73	1.2385	0.0121
210	3.32	1.2210	0.0146
220	4.02	1.2037	0.0174
230	4.82	1.1876	0.0208
240	5.74	1.1689	0.0248
250	6.79	1.1510	0.0293
260	8.00	1.1310	0.0343
270	9.35	1.1099	0.0402
397	44.61	0.4859	0.4859

n-Butyric Acid $C_3H_7CO_2H$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
160(*l*)	......	0.818	0.003
170	......	0.807	0.003
180	......	0.796	0.004
190	......	0.784	0.005
200	......	0.771	0.007
210	......	0.758	0.009
220	......	0.744	0.012
230	......	0.730	0.015
240	......	0.715	0.018
250	......	0.700	0.022
260	......	0.685	0.027
270	......	0.669	0.032
280	......	0.652	0.038
290	......	0.633	0.045
300	......	0.612	0.053
355	......	0.302	0.302

iso-Butyric Acid $C_3H_7CO_2H$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
150(*l*)	......	0.812	0.003
160	......	0.801	0.004
170	......	0.789	0.005
180	......	0.777	0.007
190	......	0.764	0.009
200	......	0.751	0.012
210	......	0.737	0.015
220	......	0.723	0.018
230	......	0.708	0.022
240	......	0.692	0.026
250	......	0.675	0.032
260	......	0.657	0.039

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

iso—Butyric Acid (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
270	......	0.638	0.047
280	......	0.617	0.056
290	......	0.594	0.067
300	......	0.569	0.080
336	......	0.304	0.304

Carbon Dioxide CO_2

°C	atm	*V liq*, cc/g	*V vap*, cc/g
−56.6(*l*)	5.1148	0.8482	.....
−56	5.2485	0.8496	.....
−54	5.7156	0.8554	.....
−52	6.2139	0.8606	.....
−50	6.7446	0.8658	.....
−48	7.3089	0.8718	.....
−46	7.9078	0.8780	.....
−44	8.5426	0.8834	.....
−42	9.2147	0.8897	.....
−40	9.9251	0.8961	.....
−38	10.675	0.9025	.....
−36	11.466	0.9091	.....
−34	12.299	0.9158	.....
−32	13.176	0.9226	.....
−30	14.099	0.9302	27.19
−28	15.067	0.9381	25.40
−26	16.084	0.9452	23.71
−24	17.150	0.9533	22.11
−22	18.267	0.9615	20.62
−20	19.437	0.9699	19.22
−18	20.661	0.9794	17.95
−16	21.940	0.9892	16.78
−14	23.277	0.9990	15.70
−12	24.673	1.0091	14.73
−10	26.129	1.0194	13.83
− 8	27.648	1.0309	13.01
− 6	29.231	1.0428	12.25
− 4	30.879	1.0548	11.54
− 2	32.595	1.0683	10.88
0	34.379	1.0810	10.26
+ 2	36.235	1.0953	9.68
4	38.163	1.1099	9.13
6	40.166	1.1261	8.59
8	42.247	1.1442	8.06
10	44.406	1.1628	7.57
12	46.648	1.1834	7.04
14	48.974	1.2063	6.58
16	51.388	1.2330	6.14
18	53.895	1.2626	5.68
20	56.495	1.2953	5.26
22	59.197	1.3351	4.83
24	62.006	1.3831	4.39
26	64.928	1.4430	3.97
28	67.971	1.5267	3.53
30	71.143	1.6722	3.00
31.1	72.947	2.1547	2.15

Carbon Disulfide CS_2

°C	atm	*d liq*, g/cc	*d vap*, g/cc
46.25(*l*)	1.00	1.225	....
52.17	......	....	0.003559
53.53	......	....	0.003709
57.08	......	....	0.004064
59.95	......	....	0.004452
64.24	......	....	0.005000
66.96	......	....	0.005376
70.10	......	....	0.005797
75.55	......	....	0.006658
78.82	......	....	0.007288
85.03	......	....	0.008361
99.24	......	....	0.01167
130.48	......	....	0.02166
159.10	......	....	0.03484
171.52	......	....	0.04185
183.48	......	....	0.05846
193.05	......	....	0.07309
209.32	.....	......	0.09907
217.35	......	....	0.1163
229.46	......	....	0.1420
262.8	......	....	0.2570
271.6	......	....	0.3215
273.0	76	0.3679	0.3679

Carbon Monoxide CO

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−192(*l*)	1.0	0.803	0.0044
−190	1.2	0.794	0.0054
−180	3.2	0.748	0.013
−170	6.7	0.697	0.027
−160	12.4	0.639	0.046
−150	20.9	0.560	0.088
−140	33.2	0.420	0.190
−139	35	0.303	0.303

Carbon Tetrachloride CCl_4

°C	atm	*d liq*, g/cc	*d vap*, g/cc
76.75(*l*)	1.000	....	....
80	1.103	1.4765	0.0061
90	1.463	1.4554	0.0080
100	1.917	1.4343	0.0103
110	2.474	1.4124	0.0131
120	3.145	1.3902	0.0164
130	3.947	1.3680	0.0204
140	4.901	1.3450	0.0250
150	5.993	1.3215	0.0304
160	7.283	1.2983	0.0365
170	8.737	1.2734	0.0437
180	10.39	1.2470	0.0525
190	12.26	1.2192	0.0625
200	14.39	1.1888	0.0742
210	16.79	1.1566	0.0879
220	19.46	1.1227	0.1040
230	22.45	1.0857	0.1232
240	25.79	1.0444	0.1464

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Carbon Tetrachloride (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
250	29.49	0.9980	0.1754
260	33.60	0.9409	0.2146
270	38.16	0.8666	0.2710
280	43.16	0.7634	0.3597
283.15	45.00	0.5576	0.5576

Chlorine Cl_2

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−34.6(*l*)	1.00	1.561	....
−30	1.23	1.550	....
−20	1.84	1.524	....
−10	2.63	1.496	....
0	3.66	1.468	0.0128
+10	4.95	1.438	0.0175
20	6.62	1.408	0.0226
30	8.75	1.377	0.0300
40	......	1.344	0.0384
50	14.7	1.310	0.0486
60	......	1.275	0.0600
70	23.0	1.240	0.0740
80	......	1.199	0.0910
90	34.5	1.156	0.1125
100	......	1.109	0.136
110	50.8	1.059	0.164
120	......	0.998	0.206
130	71.60	0.920	0.258
140	......	0.750	0.405
146	93.5	0.573	0.573

Chlorobenzene C_6H_5Cl

°C	atm	*d liq*, g/cc	*d vap*, g/cc
132(*l*)	1.000	....	....
140	1.236	0.9723	0.0043
150	1.590	0.9599	0.0054
160	2.020	0.9480	0.0068
170	2.526	0.9354	0.0084
180	3.118	0.9224	0.0102
190	3.816	0.9091	0.0125
200	4.632	0.8955	0.0151
210	5.566	0.8815	0.0181
220	6.651	0.8672	0.0214
230	7.882	0.8518	0.0254
240	9.276	0.8356	0.0300
250	10.88	0.8196	0.0354
260	12.70	0.8016	0.0417
270	14.73	0.7834	0.0492
359.2	44.61	0.3654	0.3654

Cyclohexane C_6H_{12}

°C	atm	*d liq*, g/cc	*d vap*, g/cc
80.75(*l*)	1.000	0.7199	0.0029
90	1.307	0.7098	0.0038
100	1.716	0.6988	0.0049
110	2.220	0.6883	0.0063
120	2.816	0.6775	0.0080

Cyclohexane (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
130	3.536	0.6667	0.0100
140	4.414	0.6553	0.0123
150	5.447	0.6435	0.0150
160	6.632	0.6313	0.0184
170	8.020	......	......
180	9.586	0.6060	0.0265
190	11.36	0.5917	0.0317
200	13.33	0.5773	0.0380
210	15.56	0.5614	0.0450
220	18.01	0.5443	0.0534
230	20.80	0.5257	0.0632
240	23.87	0.5058	0.0746
250	27.24	0.4824	0.0896
260	31.04	0.4537	0.1097
270	35.30	0.4154	0.1401
281.0	40.57	0.2703	0.2703

Diethylamine $NH(C_2H_5)_2$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
55.4(*l*)	1.000	0.668	0.003
60	1.16	0.663	0.003
70	1.59	0.652	0.004
80	2.13	0.640	0.005
90	2.82	0.628	0.006
100	3.67	0.616	0.008
110	4.70	0.604	0.011
120	5.92	0.591	0.014
130	7.39	0.577	0.018
140	9.10	0.562	0.022
150	11.1	0.546	0.028
160	13.4	0.528	0.035
170	15.9	0.510	0.043
180	18.9	0.489	0.053
190	22.2	0.466	0.065
200	25.8	0.438	0.080
210	30.0	0.400	0.103
220	34.4	0.339	0.150
223.5	36.2	0.246	0.246

Ethane C_2H_6

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−88.62(*l*)	1.000	0.546	0.00206
−80	1.556	0.535	0.00311
−70	2.471	0.522	0.00478
−60	3.743	0.509	0.00707
−50	5.449	0.496	0.0101
−40	7.672	0.482	0.0141
−30	10.50	0.468	0.0193
−20	14.02	0.453	0.0260
−10	18.34	0.435	0.0348
0	23.56	0.416	0.0463
+10	29.83	0.393	0.0619
20	37.28	0.363	0.085
30	46.1	0.30	0.14
32.3	48.2	0.220	0.220

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Ethyl Acetate $CH_3CO_2C_2H_5$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
77.15(*l*)	1.000	0.8283	0.003230
80	1.093	0.8245	0.003495
90	1.494	0.8112	0.004677
100	2.000	0.7972	0.006158
110	2.630	0.7831	0.008006
120	3.404	0.7683	0.01030
130	4.340	0.7533	0.01314
140	5.461	0.7378	0.01650
150	6.789	0.7210	0.02070
160	8.349	0.7033	0.02577
170	10.17	0.6848	0.03165
180	12.27	0.6653	0.03883
190	14.68	0.6441	0.04751
200	17.45	0.6210	0.05797
210	20.59	0.5944	0.07128
220	24.15	0.5648	0.08905
230	28.16	0.5281	0.1131
240	32.68	0.4778	0.1499
245	35.14	0.4401	0.1802
250.1	37.80	0.3077	0.3077

Ethyl Alcohol C_2H_5OH

°C	atm	*d liq*, g/cc	*d vap*, g/cc
78.3(*l*)	1.000	0.7365	0.00165
80	1.069	0.7348	0.00174
90	1.562	0.7251	0.00250
100	2.228	0.7157	0.00351
110	3.107	0.7057	0.00486
120	4.243	0.6925	0.00658
130	5.685	0.6789	0.00877
140	7.486	0.6631	0.01152
150	9.700	0.6489	0.01488
160	12.39	0.6329	0.01916
170	15.61	0.6165	0.02446
180	19.44	0.5984	0.03115
190	23.94	0.5782	0.0397
200	29.20	0.5568	0.0508
210	35.31	0.5291	0.0655
220	42.38	0.4958	0.0854
230	50.53	0.4550	0.1135
240	59.92	0.3825	0.1715
243.1	63.11	0.2755	0.2755

Ethyl Chloride C_2H_5Cl

°C	atm	*d liq*, g/cc	*d vap*, g/cc
12.2(*l*)	1.00	0.9060	0.00285
20	1.33	0.8943	0.00372
30	1.86	0.8790	0.00513
40	2.55	0.8633	0.00692
50	3.42	0.8472	0.00917
60	4.50	0.8306	0.0120
70	5.82	0.8134	0.0152
80	7.41	0.7958	0.0190
90	9.31	0.7770	0.0236
100	11.5	0.7575	0.0294

Ethyl Chloride (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
110	14.2	0.737	0.035
120	17.2	0.715	0.043
130	20.7	0.691	0.052
140	24.7	0.665	0.064
150	29.2	0.636	0.079
160	34.3	0.602	0.099
170	40.1	0.559	0.128
180	46.6	0.494	0.178
187.2	51.6	0.331	0.331

Ethylene C_2H_4

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−103.8(*l*)	1.00	0.569	0.0022
−100	1.24	0.564	0.0026
− 90	2.10	0.549	0.0041
− 80	3.35	0.534	0.0063
− 70	5.07	0.517	0.0093
− 60	7.38	0.500	0.0133
− 50	10.4	0.481	0.019
− 40	14.2	0.461	0.025
− 30	18.9	0.439	0.034
− 20	24.8	0.414	0.046
− 10	31.9	0.384	0.062
0	40.6	0.345	0.088
+ 9.6	50.6	0.210	0.210

Ethyl Ether $(C_2H_5)_2O$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
34.6(*l*)	1.000	0.6962	0.003162
40	1.212	0.6894	0.003731
50	1.680	0.6764	0.005079
60	2.275	0.6658	0.006771
70	3.021	0.6532	0.00892
80	3.939	0.6402	0.01155
90	5.054	0.6250	0.01477
100	6.394	0.6105	0.01867
110	7.987	0.5942	0.02349
120	9.861	0.5764	0.02934
130	12.05	0.5580	0.03638
140	14.58	0.5385	0.04488
150	17.48	0.5179	0.05551
160	20.80	0.4947	0.06911
170	24.57	0.4658	0.08731
180	28.81	0.4268	0.1135
185	31.12	0.4018	0.1320
190	33.57	0.3663	0.1620
193.8	35.52	0.2625	0.2625

Ethyl Formate $HCO_2C_2H_5$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
54.35(*l*)	1.000	0.8767	0.002843
60	1.208	0.8689	0.003370
70	1.667	0.8552	0.004570
80	2.251	0.8409	0.006098
90	2.983	0.8262	0.007994

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Ethyl Formate (Cont.)

°C	atm	d liq, g/cc	d vap, g/cc
100	3.883	0.8112	0.01032
110	4.978	0.7955	0.01312
120	6.290	0.7796	0.01657
130	7.846	0.7628	0.02073
140	9.674	0.7448	0.02564
150	11.80	0.7257	0.03164
160	14.26	0.7058	0.03876
170	17.07	0.6843	0.04739
180	20.28	0.6610	0.05747
190	23.91	0.6355	0.07018
200	28.00	0.6066	0.08621
210	32.59	0.5724	0.1073
220	37.70	0.5290	0.1379
225	40.47	0.5014	0.1587
230	43.39	0.4635	0.1890
235.3	46.65	0.3232	0.3232

Ethyl Mercaptan C_2H_5SH

°C	atm	d liq, g/cc	d vap, g/cc
34.4 (*l*)	1.000	0.822	0.002
40	1.21	0.815	0.003
50	1.66	0.803	0.003
60	2.22	0.790	0.004
70	2.95	0.777	0.006
80	3.84	0.762	0.007
90	4.92	0.749	0.009
100	6.24	0.735	0.012
110	7.80	0.721	0.015
120	9.64	0.706	0.019
130	11.8	0.689	0.023
140	14.3	0.672	0.029
150	17.2	0.653	0.036
160	20.5	0.634	0.044
170	24.2	0.613	0.054
180	28.2	0.590	0.065
190	33.0	0.564	0.079
200	38.2	0.534	0.095
210	44.1	0.499	0.117
220	50.5	0.444	0.161
225.5	54.2	0.301	0.301

Ethyl Propionate $C_2H_5CO_2C_2H_5$

°C	atm	d liq, g/cc	d vap, g/cc
99.0	1.000	0.7964	0.003489
100	1.027	0.7951	0.003580
110	1.383	0.7823	0.004748
120	1.828	0.7692	0.00620
130	2.376	0.7548	0.00800
140	3.042	0.7413	0.01024
150	3.840	0.7267	0.01292
160	4.788	0.7115	0.01615
170	5.904	0.6958	0.02004
180	7.206	0.6795	0.02469
190	8.727	0.6625	0.03012
200	10.45	0.6443	0.03676
210	12.45	0.6243	0.04464
220	14.73	0.6027	0.05435
230	17.33	0.5784	0.06667
240	20.28	0.5501	0.08230
250	23.62	0.5181	0.1030
260	27.40	0.4744	0.1337
265	29.48	0.4459	0.1562
270	31.69	0.4018	0.1957
272.9	33.03	0.2965	0.2965

Ethyl Propyl Ether $C_2H_5OC_3H_7$

°C	atm	d liq, g/cc	d vap, g/cc
61.4 (*l*)	1.000	0.682	0.008
70	1.30	0.672	0.010
80	1.73	0.659	0.013
90	2.27	0.646	0.015
100	2.94	0.633	0.018
110	3.76	0.620	0.021
120	4.72	0.607	0.025
130	5.89	0.593	0.029
140	7.28	0.579	0.032
150	8.89	0.564	0.036
160	10.7	0.548	0.041
170	12.9	0.530	0.047
180	15.2	0.511	0.055
190	18.0	0.491	0.067
200	21.2	0.462	0.082
210	24.8	0.433	0.104
220	28.8	0.385	0.142
227.4	32.1	0.258	0.258

Ethyl Sulfide $(C_2H_5)_2S$

°C	atm	d liq, g/cc	d vap, g/cc
90.3 (*l*)	1.000	0.765	0.003
100	1.32	0.755	0.003
110	1.75	0.744	0.004
120	2.26	0.732	0.005
130	2.90	0.721	0.006
140	3.66	0.709	0.008
150	4.58	0.697	0.009
160	5.68	0.684	0.011
170	6.93	0.671	0.013
180	8.36	0.656	0.017
190	10.00	0.641	0.022
200	12.0	0.625	0.027
210	14.2	0.608	0.034
220	16.6	0.590	0.041
230	19.3	0.571	0.050
240	22.3	0.549	0.061
250	25.6	0.524	0.075
260	29.3	0.494	0.094
270	33.2	0.457	0.121
280	37.6	0.395	0.175
283.8	39.1	0.279	0.279

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Fluorobenzene C_6H_5F

°C	atm	*d liq*, g/cc	*d vap*, g/cc
85.2(*l*)	1.000	......	....
90	1.162	0.9366	0.0038
100	1.549	0.9233	0.0050
110	2.029	0.9096	0.0065
120	2.566	0.8955	0.0083
130	3.329	0.8811	0.0105
140	4.171	0.8665	0.0131
150	5.17	0.8519	0.0163
160	6.35	0.8363	0.0199
170	7.68	0.8203	0.0241
180	9.23	0.8037	0.0291
190	11.02	0.7857	0.0350
200	13.03	0.7671	0.0418
210	15.28	0.7480	0.0497
220	17.83	0.7265	0.0591
230	20.69	0.7036	0.0704
240	23.90	0.6789	0.0840
250	27.50	0.6504	0.1008
260	31.51	0.6163	0.1226
270	35.99	0.5739	0.1535
280	41.05	0.5133	0.2034
286.5	44.61	0.3541	0.3541

Helium He

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−271.93(*l*)	......	0.1459	....
−271.54	......	0.1460	....
−271.21	......	0.1462	....
−271.03	......	0.1464	....
−270.92	......	0.1466	....
−270.83	......	0.1469	0.001159
−270.76	......	0.1466	0.001368
−270.57	......	0.1457	0.002079
−269.83	......	0.1395	0.006435
−269.23	......	0.1311	0.01176
−268.91	......	0.1255	0.01618
−268.54	......	0.1165	0.02389
−268.42	......	0.1139	0.02699
−267.93	2.261	0.06930	0.06930

n-Heptane C_7H_{16}

°C	atm	*d liq*, g/cc	*d vap*, g/cc
98.4(*l*)	1.000	....	....
100	1.046	0.6124	0.0036
110	1.378	0.6027	0.0047
120	1.799	0.5926	0.0061
130	2.307	0.5821	0.0078
140	2.933	0.5711	0.0098
150	3.664	0.5598	0.0122
160	4.540	0.5481	0.0151
170	5.540	0.5359	0.0185
180	6.566	0.5232	0.0224
190	8.020	0.5066	0.0271
200	9.553	0.4952	0.0330
210	11.31	0.4793	0.0401

n-Heptane (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
220	13.30	0.4616	0.0489
230	15.54	0.4414	0.0600
240	18.14	0.4177	0.0745
250	21.03	0.3882	0.0954
260	24.30	0.3457	0.1287
266.85	26.84	0.2341	0.2341

n-Hexane C_6H_{14}

°C	atm	*d liq*, g/cc	*d vap*, g/cc
68.95(*l*)	1.000	......	......
70	1.036	0.6122	0.0034
80	1.397	0.6022	0.0045
90	1.851	0.5918	0.0058
100	2.416	0.5814	0.0075
110	3.103	0.5703	0.0096
120	3.921	0.5588	0.0120
130	4.895	0.5467	0.0150
140	6.060	0.5343	0.0187
150	7.382	0.5207	0.0230
160	8.934	0.5063	0.0283
170	10.68	0.4913	0.0347
180	12.70	0.4751	0.0423
190	13.66	0.4570	0.0516
200	17.57	0.4365	0.0633
210	20.50	0.4124	0.0790
220	23.82	0.3810	0.1011
230	27.57	0.3329	0.1405
234.8	29.61	0.2344	0.2344

Hydrogen H_2

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−258.27(*l*)	.....	0.07631	0.00020
−256.75	......	0.07494	0.00038
−253.24	......	0.07134	0.00116
−252.74	1.0000	....	....
−249.89	......	0.06724	0.00264
−245.73	......	0.06050	0.00613
−243.03	......	0.05402	0.01081
−240.57	......	0.04316	0.01922
−239.91	12.80	0.03102	0.03102

Hydrogen Chloride HCl

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−85.03(*l*)	1.00	1.191	0.0025
−80	1.32	1.178	0.0032
−70	2.19	1.151	0.0052
−60	3.45	1.122	0.0083
−50	5.20	1.093	0.012
−40	7.55	1.063	0.017
−30	10.62	1.031	0.023
−20	14.53	0.997	0.032
−10	19.43	0.962	0.042
0	25.46	0.924	0.054
+10	32.78	0.881	0.072
20	41.58	0.831	0.097

Hydrogen Chloride (Cont.)

°C	atm	d liq, g/cc	d vap, g/cc
30	52.08	0.772	0.130
40	64.52	0.697	0.180
50	79.19	0.592	0.260
51.4	81.55	0.424	0.424

Iodobenzene C_6H_5I

°C	atm	d liq, g/cc	d vap, g/cc
188.45(*l*)	1.000	....	....
190	1.043	1.5639	0.0059
200	1.304	1.5470	0.0073
210	1.621	1.5297	0.0089
220	2.000	1.5124	0.0108
230	2.441	1.4941	0.0130
240	2.954	1.4764	0.0156
250	3.553	1.4581	0.0185
260	4.237	1.4384	0.0220
270	5.020	1.4190	0.0260
448	44.61	0.5814	0.5814

Methane CH_4

°C	atm	d liq, g/cc	d vap, g/cc
−161.5 (*l*)	1.00	0.4245	0.0018
−160	1.13	0.4222	0.0020
−150	2.35	0.4075	0.0039
−140	4.38	0.3916	0.0068
−130	7.45	0.3742	0.0112
−120	11.84	0.3547	0.0175
−110	17.83	0.3324	0.0269
−100	25.7	0.3050	0.0413
− 90	35.9	0.2668	0.0665
− 82.1	45.8	0.1615	0.1615

Methyl Acetate $CH_3CO_2CH_3$

°C	atm	d liq, g/cc	d vap, g/cc
57.15(*l*)	1.000	0.8840	0.002830
60	1.104	0.8800	0.003076
70	1.537	0.8662	0.004193
80	2.092	0.8519	0.005618
90	2.791	0.8374	0.007440
100	3.659	0.8221	0.009671
110	4.719	0.8060	0.01239
120	5.998	0.7893	0.01570
130	7.523	0.7715	0.01970
140	9.325	0.7532	0.02454
150	11.43	0.7339	0.03026
160	13.88	0.7133	0.03731
170	16.71	0.6907	0.04598
180	19.95	0.6671	0.05682
190	23.64	0.6410	0.06993
200	27.84	0.6100	0.08658
210	32.56	0.5741	0.1091
220	37.92	0.5281	0.1416
230	43.92	0.4527	0.2028
233.7	46.31	0.3252	0.3252

Methyl Alcohol CH_3OH

°C	atm	d liq, g/cc	d vap, g/cc
64.7(*l*)	1.000	0.7510	0.001222
70	1.220	0.7460	0.001465
80	1.764	0.7355	0.002084
90	2.494	0.7250	0.002907
100	3.452	0.7140	0.003984
110	4.688	0.7020	0.005376
120	6.255	0.6900	0.007142
130	8.213	0.6770	0.009379
140	10.63	0.6640	0.01216
150	13.57	0.6495	0.01562
160	17.11	0.6340	0.01994
170	21.34	0.6161	0.02526
180	26.35	0.5980	0.03186
190	32.23	0.5770	0.04010
200	39.08	0.5530	0.05075
210	47.03	0.5255	0.06521
220	56.18	0.4900	0.08635
225	61.25	0.4675	0.1003
230	66.67	0.4410	0.1187
235	72.47	0.4054	0.1438
240.0	78.67	0.2722	0.2722

Methyl *n*-Butyrate $C_3H_7CO_2CH_3$

°C	atm	d liq, g/cc	d vap, g/cc
102.75(*l*)	1.000	0.8035	0.003595
110	1.245	0.7945	0.004374
120	1.649	0.7816	0.005708
130	2.148	0.7685	0.007353
140	2.756	0.7551	0.009294
150	3.488	0.7415	0.01168
160	4.359	0.7270	0.01459
170	5.386	0.7122	0.01807
180	6.587	0.6964	0.02215
190	7.982	0.6800	0.02699
200	9.593	0.6633	0.03268
210	11.44	0.6448	0.03968
220	13.55	0.6251	0.04831
230	15.96	0.6018	0.05848
240	18.69	0.5773	0.07143
250	21.77	0.5505	0.08696
260	25.25	0.5166	0.1091
270	29.17	0.4721	0.1416
275	31.31	0.4386	0.1691
280	33.58	0.3812	0.2201
281.3	34.19	0.3002	0.3002

Methyl *iso*-Butyrate $C_3H_7CO_2CH_3$

°C	atm	d liq, g/cc	d vap, g/cc
92.3	1.000	0.8040	0.003617
100	1.257	0.7945	0.004472
110	1.675	0.7815	0.005882
120	2.193	0.7680	0.007628
130	2.826	0.7539	0.009718
140	3.588	0.7396	0.01224
150	4.497	0.7248	0.01533

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Methyl *iso*-Butyrate (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
160	5.569	0.7095	0.01903
170	6.825	0.6933	0.02345
180	8.280	0.6767	0.02869
190	9.960	0.6593	0.03490
200	11.89	0.6411	0.04228
210	14.09	0.6200	0.05141
220	16.59	0.5961	0.06289
230	19.43	0.5690	0.07722
240	22.64	0.5386	0.09615
250	26.25	0.5021	0.1218
260	30.32	0.4495	0.1623
265	32.54	0.4036	0.2033
267.55	33.72	0.3012	0.3012

Methyl Chloride CH_3Cl

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−24.0	1.00	0.997	0.00255
−20	1.18	0.990	0.00297
−10	1.74	0.973	0.00427
0	2.50	0.955	0.00599
+10	3.49	0.937	0.00820
20	4.75	0.918	0.0110
30	6.35	0.898	0.0145
40	8.33	0.878	0.0189
50	10.7	0.856	0.0242
60	13.6	0.832	0.032
70	17.1	0.809	0.039
80	21.2	0.783	0.049
90	25.9	0.756	0.060
100	31.4	0.725	0.075
110	37.8	0.690	0.094
120	45.0	0.647	0.120
130	53.2	0.592	0.159
140	62.6	0.497	0.238
143.1	65.8	0.365	0.365

Methyl Ether $(CH_3)_2O$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−23.7	1.000	0.7222	0.0024
−20	1.17	0.7174	0.0027
−10	1.74	0.7040	0.0039
0	2.54	0.6905	0.0055
+10	3.59	0.6759	0.0076
20	4.95	0.6610	0.0104
30	6.62	0.6455	0.0142
40	8.69	0.6292	0.0188
50	11.25	0.6116	0.0241
60	14.27	0.5932	0.0306
70	17.90	0.5735	0.0385
80	22.10	0.5517	0.0484
90	26.9	0.5257	0.0623
100	32.6	0.4950	0.0810
110	39.0	0.4575	0.1060
115	42.5	0.4350	0.1222
120	46.3	0.4040	0.1465

Methyl Ether (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
125	50.3	0.3510	0.1930
126.9	52.0	0.2714	0.2714

Methyl Ethyl Ether $CH_3OC_2H_5$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
7.5	1.000	0.716	0.003
10	1.10	0.713	0.004
20	1.61	0.700	0.006
30	2.29	0.687	0.008
40	3.14	0.672	0.010
50	4.24	0.658	0.013
60	5.56	0.644	0.016
70	7.21	0.628	0.019
80	9.16	0.612	0.023
90	11.4	0.596	0.029
100	14.2	0.579	0.034
110	17.3	0.560	0.040
120	20.9	0.540	0.050
130	25.0	0.516	0.064
140	29.6	0.487	0.082
150	34.7	0.450	0.109
160	40.5	0.401	0.153
164.7	43.4	0.270	0.270

Methyl Formate HCO_2CH_3

°C	atm	*d liq*, g/cc	*d vap*, g/cc
31.9	1.000	0.9569	0.002468
40	1.355	0.9447	0.003236
50	1.903	0.9294	0.004456
60	2.608	0.9133	0.006039
70	3.500	0.8968	0.008032
80	4.610	0.8803	0.01049
90	5.969	0.8634	0.01350
100	7.614	0.8452	0.01723
110	9.582	0.8264	0.02160
120	11.91	0.8070	0.02688
130	14.64	0.7860	0.03344
140	17.83	0.7638	0.04124
150	21.46	0.7403	0.05063
160	25.64	0.7136	0.06231
170	30.40	0.6844	0.07634
180	35.76	0.6521	0.09434
190	41.78	0.6148	0.1178
200	48.50	0.5658	0.1524
210	55.95	0.4857	0.2188
214.0	59.15	0.3489	0.3489

Methyl Mercaptan CH_3SH

°C	atm	*d liq*, g/cc	*d vap*, g/cc
6.0	1.000	0.888	0.002
10	1.16	0.882	0.002
20	1.68	0.868	0.003
30	2.36	0.854	0.004
40	3.22	0.840	0.004
50	4.33	0.827	0.005

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Methyl Mercaptan (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
60	5.68	0.813	0.005
70	7.36	0.799	0.006
80	9.33	0.783	0.008
90	11.7	0.768	0.011
100	14.5	0.752	0.015
110	17.6	0.734	0.020
120	21.3	0.714	0.027
130	25.5	0.692	0.036
140	30.3	0.669	0.048
150	35.7	0.643	0.062
160	41.6	0.612	0.079
170	48.6	0.577	0.102
180	56.2	0.535	0.131
190	65.0	0.477	0.179
196.8	71.4	0.323	0.323

Methyl Propionate $C_2H_5CO_2CH_3$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
79.7	1.000	0.8412	0.003173
80	1.006	0.8408	0.003199
90	1.379	0.8273	0.004301
100	1.851	0.8137	0.005714
110	2.440	0.7996	0.007446
120	3.165	0.7852	0.009569
130	4.043	0.7705	0.01214
140	5.096	0.7553	0.01529
150	6.345	0.7390	0.01905
160	7.812	0.7221	0.02356
170	9.523	0.7045	0.02907
180	11.50	0.6856	0.03552
190	13.78	0.6657	0.04320
200	16.38	0.6445	0.05236
210	19.33	0.6207	0.06390
220	22.68	0.5938	0.07812
230	26.46	0.5635	0.09662
240	30.70	0.5220	0.1236
245	33.01	0.4976	0.1418
250	35.46	0.4655	0.1675
255	38.04	0.4151	0.2118
257.4	39.34	0.3124	0.3124

Methyl Sulfide $(CH_3)_2S$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
35.8	1.000	0.831	0.002
40	1.15	0.826	0.003
50	1.60	0.814	0.003
60	2.15	0.803	0.003
70	2.84	0.791	0.004
80	3.68	0.777	0.006
90	4.70	0.764	0.008
100	5.97	0.750	0.010
110	7.45	0.736	0.013
120	9.14	0.721	0.016
130	11.1	0.706	0.020
140	13.4	0.689	0.026

Methyl Sulfide (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
150	16.0	0.671	0.032
160	19.1	0.652	0.040
170	22.4	0.632	0.050
180	26.2	0.610	0.063
190	30.6	0.585	0.076
200	35.6	0.559	0.092
210	41.5	0.528	0.113
220	47.0	0.486	0.146
229.9	54.6	0.306	0.306

Nitrous Oxide N_2O

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−89.5	1.00	1.226	0.0031
−80	1.70	1.199	0.0050
−70	2.81	1.170	0.0080
−60	4.40	1.140	0.0122
−50	6.6	1.108	0.018
−40	9.5	1.075	0.025
−30	13.3	0.040	0.035
−20	18.1	1.001	0.048
−10	24.0	0.958	0.066
0	31.3	0.910	0.087
+10	40.0	0.856	0.115
20	50.3	0.784	0.161
30	62.6	0.679	0.240
36.5	71.7	0.451	0.451

n-Octane C_8H_{18}

°C	atm	*d liq*, g/cc	*d vap*, g/cc
125.8	1.000	......	......
130	1.130	0.6071	0.0042
140	1.466	0.5973	0.0054
150	1.875	0.5875	0.0068
160	2.378	0.5772	0.0085
170	2.967	0.5667	0.0107
180	3.651	0.5556	0.0132
190	4.454	0.5441	0.0161
200	5.395	0.5317	0.0196
210	6.480	0.5189	0.0236
220	7.730	0.5053	0.0287
230	9.145	0.4901	0.0348
240	10.79	0.4732	0.0424
250	12.63	0.4554	0.0512
260	14.71	0.4364	0.0622
270	17.08	0.4123	0.0772
280	19.74	0.3818	0.0983
290	22.57	0.3365	0.1346
296.2	24.61	0.2327	0.2327

Oxygen O_2

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−210.4	.....	1.2746	0.0_4865
−182.95	1.000	....	....
−182.0	.....	1.1415	0.00490
−154.5	.....	0.9758	0.0385

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Oxygen (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−140.2	......	0.8742	0.0805
−129.9	......	0.7781	0.1320
−123.3	......	0.6779	0.2022
−120.4	......	0.6032	0.2701
−118.82	49.713	0.4299	0.4299

n-Pentane C_5H_{12}

°C	atm	*d liq*, g/cc	*d vap*, g/cc
36.15	1.000	......	......
40	1.149	0.6062	0.0034
50	1.570	0.5957	0.0045
60	2.112	0.5850	0.0060
70	2.788	0.5739	0.0079
80	3.599	0.5624	0.0101
90	4.605	0.5503	0.0123
100	5.803	0.5377	0.0163
110	7.217	0.5248	0.0202
120	8.868	0.5107	0.0250
130	10.78	0.4957	0.0310
140	13.01	0.4787	0.0386
150	15.54	0.4604	0.0476
160	18.49	0.4349	0.0591
170	21.78	0.4162	0.0735
180	25.46	0.3867	0.0935
190	29.61	0.3485	0.1269
195	31.91	0.3065	0.1609
197.2	33.03	0.2323	0.2323

iso-Pentane C_5H_{12}

°C	atm	*d liq*, g/cc	*d vap*, g/cc
27.95	1.000	....	....
30	1.078	0.6092	0.0033
40	1.500	0.5988	0.0045
50	2.020	0.5881	0.0060
60	2.679	0.5769	0.0078
70	3.495	0.5656	0.0101
80	4.454	0.5540	0.0129
90	5.632	0.5413	0.0162
100	7.033	0.5278	0.0202
110	8.664	0.5140	0.0251
120	10.55	0.4991	0.0311
130	12.74	0.4826	0.0383
140	15.30	0.4642	0.0473
150	18.16	0.4445	0.0583
160	21.45	0.4206	0.0729
170	25.14	0.3914	0.0934
180	29.20	0.3498	0.1258
185	31.58	0.3142	0.1574
187.8	32.90	0.2343	0.2343

Phosgene $COCl_2$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
7.95	1.00	1.409	0.005
10	1.08	1.405	0.005
20	1.55	1.381	0.007

Phosgene (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
30	2.17	1.357	0.009
40	2.97	1.332	0.012
50	3.99	1.306	0.016
60	5.25	1.280	0.020
70	6.81	1.252	0.024
80	8.68	1.224	0.030
90	10.94	1.195	0.037
100	13.6	1.165	0.046
110	16.7	1.134	0.057
120	20.3	1.100	0.072
130	24.4	1.062	0.090
140	29.1	1.017	0.112
150	34.4	0.966	0.142
160	40.4	0.903	0.182
170	47.0	0.826	0.239
180	54.4	0.685	0.359
182	56	0.520	0.520

Phosphine PH_3

°C	atm	*d liq*, g/cc	*d vap*, g/cc
−87.5	1.00	0.746	0.0023
−80	1.46	0.738	0.0032
−70	2.30	0.725	0.0050
−60	3.47	0.712	0.0073
−50	5.0	0.698	0.010
−40	7.1	0.684	0.014
−30	9.7	0.668	0.019
−20	12.9	0.651	0.025
−10	16.8	0.633	0.033
0	21.6	0.613	0.042
+10	27.4	0.591	0.053
20	34.2	0.566	0.067
30	42.3	0.537	0.086
40	51.9	0.50	0.11
51.3	64.5	0.30	0.30

Propionic Acid $C_2H_5CO_2H$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
140	......	0.860	0.004
150	......	0.848	0.004
160	......	0.837	0.005
170	......	0.825	0.006
180	......	0.813	0.008
190	......	0.800	0.010
200	......	0.786	0.012
210	......	0.772	0.015
220	......	0.757	0.019
230	......	0.740	0.024
240	......	0.722	0.029
250	......	0.703	0.035
260	......	0.683	0.043
270	......	0.663	0.051
280	......	0.642	0.060
290	......	0.619	0.071

Propionic Acid (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
300	......	0.595	0.083
339.5	53.0	0.315	0.315

Propionitrile C_2H_5CN

°C	atm	*d liq*, g/cc	*d vap*, g/cc
90	......	0.711	0.002
100	......	0.700	0.002
110	......	0.689	0.003
120	......	0.678	0.003
130	......	0.666	0.004
140	......	0.654	0.005
150	......	0.642	0.006
160	......	0.629	0.007
170	......	0.615	0.008
180	......	0.602	0.010
190	......	0.588	0.012
200	......	0.573	0.015
210	......	0.557	0.019
220	......	0.541	0.025
230	......	0.524	0.033
240	......	0.505	0.041
250	......	0.483	0.051
260	......	0.458	0.063
270	......	0.428	0.080
280	......	0.388	0.108
290	......	0.311	0.171
291.2	41.3	0.241	0.241

Propyl Acetate $CH_3CO_2C_3H_7$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
101.55	1.000	0.7938	0.003495
110	1.284	0.7830	0.004405
120	1.703	0.7702	0.005760
130	2.223	0.7571	0.007440
140	2.851	0.7435	0.009497
150	3.611	0.7297	0.01195
160	4.518	0.7149	0.01489
170	5.581	0.6997	0.01848
180	6.832	0.6835	0.02268
190	8.276	0.6667	0.02778
200	9.947	0.6488	0.03390
210	11.86	0.6301	0.04115
220	14.05	0.6087	0.05025
230	16.54	0.5855	0.06154
240	19.36	0.5586	0.07576
250	22.54	0.5289	0.09390
260	26.13	0.4908	0.1205
270	30.16	0.4333	0.1661
275	32.36	0.3769	0.2169
276.2	32.91	0.2957	0.2957

Propyl Alcohol C_3H_7OH

°C	atm	*d liq*, g/cc	*d vap*, g/cc
97.4	1.000	0.7351	0.00208
100	1.100	0.7325	0.00226

Propyl Alcohol (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
110	1.577	0.7220	0.00320
120	2.208	0.7110	0.00443
130	3.022	0.6995	0.00605
140	4.055	0.6875	0.00805
150	5.341	0.6740	0.01060
160	6.915	0.6600	0.01380
170	8.817	0.6450	0.01770
180	11.08	0.6285	0.0225
190	13.75	0.6110	0.0282
200	16.86	0.5920	0.0353
210	20.46	0.5715	0.0442
220	24.57	0.5485	0.0556
230	29.26	0.5230	0.0704
240	34.57	0.4920	0.0904
250	40.55	0.4525	0.1180
260	47.27	0.3905	0.1610
263.7	49.95	0.2734	0.2734

Propyl Formate $HCO_2C_3H_7$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
80.9	1.000	0.8330	0.003136
90	1.320	0.8214	0.004107
100	1.769	0.8080	0.005432
110	2.327	0.7947	0.007047
120	3.010	0.7811	0.009033
130	3.836	0.7670	0.01140
140	4.821	0.7523	0.01422
150	5.984	0.7369	0.01770
160	7.343	0.7209	0.02179
170	8.921	0.7045	0.02667
180	10.74	0.6873	0.03236
190	12.82	0.6691	0.03891
200	15.20	0.6487	0.04717
210	17.90	0.6259	0.05698
220	20.94	0.6024	0.06897
230	24.39	0.5757	0.08403
240	28.27	0.5438	0.1045
250	32.63	0.5025	0.1340
260	37.54	0.4404	0.1848
264.85	40.06	0.3093	0.3093

Stannic Chloride $SnCl_4$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
114.1	1.00	1.978	0.0085
120	1.18	1.963	0.0099
130	1.53	1.935	0.0127
140	1.96	1.907	0.0162
150	2.48	1.878	0.0202
160	3.10	1.849	0.0251
170	3.82	1.819	0.0308
180	4.67	1.787	0.0374
190	5.66	1.755	0.0454
200	6.79	1.721	0.0546
220	9.55	1.649	0.0773
240	13.07	1.569	0.108

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Stannic Chloride (Cont.)

°C	atm	*d liq*, g/cc	*d vap*, g/cc
260	17.48	1.476	0.152
280	22.92	1.363	0.216
300	29.56	1.21	0.32
318.7	36.95	0.742	0.742

Sulfur Dioxide SO_2

°C	atm	*V liq*, cc/g	*V vap*, cc/g
−50	0.11411	0.6423	....
−45	0.1576	0.6472	....
−40	0.2135	0.6523	....
−35	0.2857	0.6575	....
−30	0.3759	0.6627	....
−25	0.4892	0.6680	....
−20	0.6274	0.6739	....
−15	0.7970	0.6798	....
−10	0.9995	0.6859	....
− 5	1.243	0.6916	....
0	1.529	0.6974	....
2	1.657	0.6998	....
4	1.793	0.7022	....
6	1.938	0.7047	....
8	2.092	0.7072	156.3
10	2.256	0.7097	147.1
12	2.429	0.7123	137.0
14	2.613	0.7153	128.2
16	2.807	0.7179	119.0
18	3.012	0.7205	111.1
20	3.228	0.7231	103.1
22	3.456	0.7262	97.09
24	3.697	0.7289	90.91
26	3.951	0.7315	86.21
28	4.217	0.7348	81.30
30	4.498	0.7375	75.76
32	4.793	0.7407	70.92
34	5.102	0.7440	66.67
36	5.427	0.7474	62.50
38	5.768	0.7508	58.14
40	6.125	0.7536	54.64
42	6.499	0.7570	51.02
44	6.890	0.7610	48.08
46	7.300	0.7646	45.25
48	7.729	0.7680	42.74
50	8.176	0.7722	40.65
52	......	0.7758	38.61
54	......	0.7794	36.76
56	......	0.7837	34.84
58	......	0.7874	33.33
60	10.729	0.7918	31.85
62	......	0.7962	30.49
64	......	0.8000	29.15
66	......	0.8046	28.01
68	......	0.8091	26.88
70	13.867	0.8137	25.77
72	......	0.8183	24.81
74	......	0.8230	23.81
76	......	0.8278	22.88
78	......	0.8333	21.93
80	17.682	0.8382	20.92
82	......	0.8432	19.96
84	......	0.8489	19.01
86	......	0.8547	18.15
88	......	0.8606	17.24
90	22.268	0.8658	16.39
92	......	0.8718	15.60
94	......	0.8780	14.88
96	......	0.8850	14.20
98	......	0.8913	13.51
100	27.714	0.8977	12.94
105	30.784	0.9158	11.51
110	34.091	0.9355	10.31
115	37.641	0.9570	9.159
120	41.432	0.9823	8.078
125	45.457	1.0111	7.073
130	49.705	1.0449	6.146
135	54.157	1.0858	5.310
140	58.783	1.1363	4.554
145	63.549	1.2019	3.882
150	68.405	1.3038	3.256
155	73.296	....	....
157	75.245	....	....
157.2	77.7	1.9305	1.9305

Sulfur Trioxide SO_3

°C	atm	*d liq*, g/cc	*d vap*, g/cc
44.6	1.00	1.807	0.003
60	2.0	1.732	0.006
80	4.3	1.639	0.013
100	8.0	1.547	0.025
110	10.4	1.506	0.031
120	13.3	1.465	0.037
130	16.7	1.424	0.045
140	20.6	1.382	0.056
150	25.1	1.340	0.069
160	30.3	1.296	0.086
170	36.4	1.249	0.107
180	43.4	1.196	0.137
190	51.5	1.134	0.177
200	61.1	1.058	0.233
210	72.5	0.960	0.313
218.3	83.6	0.630	0.630

Triethylamine $N(C_2H_5)_3$

°C	atm	*d liq*, g/cc	*d vap*, g/cc
90	......	0.661	0.005
100	......	0.650	0.006
110	......	0.638	0.008
120	......	0.626	0.010
130	......	0.614	0.013
140	......	0.603	0.016
150	......	0.591	0.019
160	......	0.578	0.022

ORTHOBARIC DENSITIES OR VOLUMES OF VARIOUS SUBSTANCES

Triethylamine (Cont.)			
°C	atm	*d liq*, g/cc	*d vap*, g/cc
170	......	0.565	0.026
180	......	0.552	0.030
190	......	0.538	0.035
200	......	0.523	0.040
210	......	0.507	0.046
220	......	0.488	0.056
230	......	0.466	0.071
240	......	0.437	0.090
250	......	0.399	0.115
260	......	0.335	0.175
262	30	0.251	0.251

Xenon Xe			
°C	atm	*d liq*, g/cc	*d vap*, g/cc
−70	......	2.792	0.048
−60	8.570	2.699	0.079
−50	......	2.605	0.108
−40	15.85	2.511	0.137
−30	......	2.410	0.180
−20	26.73	2.292	0.238
−10	......	2.169	0.313
0	41.24	1.987	0.421
+10	......	1.745	0.602
15	......	1.528	0.791
16	......	1.468	0.844
16.6	58.22	1.154	1.154

SPECIFIC GRAVITY OF AIR AT VARIOUS TEMPERATURES

The table below gives the weight in grams $\times 10^4$ of one milliliter of air at 760 mm of mercury pressure and at the temperature indicated. Density in grams per milliliter is the same as the specific gravity referred to water at 4°C. as unity. To convert to density referred to air at 70°F. as unity, divide the values below by 12.00.

t°C.	Sp.Gr. $\times 10^4$	t°C.	Sp.Gr. $\times 10^4$	t°C.	Sp.Gr. $\times 10^4$	t°C.	Sp.Gr. $\times 10^4$
−25	14.240	15	12.255	60	10.596	140	8.541
−24	14.182	16	12.213	62	10.532	142	8.500
−23	14.125	17	12.170	64	10.470	144	8.459
−22	14.069	18	12.129	66	10.408	146	8.419
−21	14.013	19	12.087	68	10.347	148	8.379
−20	13.957	20	12.046	70	10.286	150	8.339
−19	13.902	21	12.004	72	10.227	155	8.242
−18	13.847	22	11.964	74	10.168	160	8.147
−17	13.793	23	11.923	76	10.109	165	8.054
−16	13.739	24	11.883	78	10.052	170	7.963
−15	13.685	25	11.843	80	9.995	175	7.874
−14	13.632	26	11.803	82	9.938	180	7.787
−13	13.580	27	11.764	84	9.882	185	7.702
−12	13.527	28	11.725	86	9.828	190	7.619
−11	13.476	29	11.686	88	9.773	195	7.537
−10	13.424	30	11.647	90	9.719	200	7.457
−9	13.373	31	11.609	92	9.666	205	7.379
−8	13.322	32	11.570	94	9.613	210	7.303
−7	13.272	33	11.533	96	9.561	215	7.228
−6	13.222	34	11.495	98	9.509	220	7.155
−5	13.173	35	11.458	100	9.458	230	7.013
−4	13.124	36	11.420	102	9.408	240	6.881
−3	13.075	37	11.383	104	9.358	250	6.753
−2	13.026	38	11.347	106	9.308	260	6.624
−1	12.978	39	11.310	108	9.259	270	6.504
0	12.931	40	11.274	110	9.211	280	6.389
+1	12.883	41	11.238	112	9.163	290	6.277
2	12.836	42	11.202	114	9.116	300	6.166
3	12.790	43	11.167	116	9.069	310	6.062
4	12.743	44	11.132	118	9.022	320	5.942
5	12.697	45	11.097	120	8.976	330	5.847
6	12.652	46	11.062	122	8.931	340	5.755
7	12.606	47	11.027	124	8.886	350	5.664
8	12.561	48	10.993	126	8.841	360	5.578
9	12.517	49	10.958	128	8.797	370	5.493
10	12.472	50	10.924	130	8.753	380	5.407
11	12.428	52	10.857	132	8.710	400	5.248
12	12.385	54	10.791	134	8.667	420	5.101
13	12.341	56	10.725	136	8.625	440	4.952
14	12.298	58	10.660	138	8.583	460	4.812

VAPOR PRESSURE OF MERCURY

From −38° to 1300°C.

Temp. °C.	mm of Hg	Temp. °C.	mm of Hg	Temp. °C.	mm of Hg
−38	0.0_5145	88	0.1413	214	26.826
−36	0.0_5197	90	0.1582	216	28.504
−34	0.0_5266	92	0.1769	218	30.271
−32	0.0_5359	94	0.1976	220	32.133
−30	0.0_5478	96	0.2202	222	34.092
−28	0.0_5630	98	0.2453	224	36.153
−26	0.0_5828	100	0.2729	226	38.318
−24	0.0_4108	102	0.3032	228	40.595
−22	0.0_4140	104	0.3366	230	42.989
−20	0.0_4181	106	0.3731	232	45.503
−18	0.0_4232	108	0.4132	234	48.141
−16	0.0_4298	110	0.4572	236	50.909
−14	0.0_4380	112	0.5052	238	53.812
−12	0.0_4481	114	0.5576	240	56.855
−10	0.0_4606	116	0.6150	242	60.044
− 8	0.0_4762	118	0.6776	244	63.384
− 6	0.0_4954	120	0.7457	246	66.882
− 4	0.0_3119	122	0.8198	248	70.543
− 2	0.0_3149	124	0.9004	250	74.375
0	0.0_3185	126	0.9882	252	78.381
+ 2	0.0_3228	128	1.084	254	82.568
4	0.0_3276	130	1.186	256	86.944
6	0.0_3335	132	1.298	258	91.518
8	0.0_3406	134	1.419	260	96.296
10	0.0_3490	136	1.551	262	101.28
12	0.0_3588	138	1.692	264	106.48
14	0.0_3706	140	1.845	266	111.91
16	0.0_3846	142	2.010	268	117.57
18	0.001009	144	2.188	270	123.47
20	0.001201	146	2.379	272	129.62
22	0.001426	148	2.585	274	136.02
24	0.001691	150	2.807	276	142.69
26	0.002000	152	3.046	278	149.64
28	0.002359	154	3.303	280	156.87
30	0.002777	156	3.578	282	164.39
32	0.003261	158	3.873	284	172.21
34	0.003823	160	4.189	286	180.34
36	0.004471	162	4.528	288	188.79
38	0.005219	164	4.890	290	197.57
40	0.006079	166	5.277	292	206.70
42	0.007067	168	5.689	294	216.17
44	0.008200	170	6.128	296	226.00
46	0.009497	172	6.596	298	236.21
48	0.01098	174	7.095	300	246.80
50	0.01267	176	7.626	302	257.78
52	0.01459	178	8.193	304	269.17
54	0.01677	180	8.796	306	280.98
56	0.01925	182	9.436	308	293.21
58	0.02206	184	10.116	310	305.89
60	0.02524	186	10.839	312	319.02
62	0.02883	188	11.607	314	332.62
64	0.03287	190	12.423	316	346.70
66	0.03740	192	13.287	318	361.26
68	0.04251	194	14.203	320	376.33
70	0.04825	196	15.173	322	391.92
72	0.05469	198	16.200	324	408.04
74	0.06189	200	17.287	326	424.71
76	0.06993	202	18.437	328	441.94
78	0.07889	204	19.652	330	459.74
80	0.08880	206	20.936	332	478.13
82	0.1000	208	22.292	334	497.12
84	0.1124	210	23.723	336	516.74
86	0.1261	212	25.233	338	537.00

VAPOR PRESSURE OF MERCURY

Temp. °C.	mm of Hg	Temp. °C.	mm of Hg	Temp. °C.	mm of Hg
340	557.90	374	1028.9	520	7691
342	579.45	376	1064.4	550	10650
344	601.69	378	1100.9	600	22.87atm.
346	624.64	380	1138.4	650	35.49atm.
348	648.30	382	1177.0	700	52.51atm.
350	672.69	384	1216.6	750	74.86atm.
352	697.83	386	1257.3	800	103.31atm.
354	723.73	388	1299.1	850	138.42atm.
356	750.43	390	1341.9	900	180.92atm.
358	777.92	392	1386.1	950	226.58atm.
360	806.23	394	1431.3	1000	290.5atm.
362	835.38	396	1477.7	1050	358.1atm.
364	865.36	398	1525.2	1100	437.3atm.
366	896.23	400	1574.1	1150	521.3atm.
368	928.02	430	2464	1200	616.8atm.
370	960.66	460	3715	1250	721.4atm.
372	994.34	490	5420	1300	835.9atm.

VAPOR PRESSURE OF LIQUID AMMONIA, NH_3

See also Orthobaric Densities or Volumes of Various Substances.

t°C.	*p* in atm	*t*°C.	*p* in atm	*t*°C.	*p* in atm
−78	0.0582	−6	3.3677	66	29.784
−76	0.0683	−4	3.6405	68	31.211
−74	0.0797	−2	3.9303	70	32.687
−72	0.0929	0	4.2380	72	34.227
−70	0.1078	+2	4.5640	74	35.813
−68	0.1246	4	4.9090	76	37.453
−66	0.1437	6	5.2750	78	39.149
−64	0.1651	8	5.6610	80	40.902
−62	0.1891	10	6.0685	82	42.712
−60	0.2161	12	6.4985	84	44.582
−58	0.2461	14	6.9520	86	46.511
−56	0.2796	16	7.4290	88	48.503
−54	0.3167	18	7.9310	90	50.558
−52	0.3578	20	8.4585	92	52.677
−50	0.4034	22	9.0125	94	54.860
−48	0.4536	24	9.5940	96	57.111
−46	0.5087	26	10.2040	98	59.429
−44	0.5693	28	10.8430	100	61.816
−42	0.6357	30	11.512	102	64.274
−40	0.7083	32	12.212	104	66.804
−38	0.7875	34	12.943	106	69.406
−36	0.8738	36	13.708	108	72.084
−34	0.9676	38	14.507	110	74.837
−32	1.0695	40	15.339	112	77.668
−30	1.1799	42	16.209	114	80.578
−28	1.2992	44	17.113	116	83.570
−26	1.4281	46	18.056	118	86.644
−24	1.5671	48	19.038	120	89.802
−22	1.7166	50	20.059	122	93.045
−20	1.8774	52	21.121	124	96.376
−18	2.0499	54	22.224	126	99.796
−16	2.2349	56	23.372	128	103.309
−14	2.4328	58	24.562	130	106.913
−12	2.6443	60	25.797	132	110.613
−10	2.8703	62	27.079	132.9	112.3(c.p.)
− 8	3.1112	64	28.407		

PROPERTIES OF SATURATED AMMONIA

Heat Content Above −40°F. Entropy From −40°F.

U. S. Bureau of Standards, Circ. 142, 1923.

To convert: lb/ft³ to kg/m³ multiply by 16.018
ft³/lb to m³/kg multiply by 0.062426
lb/in.² to kg/cm² multiply by 0.07032
btu/lb to gcal/g multiply by 0.5556
thermochemical calory to int. joule multiply by 4.1833
absolute pressures above 14.71 lb/in.² to gage pressures lb/in.², subtract 14.71

Temp., t		Saturated vapor			Liq.	Heat btu/lb			Entropy btu/lb/°F	
		Abs. press. lb/in.²	Spec. vol. ft³/lb	Density lb/ft³	Density lb/ft³	Liquid	Vapor	Latent	Liquid	Vapor
°F	°C	p	v_g	ρ_g	d	h_f	h_g	h_{fg}	s_f	s_{fg}
−60	−51.11	5.55	44.73	0.02235	43.91	−21.2	589.6	610.8	−0.0517	1.4769
−58	−50.00	5.93	42.05	.02378		−19.1	590.4	609.5	−0.0464	1.4713
−56	−48.89	6.33	39.56	.02528		−17.0	591.2	608.2	−0.0412	1.4658
−54	−47.78	6.75	37.24	.02685		−14.8	592.1	606.9	−0.0360	1.4604
−52	−46.67	7.20	35.09	.02850		−12.7	592.9	605.6	−0.0307	1.4551
−50	−45.56	7.67	33.08	.03023	43.49	−10.6	593.7	604.3	−0.0256	1.4497
−48	−44.44	8.16	31.20	.03205		−8.5	594.4	602.9	−0.0204	1.4445
−46	−43.33	8.68	29.45	.03395		−6.4	595.2	601.6	−0.0153	1.4393
−44	−42.22	9.23	27.82	.03595		−4.3	596.0	600.3	−0.0102	1.4342
−42	−41.11	9.81	26.29	.03804		−2.1	596.8	598.9	−0.0051	1.4292
−40	−40.00	10.41	24.86	.04022	43.08	0.0	597.6	597.6	0.0000	1.4242
−38	−38.89	11.04	23.53	.04251		2.1	598.3	596.2	.0051	1.4193
−36	−37.78	11.71	22.27	.04489		4.3	599.1	594.8	.0101	1.4144
−34	−36.67	12.41	21.10	.04739		6.4	599.9	593.5	.0151	1.4096
−32	−35.56	13.14	20.00	.04999		8.5	600.6	592.1	.0201	1.4048
−30	−34.44	13.90	18.97	.05271	42.65	10.7	601.4	590.7	.0250	1.4001
−28	−33.33	14.71	18.00	.05555		12.8	602.1	589.3	.0300	1.3955
−26	−32.22	15.55	17.09	.05850		14.9	602.8	587.9	.0350	1.3909
−24	−31.11	16.42	16.24	.06158		17.1	603.6	586.5	.0399	1.3863
−22	−30.00	17.34	15.43	.06479		19.2	604.3	585.1	.0448	1.3818
−20	−28.89	18.30	14.68	.06813	42.22	21.4	605.0	583.6	.0497	1.3774
−18	−27.78	19.30	13.97	.07161		23.5	605.7	582.2	.0545	1.3729
−16	−26.67	20.34	13.29	.07522		25.6	606.4	580.8	.0594	1.3686
−14	−25.56	21.43	12.66	.07898		27.8	607.1	579.3	.0642	1.3643
−12	−24.44	22.56	12.06	.08289		30.0	607.8	577.8	.0690	1.3600
−10	−23.33	23.74	11.50	.08695	41.78	32.1	608.5	576.4	.0738	1.3558
−8	−22.22	24.97	10.97	.09117		34.3	609.2	574.9	.0786	1.3516
−6	−21.11	26.26	10.47	.09555		36.4	609.8	573.4	.0833	1.3474
−4	−20.00	27.59	9.991	.1001		38.6	610.5	571.9	.0880	1.3433
−2	−18.89	28.98	9.541	.1048		40.7	611.1	570.4	.0928	1.3393
0	−17.78	30.42	9.116	.1097	41.34	42.9	611.8	568.9	.0975	1.3352
2	−16.67	31.92	8.714	.1148		45.1	612.4	567.3	.1022	1.3312
4	−15.56	33.47	8.333	.1200		47.2	613.0	565.8	.1069	1.3273
6	−14.44	35.09	7.971	.1254		49.4	613.6	564.2	.1115	1.3234
8	−13.33	36.77	7.629	.1311		51.6	614.3	562.7	.1162	1.3195
10	−12.22	38.51	7.304	.1369	40.89	53.8	614.9	561.1	.1208	1.3157
12	−11.11	40.31	6.996	.1429		56.0	615.5	559.5	.1254	1.3118
14	−10.00	42.18	6.703	.1492		58.2	616.1	557.9	.1300	1.3081
16	−8.89	44.12	6.425	.1556		60.3	616.6	556.3	.1346	1.3043
18	−7.78	46.13	6.161	.1623		62.5	617.2	554.7	.1392	1.3006

PROPERTIES OF SATURATED AMMONIA

Temp., t		Saturated vapor			Liq.	Heat btu/lb			Entropy btu/lb/°F	
		Abs. press. lb/in.^{2}	Spec. vol. ft^3/lb	Density lb/ft^3	Density lb/ft^3	Liquid	Vapor	Latent	Liquid	Vapor
°F	°C	p	v_g	ρ_g	d	h_f	h_g	h_{fg}	s_f	s_{fg}
20	−6.67	48.21	5.910	0.1692	40.43	64.7	617.8	553.1	0.1437	1.2969
22	−5.56	50.36	5.671	.1763		66.9	618.3	551.4	.1483	1.2933
24	−4.44	52.59	5.443	.1837		69.1	618.9	549.8	.1528	1.2897
26	−3.33	54.90	5.227	.1913		71.3	619.4	548.1	.1573	1.2861
28	−2.22	57.28	5.021	.1992		73.5	619.9	546.4	.1618	1.2825
30	−1.11	59.74	4.825	.2073	39.96	75.7	620.5	544.8	.1663	1.2790
32	0.00	62.29	4.637	.2156		77.9	621.0	543.1	.1708	1.2755
34	1.11	64.91	4.459	.2243		80.1	621.5	541.4	.1753	1.2721
36	2.22	67.63	4.289	.2332		82.3	622.0	539.7	.1797	1.2686
38	3.33	70.43	4.126	.2423		84.6	622.5	537.9	.1841	1.2652
40	4.44	73.32	3.971	.2518	39.49	86.8	623.0	536.2	.1885	1.2618
42	5.56	76.31	3.823	.2616		89.0	623.4	534.4	.1930	1.2585
44	6.67	79.38	3.682	.2716		91.2	623.9	532.7	.1974	1.2552
46	7.78	82.55	3.547	.2819		93.5	624.4	530.9	.2018	1.2519
48	8.89	85.82	3.418	.2926		95.7	624.8	529.1	.2062	1.2486
50	10.00	89.19	3.294	.3036	39.00	97.9	625.2	527.3	.2105	1.2453
52	11.11	92.66	3.176	.3149		100.2	625.7	525.5	.2149	1.2421
54	12.22	96.23	3.063	.3265		102.4	626.1	523.7	.2192	1.2389
56	13.33	99.91	2.954	.3385		104.7	626.5	521.8	.2236	1.2357
58	14.44	103.7	2.851	.3508		106.9	626.9	520.0	.2279	1.2325
60	15.56	107.6	2.751	.3635	38.50	109.2	627.3	518.1	.2322	1.2294
62	16.67	111.6	2.656	.3765		111.5	627.7	516.2	.2365	1.2262
64	17.78	115.7	2.565	.3899		113.7	628.0	514.3	.2408	1.2231
66	18.89	120.0	2.477	.4037		116.0	628.4	512.4	.2451	1.2201
68	20.00	124.3	2.393	.4179		118.3	628.8	510.5	.2494	1.2170
70	21.11	128.8	2.312	.4325	38.00	120.5	629.1	508.6	.2537	1.2140
72	22.22	133.4	2.235	.4474		122.8	629.4	506.6	.2579	1.2110
74	23.33	138.1	2.161	.4628		125.1	629.8	504.7	.2622	1.2080
76	24.44	143.0	2.089	.4786		127.4	630.1	502.7	.2664	1.2050
78	25.56	147.9	2.021	.4949		129.7	630.4	500.7	.2706	1.2020
80	26.67	153.0	1.955	.5115	37.48	132.0	630.7	498.7	.2749	1.1991
82	27.78	158.3	1.892	.5287		134.3	631.0	496.7	.2791	1.1962
84	28.89	163.7	1.831	.5462		136.6	631.3	494.7	.2833	1.1933
86	30.00	169.2	1.772	.5643		138.9	631.5	492.6	.2875	1.1904
88	31.11	174.8	1.716	.5828		141.2	631.8	490.6	.2917	1.1875
90	32.22	180.6	1.661	.6019	36.95	143.5	632.0	488.5	.2958	1.1846
92	33.33	186.6	1.609	.6214		145.8	632.2	486.4	.3000	1.1818
94	34.44	192.7	1.559	.6415		148.2	632.5	484.3	.3041	1.1789
96	35.56	198.9	1.510	.6620		150.5	632.7	482.1	.3083	1.1761
98	36.67	205.3	1.464	.6832		152.9	632.9	480.0	.3125	1.1733
100	37.78	211.9	1.419	.7048	36.40	155.2	633.0	477.8	.3166	1.1705
102	38.89	218.6	1.375	.7270		157.6	633.2	475.6	.3207	1.1677
104	40.00	225.4	1.334	.7498		159.9	633.4	473.5	.3248	1.1649
106	41.11	232.5	1.293	.7732		162.3	633.5	471.2	.3289	1.1621
108	42.22	239.7	1.254	.7972		164.6	633.6	469.0	.3330	1.1593
110	43.33	247.0	1.217	.8219	35.84	167.0	633.7	466.7	.3372	1.1566
112	44.44	254.5	1.180	.8471		169.4	633.8	464.4	.3413	1.1538
114	45.56	262.2	1.145	.8730		171.8	633.9	462.1	.3453	1.1510
116	46.67	270.1	1.112	.8996		174.2	634.0	459.8	.3495	1.1483
118	47.78	278.2	1.079	.9269		176.6	634.0	457.4	.3535	1.1455
120	48.89	286.4	1.047	.9549	35.26	179.0	634.0	455.0	.3576	1.1427
122	50.00	294.8	1.017	.9837		181.4	634.0	452.6	.3618	1.1400
124	51.11	303.4	0.987	1.0132		183.9	634.0	450.1	.3659	1.1372
125	51.66	307.8	0.973	1.028		185.1	634.0	448.9	.3679	1.1358

PARTIAL PRESSURES OF AQUEOUS AMMONIA SOLUTIONS

Perman, *Jour. Chem. Soc.* 83, *1168* (*1903*).

°C	% Wt. NH_3	Partial Pressure mm Hg		°C	% Wt. NH_3	Partial Pressure mm Hg	
		NH_3	H_2O			NH_3	H_2O
0	4.72	11.4	5.1	+30.09	9.75	120.0	28.5
	9.15	24.8	5.3		12.77	175.0	26.6
	14.73	51.3	4.1		17.76	290.2	24.8
	19.62	82.5	3.0		17.84	291.1	24.3
	22.90	116.6	2.8		21.47	404.6	22.1
+10	4.16	16.5	9.1	+40	3.79	61.1	53.5
	8.26	37.2	8.8		7.36	133.0	50.7
	12.32	64.2	7.6		11.06	218.5	49.1
	15.88	95.1	7.0		15.55	353.6	44.1
	20.54	149.2	6.2		17.33	427.7	.....
	21.83	169.8	5.5		20.85	576.1	37.8
+19.9	4.18	27.4	16.4	+50	3.29	79.1	89.6
	6.50	45.8	16.1		5.90	151.3	87.1
	6.55	46.0	16.0		8.91	246.6	83.0
	7.72	56.2	15.6		11.57	341.7	80.6
	10.15	80.6	15.1		14.15	451.4	77.0
	10.75	86.3	14.7		14.94	487.1	75.2
	16.64	166.1	12.9				
	19.40	215.6	12.3	+60	3.86	136.9	144.1
	23.37	302.4	10.3		5.77	215.9	.....
					7.78	300.4	138.5
+30.09	3.93	41.2	31.1		9.37	375.7	135.5
	7.43	86.3	29.2		11.31	475.8	130.4

VAPOR PRESSURE OF WATER IN MILLIMETERS OF MERCURY

For Temperatures from −10° to 118°C

The values in the table below are for water in contact with its own vapor. Where the water is in contact with air at a temperature t°C, the following correction must be added: Correction for temperatures up to 40°C $= p(0.0775 - 3.13 \times 10^{-4} t)/100$; for temperatures above 50°C $= p(0.0652 - 8.75 \times 10^{-5} t)/100$.

See also Steam Table.

t°C.	p mm Hg	t°C.	p mm Hg	t°C.	p mm Hg
−10.0	2.149	−4.5	3.284	1.0	4.926
−9.9	2.167	−4.4	3.309	1.1	4.962
−9.8	2.184	−4.3	3.334	1.2	4.998
−9.7	2.201	−4.2	3.359	1.3	5.034
−9.6	2.219	−4.1	3.384	1.4	5.070
−9.5	2.236	−4.0	3.410	1.5	5.107
−9.4	2.254	−3.9	3.436	1.6	5.144
−9.3	2.271	−3.8	3.461	1.7	5.181
−9.2	2.289	−3.7	3.487	1.8	5.219
−9.1	2.307	−3.6	3.514	1.9	5.256
−9.0	2.326	−3.5	3.540	2.0	5.294
−8.9	2.343	−3.4	3.567	2.1	5.332
−8.8	2.362	−3.3	3.593	2.2	5.370
−8.7	2.380	−3.2	3.620	2.3	5.408
−8.6	2.399	−3.1	3.647	2.4	5.447
−8.5	2.418	−3.0	3.673	2.5	5.486
−8.4	2.437	−2.9	3.702	2.6	5.525
−8.3	2.456	−2.8	3.730	2.7	5.565
−8.2	2.475	−2.7	3.757	2.8	5.605
−8.1	2.495	−2.6	3.785	2.9	5.645
−8.0	2.514	−2.5	3.813	3.0	5.685
−7.9	2.533	−2.4	3.841	3.1	5.725
−7.8	2.553	−2.3	3.871	3.2	5.766
−7.7	2.572	−2.2	3.898	3.3	5.807
−7.6	2.593	−2.1	3.927	3.4	5.848
−7.5	2.613	−2.0	3.956	3.5	5.889
−7.4	2.633	−1.9	3.986	3.6	5.931
−7.3	2.654	−1.8	4.016	3.7	5.973
−7.2	2.674	−1.7	4.045	3.8	6.015
−7.1	2.695	−1.6	4.075	3.9	6.058
−7.0	2.715	−1.5	4.105	4.0	6.101
−6.9	2.736	−1.4	4.135	4.1	6.144
−6.8	2.757	−1.3	4.165	4.2	6.187
−6.7	2.778	−1.2	4.196	4.3	6.230
−6.6	2.800	−1.1	4.227	4.4	6.274
−6.5	2.822	−1.0	4.258	4.5	6.318
−6.4	2.843	−0.9	4.289	4.6	6.363
−6.3	2.866	−0.8	4.320	4.7	6.408
−6.2	2.887	−0.7	4.353	4.8	6.453
−6.1	2.909	−0.6	4.385	4.9	6.498
−6.0	2.931	−0.5	4.416	5.0	6.543
−5.9	2.955	−0.4	4.448	5.1	6.589
−5.8	2.976	−0.3	4.480	5.2	6.635
−5.7	3.000	−0.2	4.513	5.3	6.681
−5.6	3.022	−0.1	4.546	5.4	6.728
−5.5	3.046	0.0	4.579	5.5	6.775
−5.4	3.069	+0.1	4.613	5.6	6.822
−5.3	3.092	0.2	4.647	5.7	6.869
−5.2	3.115	0.3	4.681	5.8	6.917
−5.1	3.139	0.4	4.715	5.9	6.965
−5.0	3.163	0.5	4.750	6.0	7.013
−4.9	3.187	0.6	4.785	6.1	7.062
−4.8	3.211	0.7	4.820	6.2	7.111
−4.7	3.235	0.8	4.855	6.3	7.160
−4.6	3.259	0.9	4.890	6.4	7.209

VAPOR PRESSURE OF WATER IN MILLIMETERS OF MERCURY

t°C.	p mm Hg	t°C.	p mm Hg	t°C.	p mm Hg
6.5	7.259	12.8	11.085	19.1	16.581
6.6	7.309	12.9	11.158	19.2	16.685
6.7	7.360	13.0	11.231	19.3	16.789
6.8	7.411	13.1	11.305	19.4	16.894
6.9	7.462	13.2	11.379	19.5	16.999
7.0	7.513	13.3	11.453	19.6	17.105
7.1	7.565	13.4	11.528	19.7	17.212
7.2	7.617	13.5	11.604	19.8	17.319
7.3	7.669	13.6	11.680	19.9	17.427
7.4	7.722	13.7	11.756	20.0	17.535
7.5	7.775	13.8	11.833	20.1	17.644
7.6	7.828	13.9	11.910	20.2	17.753
7.7	7.882	14.0	11.987	20.3	17.863
7.8	7.936	14.1	12.065	20.4	17.974
7.9	7.990	14.2	12.144	20.5	18.085
8.0	8.045	14.3	12.223	20.6	18.197
8.1	8.100	14.4	12.302	20.7	18.309
8.2	8.155	14.5	12.382	20.8	18.422
8.3	8.211	14.6	12.462	20.9	18.536
8.4	8.267	14.7	12.543	21.0	18.650
8.5	8.323	14.8	12.624	21.1	18.765
8.6	8.380	14.9	12.706	21.2	18.880
8.7	8.437	15.0	12.788	21.3	18.996
8.8	8.494	15.1	12.870	21.4	19.113
8.9	8.551	15.2	12.953	21.5	19.231
9.0	8.609	15.3	13.037	21.6	19.349
9.1	8.668	15.4	13.121	21.7	19.468
9.2	8.727	15.5	13.205	21.8	19.587
9.3	8.786	15.6	13.290	21.9	19.707
9.4	8.845	15.7	13.375	22.0	19.827
9.5	8.905	15.8	13.461	22.1	19.948
9.6	8.965	15.9	13.547	22.2	20.070
9.7	9.025	16.0	13.634	22.3	20.193
9.8	9.086	16.1	13.721	22.4	20.316
9.9	9.147	16.2	13.809	22.5	20.440
10.0	9.209	16.3	13.898	22.6	20.565
10.1	9.271	16.4	13.987	22.7	20.690
10.2	9.333	16.5	14.076	22.8	20.815
10.3	9.395	16.6	14.166	22.9	20.941
10.4	9.458	16.7	14.256	23.0	21.068
10.5	9.521	16.8	14.347	23.1	21.196
10.6	9.585	16.9	14.438	23.2	21.324
10.7	9.649	17.0	14.530	23.3	21.453
10.8	9.714	17.1	14.622	23.4	21.583
10.9	9.779	17.2	14.715	23.5	21.714
11.0	9.844	17.3	14.809	23.6	21.845
11.1	9.910	17.4	14.903	23.7	21.977
11.2	9.976	17.5	14.997	23.8	22.110
11.3	10.042	17.6	15.092	23.9	22.243
11.4	10.109	17.7	15.188	24.0	22.377
11.5	10.176	17.8	15.284	24.1	22.512
11.6	10.244	17.9	15.380	24.2	22.648
11.7	10.312	18.0	15.477	24.3	22.785
11.8	10.380	18.1	15.575	24.4	22.922
11.9	10.449	18.2	15.673	24.5	23.060
12.0	10.518	18.3	15.772	24.6	23.198
12.1	10.588	18.4	15.871	24.7	23.337
12.2	10.658	18.5	15.971	24.8	23.476
12.3	10.728	18.6	16.071	24.9	23.616
12.4	10.799	18.7	16.171	25.0	23.756
12.5	10.870	18.8	16.272	25.1	23.897
12.6	10.941	18.9	16.374	25.2	24.039
12.7	11.013	19.0	16.477	25.3	24.182

VAPOR PRESSURE OF WATER IN MILLIMETERS OF MERCURY

t°C.	p mm Hg	t°C.	p mm Hg	t°C.	p mm Hg
25.4	24.326	31.7	35.062	38.0	49.692
25.5	24.471	31.8	35.261	38.1	49.961
25.6	24.617	31.9	35.462	38.2	50.231
25.7	24.764	32.0	35.663	38.3	50.502
25.8	24.912	32.1	35.865	38.4	50.774
25.9	25.060	32.2	36.068	38.5	51.048
26.0	25.209	32.3	36.272	38.6	51.323
26.1	25.359	32.4	36.477	38.7	51.600
26.2	25.509	32.5	36.683	38.8	51.879
26.3	25.660	32.6	36.891	38.9	52.160
26.4	25.812	32.7	37.099	39.0	52.442
26.5	25.964	32.8	37.308	39.1	52.725
26.6	26.117	32.9	37.518	39.2	53.009
26.7	26.271	33.0	37.729	39.3	53.294
26.8	26.426	33.1	37.942	39.4	53.580
26.9	26.582	33.2	38.155	39.5	53.867
27.0	26.739	33.3	38.369	39.6	54.156
27.1	26.897	33.4	38.584	39.7	54.446
27.2	27.055	33.5	38.801	39.8	54.737
27.3	27.214	33.6	39.018	39.9	55.030
27.4	27.374	33.7	39.237	40.0	55.324
27.5	27.535	33.8	39.457	40.2	55.91
27.6	27.696	33.9	39.677	40.4	56.51
27.7	27.858	34.0	39.898	40.6	57.11
27.8	28.021	34.1	40.121	40.8	57.72
27.9	28.185	34.2	40.344	41.0	58.34
28.0	28.349	34.3	40.569	41.2	58.96
28.1	28.514	34.4	40.796	41.4	59.58
28.2	28.680	34.5	41.023	41.6	60.22
28.3	28.847	34.6	41.251	41.8	60.86
28.4	29.015	34.7	41.480	42.0	61.50
28.5	29.184	34.8	41.710	42.2	62.14
28.6	29.354	34.9	41.942	42.4	62.80
28.7	29.525	35.0	42.175	42.6	63.46
28.8	29.697	35.1	42.409	42.8	64.12
28.9	29.870	35.2	42.644	43.0	64.80
29.0	30.043	35.3	42.880	43.2	65.48
29.1	30.217	35.4	43.117	43.4	66.16
29.2	30.392	35.5	43.355	43.6	66.86
29.3	30.568	35.6	43.595	43.8	67.56
29.4	30.745	35.7	43.836	44.0	68.26
29.5	30.923	35.8	44.078	44.2	68.97
29.6	31.102	35.9	44.320	44.4	69.69
29.7	31.281	36.0	44.563	44.6	70.41
29.8	31.461	36.1	44.808	44.8	71.14
29.9	31.642	36.2	45.054	45.0	71.88
30.0	31.824	36.3	45.301	45.2	72.62
30.1	32.007	36.4	45.549	45.4	73.36
30.2	32.191	36.5	45.799	45.6	74.12
30.3	32.376	36.6	46.050	45.8	74.88
30.4	32.561	36.7	46.302	46.0	75.65
30.5	32.747	36.8	46.556	46.2	76.43
30.6	32.934	36.9	46.811	46.4	77.21
30.7	33.122	37.0	47.067	46.6	78.00
30.8	33.312	37.1	47.324	46.8	78.80
30.9	33.503	37.2	47.582	47.0	79.60
31.0	33.695	37.3	47.841	47.2	80.41
31.1	33.888	37.4	48.102	47.4	81.23
31.2	34.082	37.5	48.364	47.6	82.05
31.3	34.276	37.6	48.627	47.8	82.87
31.4	34.471	37.7	48.891	48.0	83.71
31.5	34.667	37.8	49.157	48.2	84.56
31.6	34.864	37.9	49.424	48.4	85.42

VAPOR PRESSURE OF WATER IN MILLIMETERS OF MERCURY

t°C.	p mm Hg	t°C.	p mm Hg	t°C.	p mm Hg
48.6	86.28	71.0	243.9	92.2	571.26
48.8	87.14	71.5	249.3	92.4	575.55
49.0	88.02	72.0	254.6	92.6	579.87
49.2	88.90	72.5	260.2	92.8	584.22
49.4	89.79	73.0	265.7	93.0	588.60
49.6	90.69	73.5	271.5	93.2	593.00
49.8	91.59	74.0	277.2	93.4	597.43
50.0	92.51	74.5	283.2	93.6	601.89
50.5	94.86	75.0	289.1	93.8	606.38
51.0	97.20	75.5	295.3	94.0	610.90
51.5	99.65	76.0	301.4	94.2	615.44
52.0	102.09	76.5	307.7	94.4	620.01
52.5	104.65	77.0	314.1	94.6	624.61
53.0	107.20	77.5	320.7	94.8	629.24
53.5	109.86	78.0	327.3	95.0	633.90
54.0	112.51	78.5	334.2	95.2	638.59
54.5	115.28	79.0	341.0	95.4	643.30
55.0	118.04	79.5	348.1	95.6	648.05
55.5	120.92	80.0	355.1	95.8	652.82
56.0	123.80	80.5	362.4	96.0	657.62
56.5	126.81	81.0	369.7	96.2	662.45
57.0	129.82	81.5	377.3	96.4	667.31
57.5	132.95	82.0	384.9	96.6	672.20
58.0	136.08	82.5	392.8	96.8	677.12
58.5	139.34	83.0	400.6	97.0	682.07
59.0	142.60	83.5	408.7	97.2	687.04
59.5	145.99	84.0	416.8	97.4	692.05
60.0	149.38	84.5	425.2	97.6	697.10
60.5	152.91	85.0	433.6	97.8	702.17
61.0	156.43	85.5	442.3	98.0	707.27
61.5	160.10	86.0	450.9	98.2	712.40
62.0	163.77	86.5	459.8	98.4	717.56
62.5	167.58	87.0	468.7	98.6	722.75
63.0	171.38	87.5	477.9	98.8	727.98
63.5	175.35	88.0	487.1	99.0	733.24
64.0	179.31	88.5	496.6	99.2	738.53
64.5	183.43	89.0	506.1	99.4	743.85
65.0	187.54	89.5	515.9	99.6	749.20
65.5	191.82	90.0	525.76	99.8	754.58
66.0	196.09	90.2	529.77	100.0	760.00
66.5	200.53	90.4	533.80	102	815.86
67.0	204.96	90.6	537.86	104	875.06
67.5	209.57	90.8	541.95	106	937.92
68.0	214.17	91.0	546.05	108	1004.4
68.5	218.95	91.2	550.18	110	1074.6
69.0	223.73	91.4	554.35	112	1148.7
69.5	228.72	91.6	558.53	114	1227.2
70.0	233.7	91.8	562.75	116	1309.9
70.5	238.8	92.0	566.99	118	1397.2

VAPOR PRESSURE OF ICE IN MILLIMETERS OF MERCURY

For Temperatures from −99° to 0°C

The values in the table below are for ice in contact with its own vapor. Where the ice is in contact with air at a temperature t°C, the following correction must be added: Correction $= 20p/100\,(t+273)$.

t°C.	p mm Hg	t°C.	p mm Hg	t°C.	p mm Hg
−99	0.000012	−41	0.0862	−25.3	0.462
−98	0.000015	−40	0.0966	−25.2	0.467
−97	0.000018	−39	0.1081	−25.1	0.471
−96	0.000022	−38	0.1209	−25.0	0.476
−95	0.000027	−37	0.1351	−24.9	0.481
−94	0.000033	−36	0.1507	−24.8	0.486
−93	0.000040	−35	0.1681	−24.7	0.490
−92	0.000048	−34	0.1873	−24.6	0.495
−91	0.000058	−33	0.2084	−24.5	0.500
−90	0.000070	−32	0.2318	−24.4	0.505
−89	0.000084	−31	0.2575	−24.3	0.510
−88	0.00010	−30	0.2859	−24.2	0.515
−87	0.00012	−29.9	0.289	−24.1	0.520
−86	0.00014	−29.8	0.292	−24.0	0.526
−85	0.00017	−29.7	0.295	−23.9	0.531
−84	0.00020	−29.6	0.298	−23.8	0.536
−83	0.00024	−29.5	0.301	−23.7	0.541
−82	0.00029	−29.4	0.304	−23.6	0.547
−81	0.00034	−29.3	0.307	−23.5	0.552
−80	0.00040	−29.2	0.311	−23.4	0.558
−79	0.00047	−29.1	0.314	−23.3	0.563
−78	0.00056	−29.0	0.317	−23.2	0.569
−77	0.00066	−28.9	0.320	−23.1	0.574
−76	0.00077	−28.8	0.324	−23.0	0.580
−75	0.00090	−28.7	0.327	−22.9	0.586
−74	0.00105	−28.6	0.330	−22.8	0.592
−73	0.00123	−28.5	0.334	−22.7	0.597
−72	0.00143	−28.4	0.337	−22.6	0.603
−71	0.00167	−28.3	0.341	−22.5	0.609
−70	0.00194	−28.2	0.344	−22.4	0.615
−69	0.00225	−28.1	0.348	−22.3	0.621
−68	0.00261	−28.0	0.351	−22.2	0.627
−67	0.00302	−27.9	0.355	−22.1	0.633
−66	0.00349	−27.8	0.359	−22.0	0.640
−65	0.00403	−27.7	0.362	−21.9	0.646
−64	0.00464	−27.6	0.366	−21.8	0.652
−63	0.00534	−27.5	0.370	−21.7	0.659
−62	0.00614	−27.4	0.374	−21.6	0.665
−61	0.00703	−27.3	0.377	−21.5	0.672
−60	0.00808	−27.2	0.381	−21.4	0.678
−59	0.00925	−27.1	0.385	−21.3	0.685
−58	0.0106	−27.0	0.389	−21.2	0.691
−57	0.0121	−26.9	0.393	−21.1	0.698
−56	0.0138	−26.8	0.397	−21.0	0.705
−55	0.0157	−26.7	0.401	−20.9	0.712
−54	0.0178	−26.6	0.405	−20.8	0.719
−53	0.0203	−26.5	0.409	−20.7	0.726
−52	0.0230	−26.4	0.414	−20.6	0.733
−51	0.0261	−26.3	0.418	−20.5	0.740
−50	0.0296	−26.2	0.422	−20.4	0.747
−49	0.0334	−26.1	0.426	−20.3	0.754
−48	0.0378	−26.0	0.430	−20.2	0.761
−47	0.0426	−25.9	0.435	−20.1	0.769
−46	0.0481	−25.8	0.439	−20.0	0.776
−45	0.0541	−25.7	0.444	−19.9	0.783
−44	0.0609	−25.6	0.448	−19.8	0.791
−43	0.0684	−25.5	0.453	−19.7	0.799
−42	0.0768	−25.4	0.457	−19.6	0.806

VAPOR PRESSURE OF ICE IN MILLIMETERS OF MERCURY

t°C.	p mm Hg	t°C.	p mm Hg	t°C.	p mm Hg
−19.5	0.814	−13.0	1.490	−6.5	2.649
−19.4	0.822	−12.9	1.504	−6.4	2.672
−19.3	0.830	−12.8	1.518	−6.3	2.695
−19.2	0.838	−12.7	1.532	−6.2	2.718
−19.1	0.846	−12.6	1.546	−6.1	2.742
−19.0	0.854	−12.5	1.559	−6.0	2.765
−18.9	0.862	−12.4	1.574	−5.9	2.790
−18.8	0.870	−12.3	1.588	−5.8	2.813
−18.7	0.879	−12.2	1.602	−5.7	2.838
−18.6	0.887	−12.1	1.617	−5.6	2.862
−18.5	0.895	−12.0	1.632	−5.5	2.887
−18.4	0.904	−11.9	1.646	−5.4	2.912
−18.3	0.912	−11.8	1.661	−5.3	2.937
−18.2	0.921	−11.7	1.676	−5.2	2.962
−18.1	0.930	−11.6	1.691	−5.1	2.987
−18.0	0.939	−11.5	1.707	−5.0	3.013
−17.9	0.947	−11.4	1.722	−4.9	3.039
−17.8	0.956	−11.3	1.737	−4.8	3.065
−17.7	0.966	−11.2	1.753	−4.7	3.091
−17.6	0.975	−11.1	1.769	−4.6	3.117
−17.5	0.984	−11.0	1.785	−4.5	3.144
−17.4	0.993	−10.9	1.800	−4.4	3.171
−17.3	1.002	−10.8	1.817	−4.3	3.198
−17.2	1.012	−10.7	1.833	−4.2	3.225
−17.1	1.021	−10.6	1.849	−4.1	3.252
−17.0	1.031	−10.5	1.866	−4.0	3.280
−16.9	1.041	−10.4	1.883	−3.9	3.308
−16.8	1.051	−10.3	1.899	−3.8	3.336
−16.7	1.060	−10.2	1.916	−3.7	3.364
−16.6	1.070	−10.1	1.934	−3.6	3.393
−16.5	1.080	−10.0	1.950	−3.5	3.422
−16.4	1.091	−9.9	1.968	−3.4	3.451
−16.3	1.101	−9 8	1 985	−3.3	3.480
−16.2	1.111	−9.7	2.003	−3.2	3.509
−16.1	1.121	−9.6	2.021	−3.1	3.539
−16.0	1.132	−9.5	2.039	−3.0	3.568
−15.9	1.142	−9.4	2.057	−2.9	3.599
−15.8	1.153	9.3	2.075	−2.8	3.630
−15.7	1.164	9.2	2.093	−2.7	3.660
−15.6	1.175	9.1	2.112	−2.6	3.691
−15.5	1.186	9.0	2.131	−2.5	3.722
−15.4	1.196	−8.9	2.149	−2.4	3.753
−15.3	1.208	−8.8	2.168	−2.3	3.785
−15.2	1.219	−8.7	2.187	−2.2	3.816
−15.1	1.230	−8.6	2.207	−2.1	3.848
−15.0	1.241	−8.5	2.226	−2.0	3.880
−14.9	1.253	−8.4	2.246	−1.9	3.913
−14.8	1.264	−8.3	2.266	−1.8	3.946
−14.7	1.276	−8.2	2.285	−1.7	3.979
−14.6	1.288	−8.1	2.306	−1.6	4.012
−14.5	1.300	−8.0	2.326	−1.5	4.045
−14.4	1.312	−7.9	2.346	−1.4	4.079
−14.3	1.324	−7.8	2.367	−1.3	4.113
−14.2	1.336	−7.7	2.387	−1.2	4.147
−14.1	1.348	−7.6	2.408	−1.1	4.182
−14.0	1.361	−7.5	2.429	−1.0	4.217
−13.9	1.373	−7.4	2.450	−0.9	4.252
−13.8	1.386	−7.3	2.472	−0.8	4.287
−13.7	1.399	−7.2	2.493	−0.7	4.323
−13.6	1.411	−7.1	2.515	−0.6	4.359
−13.5	1.424	−7.0	2.537	−0.5	4.395
−13.4	1.437	−6.9	2.559	−0.4	4.431
−13.3	1.450	−6.8	2.581	−0.3	4.467
−13.2	1.464	−6.7	2.603	−0.2	4.504
−13.1	1.477	−6.6	2.626	−0.1	4.542
				0.0	4.579

BOILING POINT OF WATER AT VARIOUS BAROMETRIC PRESSURES

emp. °C.	0.0° mm of Hg	0.2° mm of Hg	0.4° mm of Hg	0.6° mm of Hg	0.8° mm of Hg
80	355.40	358.28	361.19	364.11	367.06
81	370.03	373.01	376.02	379.05	382.09
82	385.16	388.25	391.36	394.49	397.64
83	400.81	404.00	407.22	410.45	413.71
84	416.99	420.29	423.61	426.95	430.32
85	433.71	437.12	440.55	444.01	447.49
86	450.99	454.51	458.06	461.63	465.22
87	468.84	472.48	476.14	479.83	483.54
88	487.28	491.04	494.82	498.63	502.46
89	506.32	510.20	514.11	518.04	521.99
90	525.97	529.98	534.01	538.07	542.15
91	546.26	550.40	554.56	558.75	562.96
92	567.20	571.47	575.76	580.08	584.43
93	588.80	593.20	597.63	602.09	606.57
94	611.08	615.62	620.19	624.79	629.41
95	634.06	638.74	643.45	648.19	652.96
96	657.75	662.58	667.43	672.32	677.23
97	682.18	687.15	692.15	697.19	702.25
98	707.35	712.47	717.63	722.81	728.03
99	733.28	738.56	743.87	749.22	754.59
100	760.00	765.44	770.91	776.42	781.95

BOILING POINT OF WATER AT VARIOUS PRESSURES

The table below gives the boiling point of water in degrees Centigrade at various ressures in millimeters of mercury at 0°C.

See also Steam Table.

Pressure	Tenths of a millimeter of Hg									
nm of Hg	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
690	97.317°	321	325	329	333	337	341	345	349	353
691	97.357°	361	365	369	373	377	381	385	389	393
692	97.397°	401	405	409	413	417	421	425	429	433
693	97.437°	441	445	449	453	457	461	465	469	473
694	97.477°	480	484	488	492	496	500	504	508	512
695	97.516°	520	524	528	532	536	540	544	548	552
696	97.556°	560	564	568	572	576	580	584	588	592
697	97.596°	599	603	607	611	615	619	623	627	631
698	97.635°	639	643	647	651	655	659	663	667	671
699	97.675°	678	682	686	690	694	698	702	706	710
700	97.714°	718	722	726	730	734	738	742	746	750
701	97.754°	757	761	765	769	773	777	781	785	789
702	97.793°	797	801	805	809	813	816	820	824	828
703	97.832°	836	840	844	848	852	856	860	864	868
704	97.872°	876	879	883	887	891	895	899	903	907
705	97.911°	915	919	923	927	931	935	939	943	947
706	97.950°	954	958	962	966	970	974	977	981	985
707	97.989°	993	996	*000	*004	*008	*012	*016	*020	*024
708	98.028°	032	036	040	043	047	051	055	059	063
709	98.067	071	075	079	082	086	090	094	098	102
710	98.106°	110	114	118	121	125	129	133	137	141
711	98.145°	149	153	157	160	164	168	172	176	180
712	98.184°	188	192	195	199	203	207	211	215	219
713	98.223°	227	230	234	238	242	246	250	254	258
714	98.262°	266	270	274	278	282	286	290	293	297
715	98.301°	304	308	312	316	320	323	327	331	335
716	98.339°	343	347	351	355	358	362	366	370	374
717	98.378°	382	385	389	393	397	401	405	409	413
718	98.417°	420	424	428	432	436	440	443	447	451
719	98.455°	459	463	467	470	474	478	482	486	490

BOILING POINT OF WATER AT VARIOUS PRESSURES

Pressure	Tenths of a millimeter of Hg									
mm of Hg	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
720	98.494°	497	501	505	509	513	517	520	524	528
721	98.532°	536	540	544	547	551	555	559	563	567
722	98.571°	574	578	582	586	590	593	597	601	605
723	98.609°	613	617	620	624	628	632	636	640	644
724	98.648°	652	655	659	663	667	671	675	678	682
725	98.686°	689	693	697	701	705	709	712	716	720
726	98.724°	728	732	735	739	743	747	751	755	758
727	98.762°	766	770	774	777	781	785	789	793	797
728	98.801°	804	808	812	816	819	823	827	831	835
729	98.839°	843	846	850	854	858	861	865	869	873
730	98.877°	880	884	888	892	896	899	903	907	911
731	98.915°	918	922	926	930	934	937	941	945	949
732	98.953°	956	960	964	968	972	975	979	983	987
733	98.991°	994	998	*002	*006	*010	*013	*017	*021	*025
734	99.029°	032	036	040	044	048	051	055	059	063
735	99.067°	070	074	078	082	085	089	093	097	101
736	99.105°	109	112	116	119	123	127	131	135	138
737	99.142°	146	150	153	157	161	165	169	172	176
738	99.180°	184	187	191	195	199	203	206	210	214
739	99.218°	221	225	229	233	236	240	244	248	252
740	99.255°	259	263	267	270	274	278	282	285	289
741	99.293°	297	300	304	308	312	316	319	323	327
742	99.331°	334	338	342	346	349	353	357	361	364
743	99.368°	372	376	379	383	387	391	394	398	402
744	99.406°	409	413	417	421	424	428	432	436	439
745	99.443°	447	451	454	458	462	466	469	473	477
746	99.481°	484	488	492	495	499	503	507	510	514
747	99.518°	522	525	529	533	537	540	544	548	551
748	99.555°	559	563	566	570	574	578	581	585	589
749	99.593°	596	600	604	607	611	615	619	622	626
750	99.630°	633	637	641	645	648	652	656	659	663
751	99.667°	671	674	678	682	686	689	693	697	700
752	99.704°	708	712	715	719	723	726	730	734	738
753	99.741°	745	749	752	756	760	764	767	771	775
754	99.778°	782	786	790	793	797	801	804	808	812
755	99.815°	819	823	827	830	834	838	841	845	849
756	99.852°	856	860	863	867	871	875	878	882	886
757	99.889°	893	897	900	904	908	911	915	919	923
758	99.926°	930	934	937	941	945	948	952	956	959
759	99.963°	967	970	974	978	982	985	989	993	996
760	100.000°	004	007	011	015	018	022	026	029	033
761	100.037°	040	044	048	052	055	059	063	066	070
762	100.073°	077	081	085	088	092	096	099	103	107
763	100.110°	114	118	121	125	129	132	136	140	143
764	100.147°	151	154	158	162	165	169	173	176	180
765	100.184°	187	191	195	198	202	206	209	213	216
766	100.220°	224	227	231	235	238	242	246	249	253
767	100.257°	260	264	268	271	275	279	283	286	290
768	100.293°	297	300	304	308	311	315	319	322	326
769	100.330°	333	337	341	344	348	352	355	359	363
770	100.366°	370	373	377	381	384	388	392	395	399
771	100.402°	406	410	414	417	421	424	428	432	435
772	100.439°	442	446	450	453	457	461	464	468	472
773	100.475°	479	483	486	490	493	497	501	504	508
774	100.511°	515	519	522	526	530	533	537	540	544
775	100.547°	551	555	559	562	566	569	573	577	580
776	100.584°	588	591	595	598	602	606	609	613	616
777	100.620°	624	627	631	634	638	642	645	649	653
778	100.656°	660	663	667	671	674	678	681	685	689
779	100.692°	696	699	703	707	710	714	718	721	725

BOILING POINT OF WATER AT VARIOUS PRESSURES

Pressure mm of Hg	Tenths of a millimeter of Hg									
	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
780	100.728°	732	735	739	743	746	750	753	757	761
781	100.764°	768	772	775	779	782	786	789	793	797
782	100.800°	804	807	811	815	818	822	825	829	833
783	100.836°	840	843	847	851	854	858	861	865	869
784	100.872°	876	879	883	886	890	894	897	901	904
785	100.908°	912	915	919	922	926	929	933	937	940
786	100.944°	947	951	954	958	962	965	969	972	976
787	100.980°	984	988	991	995	998	*002	*006	*009	*013
788	101.016°	020	023	027	030	034	037	040	044	047
789	101.051°	054	058	062	065	069	072	076	079	083
790	101.087°	090	094	097	101	104	108	112	115	119
791	101.122°	126	129	133	136	140	144	147	151	154
792	101.158°	161	165	168	172	176	179	183	186	190
793	101.194°	197	201	204	208	211	215	218	222	225
794	101.229°	232	236	239	243	246	250	254	257	261
795	101.265°	269	272	276	279	283	287	290	294	297
796	101.300°	303	307	310	314	317	321	324	328	332
797	101.335°	339	342	346	349	353	356	360	363	367
798	101.371°	375	378	382	385	388	392	395	399	402
799	101.406°	409	413	416	420	423	427	430	434	437
800	101.441°									

Pressure, atm.	Boiling Point, °C.	Pressure, atm.	Boiling Point, °C.	Pressure, atm.	Boiling Point, °C.	Pressure, atm.	Boiling Point, °C
0.5	80.9	7	164.2	14	194.1	21	213.9
1	100.0	8	169.6	15	197.4	22	216.2
2	119.6	9	174.5	16	200.4	23	218.5
3	132.9	10	179.0	17	203.4	24	220.8
4	142.9	11	183.2	18	206.1	25	222.9
5	151.1	12	187.1	19	208.8	26	225.0
6	158.1	13	190.7	20	211.4	27	227.0

PROPERTIES OF

METRIC AND

The values given in the table below are based upon the values given in Keenan's Steam Tables. (Copyright 1930 by The American Society of Mechanical Engineers, by permission.) The B. T. U. is 778.57 ft.-lb. (=J) which is 1/180 of the change in total heat along the saturated liquid line between 32°F. and 212° F. as determined by Osborne, Fiock and Stimson at the Bu. of Standards. The P. C. U. is 1.8 B. T. U. The values given in Calories per kilogram have been computed from the values in B. T. U. per pound by means of the conversion factor 0.5556. The heat of vaporization h_{fg} is the heat required to vaporize unit mass of water at the indicated temperature and

	Pressure			Heat						
				Of the liquid		Of vaporization.		Equivalent of internal work of evapn.		
Temperature Degrees Fahrenheit.	Pounds per square inch.	Kilograms per square centimeter.	Millimeters of mercury.	B.T.U. per pound.	Cal. /kg. or P.C.U. /lb.	B.T.U. per pound.	Cal. /kg. or P.C.U. /lb.	B.T.U. per pound.	Cal. /kg. or P.C.U. /lb.	Temperature Degrees Centigrade.
t	p	p	p	h_f	h_f	h_{fg}	h_{fg}	u_{fg}	u_{fg}	t
32	0.0887	0.00624	4.587	0.00	0.00	1073.4	596.4	1019.2	566.3	0.0
34	0.0961	0.00676	4.970	2.01	1.12	1072.3	595.7	1017.9	565.5	1.1
36	0.1041	0.00732	5.384	4.03	2.24	1071.2	595.2	1016.6	564.8	2.2
38	0.1126	0.00792	5.823	6.04	3.36	1070.2	594.6	1015.4	564.2	3.3
40	0.1217	0.00856	6.294	8.05	4.47	1069.1	594.0	1014.1	563.4	4.4
42	0.1315	0.00925	6.801	10.05	5.58	1068.0	593.4	1012.7	562.7	5.6
44	0.1420	0.00998	7.344	12.05	6.69	1066.9	592.8	1011.4	561.9	6.7
46	0.1532	0.01077	7.923	14.06	7.81	1065.8	592.2	1010.1	561.2	7.8
48	0.1652	0.01161	8.543	16.06	8.92	1064.7	591.5	1008.8	560.5	8.9
50	0.1780	0.01251	9.205	18.06	10.03	1063.6	590.9	1007.5	559.8	10.0
52	0.1918	0.01348	9.919	20.06	11.15	1062.5	590.3	1006.2	559.0	11.1
54	0.2063	0.01450	10.669	22.06	12.26	1061.4	589.7	1004.8	558.3	12.2
56	0.2219	0.01560	11.476	24.05	13.36	1060.3	589.1	1003.5	557.5	13.3
58	0.2384	0.01676	12.329	26.05	14.47	1059.3	588.5	1002.3	556.9	14.4
60	0.2561	0.01801	13.244	28.05	15.58	1058.2	587.9	1001.0	556.2	15.6
62	0.2749	0.01933	14.216	30.05	16.70	1057.1	587.3	999.7	555.4	16.7
64	0.2949	0.02073	15.251	32.04	17.80	1056.0	586.7	998.3	554.7	17.8
66	0.3162	0.02223	16.352	34.04	18.91	1054.9	586.1	997.0	553.9	18.9
68	0.3388	0.02382	17.52	36.03	20.02	1053.8	585.5	995.7	553.2	20.0
70	0.3628	0.02551	18.76	38.03	21.13	1052.7	584.9	994.4	552.5	21.1
72	0.3883	0.02730	20.08	40.02	22.24	1051.6	584.5	993.1	551.8	22.2
74	0.4153	0.02920	21.48	42.02	23.35	1050.6	583.7	991.9	551.1	23.3
76	0.4440	0.03122	22.96	44.01	24.45	1049.5	583.1	990.5	550.3	24.4
78	0.4744	0.03335	24.53	46.00	25.56	1048.4	582.5	989.2	549.6	25.6
80	0.5067	0.03562	26.20	48.00	26.67	1047.3	581.9	987.9	548.9	26.7
82	0.5409	0.03803	27.97	50.00	27.78	1046.2	581.3	986.6	548.2	27.8
84	0.5772	0.04058	29.85	52.00	28.89	1045.1	580.7	985.3	547.4	28.9
86	0.6153	0.04326	31.82	54.00	30.00	1044.0	580.0	983.9	546.7	30.0
88	0.6555	0.04609	33.90	56.00	31.11	1042.9	579.4	982.6	545.9	31.1
90	0.6980	0.04907	36.10	58.00	32.22	1041.8	578.8	981.3	545.2	32.2
92	0.7429	0.05223	38.42	59.98	33.32	1040.7	578.2	980.0	544.5	33.3
94	0.7902	0.05556	40.87	61.97	34.43	1039.6	577.6	978.7	543.8	34.4
96	0.8403	0.05908	43.46	63.96	35.54	1038.5	577.0	977.4	543.0	35.6
98	0.8930	0.06278	46.18	65.94	36.64	1037.4	576.4	976.1	542.3	36.7
100	0.9487	0.06670	49.06	67.93	37.74	1036.3	575.8	974.7	541.5	37.8
102	1.0072	0.07081	52.09	69.92	38.85	1035.2	575.2	973.4	540.8	38.9
104	1.0689	0.07515	55.28	71.91	39.95	1034.1	574.5	972.1	540.1	40.0
106	1.1338	0.07971	58.63	73.90	41.06	1033.0	573.9	970.8	539.4	41.1
108	1.2020	0.08451	62.16	75.90	42.17	1031.9	573.3	969.5	538.7	42.2
110	1.274	0.08957	65.88	77.89	43.28	1030.8	572.7	968.2	537.9	43.3
112	1.350	0.09491	69.82	79.89	44.39	1029.6	572.0	966.8	537.2	44.4

pressure. Total heat involved is $H = h_{fg} + h_f$. The external work is pv and the corresponding amount of heat is $144\ pv/J$. The heat equivalent of internal work is $u_{fg} = h_{fg} - 144\ pv/J$. The values in kilograms per square centimeter and in millimeters of mercury have been computed from the values in pounds per square inch by means of the conversion factors 0.070307 and 51.715 respectively. The values in cubic meters per kilogram have been computed from the values in cubic feet per pound by means of the factor 0.062428. The densities are the reciprocals of the corresponding specific volumes.

	Heat equivalent of external work.				Saturated vapor				
	144 pv/J				Specific volume		Density		
Temperature Degrees Fahrenheit. t	B.T.U. per pound.	Calories per kilogram.	Entropy of the liquid. s_f	Entropy of vaporization. s_{fg}	Cubic feet per pound. v_g	Cubic meters per kilogram. v_g	Pounds per cubic foot. ρ_g	Kilograms per cubic meter. ρ_g	Temperature Degrees Centigrade. t
32	54.154	30.09	0.0000	2.1834	3301	206.1	0.000303	0.004845	0.0
34	54.371	30.21	0.0041	2.1723	3059	191.0	0.000327	0.005236	1.1
36	54.588	30.33	0.0081	2.1614	2835	177.0	0.000352	0.005650	2.2
38	54.814	30.45	0.0122	2.1505	2632	164.3	0.000380	0.006086	3.3
40	55.034	30.58	0.0162	2.1397	2445	152.6	0.000409	0.006553	4.4
42	55.258	30.70	0.0202	2.1290	2272	141.8	0.000441	0.007052	5.6
44	55.468	30.82	0.0242	2.1184	2112	131.8	0.000474	0.007587	6.7
46	55.687	30.94	0.0282	2.1078	1965.3	122.7	0.000509	0.008150	7.8
48	55.905	31.06	0.0321	2.0974	1829.7	114.2	0.000546	0.008757	8.9
50	56.125	31.18	0.0361	2.0870	1704.8	106.4	0.000586	0.009398	10.0
52	56.344	31.30	0.0400	2.0767	1588.3	99.15	0.000629	0.01009	11.1
54	56.563	31.43	0.0439	2.0665	1482.4	92.54	0.000674	0.01081	12.2
56	56.781	31.55	0.0478	2.0564	1383.5	86.37	0.000722	0.01158	13.3
58	57.004	31.67	0.0517	2.0464	1292.8	80.71	0.000773	0.01239	14.4
60	57.219	31.79	0.0555	2.0364	1208.0	75.41	0.000828	0.01326	15.6
62	57.438	31.91	0.0594	2.0265	1129.7	70.52	0.000885	0.01418	16.7
64	57.657	32.03	0.0632	2.0167	1057.1	65.99	0.000948	0.01515	17.8
66	57.874	32.15	0.0670	2.0069	989.6	61.78	0.001010	0.01619	18.9
68	58.094	32.28	0.0708	1.9973	927.1	57.88	0.001079	0.01728	20.0
70	58.311	32.40	0.0746	1.9877	869.0	54.25	0.001151	0.01843	21.1
72	58.532	32.52	0.0783	1.9782	815.0	50.88	0.001227	0.01965	22.2
74	58.745	32.64	0.0820	1.9687	764.8	47.74	0.001307	0.02095	23.3
76	58.962	32.76	0.0858	1.9593	718.0	44.82	0.001398	0.02231	24.4
78	59.182	32.88	0.0895	1.9500	674.5	42.11	0.001488	0.02375	25.6
80	59.397	33.00	0.0932	1.9407	633.8	39.57	0.001577	0.02527	26.7
82	59.615	33.12	0.0969	1.9316	595.9	37.20	0.001678	0.02688	27.8
84	59.837	33.25	0.1006	1.9224	560.5	34.99	0.001784	0.02856	28.9
86	60.053	33.37	0.1042	1.9134	527.7	32.94	0.001894	0.03036	30.0
88	60.267	33.48	0.1079	1.9044	497.1	31.03	0.002012	0.03222	31.1
90	60.482	33.60	0.1115	1.8955	468.5	29.25	0.002134	0.03419	32.2
92	60.704	33.73	0.1152	1.8866	441.8	27.58	0.002263	0.03626	33.3
94	60.916	33.84	0.1188	1.8778	416.8	26.02	0.002399	0.03843	34.4
96	61.125	33.96	0.1224	1.8691	393.3	24.55	0.002542	0.04073	35.6
98	61.342	34.08	0.1260	1.8604	371.4	23.19	0.002692	0.04312	36.7
100	61.553	34.20	0.1295	1.8518	350.8	21.90	0.002851	0.04566	37.8
102	61.772	34.32	0.1331	1.8432	331.6	20.70	0.003016	0.04831	38.9
104	61.998	34.45	0.1366	1.8347	313.6	19.58	0.003188	0.05107	40.0
106	62.197	34.56	0.1402	1.8262	296.6	18.52	0.003371	0.05400	41.1
108	62.426	34.68	0.1437	1.8179	280.8	17.53	0.003561	0.05704	42.2
110	62.631	34.80	0.1472	1.8095	265.8	16.59	0.003762	0.06028	43.3
112	62.846	34.92	0.1507	1.8012	251.7	15.71	0.003973	0.06365	44.4

PROPERTIES OF
METRIC AND

	Pressure			Heat						
				Of the liquid		Of vaporization.		Equivalent of internal work of evapn.		
Temperature Degrees Fahrenheit	Pounds per square inch.	Kilograms per square centimeter.	Millimeters of mercury.	B.T.U. per pound.	Cal. /kg. or P.C.U. /lb.	B.T.U. per pound.	Cal. /kg. or P.C.U. /lb.	B.T.U. per pound.	Cal. /kg. or P.C.U. /lb.	Temperature Degrees Centigrade.
t	p	p	p	h_f	h_f	h_{fg}	h_{fg}	u_{fg}	u_{fg}	t
114	1.429	0.10047	73.90	81.89	45.50	1028.5	571.4	965.4	536.4	45.6
116	1.512	0.10630	78.19	83.88	46.60	1027.4	570.8	964.1	535.7	46.7
118	1.600	0.11249	82.74	85.88	47.71	1026.2	570.2	962.7	534.9	47.8
120	1.692	0.11896	87.50	87.88	48.83	1025.1	569.5	961.4	534.2	48.9
122	1.788	0.12571	92.47	89.88	49.94	1024.0	568.9	960.1	533.4	50.0
124	1.889	0.13281	97.69	91.88	51.05	1022.8	568.3	958.7	532.7	51.1
126	1.995	0.14026	103.17	93.87	52.15	1021.7	567.7	957.3	531.9	52.2
128	2.105	0.14800	108.86	95.87	53.27	1020.5	567.0	955.9	531.1	53.3
130	2.221	0.15615	114.86	97.86	54.37	1019.4	566.4	954.6	530.4	54.4
132	2.343	0.16473	121.17	99.86	55.48	1018.2	565.7	953.2	529.6	55.6
134	2.470	0.17366	127.74	101.85	56.59	1017.0	565.0	951.8	528.8	56.7
136	2.603	0.18301	134.61	103.85	57.70	1015.9	564.4	950.5	528.1	57.8
138	2.742	0.19278	141.80	105.84	58.80	1014.7	563.8	949.1	527.3	58.9
140	2.887	0.20298	149.30	107.84	59.92	1013.6	563.2	947.8	526.6	60.0
142	3.039	0.21366	157.16	109.84	61.03	1012.4	562.5	946.4	525.8	61.1
144	3.198	0.22484	165.38	111.84	62.14	1011.2	561.8	945.0	525.0	62.2
146	3.363	0.23644	173.92	113.84	63.25	1010.0	561.2	943.6	524.3	63.3
148	3.536	0.24861	182.86	115.84	64.36	1008.9	560.5	942.3	523.5	64.4
150	3.716	0.26126	192.17	117.84	65.47	1007.7	559.9	940.9	522.8	65.6
152	3.904	0.27448	201.90	119.85	66.59	1006.5	559.2	939.5	522.0	66.7
154	4.100	0.28826	212.03	121.85	67.70	1005.3	558.5	938.1	521.2	67.8
156	4.305	0.30267	222.63	123.85	68.81	1004.2	557.9	936.7	520.4	68.9
158	4.518	0.31765	233.65	125.85	69.92	1003.0	557.3	935.4	519.7	70.0
160	4.739	0.33318	245.08	127.85	71.03	1001.8	556.6	934.0	518.9	71.1
162	4.970	0.34943	257.02	129.85	72.14	1000.6	555.9	932.6	518.2	72.2
164	5.210	0.36630	269.44	131.85	73.26	999.4	555.3	931.2	517.4	73.3
166	5.460	0.38388	282.36	133.85	74.37	998.2	554.6	929.8	516.6	74.4
168	5.720	0.40216	295.81	135.85	75.48	997.0	553.9	928.3	515.8	75.6
170	5.990	0.42114	309.77	137.85	76.59	995.8	553.3	927.0	515.0	76.7
172	6.272	0.44097	324.36	139.85	77.70	994.6	552.6	925.6	514.3	77.8
174	6.565	0.46157	339.51	141.85	78.81	993.4	551.9	924.2	513.5	78.9
176	6.869	0.48294	355.23	143.86	79.93	992.2	551.3	922.8	512.7	80.0
178	7.184	0.50509	371.52	145.86	81.04	991.0	550.6	921.4	511.9	81.1
180	7.510	0.52801	388.38	147.87	82.16	989.8	549.9	920.0	511.2	82.2
182	7.849	0.55184	405.91	149.87	83.27	988.6	549.3	918.6	510.4	83.3
184	8.201	0.57659	424.11	151.87	84.38	987.4	548.6	917.2	509.6	84.4
186	8.566	0.60225	442.99	153.88	85.50	986.2	547.9	915.8	508.8	85.6
188	8.944	0.62883	462.54	155.88	86.61	985.0	547.3	914.4	508.0	86.7
190	9.336	0.65639	482.81	157.89	87.72	983.8	546.6	913.0	507.3	87.8
192	9.744	0.68507	503.91	159.90	88.84	982.6	545.9	911.6	506.5	88.9
194	10.168	0.71488	525.84	161.91	89.96	981.4	545.3	910.2	505.7	90.0
196	10.605	0.74561	548.44	163.92	91.07	980.2	544.6	908.8	504.9	91.1
198	11.057	0.77738	571.81	165.93	92.19	978.9	543.9	907.3	504.1	92.2
200	11.525	0.81029	596.0	167.94	93.31	977.7	543.2	905.9	503.3	93.3
202	12.010	0.84439	621.1	169.95	94.42	976.5	542.5	904.6	502.6	94.4
204	12.512	0.87968	647.1	171.96	95.54	975.2	541.8	903.1	501.8	95.6
206	13.031	0.91617	673.9	173.97	96.66	974.0	541.1	901.7	501.0	96.7
208	13.568	0.95393	701.7	175.98	97.77	972.7	540.4	900.2	500.2	97.8
210	14.123	0.99295	730.4	177.99	98.89	971.5	539.8	898.8	499.4	98.9
212	14.696	1.0332	760.0	180.00	100.01	970.2	539.0	897.3	498.5	100.0
214	15.288	1.0749	790.6	182.02	101.13	968.9	538.3	895.8	497.7	101.1
216	15.900	1.1179	822.3	184.03	102.25	967.6	537.6	894.4	496.9	102.2

SATURATED STEAM
ENGLISH UNITS

	Heat equivalent of external work.				Saturated vapor				
	144 pv/J				Specific volume		Density		
Temperature Degrees Fahrenheit t	B.T.U. per pound.	Calories per kilogram.	Entropy of the liquid. s_f	Entropy of vaporization. s_{fg}	Cubic feet per pound. v_g	Cubic meters per kilogram. v_g	Pounds per cubic foot. ρ_g	Kilograms per cubic meter. ρ_g	Temperature Degrees Centigrade. t
114	63.062	35.04	0.1542	1.7930	238.6	14.90	0.004291	0.06711	45.6
116	63.257	35.15	0.1576	1.7848	226.2	14.12	0.004420	0.07082	46.7
118	63.476	35.27	0.1611	1.7766	214.5	13.39	0.004662	0.07468	47.8
120	63.715	35.40	0.1646	1.7685	203.6	12.71	0.004921	0.07868	48.9
122	63.924	35.52	0.1680	1.7605	193.3	12.07	0.005173	0.08285	50.0
124	64.111	35.62	0.1714	1.7525	183.5	11.46	0.005449	0.08726	51.1
126	64.351	35.75	0.1748	1.7446	174.4	10.89	0.005734	0.09182	52.2
128	64.551	35.86	0.1782	1.7366	165.8	10.35	0.006031	0.09662	53.3
130	64.756	35.98	0.1816	1.7288	157.64	9.841	0.006345	0.1016	54.4
132	64.955	36.09	0.1850	1.7210	149.91	9.359	0.006670	0.1068	55.6
134	65.163	36.20	0.1884	1.7133	142.66	8.906	0.007008	0.1123	56.7
136	65.369	36.32	0.1917	1.7056	135.80	8.478	0.007363	0.1179	57.8
138	65.579	36.44	0.1951	1.6979	129.33	8.074	0.007733	0.1239	58.9
140	65.784	36.55	0.1984	1.6903	123.22	7.692	0.008117	0.1300	60.0
142	65.993	36.67	0.2017	1.6827	117.43	7.331	0.008518	0.1364	61.1
144	66.200	36.78	0.2050	1.6752	111.94	6.988	0.008937	0.1431	62.2
146	66.398	36.89	0.2084	1.6678	106.77	6.665	0.009366	0.1500	63.3
148	66.603	37.00	0.2116	1.6603	101.86	6.359	0.009813	0.1572	64.4
150	66.811	37.12	0.2149	1.6530	97.23	6.070	0.01028	0.1647	65.6
152	67.015	37.23	0.2182	1.6456	92.83	5.795	0.01077	0.1726	66.7
154	67.217	37.35	0.2214	1.6383	88.66	5.535	0.01129	0.1807	67.8
156	67.424	37.46	0.2247	1.6311	84.69	5.287	0.01180	0.1891	68.9
158	67.627	37.57	0.2279	1.6239	80.94	5.053	0.01235	0.1979	70.0
160	67.823	37.68	0.2312	1.6168	77.40	4.832	0.01292	0.2070	71.1
162	68.031	37.80	0.2344	1.6096	74.02	4.621	0.01351	0.2164	72.2
164	68.233	37.91	0.2376	1.6026	70.82	4.421	0.01412	0.2262	73.3
166	68.427	38.02	0.2408	1.5956	67.78	4.231	0.01475	0.2364	74.4
168	68.629	38.13	0.2440	1.5886	64.89	4.051	0.01540	0.2469	75.6
170	68.832	38.24	0.2472	1.5816	62.14	3.879	0.01609	0.2578	76.7
172	69.022	38.35	0.2504	1.5747	59.52	3.716	0.01680	0.2691	77.8
174	69.223	38.46	0.2535	1.5679	57.03	3.560	0.01753	0.2809	78.9
176	69.417	38.57	0.2567	1.5610	54.66	3.412	0.01829	0.2931	80.0
178	69.624	38.68	0.2598	1.5543	52.41	3.272	0.01908	0.3056	81.1
180	69.811	38.79	0.2629	1.5475	50.28	3.139	0.01989	0.3186	82.2
182	70.016	38.90	0.2661	1.5408	48.24	3.012	0.02072	0.3320	83.3
184	70.213	39.01	0.2692	1.5342	46.30	2.890	0.02160	0.3460	84.4
186	70.407	39.12	0.2723	1.5276	44.45	2.775	0.02249	0.3604	85.6
188	70.586	39.22	0.2754	1.5210	42.69	2.665	0.02342	0.3752	86.7
190	70.779	39.32	0.2785	1.5144	41.01	2.560	0.02438	0.3906	87.8
192	70.970	39.43	0.2816	1.5079	39.40	2.460	0.02538	0.4065	88.9
194	71.162	39.54	0.2846	1.5014	37.86	2.363	0.02641	0.4232	90.0
196	71.357	39.65	0.2877	1.4950	36.40	2.272	0.02747	0.4401	91.1
198	71.535	39.74	0.2908	1.4886	35.00	2.185	0.02857	0.4577	92.2
200	71.728	39.85	0.2938	1.4822	33.67	2.102	0.02970	0.4753	93.3
202	71.926	39.96	0.2968	1.4759	32.39	2.022	0.03087	0.4946	94.4
204	72.109	40.06	0.2999	1.4695	31.17	1.946	0.03208	0.5139	95.6
206	72.280	40.16	0.3029	1.4633	30.01	1.873	0.03334	0.5339	96.7
208	72.473	40.27	0.3059	1.4570	28.90	1.804	0.03460	0.5543	97.8
210	72.669	40.37	0.3089	1.4508	27.83	1.737	0.03593	0.5757	98.9
212	72.845	40.47	0.3119	1.4446	26.82	1.674	0.03728	0.5974	100.0
214	73.036	40.58	0.3149	1.4384	25.84	1.613	0.03870	0.6200	101.1
216	73.196	40.67	0.3179	1.4322	24.91	1.555	0.04014	0.6431	102.2

Temperature Degrees Fahrenheit.	Pressure			Heat						Temperature Degrees Centigrade.
				Of the liquid		Of vaporization.		Equivalent of internal work of evapn.		
	Pounds per square inch.	Kilograms per square centimeter.	Millimeters of mercury.	B.T.U. per pound.	Cal./kg. or P.C.U./lb.	B.T.U. per pound.	Cal./kg. or P.C.U./lb.	B.T.U. per pound.	Cal./kg. or P.C.U./lb.	
t	p	p	p	h_f	h_f	h_{fg}	h_{fg}	u_{fg}	u_{fg}	t
218	16.534	1.1625	855.1	186.04	103.36	966.4	536.9	892.9	496.1	103.3
220	17.188	1.2084	888.9	188.06	104.49	965.1	536.2	891.5	495.3	104.4
222	17.864	1.2560	923.8	190.07	105.60	963.8	535.5	890.0	494.5	105.6
224	18.560	1.3049	959.8	192.09	106.73	962.5	534.8	888.5	493.7	106.7
226	19.276	1.3552	996.9	194.11	107.85	961.2	534.0	887.0	492.8	107.8
228	20.015	1.4072	1035.1	196.13	108.97	959.9	533.3	885.6	492.0	108.9
230	20.78	1.4610	1074.6	198.15	110.09	958.6	532.6	884.1	491.2	110.0
232	21.57	1.5165	1115.5	200.17	111.21	957.3	531.9	882.6	490.4	111.1
234	22.38	1.5735	1157.4	202.19	112.34	955.9	531.1	881.0	489.5	112.2
236	23.22	1.6325	1200.8	204.21	113.46	954.6	530.4	879.6	488.7	113.3
238	24.08	1.6930	1245.3	206.24	114.59	953.3	529.7	878.1	487.9	114.4
240	24.97	1.7556	1291.3	208.26	115.71	952.0	528.9	876.6	487.0	115.6
242	25.88	1.8195	1338.4	210.29	116.84	950.6	528.2	875.0	486.2	116.7
244	26.83	1.8863	1387.5	212.31	117.96	949.3	527.4	873.6	485.4	117.8
246	27.80	1.9545	1437.7	214.33	119.08	947.9	526.7	872.0	484.5	118.9
248	28.79	2.0241	1488.9	216.36	120.21	946.6	525.9	870.5	483.6	120.0
250	29.82	2.0966	1542.1	218.39	121.34	945.2	525.2	869.0	482.9	121.1
252	30.88	2.1711	1597.0	220.42	122.47	943.9	524.4	867.6	482.0	122.2
254	31.97	2.2477	1653.3	222.45	123.59	942.5	523.7	866.0	481.2	123.3
256	33.09	2.3265	1711.2	224.48	124.72	941.1	522.9	864.8	480.5	124.4
258	34.24	2.4073	1770.7	226.52	125.85	939.8	522.2	863.0	479.5	125.6
260	35.43	2.4910	1832.3	228.55	126.98	938.4	521.4	861.4	478.6	126.7
262	36.65	2.5768	1895.4	230.58	128.11	937.0	520.6	859.9	477.7	127.8
264	37.90	2.6646	1960.0	232.62	129.24	935.6	519.8	858.3	476.9	128.9
266	39.18	2.7546	2026.2	234.66	130.38	934.2	519.0	856.8	476.0	130.0
268	40.50	2.8474	2094.5	236.70	131.51	932.8	518.3	855.2	475.2	131.1
270	41.85	2.9423	2164.3	238.74	132.64	931.4	517.5	853.7	474.3	132.2
272	43.25	3.0408	2236.7	240.78	133.78	930.0	516.7	852.1	473.4	133.3
274	44.67	3.1406	2310.1	242.82	134.91	928.5	515.9	850.5	472.5	134.4
276	46.14	3.2440	2386.1	244.86	136.04	927.1	515.1	848.9	471.6	135.6
278	47.65	3.3501	2464.2	246.90	137.18	925.7	514.3	847.4	470.8	136.7
280	49.20	3.4591	2544.4	248.95	138.32	924.2	513.5	845.7	469.9	137.8
282	50.79	3.5709	2626.6	251.00	139.46	922.8	512.7	844.2	469.0	138.9
284	52.42	3.6855	2710.9	253.05	140.59	921.4	511.9	842.6	468.1	140.0
286	54.09	3.8029	2797.3	255.10	141.73	919.9	511.1	841.0	467.2	141.1
288	55.80	3.9231	2885.7	257.15	142.87	918.5	510.3	839.4	466.4	142.2
290	57.55	4.0462	2976.2	259.20	144.01	917.0	509.5	837.8	465.5	143.3
292	59.35	4.1727	3069.3	261.26	145.16	915.5	508.7	836.1	464.6	144.4
294	61.19	4.3021	3164.4	263.31	146.30	914.1	507.9	834.6	463.7	145.6
296	63.09	4.4357	3262.7	265.36	147.43	912.6	507.0	833.0	462.8	146.7
298	65.03	4.5721	3363.0	267.42	148.58	911.1	506.2	831.3	461.9	147.8
300	67.01	4.7113	3465.4	269.48	149.72	909.6	505.4	829.7	461.0	148.9
302	69.04	4.8540	3570.4	271.54	150.87	908.1	504.5	828.1	460.0	150.0
304	71.12	5.0002	3678.0	273.60	152.01	906.6	503.7	826.4	459.2	151.1
306	73.26	5.1507	3788.6	275.67	153.16	905.1	502.9	824.8	458.3	152.2
308	75.44	5.3040	3901.4	277.73	154.31	903.6	502.0	823.2	457.3	153.3
310	77.68	5.4614	4017.2	279.80	155.46	902.1	501.2	821.6	456.4	154.4
312	79.97	5.6225	4135.6	281.87	156.61	900.6	500.4	819.9	455.6	155.6
314	82.31	5.7870	4256.7	283.94	157.76	899.0	499.5	818.7	454.6	156.7
316	84.70	5.9550	4380.3	286.02	158.91	897.5	498.7	816.6	453.8	157.8
318	87.15	6.1273	4507.0	288.09	160.06	896.0	497.8	815.0	452.8	158.9
320	89.65	6.3030	4636.2	290.17	161.22	894.4	496.9	813.3	451.8	160.0

SATURATED STEAM ENGLISH UNITS

Temperature Degrees Fahrenheit. t	Heat equivalent of external work. 144 pv/J B.T.U. per pound.	Calories per kilogram.	Entropy of the liquid. s_f	Entropy of vaporization. s_{fg}	Saturated vapor Specific volume Cubic feet per pound. v_g	Cubic meters per kilogram. v_g	Density Pounds per cubic foot. ρ_g	Kilograms per cubic meter. ρ_g	Temperature Degrees Centigrade. t
218	73.393	40.78	0.3209	1.4261	24.02	1.500	0.04163	0.6667	103.3
220	73.562	40.87	0.3238	1.4200	24.16	1.446	0.04318	0.6916	104.4
222	73.746	40.97	0.3268	1.4140	22.34	1.395	0.04476	0.7168	105.6
224	73.907	41.06	0.3298	1.4079	21.55	1.345	0.04640	0.7435	106.7
226	74.084	41.16	0.3327	1.4019	20.80	1.299	0.04808	0.7698	107.8
228	74.259	41.26	0.3357	1.3959	20.08	1.254	0.04980	0.7974	108.9
230	74.449	41.36	0.3386	1.3900	19.388	1.210	0.05157	0.8264	110.0
232	74.623	41.46	0.3416	1.3841	18.722	1.169	0.05341	0.8554	111.1
234	74.792	41.55	0.3445	1.3782	18.086	1.129	0.05528	0.8857	112.2
236	74.967	41.65	0.3474	1.3723	17.473	1.091	0.05723	0.9166	113.3
238	75.138	41.75	0.3503	1.3665	16.888	1.054	0.05930	0.9488	114.4
240	75.311	41.84	0.3532	1.3607	16.324	1.019	0.06125	0.9814	115.6
242	75.480	41.94	0.3560	1.3549	15.786	0.9855	0.06333	1.015	116.7
244	75.646	42.03	0.3589	1.3491	15.261	0.9527	0.06552	1.050	117.8
246	75.815	42.12	0.3618	1.3434	14.762	0.9216	0.06774	1.085	118.9
248	75.985	42.22	0.3646	1.3377	14.287	0.8919	0.06997	1.121	120.0
250	76.150	42.31	0.3675	1.3320	13.824	0.8630	0.07233	1.159	121.1
252	76.316	42.40	0.3703	1.3264	13.379	0.8352	0.07474	1.197	122.2
254	76.479	42.49	0.3732	1.3207	12.951	0.8085	0.07721	1.237	123.3
256	76.269	42.38	0.3760	1.3151	12.540	0.7828	0.07974	1.277	124.4
258	76.804	42.67	0.3789	1.3095	12.145	0.7582	0.08231	1.319	125.6
260	76.964	42.76	0.3817	1.3040	11.762	0.7343	0.08511	1.362	126.7
262	77.120	42.85	0.3845	1.2984	11.394	0.7113	0.08779	1.406	127.8
264	77.283	42.94	0.3873	1.2929	11.042	0.6893	0.09058	1.451	128.9
266	77.436	43.02	0.3902	1.2874	10.703	0.6682	0.09342	1.497	130.0
268	77.588	43.11	0.3930	1.2819	10.375	0.6477	0.09639	1.544	131.1
270	77.744	43.19	0.3958	1.2765	10.061	0.6281	0.09946	1.592	132.2
272	77.897	43.28	0.3986	1.2711	9.755	0.6090	0.1025	1.642	133.3
274	78.042	43.36	0.4014	1.2657	9.464	0.5908	0.1056	1.693	134.4
276	78.204	43.45	0.4042	1.2603	9.181	0.5732	0.1089	1.745	135.6
278	78.348	43.53	0.4069	1.2550	8.907	0.5560	0.1123	1.799	136.7
280	78.494	43.61	0.4097	1.2496	8.644	0.5396	0.1157	1.853	137.8
282	78.645	43.70	0.4125	1.2443	8.390	0.5238	0.1192	1.909	138.9
284	78.784	43.77	0.4152	1.2390	8.144	0.5084	0.1228	1.967	140.0
286	78.933	43.86	0.4180	1.2337	7.907	0.4936	0.1265	2.026	141.1
288	79.065	43.93	0.4207	1.2285	7.679	0.4794	0.1302	2.086	142.2
290	79.214	44.01	0.4234	1.2233	7.459	0.4657	0.1342	2.147	143.3
292	79.353	44.09	0.4262	1.2181	7.246	0.4524	0.1380	2.210	144.4
294	79.493	44.17	0.4289	1.2129	7.041	0.4396	0.1420	2.275	145.6
296	79.628	44.24	0.4316	1.2077	6.841	0.4271	0.1462	2.341	146.7
298	79.755	44.31	0.4343	1.2026	6.649	0.4151	0.1504	2.409	147.8
300	79.890	44.39	0.4370	1.1974	6.464	0.4035	0.1547	2.478	148.9
302	80.025	44.46	0.4397	1.1924	6.285	0.3924	0.1590	2.548	150.0
304	80.160	44.54	0.4424	1.1873	6.112	0.3816	0.1636	2.621	151.1
306	80.296	44.61	0.4451	1.1822	5.943	0.3710	0.1683	2.695	152.2
308	80.411	44.68	0.4478	1.1771	5.781	0.3609	0.1730	2.771	153.3
310	80.543	44.75	0.4505	1.1721	5.623	0.3510	0.1778	2.849	154.4
312	80.653	44.81	0.4532	1.1671	5.471	0.3415	0.1828	2.928	155.6
314	80.776	44.88	0.4558	1.1621	5.324	0.3324	0.1878	3.008	156.7
316	80.882	44.94	0.4585	1.1571	5.181	0.3234	0.1930	3.092	157.8
318	81.013	45.01	0.4612	1.1522	5.043	0.3148	0.1983	3.177	158.9
320	81.115	45.07	0.4638	1.1472	4.910	0.3065	0.2037	3.263	160.0

	Pressure			Heat: Of the liquid		Heat: Of vaporization.		Heat: Equivalent of internal work of evapn.		
Temperature Degrees Fahrenheit. t	Pounds per square inch. p	Kilograms per square centimeter. p	Millimeters of mercury. p	B.T.U. per pound. h_f	Cal./kg. or P.C.U./lb. h_f	B.T.U. per pound. h_{fg}	Cal./kg. or P.C.U./lb. h_{fg}	B.T.U. per pound. u_{fg}	Cal./kg. or P.C.U./lb. u_{fg}	Temperature Degrees Centigrade. t
322	92.21	6.4830	4768.6	292.25	162.37	892.8	496.0	811.6	450.9	161.1
324	94.83	6.6672	4904.1	294.33	163.53	891.3	495.2	810.0	450.0	162.2
326	97.50	6.8549	5042.2	296.41	164.69	889.7	494.3	808.2	449.0	163.3
328	100.23	7.0469	5183.4	298.50	165.85	888.1	493.4	806.6	448.1	164.4
330	103.03	7.2437	5328.2	300.59	167.01	886.5	492.5	804.8	447.1	165.6
332	105.89	7.4448	5476.1	302.67	168.16	885.0	491.7	803.2	446.3	166.7
334	108.82	7.6508	5627.6	304.76	169.32	883.3	490.8	801.4	445.3	167.8
336	111.81	7.8610	5782.3	306.86	170.49	881.7	489.9	799.7	444.4	168.9
338	114.87	8.0762	5940.5	308.95	171.65	880.1	489.0	798.0	443.4	170.0
340	117.99	8.2955	6101.9	311.05	172.82	878.5	488.1	796.3	442.4	171.1
342	121.18	8.5198	6266.8	313.15	173.99	876.8	487.2	794.5	441.5	172.2
344	124.44	8.7490	6435.4	315.24	175.15	875.2	486.3	792.8	440.5	173.3
346	127.77	8.9831	6607.6	317.34	176.31	873.5	485.3	791.0	439.5	174.4
348	131.16	9.2215	6782.9	319.45	177.49	871.9	484.4	789.3	438.5	175.6
350	134.62	9.4647	6961.9	321.55	178.65	870.2	483.5	787.5	437.6	176.7
352	138.15	9.7129	7144.4	323.66	179.83	868.5	482.5	785.7	436.5	177.8
354	141.75	9.9660	7330.6	325.76	180.99	866.8	481.6	784.0	435.6	178.9
356	145.43	10.2247	7520.9	327.87	182.16	865.2	480.7	782.3	434.6	180.0
358	149.18	10.4884	7714.8	329.99	183.34	863.4	479.7	780.4	433.6	181.1
360	153.01	10.7577	7912.9	332.10	184.51	861.7	478.8	778.6	432.6	182.2
362	156.92	11.0326	8115.1	334.21	185.69	860.0	477.8	776.8	431.6	183.3
364	160.91	11.3131	8321.5	336.33	186.86	858.3	476.9	775.1	430.6	184.4
366	164.97	11.5985	8531.4	338.46	188.05	856.5	475.9	773.2	429.6	185.6
368	169.11	11.8896	8745.5	340.58	189.23	854.8	474.9	771.4	428.6	186.7
370	173.33	12.1863	8963.8	342.71	190.41	853.0	473.9	769.5	427.5	187.8
372	177.63	12.4886	9186.1	344.84	191.59	851.2	472.9	767.7	426.5	188.9
374	182.01	12.7966	9412.6	346.97	192.78	849.5	472.0	765.9	425.5	190.0
376	186.48	13.1108	9643.8	349.11	193.97	847.7	471.0	764.0	424.5	191.1
378	191.03	13.4307	9879.1	351.25	195.15	845.9	470.0	762.2	423.5	192.2
380	195.70	13.7591	10120.6	353.39	196.34	844.1	469.0	760.3	422.4	193.3
382	200.44	14.0923	10365.8	355.53	197.53	842.3	468.0	758.4	421.4	194.4
384	205.26	14.4312	10615.0	357.68	198.73	840.4	467.0	756.5	420.4	195.6
386	210.18	14.7771	10869.5	359.83	199.92	838.6	466.0	754.6	419.3	196.7
388	215.19	15.1294	11128.6	361.98	201.12	836.7	464.9	752.7	418.2	197.8
390	220.29	15.4879	11392.3	364.14	202.32	834.9	463.9	750.8	417.2	198.9
392	225.49	15.8535	11661.2	366.29	203.51	833.0	462.8	748.9	416.1	200.0
394	230.79	16.2262	11935.3	368.45	204.71	831.2	461.8	747.1	415.0	201.1
396	236.18	16.6051	12214.0	370.62	205.92	829.3	460.8	745.1	414.0	202.2
398	241.66	16.9904	12497.4	372.79	207.12	827.4	459.7	743.2	412.9	203.3
400	247.25	17.3834	12787	374.96	208.3	825.5	458.6	741.3	411.8	204.4
405	261.67	18.3972	13532	380.40	211.4	820.6	455.9	736.3	409.0	207.2
410	276.72	19.4554	14311	385.86	214.4	815.8	453.3	731.4	406.4	210.0
415	292.44	20.5606	15124	391.34	217.4	810.8	450.5	726.3	403.6	212.8
420	308.82	21.7122	15971	396.84	220.5	805.8	447.7	721.3	400.8	215.6
425	325.91	22.9138	16854	402.36	223.6	800.7	444.9	716.2	396.9	218.3
430	343.71	24.1652	17775	407.91	226.6	795.5	442.0	711.0	395.0	221.1
435	362.27	25.4701	18735	413.48	229.7	790.2	439.0	705.7	392.1	223.9
440	381.59	26.8284	19734	419.07	232.8	784.9	436.1	700.5	389.2	226.7
445	401.70	28.2423	20774	424.68	236.0	779.4	433.0	695.0	386.1	229.4
450	422.61	29.7124	21855	430.3	239.1	773.8	429.9	689.6	383.1	232.2
455	444.35	31.2409	22980	436.0	242.2	768.1	426.8	683.9	380.0	235.0
460	466.94	32.8292	24148	441.7	245.4	762.3	423.5	678.3	376.8	237.8

SATURATED STEAM ENGLISH UNITS

	Heat equivalent of external work.				Saturated vapor				
	144 pv/J				Specific volume		Density		
Temperature Degrees Fahrenheit t	B.T.U. per pound.	Calories per kilogram.	Entropy of the liquid. s_f	Entropy of vaporization. s_{fg}	Cubic feet per pound. v_g	Cubic meters per kilogram. v_g	Pounds per cubic foot. ρ_g	Kilograms per cubic meter. ρ_g	Temperature Degrees Centigrade. t
322	81.231	45.13	0.4665	1.1423	4.781	0.2985	0.2092	3.350	161.1
324	81.347	45.20	0.4691	1.1374	4.656	0.2906	0.2148	3.441	162.2
326	81.455	45.26	0.4718	1.1325	4.534	0.2830	0.2206	3.534	163.3
328	81.548	45.31	0.4744	1.1276	4.417	0.2757	0.2264	3.627	164.4
330	81.654	45.37	0.4770	1.1227	4.303	0.2686	0.2324	3.723	165.6
332	81.766	45.43	0.4797	1.1179	4.192	0.2617	0.2386	3.821	166.7
334	81.875	45.49	0.4823	1.1130	4.086	0.2551	0.2447	3.920	167.8
336	81.974	45.54	0.4849	1.1082	3.982	0.2486	0.2511	4.023	168.9
338	82.093	45.61	0.4875	1.1034	3.882	0.2423	0.2576	4.127	170.0
340	82.184	45.66	0.4901	1.0986	3.784	0.2362	0.2643	4.234	171.1
342	82.300	45.73	0.4927	1.0938	3.690	0.2304	0.2710	4.340	172.2
344	82.396	45.78	0.4953	1.0890	3.598	0.2246	0.2780	4.452	173.3
346	82.498	45.84	0.4979	1.0843	3.509	0.2191	0.2850	4.564	174.4
348	82.576	45.88	0.5005	1.0796	3.422	0.2136	0.2922	4.682	175.6
350	82.688	45.94	0.5031	1.0748	3.338	0.2084	0.2996	4.798	176.7
352	82.761	45.98	0.5057	1.0701	3.257	0.2033	0.3070	4.919	177.8
354	82.846	46.03	0.5082	1.0654	3.178	0.1984	0.3147	5.040	178.9
356	82.926	46.07	0.5108	1.0607	3.101	0.1936	0.3225	5.165	180.0
358	82.995	46.11	0.5134	1.0560	3.026	0.1889	0.3305	5.294	181.1
360	83.088	46.16	0.5160	1.0514	2.954	0.1844	0.3385	5.423	182.2
362	83.151	46.20	0.5185	1.0467	2.884	0.1800	0.3467	5.556	183.3
364	83.241	46.25	0.5211	1.0421	2.815	0.1757	0.3552	5.692	184.4
366	83.328	46.30	0.5237	1.0374	2.749	0.1716	0.3638	5.824	185.6
368	83.386	46.33	0.5262	1.0328	2.684	0.1676	0.3726	5.967	186.7
370	83.479	46.38	0.5288	1.0282	2.622	0.1637	0.3814	6.109	187.8
372	83.546	46.42	0.5313	1.0236	2.561	0.1599	0.3905	6.254	188.9
374	83.620	46.46	0.5339	1.0190	2.502	0.1562	0.3997	6.402	190.0
376	83.673	46.49	0.5364	1.0144	2.444	0.1526	0.4092	6.553	191.1
378	83.736	46.52	0.5390	1.0098	2.388	0.1491	0.4189	6.707	192.2
380	83.793	46.56	0.5415	1.0053	2.333	0.1456	0.4286	6.868	193.3
382	83.857	46.59	0.5440	1.0008	2.280	0.1423	0.4386	7.027	194.4
384	83.900	46.61	0.5466	0.9962	2.228	0.1391	0.4488	7.189	195.6
386	83.967	46.65	0.5491	0.9917	2.178	0.1360	0.4591	7.353	196.7
388	84.018	46.68	0.5516	0.9872	2.129	0.1329	0.4697	7.524	197.8
390	84.058	46.71	0.5542	0.9826	2.0816	0.1300	0.4804	7.692	198.9
392	84.107	46.73	0.5567	0.9782	2.0352	0.1271	0.4914	7.868	200.0
394	84.142	46.75	0.5592	0.9737	1.9898	0.1242	0.5026	8.052	201.1
396	84.163	46.76	0.5617	0.9692	1.9453	0.1214	0.5141	8.237	202.3
398	84.194	46.78	0.5642	0.9647	1.9023	0.1188	0.5257	8.418	203.3
400	84.239	46.80	0.5668	0.9602	1.8608	0.1162	0.537	8.606	204.4
405	84.346	46.86	0.5730	0.9491	1.7615	0.1100	0.568	9.091	207.2
410	84.412	46.90	0.5792	0.9381	1.6681	0.1041	0.599	9.606	210.0
415	84.458	46.92	0.5854	0.9271	1.5804	0.09866	0.633	10.14	212.8
420	84.488	46.94	0.5916	0.9161	1.4982	0.09353	0.663	10.69	215.6
425	84.522	46.96	0.5978	0.9052	1.4212	0.08872	0.704	11.27	218.3
430	84.517	46.96	0.6039	0.8942	1.3486	0.08419	0.742	11.88	221.1
435	84.491	46.94	0.6101	0.8833	1.2802	0.07992	0.781	12.51	223.9
440	84.445	46.92	0.6162	0.8724	1.2158	0.07590	0.823	13.18	226.7
445	84.371	46.88	0.6224	0.8616	1.1550	0.07210	0.866	13.87	229.4
450	84.173	46.77	0.6284	0.8507	1.0977	0.06853	0.911	14.59	232.2
455	84.165	46.76	0.6346	0.8398	1.0436	0.06515	0.958	15.35	235.0
460	84.031	46.69	0.6407	0.8290	0.9927	0.06197	1.007	16.14	237.8

Temperature Degrees Fahrenheit.	Pressure			Heat						Temperature Degrees Centigrade.
				Of the liquid		Of vaporization.		Equivalent of internal work of evapn.		
	Pounds per square inch.	Kilograms per square centimeter.	Millimeters of mercury.	B.T.U. per pound.	Cal./kg. or P.C.U./lb.	B.T.U. per pound.	Cal./kg. or P.C.U./lb.	B.T.U. per pound	Cal./kg. or P.C.U./lb.	
t	p	p	p	h_f	h_f	h_{fg}	h_{fg}	u_{fg}	u_{fg}	t
465	490.40	34.4786	25361	447.4	248.6	756.4	420.3	672.5	373.7	240.6
470	514.76	36.1912	26621	453.2	251.8	750.3	416.9	666.6	370.4	243.3
475	540.04	37.9686	28445	459.1	255.1	744.1	413.4	660.6	367.0	246.1
480	566.26	39.8120	29284	465.0	258.4	737.8	409.9	654.5	363.6	248.9
485	593.47	41.7251	30691	470.9	261.6	731.3	406.3	648.3	360.2	251.7
490	621.67	43.7078	32150	477.0	265.0	724.7	402.6	642.0	356.6	254.4
495	650.87	45.7607	33660	483.0	268.4	718.0	398.9	635.6	353.1	257.2
500	681.09	47.8854	35223	489.1	271.7	711.1	395.1	629.0	349.5	260.0
505	712.40	50.0867	36842	495.3	275.2	704.1	391.2	622.4	345.8	262.8
510	744.74	52.3604	38514	501.6	278.7	696.9	387.2	615.6	342.0	265.6
515	778.16	54.7101	40243	507.8	282.1	689.6	383.1	608.7	338.2	268.3
520	812.72	57.1399	42030	514.2	285.7	682.1	379.0	601.7	334.3	271.1
525	848.43	59.6506	43877	520.5	289.2	674.6	374.8	594.7	330.4	273.9
530	885.31	62.2435	45784	527.0	292.8	666.8	370.5	587.5	326.4	276.7
535	923.39	64.9208	47753	533.4	296.4	659.0	366.1	580.2	322.3	279.4
540	962.73	67.6867	49788	540.0	300.0	651.0	361.7	572.8	318.2	282.2
545	1003.4	70.5460	51891	546.6	303.7	642.8	357.1	565.2	314.0	285.0
550	1045.4	73.4989	54063	553.2	307.4	634.5	352.5	557.5	309.7	287.8
555	1088.7	76.5432	56302	560.0	311.1	626.1	347.9	549.8	305.5	290.6
560	1133.4	79.6860	58614	566.7	314.9	617.5	343.1	541.9	301.1	293.3
565	1179.7	82.9412	61008	573.6	318.7	608.7	338.2	533.9	296.6	296.1
570	1227.6	86.3089	63485	580.4	322.5	599.7	333.2	525.7	292.1	298.9
575	1276.7	89.7609	66025	587.4	326.4	590.6	328.1	517.4	287.4	301.7
580	1327.2	93.3115	68636	594.4	330.2	581.3	323.0	508.9	282.8	304.4
585	1379.2	96.9674	71325	601.5	334.2	571.8	317.7	500.3	278.0	307.2
590	1432.7	100.729	74092	608.7	338.2	562.2	312.4	491.6	273.2	310.0
595	1487.8	104.603	76942	615.9	342.2	552.3	306.9	482.7	268.2	312.8
600	1544.6	108.596	79879	623.2	346.2	542.3	301.3	473.7	263.2	315.6
605	1603.0	112.702	82899	630.6	350.4	532.0	295.6	464.5	258.1	318.3
610	1663.2	116.935	86012	638.0	354.5	521.4	289.7	455.0	252.8	321.1
615	1725.1	121.287	89214	645.6	358.7	510.5	283.6	445.3	247.4	323.9
620	1788.8	125.765	92508	653.4	363.0	499.2	277.4	435.2	241.9	326.7
625	1854.4	130.377	95900	661.3	367.4	487.3	270.7	424.7	235.9	329.4
630	1921.9	135.123	99391	669.5	372.0	474.8	263.8	413.6	229.8	332.2
635	1991.4	140.009	102985	677.9	376.6	461.7	256.5	402.0	223.3	335.0
640	2062.8	145.029	106678	686.6	381.5	447.9	248.9	389.8	216.6	337.8
645	2136.0	150.176	110463	695.7	386.5	433.2	240.7	376.9	209.4	340.6
650	2211.4	155.477	114363	705.2	391.8	417.7	232.1	363.3	201.8	343.3
655	2289.0	160.933	118376	715.0	397.3	401.2	222.9	348.7	193.8	346.1
660	2368.6	166.529	122492	725.3	403.0	383.6	213.1	333.3	185.2	348.9
665	2450.3	172.273	126717	736.1	409.0	364.7	202.6	316.8	176.0	351.7
670	2534.2	178.172	131056	747.5	415.3	344.4	191.3	299.1	166.1	354.4
675	2620.6	184.247	135524	759.6	422.0	322.5	179.2	280.1	155.7	357.2
680	2709.7	190.511	140132	772.6	429.3	298.5	165.8	259.4	144.0	360.0
685	2801.7	196.979	144890	786.9	437.2	271.8	151.0	236.3	131.2	362.8
690	2896.8	203.665	149808	803.0	446.1	241.2	134.0	209.6	116.5	365.6
695	2994.9	210.562	154681	822.0	456.7	204.6	113.7	177.8	98.8	368.3
700	3096.4	217.699	160130	846.3	470.2	157.0	87.2	136.8	76.0	371.1
705	3202.0	225.123	165591	888.3	493.5	73.4	40.8	65.4	36.4	373.9
706.1	3226.0	226.810	166832	925.0	513.9	0	0	0	0	374.4

SATURATED STEAM
ENGLISH UNITS

Temperature Degrees Fahrenheit	Heat equivalent of external work.				Saturated vapor				Temperature Degrees Centigrade.
	144 pv/J				Specific volume		Density		
	B.T.U. per pound.	Calories per kilogram.	Entropy of the liquid.	Entropy of vaporization.	Cubic feet per pound.	Cubic meters per kilogram.	Pounds per cubic foot.	Kilogramsper cubic meter.	
t			s_f	s_{fg}	v_g	v_g	ρ_g	ρ_g	t
465	83.890	46.61	0.6468	0.8180	0.9446	0.05897	1.059	16.96	240.6
470	83.715	46.51	0.6530	0.8071	0.8991	0.05613	1.112	17.82	243.3
475	83.512	46.40	0.6592	0.7962	0.8560	0.05344	1.168	18.71	246.1
480	83.272	46.27	0.6654	0.7852	0.8151	0.05087	1.227	19.66	248.9
485	83.015	46.12	0.6716	0.7742	0.7764	0.04847	1.288	20.63	251.7
490	82.728	45.96	0.6779	0.7632	0.7398	0.04618	1.352	21.65	254.4
495	82.425	45.80	0.6842	0.7521	0.7050	0.04401	1.418	22.72	257.2
500	82.082	45.60	0.6904	0.7410	0.6721	0.04195	1.488	23.84	260.0
505	81.705	45.40	0.6968	0.7299	0.6408	0.04000	1.560	25.00	262.8
510	81.309	45.18	0.7031	0.7187	0.6110	0.03814	1.637	26.22	265.6
515	80.856	44.92	0.7094	0.7075	0.5826	0.03637	1.716	27.50	268.3
520	80.374	44.66	0.7158	0.6963	0.5557	0.03469	1.800	28.83	271.1
525	79.873	44.38	0.7222	0.6851	0.5301	0.03309	1.886	30.22	273.9
530	79.333	44.08	0.7286	0.6738	0.5058	0.03158	1.977	31.67	276.7
535	78.819	43.79	0.7350	0.6625	0.4828	0.03014	2.071	33.18	279.4
540	78.240	43.47	0.7414	0.6512	0.4610	0.02878	2.169	34.75	282.2
545	77.648	43.14	0.7478	0.6399	0.4401	0.02747	2.272	36.40	285.0
550	76.992	42.78	0.7543	0.6285	0.4201	0.02623	2.380	38.12	287.8
555	76.295	42.39	0.7607	0.6170	0.4010	0.02503	2.494	39.95	290.6
560	75.570	41.99	0.7672	0.6056	0.3828	0.02390	2.612	41.84	293.3
565	74.817	41.57	0.7737	0.5940	0.3654	0.02281	2.737	43.84	296.1
570	74.041	41.14	0.7802	0.5825	0.3488	0.02177	2.867	45.93	298.9
575	73.224	40.68	0.7867	0.5709	0.3330	0.02079	3.003	48.10	301.7
580	72.389	40.22	0.7932	0.5592	0.3180	0.01985	3.145	50.38	304.4
585	71.527	39.74	0.7998	0.5474	0.3037	0.01896	3.293	52.74	307.2
590	70.592	39.22	0.8064	0.5356	0.2900	0.01810	3.448	55.25	310.0
595	69.619	38.68	0.8131	0.5237	0.2769	0.01729	3.611	57.84	312.8
600	68.592	38.11	0.8198	0.5118	0.2642	0.01649	3.785	60.64	315.6
605	67.538	37.52	0.8265	0.4997	0.2522	0.01574	3.965	63.53	318.3
610	66.414	36.90	0.8332	0.4875	0.2406	0.01502	4.156	66.58	321.1
615	65.217	36.23	0.8401	0.4751	0.2294	0.01432	4.359	69.83	323.9
620	63.952	35.53	0.8470	0.4623	0.2186	0.01365	4.575	73.26	326.7
625	62.594	34.78	0.8540	0.4493	0.2082	0.01300	4.803	76.92	329.4
630	61.175	33.99	0.8612	0.4358	0.1982	0.01237	5.045	80.84	332.2
635	59.667	33.15	0.8686	0.4218	0.1885	0.01177	5.305	84.96	335.0
640	58.068	32.26	0.8763	0.4073	0.1791	0.01106	5.583	90.42	337.8
645	56.296	31.28	0.8842	0.3922	0.1699	0.01061	5.885	94.25	340.6
650	54.439	30.25	0.8924	0.3764	0.1610	0.01005	6.211	99.50	343.3
655	52.454	29.14	0.9009	0.3599	0.1522	0.009502	6.570	105.2	346.1
660	50.292	27.94	0.9097	0.3426	0.1437	0.008971	6.959	111.5	348.9
665	47.902	26.61	0.9190	0.3243	0.1353	0.008447	7.391	118.4	351.7
670	45.278	25.16	0.9287	0.3049	0.1269	0.007922	7.880	126.2	354.4
675	42.362	23.54	0.9389	0.2842	0.1186	0.007404	8.432	135.1	357.2
680	39.141	21.75	0.9499	0.2619	0.1102	0.006880	9.075	145.3	360.0
685	35.547	19.75	0.9620	0.2374	0.1019	0.006361	9.814	157.2	362.8
690	31.557	17.53	0.9755	0.2098	0.0936	0.005843	10.68	171.1	365.6
695	26.754	14.86	0.9914	0.1772	0.0848	0.005294	11.79	188.9	368.3
700	20.216	11.23	1.0117	0.1354	0.0747	0.004663	13.39	214.5	371.1
705	7.995	4.44	1.0472	0.0630	0.0597	0.003727	16.75	268.3	373.9
706.1	0	0	1.0785	0	0.0522	0.003259	19.16	306.8	374.4

CRITICAL CONSTANTS OF GASES

See also values for critical points given in the tables: *Vapor Pressures of Variou* *Substances* and *Orthobaric Densities or Volumes of Various Substances.*

Name	Formula	tc, °C.	pc, atm.	dc, g/cc
Acetic acid	CH_3CO_2H	321.6	57.2	0.351
Acetic anhydride	$(CH_3CO)_2O$	296	46	......
Acetylene dichloride (cis)	CHClCHCl	271.0	......	......
Acetylene dichloride (trans)	CHClCHCl	243.3	54.4	......
Air	......	−140.7	37.2	0.35*
Allyl alcohol	C_3H_5OH	272	......	......
Allyl sulfide	$(C_3H_5)_2S$	380	......	......
Allylene	CH_3CCH	128	......	......
iso-Amyl acetate	$CH_3CO_2C_5H_{11}$	326	......	......
iso-Amyl alcohol	$C_5H_{11}OH$	307	......	......
tert-Amyl alcohol	$C_5H_{11}OH$	272	......	......
iso-Amyl *n*-butyrate	$C_3H_7CO_2C_5H_{11}$	346	......	......
iso-Amyl formate	$HCO_2C_5H_{11}$	303	34	0.282
iso-Amyl mercaptan	$C_5H_{11}SH$	321	......	......
iso-Amyl propionate	$C_2H_5CO_2C_5H_{11}$	338	......	......
iso-Amyl sulfide	$(C_5H_{11})_2S$	391	......	......
Aniline	$C_6H_5NH_2$	426	52.4	......
Anisole	$C_6H_5OCH_3$	369	41.3	......
Benzonitrile	C_6H_5CN	426	41.6	......
Bromine	Br_2	302	......	......
n-Butane	C_4H_{10}	153	36	......
iso-Butane	C_4H_{10}	134	37	......
n-Butyl acetate	$CH_3CO_2C_4H_9$	306	......	......
iso-Butyl acetate	$CH_3CO_2C_4H_9$	288	31	0.281
n-Butyl alcohol	C_4H_9OH	287	48.4	......
iso-Butyl alcohol	C_4H_9OH	265	48	......
sec-Butyl alcohol	C_4H_9OH	265	......	......
tert-Butyl alcohol	C_4H_9OH	235	......	......
iso-Butyl *n*-butyrate	$C_3H_7CO_2C_4H_9$	338	......	......
iso-Butyl *iso*-butyrate	$C_3H_7CO_2C_4H_9$	329	......	......
iso-Butyl formate	$HCO_2C_4H_9$	278	38	0.268
iso-Butyl propionate	$C_2H_5CO_2C_4H_9$	319	......	......
iso-Butyl *iso*-valerate	$C_4H_9CO_2C_4H_9$	348	......	......
Butyronitrile	C_3H_7CN	309	37.4	......
Capronitrile	$C_5H_{11}CN$	349	32.2	......
Carbon oxysulfide	COS	105	61	......
Chloroform	$CHCl_3$	263	53.8	0.516
o-Cresol	$CH_3C_6H_4OH$	422	49.4	......
m-Cresol	$CH_3C_6H_4OH$	432	45.0	......
p-Cresol	$CH_3C_6H_4OH$	426	50.8	......
Cyanogen	C_2N_2	128	59	......
Di-*iso*-butyl	C_8H_{18}	277	24.5	0.237
Dimethylamine	$(CH_3)_2NH$	164.6	51.7	......
Dimethylaniline	$C_6H_5N(CH_3)_2$	415	35.8	......
Dimethyl-*o*-toluidine	$C_7H_7N(CH_3)_2$	395	30.8	......
Di-*iso*-propyl	C_6H_{14}	227.4	30.6	0.241
Dipropylamine	$(C_3H_7)_2NH$	277	31	......
Ethyl allyl ether	$C_2H_5OC_3H_5$	245	......	......
Ethyl bromide	C_2H_5Br	231	......	0.513
Ethyl *n*-butyrate	$C_3H_7CO_2C_2H_5$	293	30	0.276
Ethyl *iso*-butyrate	$C_3H_7CO_2C_2H_5$	280	30	0.276

*Plait point.

CRITICAL CONSTANTS OF GASES

ame	Formula	tc °C.	pc atm	dc, g/cc
caprylate	$C_7H_{15}CO_2C_2H_5$	386	......	......
chloroformate	$ClCO_2C_2H_5$	< 235	......	......
crotonate	$C_3H_5CO_2C_2H_5$	326	......	......
disulfide	$(C_2H_5)_2S_2$	369	......	......
pelargonate	$CH_3(CH_2)_7CO_2C_2H_5$	409	......	......
n-valerate	$C_4H_9CO_2C_2H_5$	297	......	......
iso-valerate	$C_4H_9CO_2C_2H_5$	315	......	......
al	$CH_2(OC_2H_5)_2$	254	......	......
amine	$C_2H_5NH_2$	183.2	55.5	......
ene oxide	$(CH_2)_2O$	192.0	......	......
anium tetrachloride	$GeCl_4$	277	38	......
tyl alcohol	$C_7H_{15}OH$	365	......	......
azine	N_2H_4	380	145	......
ogen selenide	H_2Se	138	88	......
ury	Hg	> 1550	> 200	4–5
hyl ethyl sulfide	$CH_3SC_2H_5$	260	42	......
hyl fluoride	CH_3F	44.9	62.0	......
hyl oxalate	$(CO_2CH_3)_2$	260	9.48	......
hyl valerate	$C_4H_9CO_2CH_3$	294d	32	0.279
hylamine	CH_3NH_2	156.9	73.6	......
hylaniline	$C_6H_5NHCH_3$	429	51.3	......
hylene chloride	CH_2Cl_2	245.0	60.9	......
ldehyde	$C_6H_{12}O_3$	290	......	......
hlorethylene	CCl_2CCl_2	347.1	......	......
etole	$C_6H_5OC_2H_5$	374	33.8	......
nol	C_6H_5OH	419	60.5	......
Propyl alcohol	C_3H_7OH	235	53	......
pyl *n*-butyrate	$C_3H_7CO_2C_3H_7$	327	......	......
ropyl chloride	C_3H_7Cl	230	45.2	......
pyl propionate	$C_2H_5CO_2C_3H_7$	305	......	......
pyl *iso*-valerate	$C_4H_9CO_2C_3H_7$	336	......	......
pylamine	$C_3H_7NH_2$	223.8	46.8	......
pylene	C_3H_6	92.3	45.4	......
idine	C_5H_5N	344	60.0	......
con tetrafluoride	SiF_4	−1.5	50	......
con tetrahydride	SiH_4	−3.5	48	......
rachloroethane	$CHCl_2CHCl_2$	388.0	......	......
ophene	C_4H_4S	317	48	......
mol	$C_{10}H_{13}OH$	425	......	......
uene	$C_6H_5CH_3$	320.6	41.6	0.292
unitrile	C_7H_7CN	450	......	......
chloroethylene	$CHClCCl_2$	271.0	49.5	......
methylamine	$(CH_3)_3N$	161	41	......
Valeric acid	$C_4H_9CO_2H$	379	......	......
-Valeric acid	$C_4H_9CO_2H$	361	......	......
ter	H_2O	374.0	217.72	0.4

HEATS OF SOLUTION

The values given in this table are expressed in kilo-calories per gram mole o compound as shown by the formula and for a dilution as indicated (where this i not indicated the dilution is such that further dilution is without an appreciable thermal effect); a positive value indicates an evolution of heat during solution To convert from kilogram calories to B. T. U. multiply by the factor 3.9685.

Name	Formula	Dilution in moles of water	Heat of solution in kg-cal.	Temp. °C.
Acetic acid	$CH_3 \cdot COOH$	200	+0.375	18
Aluminum bromide	$AlBr_3$	2970	+85.3	9
Aluminum chloride	$AlCl_3$	1250	+76.845	18
Aluminum chloride	$AlCl_3$	960	+76.3	9
Aluminum iodide	AlI_3	2260	+89.0	9
Aluminum sulfate	$Al_2(SO_4)_3 \cdot 6H_2O$	....	+56.0	15
Aluminum sulfate	$Al_2(SO_4)_3 \cdot 18H_2O$	....	+8.02	15
Ammonium acetate	$NH_4C_2H_3O_2$	200	+0.25	24
Ammonium bicarbonate	NH_4HCO_3	220–440	−6.3	15
Ammonium bisulfide	NH_4HS	890	−3.25	12.5
Ammonium bisulfate	NH_4HSO_4	200	−0.02	18
Ammonium bromide	NH_4Br	200	−4.38	18
Ammonium chloride	NH_4Cl	200	−3.88	18
Ammonium chloroplatinate	$(NH_4)_2PtCl_4$	660	−8.48	15
Ammonium cyanide	NH_4CN	820	−4.4	15
Ammonium ferrocyanide	$(NH_4)_4Fe(CN)_6 \cdot 3H_2O$	....	−6.8	14
Ammonium fluoride	NH_4F	....	−1.5	15
Ammonium fluosilicate	$(NH_4)_2SiF_6$	2400	−8.4	7
Ammonium iodide	NH_4I	200	−3.55	15
Ammonium nitrate	NH_4NO_3	200	−6.32	18
Ammonium nitrate	NH_4NO_3	220–440	−6.2	10–15
Ammonium nitrite	NH_4NO_2	400	−4.75	12.5
Ammonium oxalate	$(NH_4)_2C_2O_4$	345–690	−8.0	15
Ammonium oxalate	$(NH_4)_2C_2O_4 \cdot H_2O$	395–790	−11.5	15
Ammonium sulfate	$(NH_4)_2SO_4$	400	−2.37	18
Ammonium sulfite	$(NH_4)_2SO_3$	220	−1.54	8
Ammonium persulfate	$(NH_4)_2S_2O_8$	1100	−9.7	9.4
Ammonium thiocyanate	NH_4CNS	....	−5.67	12
Antimony pentachloride	$SbCl_5$	1100	+35.2	15
Antimony trichloride	$SbCl_3$	....	+8.91	15
Arsenic acid	H_3AsO_4	....	−0.4	15
Arsenic trioxide	As_2O_3	....	−7.55	15
Barium acetate	$Ba(C_2H_3O_2)_2$	600	+5.2	10.8
Barium acetate	$Ba(C_2H_3O_2)_2 \cdot 3H_2O$	800	−1.15	18
Barium bromide	$BaBr_2$	400	+4.98	18
Barium bromide	$BaBr_2 \cdot 2H_2O$	400	−4.13	18
Barium chlorate	$Ba(ClO_3)_2$	500–1000	−6.7	10
Barium chlorate	$Ba(ClO_3)_2 \cdot H_2O$	600	−11.24	18
Barium chloride	$BaCl_2$	400	+2.07	18
Barium chloride	$BaCl_2 \cdot 2H_2O$	400	−4.93	18
Barium chloride	$BaCl_2 \cdot 2H_2O$	560	−5.2	10
Barium cyanide	$Ba(CN)_2$	....	+0.89	9
Barium cyanide	$Ba(CN)_2 \cdot H_2O$	....	−2.1	5
Barium cyanide	$Ba(CN)_2 \cdot 2H_2O$	....	−2.56	7
Barium ferrocyanide	$Ba_2Fe(CN)_6 \cdot 6H_2O$	....	−11.4	13.5
Barium fluoride	BaF_2	....	−1.90	15
Barium hydroxide	$Ba(OH)_2$	....	+12.26	18
Barium hydroxide	$Ba(OH)_2 \cdot H_2O$	....	+8.7	12
Barium hydroxide	$Ba(OH)_2 \cdot 8H_2O$	400	−15.21	18
Barium hypophosphate	$Ba(H_2PO_2)_2 \cdot H_2O$	800	+0.29	18

HEATS OF SOLUTION

Name	Formula	Dilution in moles of water	Heat of solution in kg-cal.	Temp. °C.
Barium iodide	BaI_2	....	+10.3	16
Barium iodide	$BaI_2\cdot 7H_2O$	500	+6.85	18
Barium nitrate	$Ba(NO_3)_2$	800	−5.7	12
Barium nitrate	$Ba(NO_3)_2\cdot H_2O$	800	−8.6	12
Barium nitride	BaN_6	700	−7.8	19.8
Barium oxide	BaO	666	+35.64	15
Barium oxide	$BaO\cdot H_2O$	666	+11.40	15
Barium oxide	$BaO\cdot 2H_2O$	666	+7.06	15
Barium oxide	$BaO\cdot 9H_2O$	666	−14.50	15
Barium perchlorate	$Ba(ClO_4)_2$	550–1100	−1.8	10
Barium perchlorate	$Ba(ClO_4)_2\cdot 3H_2O$	650–1300	−9.4	15
Barium persulfate	$BaS_2O_8\cdot 4H_2O$	1600	−11.8	12
Barium sulfate	$BaSO_4$	....	−5.58	18
Barium sulfide	BaS	....	+7.0	15
Beryllium chloride	$BeCl_2$	....	+44.5	15
Beryllium sulfate	$BeSO_4\cdot 4H_2O$	400	+1.1	18
Bismuth chloride	$BiCl_3$	1600	+7.83	18
Boric acid	$B_2O_3\cdot 3H_2O$	800	−10.79	16
Boric oxide	B_2O_3	....	+7.3	15
Cadmium bromide	$CdBr_2$	400	+0.44	18
Cadmium bromide	$CdBr_2\cdot 4H_2O$	600	−7.29	18
Cadmium chloride	$CdCl_2$	400	+3.01	18
Cadmium chloride	$CdCl_2\cdot H_2O$	400	+0.625	15
Cadmium chloride	$CdCl_2\cdot 2H_2O$	400	+0.76	18
Cadmium iodide	CdI_2	400	−0.96	18
Cadmium nitrate	$Cd(NO_3)_2\cdot H_2O$	400	+4.18	18
Cadmium nitrate	$Cd(NO_3)_2\cdot 4H_2O$	400	−5.04	18
Cadmium sulfate	$CdSO_4$	400	+10.690	15
Cadmium sulfate	$CdSO_4\cdot H_2O$	400	+6.05	18
Cadmium sulfate	$CdSO_4\cdot .\frac{8}{3}H_2O$	400	+2.539	15
Calcium acetate	$Ca(C_2H_3O_2)_2$	440	+7.0	15.5
Calcium acetate	$Ca(C_2H_3O_2)_2\cdot H_2O$	600	+5.4	17
Calcium bromide	$CaBr_2$	400	+24.51	18
Calcium bromide	$CaBr_2\cdot 6H_2O$	400	−1.09	18
Calcium chloride	$CaCl_2$	300	+17.41	18
Calcium chloride	$CaCl_2\cdot 6H_2O$	400	−4.31	19.3
Calcium ferrocyanide	$Ca_2Fe(CN)_6\cdot 12H_2O$	....	+4.6	10
Calcium fluoride	CaF_2	....	+2.70	15
Calcium hydroxide	$Ca(OH)_2$	2500	+2.79	18
Calcium iodide	CaI_2	....	+28.12	15
Calcium nitrate	$Ca(NO_3)_2$	400	+3.95	18
Calcium nitrate	$Ca(NO_3)_2\cdot 4H_2O$	400	−7.25	18
Calcium oxide	CaO	2500	+18.33	18
Calcium sulfate	$CaSO_4$	....	+4.44	18
Calcium sulfate	$CaSO_4\cdot 2H_2O$	....	−0.30	18
Calcium sulfide	CaS	....	+6.1	15
Cesium bisulfate	$CsHSO_4$	....	−3.73	15
Cesium bromide	$CsBr$	....	−6.73	15
Cesium chloride	$CsCl$	....	−4.75	15
Cesium fluoride	CsF	....	+8.37	15
Cesium hydroxide	$CsOH$	....	+16.423	15
Cesium hydroxide	$CsOH\cdot H_2O$	....	+4.317	15
Cesium iodide	CsI	....	−8.25	15
Cesium oxide	Cs_2O	....	+83.2	15
Cesium sulfate	Cs_2SO_4	....	−4.97	15

HEATS OF SOLUTION

Name	Formula	Dilution in moles of water	Heat of solution in kg-cal.	Temp. °C.
Chromium bromide (ic)	$CrBr_3 \cdot 6H_2O$-green	500	+0.7	15
Chromium bromide (ic)	$CrBr_3 \cdot 6H_2O$-blue	....	+14.35	15
Chromium chloride (ic)	$CrCl_3$	....	+35.9	15
Chromium chloride (ic)	$2CrCl_3 \cdot 13H_2O$-gray	....	+24.04	15
Chromium chloride (ic)	$2CrCl_3 \cdot 13H_2O$-green	....	−0.1	15
Chromium chloride (ous)	$CrCl_2$	....	+18.6	15
Chromium chloride (ous)	$CrCl_2 \cdot 4H_2O$	....	+2.0	15
Chromium sulfate (ic)	$Cr_2(SO_4)_3 \cdot 8H_2O$	....	+13.6	15
Chromium sulfate (ic)	$Cr_2(SO_4)_3 \cdot 16H_2O$	....	+6.2	15
Chromium trioxide	CrO_3	220	+1.9	19
Cobalt chloride	$CoCl_2$	400	+18.34	18
Cobalt chloride	$CoCl_2 \cdot 6H_2O$	400	−2.85	18
Cobalt nitrate	$Co(NO_3)_2$	280	+11.82	8
Cobalt nitrate	$Co(NO_3)_2 \cdot 6H_2O$	400	−4.96	18
Cobalt sulfate	$CoSO_4 \cdot 7H_2O$	800	−3.57	18
Copper acetate	$Cu(C_2H_3O_2)_2$	320	+2.4	16
Copper acetate	$Cu(C_2H_3O_2)_2 \cdot H_2O$	400	+0.2	18
Copper bromide	$CuBr_2$	400	+8.25	18
Copper bromide	$CuBr_2 \cdot 4H_2O$	....	−1.5	7.5
Copper chloride	$CuCl_2$	600	+11.08	18
Copper chloride	$CuCl_2 \cdot 2H_2O$	400	+4.21	18
Copper nitrate	$Cu(NO_3)_2$	280	+10.47	8
Copper nitrate	$Cu(NO_3)_2 \cdot 6H_2O$	400	−10.71	18
Copper sulfate	$CuSO_4$	400	+15.80	18
Copper sulfate	$CuSO_4 \cdot H_2O$	400	+9.34	18
Copper sulfate	$CuSO_4 \cdot 5H_2O$	400	−2.75	18
Cyanogen	C_2N_2	....	−73.0	15
Dysprosium sulfate	$Dy_2(SO_4)_3 \cdot 8H_2O$	1200	+6.3	18
Erbium acetate	$Er(C_2H_3O_2)_3 \cdot 4H_2O$	1500	+0.7	18
Gold bromic acid	$HAuBr_4 \cdot 5H_2O$	1000	−11.40	18
Gold bromide	$AuBr_3$	2000	−3.71	18
Gold chloride	$AuCl_3$	900	+4.45	18
Gold chloride	$AuCl_3 \cdot 2H_2O$	600	−1.69	18
Gold chloric acid	$HAuCl_4 \cdot 3H_2O$	400	−3.55	18
Gold chloric acid	$HAuCl_4 \cdot 4H_2O$	400	−5.83	18
Hydrobromic acid	HBr	....	+20.0	15
Hydrochloric acid	HCl	....	+17.4	15
Hydroferrocyanic acid	$H_4Fe(CN)_6$	200	+0.4	10
Hydriodic acid	HI	....	+19.6	15
Hydrogen selenide	H_2Se	....	+9.3	15
Hydrogen sulfide	H_2S	....	+4.56	15
Hydroxylamine	NH_2OH	....	−2.8	15
Iodine pentoxide	I_2O_5	....	−1.79	15
Iron chloride (ous)	$FeCl_2$	350	+17.85	18
Iron chloride (ous)	$FeCl_2 \cdot 2H_2O$	1100	+8.7	20
Iron chloride (ous)	$FeCl_2 \cdot 4H_2O$	400	+2.75	18
Iron chloride (ic)	$FeCl_3$	1000	+32.68	18
Iron chloride (ic)	$FeCl_3 \cdot 2\frac{1}{2}H_2O$	1200	+21.0	18
Iron chloride (ic)	$FeCl_3 \cdot 6H_2O$	1200	+5.65	20.8
Iron nitrate (ic)	$Fe(NO_3)_3 \cdot 9H_2O$	480	−9.0	15
Iron sulfate (ous)	$FeSO_4 \cdot 7H_2O$	400	−4.51	18
Lead acetate	$Pb(C_2H_3O_2)_2$	440	+1.4	16
Lead acetate	$Pb(C_2H_3O_2)_2 \cdot 3H_2O$	800	−6.14	18
Lead bromide	$PbBr_2$	2500	−10.04	18
Lead chloride	$PbCl_2$	1800	−6.8	18
Lead dithionate	$PbS_2O_6 \cdot 4H_2O$	400	−8.54	18

HEATS OF SOLUTION

Name	Formula	Dilution in moles of water	Heat of solution in kg-cal.	Temp. °C.
Lead nitrate	$Pb(NO_3)_2$	400	−7.61	18
Lithium bromide	$LiBr$	....	+11.25	15
Lithium chloride	$LiCl$	230	+8.37	15
Lithium chloride	$LiCl \cdot H_2O$	....	+4.211	15
Lithium chloride	$LiCl \cdot 2H_2O$	....	+0.981	15
Lithium fluoride	LiF	....	−1.04	15
Lithium fluosilicate	Li_2SiF_6	800	+1.8	15
Lithium hydroxide	$LiOH$	400	+5.82	15
Lithium hydroxide	$LiOH \cdot H_2O$	....	+0.720	18
Lithium iodide	LiI	....	+14.76	15
Lithium nitrate	$LiNO_3$	100	+0.30	18
Lithium oxide	Li_2O	222	+30.76	15
Lithium oxide	$4Li_2O \cdot 5H_2O$	888	+8.182	15
Lithium oxide	$4Li_2O \cdot 3H_2O$	888	+16.026	15
Lithium peroxide	Li_2O_2	....	+7.19	15
Lithium selenide	Li_2Se	....	+10.7	20
Lithium selenide	$Li_2Se \cdot 9H_2O$	1146–6426	−12.2	15
Lithuim sulfate	Li_2SO_4	200	+6.05	18
Lithium sulfate	$Li_2SO_4 \cdot H_2O$	400	+3.41	18
Magnesium ammonium sulfate	$MgSO_4 \cdot (NH_4)_2SO_4 \cdot 6H_2O$	....	−9.7	15
Magnesium bromide	$MgBr_2$	....	+43.3	15
Magnesium chloride	$MgCl_2$	800	+35.92	18
Magnesium chloride	$MgCl_2 \cdot 6H_2O$	400	+2.95	18
Magnesium dithionate	$MgS_2O_6 \cdot 6H_2O$	400	−2.96	18
Magnesium fluoride	MgF_2	....	+2.778	15
Magnesium hydroxide	$Mg(OH)_2$	....	−0.0	18
Magnesium iodide	MgI_2	....	+49.8	15
Magnesium nitrate	$Mg(NO_3)_2 \cdot 6H_2O$	400	−4.22	18
Magnesium potassium sulfate	$MgSO_4 \cdot K_2SO_4$	600	+10.60	18
Magnesium potassium sulfate	$MgSO_4 \cdot K_2SO_4 \cdot 6H_2O$	600	−10.02	18
Magnesium sodium sulfate	$MgSO_4 \cdot Na_2SO_4$	....	+16.7	19
Magnesium sulfate	$MgSO_4$	400	+20.28	18
Magnesium sulfate	$MgSO_4 \cdot H_2O$	400	+13.30	18
Magnesium sulfate	$MgSO_4 \cdot 7H_2O$	400	−3.80	18
Manganese chloride	$MnCl_2$	350	+16.01	18
Manganese chloride	$MnCl_2 \cdot 4H_2O$	400	+1.54	18
Manganese dithionate	$MnS_2O_6 \cdot 6H_2O$	400	−1.93	18
Manganese nitrate	$Mn(NO_3)_2$	280	+12.39	14
Manganese nitrate	$Mn(NO_3)_2 \cdot 6H_2O$	400	−6.15	18
Manganese potassium sulfate	$MnSO_4 \cdot K_2SO_4$	600	+6.38	18
Manganese potassium sulfate	$MnSO_4\ K_2SO_4 \cdot 4H_2O$	600	−6.44	18
Manganese sodium sulfate	$MnSO_4 \cdot Na_2SO_4$	....	+13.0	15
Manganese sodium sulfate	$MnSO_4 \cdot Na_2SO_4 \cdot 2H_2O$	....	+3.2	15
Manganese sodium sulfate	$MnSO_4 \cdot Na_2SO_4 \cdot 6H_2O$	....	−9.7	15
Manganese sulfate	$MnSO_4$	400	+13.79	18
Manganese sulfate	$MnSO_4 \cdot H_2O$	400	+7.82	18
Manganese sulfate	$MnSO_4 \cdot 5H_2O$	400	+0.04	18
Mercurous acetate	$HgC_2H_3O_2$	222	−3.8	13.7
Mercuric bromide	$HgBr_2$	....	−3.4	12
Mercuric chloride	$HgCl_2$	300	−3.30	18

HEATS OF SOLUTION

Name	Formula	Dilution in moles of water	Heat of solution in kg-cal.	Temp. °C.
Mercuric cyanide	$Hg(CN)_2$	....	−2.97	18
Mercuric potassium bromide	HgK_2Br_4	600	−9.75	18
Mercuric potassium chloride	$HgKCl_3$	770	−9.5	14
Mercuric potassium chloride	$HgKCl_3 \cdot H_2O$	800	−11.3	14
Mercuric potassium chloride	HgK_2Cl_4	930	−15.0	14
Mercuric potassium chloride	$HgK_2Cl_4 \cdot H_2O$	970	−16.66	14
Mercuric potassium iodide	HgK_2I_4	800	−9.81	18
Neodymium chloride	$NdCl_3$	....	+35.4	17
Neodymium chloride	$NdCl_3 \cdot 6H_2O$	....	+7.6	15
Neodymium iodide	NdI_3	....	+48.9	19
Neodymium sulfate	$Nd_2(SO_4)_3$	....	+36.5	14
Nickel chloride	$NiCl_2$	400	+19.17	18
Nickel chloride	$NiCl_2 \cdot 6H_2O$	400	−1.16	18
Nickel dithionate	$NiS_2O_6 \cdot 6H_2O$	400	−2.42	18
Nickel nitrate	$Ni(NO_3)_2$	280	+11.88	18
Nickel nitrate	$Ni(NO_3)_2 \cdot 6H_2O$	400	−7.47	18
Nickel sulfate	$NiSO_4 \cdot 7H_2O$	800	−4.25	18
Oxalic acid	$H_2C_2O_4 \cdot 2H_2O$	530	−8.59	15
Perchloric acid	$HClO_4$	....	+20.3	15
Phosphoric acid, meta	HPO_3	....	+10.1	15
Phosphoric acid, ortho	H_3PO_4	120	+2.69	15
Phosphoric acid, pyro	$H_4P_2O_7$	....	+7.9	15
Phosphorous acid, hypo	H_3PO_2	....	−0.17	15
Phosphorous acid, ortho	H_3PO_3 (solid)	120	−0.13	15
Phosphorous acid, pyro	$H_4P_2O_5$	550	+35.6	15
Phosphorus trichloride	PCl_3	1000	+65.14	15
Phosphorus pentoxide	P_2O_5	550	+35.6	15
Platinum brom acid	$H_2PtBr_6 \cdot 9H_2O$	....	−2.9	15
Platinum bromide	$PtBr_4$	....	+9.86	15
Platinum chlor acid	$H_2PtCl_6 \cdot 6H_2O$	450	+4.34	15
Platinum chloride	$PtCl_4$	....	+19.6	17
Potassium acetate	$KC_2H_3O_2$	200	+3.34	18
Potassium acid arsenate	KH_2AsO_4	....	−4.9	18
Potassium acid carbonate	$KHCO_3$	....	−5.3	10–15
Potassium acid fluoride	$KF \cdot HF$	400	−6.0	15
Potassium acid flouride	$KF \cdot 2HF$	....	−8.0	15
Potassium acid fluoride	$KF \cdot 3HF$	....	−8.6	15
Potassium acid iodate	$KH(IO_3)_2$	865	−11.8	15
Potassium acid oxalate	KHC_2O_4	....	−9.6	15
Potassium acid sulfate	$KHSO_4$	200	−3.80	18
Potassium aluminum sulfate	$KAl(SO_4)_2 \cdot 12H_2O$	1200	−10.1	18
Potassium bromate	$KBrO_3$	200	−9.76	18
Potassium bromide	KBr	200	−5.08	18
Potassium bromoplatinate	K_2PtBr_6	2000	−12.26	18
Potassium carbonate	K_2CO_3	400	+6.49	18
Potassium carbonate	$K_2CO_3 \cdot \frac{1}{2}H_2O$	400	+4.28	18
Potassium carbonate	$K_2CO_3 \cdot 1\frac{1}{2}H_2O$	400	−0.38	18
Potassium chlorate	$KClO_3$	400	−10.04	18
Potassium chloride	KCl	100	−4.19	21
Potassium chloropalladate	K_2PdCl_6	....	−15.00	18
Potassium chloroplatinate	K_2PtCl_4	600	−12.22	18
Potassium chloroplatinate	K_2PtCl_6	....	−13.76	18
Potassium chromate	K_2CrO_4	543	−5.25	15
Potassium cyanate	$KCNO$	40	−5.2	20

HEATS OF SOLUTION

Name	Formula	Dilution in moles of water	Heat of solution in kg-cal.	Temp. °C.
Potassium cyanide	KCN	175	−3.01	18
Potassium dichromate	$K_2Cr_2O_7$	400	−16.70	18
Potassium dithionate	$K_2S_2O_6$	500	−13.01	18
Potassium ferricyanide	$K_3Fe(CN)_6$	400	−14.4	12
Potassium ferrisulfate	$KFe(SO_4)_2 \cdot 12H_2O$	1000	−16.0	15
Potassium ferrocyanide	$K_4Fe(CN)_6$	820	−12.0	12
Potassium ferrocyanide	$K_4Fe(CN)_6 \cdot 3H_2O$	940	−16.9	11
Potassium fluoride	KF	....	+3.6	20
Potassium fluoride	$KF \cdot 2H_2O$	....	−1.0	20
Potassium hydroxide	KOH	250	+13.29	18
Potassium hydroxide	$KOH \cdot 2H_2O$	170	−0.03	15
Potassium iodate	KIO_3	500	−6.78	18
Potassium iodide	KI	200	−5.11	18
Potassium nitrate	KNO_3	200	−8.52	18
Potassium oxalate	$K_2C_2O_4$	465–930	−4.74	10–15
Potassium oxalate	$K_2C_2O_4 \cdot H_2O$	800	−7.41	18
Potassium oxide	K_2O	....	+75.0	15
Potassium pentathionate	$K_2S_5O_6 \cdot 1\frac{1}{2}H_2O$	2030	−13.1	9.5
Potassium perchlorate	$KClO_4$	460	−12.13	20
Potassium permanganate	$KMnO_4$	700	−10.2	16
Potassium persulfate	$K_2S_2O_8$	3300	−14.55	9
Potassium phosphate dihydrogen	KH_2PO_4	....	−4.85	15
Potassium selenide	KSe	1762–1965	+8.5	13
Potassium selenide	$KSe \cdot 9H_2O$	921–4844	−19.2	14
Potassium selenide	$KSe \cdot 14H_2O$	2145–5914	−20.4	13
Potassium selenide	$KSe \cdot 19H_2O$	....	−29.3	14
Potassium silver cyanide	$KAg(CN)_2$	440	−8.55	11
Potassium stannichloride	K_2SnCl_6	800	−3.38	18
Potassium stannochloride	$K_2SnCl_4 \cdot H_2O$	600	−13.42	18
Potassium sulfate	K_2SO_4	400	−6.38	18
Potassium sulfide	K_2S	....	+22.7	
Potassium tetrasulfide	K_2S_4	600	+1.4	10
Potassium tetrasulfide	$K_2S_4 \cdot \frac{1}{2}H_2O$	....	−1.212	15.7
Potassium tetroxalate	$KHC_2O_4 \cdot H_2C_2O_4$	....	−15.7	15
Potassium tetrathionate	$K_2S_4O_6$	500	−13.15	18
Potassium thiosulfate	$K_2S_2O_3$	950	−5.0	10
Potassium thiosulfate	$K_2S_2O_3 \cdot H_2O$	....	−6.2	14
Potassium thrithionate	$K_2S_3O_6$	500	−12.46	18
Rubidium bicarbonate	$RbHCO_3$	....	+4.731	15
Rubidium bisulfate	$RbHSO_4$	....	−3.73	15
Rubidium bromide	$RbBr$	....	−5.96	15
Rubidium chloride	$RbCl$	....	−4.50	15
Rubidium fluoride	RbF	....	+5.80	15
Rubidium hydroxide	$RbOH$	....	+14.264	15
Rubidium hydroxide	$RbOH \cdot H_2O$	....	+3.70	15
Rubidium hydroxide	$RbOH \cdot 2H_2O$	....	−0.65	15
Rubidium iodide	RbI	....	−6.50	15
Rubidium oxide	Rb_2O	....	+80.0	15
Rubidium sulfate	Rb_2SO_4	....	- 6.66	15
Rubidium sulfide	Rb_2S	....	+24.6	15
Selenic acid	H_2SeO_4	....	+16.8	15
Selenium dioxide	SeO_2	....	−0.74	15
Silver acetate	$AgC_2H_3O_2$	120	−4.3	10
Silver chloride	$AgCl$	....	−15.75	15

HEATS OF SOLUTION

Name	Formula	Dilution in moles of water	Heat of solution in kg-cal.	Temp. °C.
Silver dithionate	$Ag_2S_2O_6 \cdot 2H_2O$	400	−10.36	18
Silver fluoride	AgF	....	+3.4	10
Silver fluoride	$AgF \cdot 2H_2O$	....	−1.5	10
Silver nitrate	$AgNO_3$	200	−5.44	18
Silver nitrite	$AgNO_2$	....	−8.8	15
Silver sulfate	Ag_2SO_4	1400	−4.48	18
Sodium acetate	$NaC_2H_3O_2$	250	+4.1	5.7
Sodium acetate	$NaC_2H_3O_2$	200	+3.87	18
Sodium acetate	$NaC_2H_3O_2 \cdot 3H_2O$	400	−4.81	18
Sodium ammonium phosphate	$NaNH_4HPO_4 \cdot 4H_2O$	800	−10.75	18
Sodium arsenate	$Na_3AsO_4 \cdot 12H_2O$	670	−12.6	18–20
Sodium bicarbonate	$NaHCO_3$	....	−4.3	15
Sodium bifluoride	$NaF \cdot HF$	400	−6.2	12
Sodium bisulfate	$NaHSO_4$	200	+1.19	18
Sodium bisulfide	$NaHS$	....	+4.4	10–16
Sodium bisulfide	$NaHS \cdot 2H_2O$	....	−1.5	17.5
Sodium borate (tetra)	$Na_2B_4O_7$	....	+10.2	15
Sodium borate (tetra)	$Na_2B_4O_7 \cdot 10H_2O$	1600	−25.86	18
Sodium bromide	$NaBr$	200	−0.19	18
Sodium bromide	$NaBr \cdot 2H_2O$	300	−4.71	18
Sodium bromoplatinate	Na_2PtBr_6	600	+9.99	18
Sodium bromoplatinate	$Na_2PtBr_6 \cdot 6H_2O$	800	−8.55	18
Sodium carbonate	Na_2CO_3	400	+5.64	18
Sodium chlorate	$NaClO_3$	180–360	−5.6	10
Sodium chloride	$NaCl$	100	−1.18	18
Sodium chloroplatinate	Na_2PtCl_6	800	+8.54	18
Sodium chloroplatinate	$Na_2PtCl_6 \cdot 6H_2O$	900	−10.63	18
Sodium chromate	Na_2CrO_4	360–720	+2.2	10.5
Sodium chromate	$Na_2CrO_4 \cdot 4H_2O$	650	−7.6	11
Sodium chromate	$Na_2CrO_4 \cdot 10H_2O$	760	−15.8	10.5
Sodium cyanate	$NaCNO$	....	−4.8	12.8
Sodium cyanide	$NaCN$	100	−0.5	9
Sodium cyanide	$NaCN \cdot \frac{1}{2}H_2O$	100	−1.0	6
Sodium cyanide	$NaCN \cdot 2H_2O$	....	−4.4	9
Sodium dithionate	$Na_2S_2O_6$	400	−5.37	18
Sodium dithionate	$Na_2S_2O_6 \cdot 2H_2O$	400	−11.65	18
Sodium fluoride	NaF	400	−0.6	12
Sodium formate	$NaCHO_2$	150	−0.52	11.5
Sodium hydroxide	$NaOH$	200	+9.94	18
Sodium iodide	NaI	200	+1.22	18
Sodium iodide	$NaI \cdot 2H_2O$	300	−4.01	18
Sodium nitrate	$NaNO_3$	200	−5.03	18
Sodium oxide	Na_2O	....	+55.0	15
Sodium perchlorate	$NaClO_4$	200–400	−3.5	10
Sodium phosphate (tri)	$Na_3PO_4 \cdot 12H_2O$	670	−14.5	18–20
Sodium phosphate (di)	Na_2HPO_4	400	+5.64	18
Sodium phosphate (di)	$Na_2HPO_4 \cdot 2H_2O$	400	−0.39	18
Sodium phosphate (di)	$Na_2HPO_4 \cdot 7H_2O$	....	−11.3	15
Sodium phosphate (di)	$Na_2HPO_4 \cdot 12H_2O$	400	−22.83	18
Sodium phosphate (pyro)	$Na_4P_2O_7$	800	+11.85	18
Sodium phosphate (pyro)	$Na_4P_2O_7 \cdot 10H_2O$	800	−11.67	18
Sodium phosphite (di)	Na_2HPO_3	555	+9.15	13.5
Sodium phosphite (di)	$Na_2HPO_3 \cdot 5H_2O$	555	−4.6	13.5
Sodium phosphite (mono)	NaH_2PO_3	555	+0.75	13

HEATS OF SOLUTION

Name	Formula	Dilution in moles of water	Heat of solution in kg-cal.	Temp. °C.
Sodium phosphite (mono)	$NaH_2PO_3\cdot 2\frac{1}{2}H_2O$	555	−5.3	15
Sodium selenide	Na_2Se	789–2587	+18.6	14
Sodium selenide	$Na_2Se\cdot 4\frac{1}{2}H_2O$	1030–2125	−7.9	13
Sodium selenide	$Na_2Se\cdot 9H_2O$	723–1352	−10.6	12
Sodium selenide	$Na_2Se\cdot 16H_2O$	1476–3572	−22.0	14
Sodium sulfate	Na_2SO_4	400	+0.46	18
Sodium sulfate	$Na_2SO_4\cdot H_2O$	400	−1.90	18
Sodium sulfate	$Na_2SO_4\cdot 10H_2O$	400	−18.76	18
Sodium sulfide	Na_2S	584–1027	+15.0	14.5
Sodium sulfide	$Na_2S\cdot 4\frac{1}{2}H_2O$	589–1059	−5.0	17
Sodium sulfide	$Na_2S\cdot 5H_2O$	513–1167	−6.6	17
Sodium sulfide	$Na_2S\cdot 9H_2O$	774–1495	−16.72	13
Sodium sulfite	Na_2SO_3	....	+2.5	10
Sodium sulfite	$Na_2SO_3\cdot 7H_2O$	490	−11.2	10
Sodium tetra sulfide	Na_2S_4	....	+9.8	16.5
Sodium tetrathionate	$Na_2S_4O_6\cdot 2H_2O$	620	−9.7	9.6
Sodium thiosulfate	$Na_2S_2O_3$	440	+1.7	15
Sodium thiosulfate	$Na_2S_2O_3\cdot 5H_2O$	400	−11.37	18
Sodium trithionate	$Na_2S_3O_6\cdot 3H_2O$	675	−10.1	10
Strontium acetate	$Sr(C_2H_3O_2)_2$	300	+5.6	11.5
Strontium acetate	$Sr(C_2H_3O_2)_2\cdot \frac{1}{2}H_2O$	440	+5.3	12
Strontium bromide	$SrBr_2$	400	+16.11	18
Strontium bromide	$SrBr_2\cdot 6H_2O$	400	−7.22	18
Strontium chloride	$SrCl_2$	400	+11.14	18
Strontium chloride	$SrCl_2\cdot 6H_2O$	400	−7.50	18
Strontium cyanide	$Sr(CN)_2\cdot 4H_2O$	100	−4.15	8
Strontium dithionate	$SrS_2O_6\cdot 4H_2O$	400	−9.25	18
Strontium fluoride	SrF_2	....	−2.10	15
Strontium hydroxide	$Sr(OH)_2$	....	+11.64	18
Strontium hydroxide	$Sr(OH)_2\cdot 8H_2O$	....	−14.64	18
Strontium iodide	SrI_2	....	+20.5	12
Strontium iodide	$SrI_2\cdot 7H_2O$	....	−4.47	15
Strontium nitrate	$Sr(NO_3)_2$	400	−4.62	18
Strontium nitrate	$Sr(NO_3)_2\cdot 4H_2O$	400	−12.30	18
Strontium oxide	SrO	....	+29.34	18
Strontium oxide	$SrO\cdot 0.14H_2O$	1111	+26.10	15
Strontium oxide	$SrO\cdot H_2O$	1111	+10.33	15
Strontium oxide	$SrO\cdot 2H_2O$	1111	+5.26	15
Strontium oxide	$SrO\cdot 9H_2O$	1111	−14.27	15
Strontium selenide	$SrSe$	....	+7.4	15
Sulfur dioxide	SO_2	300	+1.50	15
Sulfur trioxide	SO_3	1600	+39.17	15
Sulfur heptoxide	S_4O_7	....	+37.29	15
Sulfuric acid	H_2SO_4	1600	+17.85	15
Thallium chloride	$TlCl$	4500	−10.10	18
Thallium hydroxide	$TlOH$	235	−3.15	18
Thallium nitrate	$TlNO_3$	300	−9.97	18
Thallium oxide	Tl_2O	570	−3.08	18
Thallium sulfate	Tl_2SO_4	1600	−8.28	18
Tin bromide (ic)	$SnBr_4$	970	+16.6	10.5
Tin bromide (ous)	$SnBr_2$	1080	−1.6	15
Tin chloride (ic)	$SnCl_4$	720	+28.5	10.5
Tin chloride (ous)	$SnCl_2$	300	+0.35	18
Tin chloride (ous)	$SnCl_2\cdot 2H_2O$	200	−5.37	18
Uranyl acetate	$UO_2(C_2H_3O_2)_2\cdot 2H_2O$	1000–2500	−4.3	18 20

HEATS OF SOLUTION

Name	Formula	Dilution in moles of water	Heat of solution in kg-cal.	Temp. °C.
Uranyl chloride	$UO_2Cl_2 \cdot H_2O$	1000–2500	+2.0	18–20
Uranyl chromate	$UO_2CrO_4 \cdot 5\frac{1}{2}H_2O$	1000–2500	−6.3	18–20
Uranyl nitrate	$UO_2(NO_3)_2 \cdot 3H_2O$	1000–2500	−3.7	18–20
Uranyl potassium chloride	$UO_2Cl_2 \cdot 2KCl \cdot 2H_2O$	1000–2500	+2.0	18–20
Uranyl sulfate	$UO_2SO_4 \cdot 3H_2O$	1000–2500	+5.1	18–20
Ytterbium sulfate	$Y_2(SO_4)_3 \cdot 8H_2O$	1200	+10.7	18
Zinc acetate	$Zn(C_2H_3O_2)_2$	720	+9.8	22.5
Zinc acetate	$Zn(C_2H_3O_2)_2 \cdot H_2O$	800	+7.0	22.5
Zinc acetate	$Zn(C_2H_3O_2)_2 \cdot 2H_2O$	500	+4.2	10.2
Zinc ammonium chloride	$3ZnCl_2 \cdot 6NH_4Cl \cdot H_2O$	....	+3.23	13
Zinc bromide	$ZnBr_2$	400	+15.03	18
Zinc chloride	$ZnCl_2$	300	+15.63	18
Zinc dithionate	$ZnS_2O_6 \cdot 6H_2O$	400	−2.42	1
Zinc formate	$Zn(CHO_2)_2$	500	+4.0	15
Zinc iodide	ZnI_2	400	+11.31	18
Zinc nitrate	$Zn(NO_3)_2 \cdot 6H_2O$	400	−5.84	18
Zinc potassium sulfate	$ZnSO_4 \cdot K_2SO_4$	600	+7.91	18
Zinc potassium sulfate	$ZnSO_4 \cdot K_2SO_4 \cdot 6H_2O$	600	−11.90	18
Zinc sulfate	$ZnSO_4$	400	+18.43	18
Zinc sulfate	$ZnSO_4 \cdot H_2O$	400	+9.95	18
Zinc sulfate	$ZnSO_4 \cdot 7H_2O$	400	−4.26	18
Zirconyl nitrate	$ZrO(NO_3)_2 \cdot 2H_2O$	....	+2.17	15
Zirconyl nitrate	$ZrO(NO_3)_2 \cdot 3\frac{1}{2}H_2O$	....	−1.92	15

VAN DER WAALS' CONSTANTS FOR GASES

Calculated from the values given in *Landolt-Bornstein Phys.-Chem. Tab.*, 5th Ed., p. 254 (1923); published by J. Springer, Berlin.

$$\left(P + \frac{a}{V^2}\right)\left(V - b\right) = RT \text{ for } \textit{one} \text{ mole}$$

To use the values of a and b in the table below, P must be expressed in atmospheres and V in liters per mole; then $R = 0.08207$ liter atmospheres per mole per degree; T is degrees absolute.

$$\left(P + \frac{n^2a}{V^2}\right)\left(V - nb\right) = nRT \text{ for } n \text{ moles}$$

Name	Formula	a $\frac{(\text{liters})^2 \times \text{atm.}}{(\text{mole})^2}$	b $\frac{\text{liters}}{\text{mole}}$
Acetic acid	CH_3CO_2H	17.59	0.1068
Acetic anhydride	$(CH_3CO)_2O$	19.90	0.1263
Acetone	$(CH_3)_2CO$	13.91	0.0994
Acetonitrile	CH_3CN	17.58	0.1168
Acetylene	$HCCH$	4.390	0.05136
Ammonia	NH_3	4.170	0.03707
Amyl formate	$HCO_2C_5H_{11}$	27.58	0.1730
Amylene	C_5H_{10}	15.90	0.1207
Aniline	$C_6H_5NH_2$	26.50	0.1369
Argon	A	1.345	0.03219
Benzene	C_6H_6	18.00	0.1154
Benzonitrile	C_6H_5CN	33.39	0.1724
Bromobenzene	C_6H_5Br	28.56	0.1539
Butane *n*	C_4H_{10}	14.47	0.1226

VAN DER WAALS' CONSTANTS FOR GASES

Name	Formula	*a* $\frac{(\text{liters})^2 \times \text{atm.}}{(\text{mole})^2}$	*b* $\frac{\text{liters}}{\text{mole}}$
Butyronitrile	C_3H_7CN	25.72	0.1596
Capronitrile	$C_5H_{11}CN$	34.16	0.1984
Carbon dioxide	CO_2	3.592	0.04267
Carbon disulfide	CS_2	11.62	0.07685
Carbon monoxide	CO	1.485	0.03985
Carbon oxysulfide	COS	3.933	0.05817
Carbon tetrachloride	CCl_4	20.39	0.1383
Chlorine	Cl_2	6.493	0.05622
Chlorobenzene	C_6H_5Cl	25.43	0.1453
Chloroform	$CHCl_3$	15.17	0.1022
Cresol *m*	$CH_3C_6H_4OH$	31.38	0.1607
Cyanogen	$(CN)_2$	7.667	0.06901
Cyclohexane	C_6H_{12}	22.81	0.1424
Cymene	$CH_3C_6H_4C_3H_7$	42.16	0.2336
Decane	$C_{10}H_{12}$	48.55	0.2905
Di-isobutyl	C_8H_{18}	34.97	0.2296
Diethylamine	$(C_2H_5)_2NH$	19.15	0.1392
Dimethylamine	$(CH_3)_2NH$	10.38	0.08570
Dimethylaniline	$C_6H_5N(CH_3)_2$	37.49	0.1970
Diphenyl	$(C_6H_5)_2$	52.79	0.2480
Diphenyl methane	$(C_6H_5)_2CH_2$	38.20	0.2240
Dipropylamine	$(C_3H_7)_2NH$	27.72	0.1820
Di-isopropyl	$(C_3H_7)_2$	23.13	0.1669
Durene	$C_{10}H_{14}$	45.32	0.2424
Ethane	C_2H_6	5.489	0.06380
Ethyl acetate	$CH_3CO_2C_2H_5$	20.45	0.1412
Ethyl alcohol	C_2H_5OH	12.02	0.08407
Ethylamine	$C_2H_5NH_2$	10.60	0.08409
Ethyl benzene	$C_2H_5C_6H_5$	28.60	0.1667
Ethyl butyrate	$C_3H_7CO_2C_2H_5$	30.07	0.1919
Ethyl isobutyrate	$C_3H_7CO_2C_2H_5$	28.87	0.1994
Ethyl chloride	C_2H_5Cl	10.91	0.08651
Ethyl ether	$(C_2H_5)_2O$	17.38	0.1344
Ethyl formate	$HCO_2C_2H_5$	14.80	0.1056
Ethyl mercaptan	C_2H_5SH	11.24	0.08098
Ethyl propionate	$C_2H_5CO_2C_2H_5$	24.39	0.1615
Ethyl sulfide	$(C_2H_5)_2S$	18.75	0.1214
Ethylene	C_2H_4	4.471	0.05714
Ethylene bromide	$(CH_2Br)_2$	13.98	0.08664
Ethylene chloride	$(CH_2Cl)_2$	16.91	0.1086
Ethylidene chloride	CH_3CHCl_2	15.50	0.1073
Fluorobenzene	C_6H_5F	19.93	0.1286
Germanium tetrachloride	$GeCl_4$	22.60	0.1485
Helium	He	0.03412	0.02370
Heptane *n*	C_7H_{16}	31.51	0.2654
Hexane *n*	C_6H_{14}	24.39	0.1735
Hydrogen	H_2	0.2444	0.02661
Hydrogen bromide	HBr	4.451	0.04431
Hydrogen chloride	HCl	3.667	0.04081
Hydrogen selenide	H_2Se	5.268	0.04637
Hydrogen sulfide	H_2S	4.431	0.04287
Iodobenzene	C_6H_5I	33.08	0.1656
Isoamylene	C_5H_{10}	18.08	0.1405
Isobutane	C_4H_{10}	12.87	0.1142
Isobutyl acetate	$CH_3CO_2C_4H_9$	28.50	0.1833

VAN DER WAALS' CONSTANTS FOR GASES

Name	Formula	a $\frac{(\text{liters})^2 \times \text{atm.}}{(\text{mole})^2}$	b $\frac{\text{liters}}{\text{mole}}$
Isobutyl alcohol	C_4H_9OH	17.03	0.1143
Isobutylbenzene	$C_6H_5C_4H_9$	38.59	0.2144
Isobutyl formate	$HCO_2C_4H_9$	22.54	0.1476
Isopentane	C_5H_{12}	18.05	0.1417
Isopropyl alcohol	C_3H_7OH	13.78	0.09804
Isopropylbenzene	$C_6H_5C_3H_7$	35.64	0.2025
Krypton	Kr	2.318	0.03978
Mercury	Hg	8.093	0.01696
Mesitylene	$(CH_3)_3C_6H_3$	34.32	0.1979
Methane	CH_4	2.253	0.04278
Methyl acetate	$CH_3CO_2CH_3$	15.29	0.1091
Methyl alcohol	CH_3OH	9.523	0.06702
Methylamine	CH_3NH_2	7.130	0.05992
Methyl butyrate	$C_3H_7CO_2CH_3$	23.94	0.1569
Methyl isobutyrate	$C_3H_7CO_2CH_3$	24.50	0.1637
Methyl chloride	CH_3Cl	7.471	0.06483
Methyl ether	$(CH_3)_2O$	8.073	0.07246
Methyl ethyl ether	$CH_3OC_2H_5$	11.95	0.09775
Methyl ethyl sulfide	$CH_3SC_2H_5$	19.23	0.1304
Methyl fluoride	CH_3F	4.631	0.05264
Methyl formate	HCO_2CH_3	10.84	0.08068
Methyl propionate	$C_2H_5CO_2CH_3$	19.91	0.1360
Methyl sulfide	$(CH_3)_2S$	12.87	0.09213
Methyl valerate	$C_4H_9CO_2CH_3$	28.96	0.1845
Naphthalene	$C_{10}H_8$	39.74	0.1937
Neon	Ne	0.2107	0.01709
Nitric oxide	NO	1.340	0.02789
Nitrogen	N_2	1.390	0.03913
Nitrogen dioxide	NO_2	5.284	0.04424
Nitrous oxide	N_2O	3.782	0.04415
Octane *n*	C_8H_{18}	37.32	0.2368
Oxygen	O_2	1.360	0.03183
Pentane *n*	C_5H_{12}	19.01	0.1460
Phenetole	$C_6H_5OC_2H_5$	35.16	0.1963
Phosphine	PH_3	4.631	0.05156
Phosphonium chloride	PH_4Cl	4.054	0.04545
Phosphorus	P	52.94	0.1566
Propane	C_3H_8	8.664	0.08445
Propionic acid	$C_2H_5CO_2H$	20.11	0.1187
Propionitrile	C_2H_5CN	16.44	0.1064
Propyl acetate	$CH_3CO_2C_3H_7$	24.63	0.1619
Propyl alcohol	C_3H_7OH	14.92	0.1019
Propylamine	$C_3H_7NH_2$	14.99	0.1090
Propyl benzene	$C_6H_5C_3H_7$	35.85	0.2028
Propyl chloride	C_3H_7Cl	15.91	0.1141
Propyl formate	$HCO_2C_3H_7$	18.95	0.1280
Propylene	C_3H_6	8.379	0.08272
Pseudo-cumene	$C_6H_3(CH_3)_3$	36.61	0.2021
Silicon fluoride	SiF_4	4.195	0.05571
Silicon tetrahydride	SiH_4	4.320	0.05786
Stannic chloride	$SnCl_4$	26.91	0.1642
Sulfur dioxide	SO_2	6.714	0.05636
Thiophene	C_4H_4S	20.72	0.1270
Toluene	$C_6H_5CH_3$	24.06	0.1463
Triethylamine	$(C_2H_5)_3N$	27.17	0.1831

VAN DER WAALS' CONSTANTS FOR GASES

Name	Formula	a $\frac{(\text{liters})^2 \times \text{atm.}}{(\text{mole})^2}$	b $\frac{\text{liters}}{\text{mole}}$
Trimethylamine	$(CH_3)_3N$	13.02	0.1084
Xenon	Xe	4.194	0.05105
Xylene *m*	$C_6H_4(CH_3)_2$	30.36	0.1772
Xylene *o*	$C_6H_4(CH_3)_2$	29.98	0.1755
Xylene *p*	$C_6H_4(CH_3)_2$	30.93	0.1809
Water	H_2O	5.464	0.03049

SPECIFIC HEAT OF GASES AND VAPORS

The values of γ in the table below are the ratios of the specific heat at constant pressure (Cp) to that at constant volume (Cv). To convert the values below into joules per gram per degree C., multiply by 4.185.*

Gas or Vapor	Temp. °C.	Press. atm.	Specific Heat in cal. 15° per gram per °C. Const. press.	Const. vol.	$\gamma = Cp/Cv$
Acetaldehyde, C_2H_4O	30	1	......	......	1.14
Acetic acid, $C_2H_4O_2$	118–140	1	1.50	......	$1.15^{136°}$
" "	140–180	1	1.27	......	......
" "	180–220	1	0.951	......	....
Acetone, C_3H_6O	26–110	1	0.347	......	....
"	130–230	1	0.412	......	....
Acetylene, C_2H_2	15	1	0.3830	0.3039	1.26
"	−71	1	0.3513	0.2676	1.31
Air	0	1	0.2399	0.1710	1.403
"	100	1	0.2404	0.1715	1.401
"	200	1	0.2413	0.1726	1.398
"	400	1	0.2430	0.1744	1.393
"	600	1	0.2471	0.1785	1.385
"	800	1	0.2521	0.1835	1.376
"	1000	1	0.2571	0.1885	1.365
"	1400	1	0.2700	0.2014	1.341
"	2000	1	0.2949	0.2263	1.088
"	0	20	0.2490	......	....
"	0	100	0.2800	......	....
"	50	220	0.2961	......	....
"	−50	10	0.2440	......	....
"	−100	10	0.2581	......	....
"	−140	10	0.4079	......	....
Allyl chloride, C_3H_5Cl	14	0.2	......	......	1.137
Ammonia, NH_3	15	1	0.5232	0.3995	1.310
"	15	3.5	......	......	1.41
Argon, A	−180	1	1.33	0.0754	1.76
"	15	1	0.1252	0.07531	1.668
Arsenic trichloride, $AsCl_3$	160–270	1	0.112	......	....
Benzene, C_6H_6	90	1	0.3254	0.2958	1.10
"	34–115	1	0.301	......	....
"	120–220	1	0.370	......	....
Bromine, Br_2	20–350	0.3–1.5	......	......	1.32
"	19–388	1	0.0550	......	....
iso-Butane, C_4H_{10}	15	1	......	......	1.11
Carbon dioxide, CO_2	0	1	0.1973	0.1506	1.310
" "	15	1	0.1988	0.1525	1.304
" "	100	1	0.2064	0.1626	1.281
" "	400	1	0.2379	0.1927	1.235
" "	1000	1	0.2763	0.2312	1.195

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* Cal. 15°C/g/°C = btu 60°F/lb/°F

SPECIFIC HEAT OF GASES AND VAPORS

Gas or Vapor	Temp. °C.	Press. atm.	Specific Heat in cal. 15° per gram per °C.		$\gamma = C_p/C_v$
			Const. press.	Const. vol.	
Carbon dioxide, CO_2	2000	1	0.3091	0.2640	1.171
" "	38	24.25	0.2879	......	....
" "	38	54.1	0.3259	......	....
" "	38	85.4	0.9950	......	....
" "	−75	1	0.184	0.144	1.37
Carbon disulfide, CS_2	99.7	sat. vap.	......	......	1.63
" "	80–190	1	0.157	......	......
" "	17	0.3	0.157	......	....
Carbon monoxide, CO	−180	1	0.259	0.176	1.41
" "	15	1	0.2478	0.1766	1.404
Carbon tetrachloride, CCl_4	0	1	0.140	......	....
" "	30	1	0.132	......	....
" "	70	1	0.115	......	....
" "	20	0.1	......	......	1.13
Chlorine, Cl_2	15	1	0.1150	0.08486	1.355
"	16	0.5	......	......	1.34
Chloroform, $CHCl_3$	27–118	1	0.145	......	....
"	120–230	1	0.157	......	....
"	20	0.15	......	......	1.15
"	100	1	......	......	1.15
Cyanogen, $(CN)_2$	15	1	0.4095	0.3260	1.256
Cyclohexane, C_6H_{12}	80	1	......	......	1.08
"	100	1	0.413	......	....
Ethane, C_2H_6	−82	1	0.347	0.271	1.28
"	15	1	0.3860	0.3136	1.22
"	50	1	......	......	1.21
"	100	1	......	......	1.19
Ethyl acetate, $C_4H_8O_2$	35–113	1	0.2369	......	....
" "	110–220	1	0.4010	......	....
Ethyl alcohol, C_2H_6O	90	1	0.406	0.359	1.13
" "	100–223	1	0.454	......	......
Ethyl bromide, C_2H_5Br	14	0.3	......	......	1.19
" "	28–116	1	0.161	......	....
" "	80–200	1	0.190	......	....
Ethyl chloride, C_2H_5Cl	−30	0.137	0.21	......	....
" "	0	0.137	0.22	......	....
" "	40	0.137	0.239	......	....
" "	40	1.37	0.244	......	....
" "	16	0.3–0.5	......	......	1.19
Ethyl cyanide, C_3H_5N	114–223	1	0.4260	......	....
Ethyl ether, $C_4H_{10}O$	35	1	0.4449	0.4119	1.08
" "	27–189	1	0.4619	......	1.086^{80°
" "	200–300	1	0.5331	......	....
" "	16	0.28	0.459	......	....
Ethyl sulfide, $C_4H_{10}S$	120–223	1	0.399	......	....
Ethylene, C_2H_4	−91	1	0.3086	0.2285	1.35
"	15	1	0.3592	0.2858	1.255
"	15–100	1	0.399	......	1.18^{100°
"	25–200	1	0.430	......	....
Ethylene chloride, $C_2H_4Cl_2$	19	0.06	......	......	1.137
" "	23	0.2	......	......	1.134
" "	111–221	1	0.229	......	....
Ethylidene chloride, $C_2H_4Cl_2$	110–220	1	0.230	......	....
Helium, He	−180	1	1.248	0.752	1.660
n-Hexane, C_6H_{14}	80	1	0.3646	......	1.08

SPECIFIC HEAT OF GASES AND VAPORS

Gas or Vapor	Temp. °C.	Press. atm.	Specific Heat in cal. 15° per gram per °C. Const. press.	Specific Heat in cal. 15° per gram per °C. Const. vol.	$\gamma = C_p/C_v$
Hydrogen, H_2	−181	1	2.64	1.66	1.597
”	−76	1	3.15	2.17	1.453
”	0	....	3.39	2.40	1.410
”	15	1	3.388	2.402	1.410
”	100	....	3.428	2.442	1.404
”	400	....	3.533	2.547	1.387
”	1000	....	3.740	2.754	1.358
”	2000	....	4.088	3.102	1.318
Hydrogen bromide, HBr	30	0.3–1.5	......	......	1.42
” ”	11–100	1	0.0820	......	....
Hydrogen chloride, HCl	15	1	0.1939	0.1375	1.41
” ”	100	1	......	......	1.40
” ”	10–190	1	0.185	......	....
Hydrogen cyanide, HCN	65	1	......	......	1.31
” ”	140	1	......	......	1.28
” ”	210	1	......	......	1.24
Hydrogen iodide, HI	20–100	1	......	......	1.40
Hydrogen sulfide, H_2S	−57	1	0.292	0.227	1.29
” ”	−45	1	0.279	0.215	1.30
” ”	15	1	0.2532	0.1918	1.32
” ”	18	0.5	......	......	1.32
” ”	10–190	1	0.2430	......	....
Iodine, I_2	185	1	......	......	1.30
”	206–377	1	0.0337	......	....
Krypton, Kr	19	1	......	......	1.68
Mercury, Hg	360	0.5–1	......	......	1.67
Methane, CH_4	−115	1	0.450	0.319	1.41
”	−74	1	0.498	0.370	1.35
”	15	1	0.5282	0.4032	1.31
”	10–200	1	0.5931	......	....
Methyl acetate, $C_3H_6O_2$	15	1	......	......	1.14
Methyl alcohol, CH_4O	77	1	0.390	0.324	1.203
” ”	100–223	1	0.4581	......	....
Methyl bromide, CH_3Br	18	0.3–0.6	......	......	1.27
Methyl chloride, CH_3Cl	16	0.8	......	......	1.28
Methyl ether, C_2H_6O	6–30	1	......	......	1.11
Methyl iodide, CH_3I	20	0.3	......	......	1.286
Neon, Ne	19	1	......	......	1.64
Nitric oxide, NO	−80	1	0.244	0.177	1.38
” ”	−45	1	0.239	0.172	1.39
” ”	15	1	0.2328	0.1664	1.400
” ”	10–180	1	0.232	......	....
Nitrogen, N_2	−181	1	0.256	0.174	1.47
”	15	1	0.2477	0.1765	1.404
Nitrogen dioxide, NO_2	27–67	1	1.62	......	....
” ”	27–100	1	1.70	......	....
” ”	27–200	1	0.851	......	....
” ”	27–300	1	0.630	......	....
Nitrous oxide, N_2O	−70	1	0.190	0.142	1.34
” ”	−30	1	0.200	0.153	1.31
” ”	15	1	0.2004	0.1538	1.303
” ”	100	1	......	......	1.28
” ”	25–200	1	0.224	......	....
Oxygen, O_2	−181	1	0.2284	0.1575	1.45
”	−76	1	0.214	0.152	1.415

SPECIFIC HEAT OF GASES AND VAPORS

Gas or Vapor	Temp. °C.	Press. atm.	Specific Heat in cal. 15° per gram per°C.		$\gamma = Cp/Cv$
			Const. press.	Const. vol.	
Oxygen O_2	15	1	0.2177	0.1554	1.401
"	100	....	0.2187	0.1563	1.399
"	200	....	0.2194	0.1570	1.397
"	400	....	0.2209	0.1585	1.394
n-Pentane, C_5H_{12}	86	1	0.4093	0.3769	1.086
iso-Pentane, C_5H_{12}	58	1	0.449	......	....
"	100	1	0.471	......	....
Phosphorus, P	300	1	......	......	1.17
Phosphorus trichloride, PCl_3	110–250	1	0.135	......	....
Potassium, K	850	1	......	......	1.77
Propane, C_3H_8	16	0.5	......	......	1.13
n- or *iso*-Propyl chloride, C_3H_7Cl	21	0.1	......	......	1.13
Silicon tetrachloride, $SiCl_4$	14	0.15	......	......	1.13
" "	90–230	1	0.132	......	....
Sodium, Na	750–920	1	......	......	1.68
Stannic chloride, $SnCl_4$	149–273	1	0.0939	......	....
Sulfonyl chloride, SO_2Cl_2	19–98	1	0.114	......	....
Sulfur dioxide, SO_2	15	1	0.1516	0.1175	1.29
" "	20	0.5	......	......	1.27
" "	20	2.5	......	......	1.35
" "	10–190	1	0.134	......	....
Titanium tetrachloride, $TiCl_4$	160–270	1	0.129	......	....
Water, H_2O	100	1	0.4836	0.3652	1.324
"	200	1	0.4791	0.3657	1.310
"	400	1	0.4801	0.3690	1.301
"	700	1	0.5024	0.3918	1.282
"	1000	1	0.5488	0.4384	1.252
"	1400	1	0.6470	0.5366	1.206
"	2000	1	0.8290	0.7187	1.155
"	2300	1	0.8634	0.7530	1.146
"	200	2	0.4769	......	....
"	200	4	0.4939	......	....
"	200	6	0.5150	......	....
"	200	10	0.5689	......	....
"	200	14	0.6710	......	....
Xenon, Xe	19	1	......	......	1.66

KOPP'S RULE

This rule, which should be used only where experimental values are lacking, states that the specific heat of a compound is approximately equal to the sum of the heat capacities of the constituent elements and that an *approximate* value expressed in gram calories per gram formula weight can be calculated by assigning the following atomic heat capacities to the elements:

For solids: C, 1.8; H, 2.3; O, 4.0; S, 5.4; P, 5.4; F, 5.0; Si, 3.8; B, 2.7; all other elements, 6.2.

For liquids: C, 2.8; H, 4.8; O, 6.0; S, 7.4; P, 7.4; F, 7.0; Si, 5.8; B, 4.7; all other elements, 8.0.

Example. For $BaCO_3$: $6.2 + 1.8 + (3 \times 4.0) = 20.0$ g cal/g formula weight; or, $20.0 \div 197.37 = 0.1013$ g cal/g. Found by experiment, 0.0999.

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES*

The values are given in gram-calories (15°) per gram per degree Centigrade. To convert to joules per gram per degree Centigrade multiply by 4.185.

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Acetal	$CH_3CH(OC_2H_5)_2$	L	0.4669	0
....	....	L	0.5198	19 to 99
Acetic acid	CH_3COOH	S	0.487	0
....	....	L	0.468	0
Acetone	$(CH_3)_2CO$	S	0.540	−210
....	....	L	0.506	0
....	....	L	0.528	20
Acetonitrile	CH_3CN	L	0.541	21 to 76
Acetophenone	$C_6H_5COCH_3$	L	0.474	20 to 196
Acetyl chloride	CH_3COCl	L	0.339	0
Albite	$Na_2O\cdot Al_2O_3\cdot 6SiO_2$	S	0.212	100
Allyl acetate	$CH_3COOC_3H_5$	L	0.431	0
alcohol	CH_2CHCH_2OH	L	0.665	21 to 96
benzoate	$C_6H_5COOC_3H_5$	L	0.388	20
butyrate	$C_3H_7COOC_3H_5$	L	0.451	20
chloride	CH_2CHCH_2Cl	L	0.313	0
chloroacetate	$ClCH_2COOC_3H_5$	L	0.3959	20
dichloroacetate	$Cl_2CHCOOC_3H_5$	L	0.3319	20
isobutyrate	$C_3H_7COOC_3H_5$	L	0.448	20
propionate	$C_2H_5COOC_3H_5$	L	0.451	20
trichloroacetate	$Cl_3CCOOC_3H_5$	L	0.2879	20
valerate	$C_4H_9COOC_3H_5$	L	0.451	20
Aluminum	Al	S	0.0092	−240.6
....	....	S	0.0165	−233
....	....	S	0.0889	−190
....	....	S	0.1466	−192 to −82
....	....	S	0.1962	−76 to −1
....	....	S	0.217	17 to 100
....	....	S	0.236	15 to 435
....	....	S	0.274	500
Aluminum chloride	$AlCl_3$	S	0.188	−22 to 15
....				
....	$AlCl_3\cdot 6H_2O$	S	0.313	35
fluoride	AlF_3	S	0.229	35
....	$2AlF_3\cdot 7H_2O$	S	0.342	35
hydroxide	$Al(OH)_3$	S	0.103	−100
....	$Al(OH)_3$	S	0.177	0
....	$Al(OH)_3$	S	0.202	50
....	$Al(OH)_3$	S	0.215	100
oxide	Al_2O_3	S	0.0992	−100
....	Al_2O_3	S	0.174	0
....	Al_2O_3	S	0.198	50
....	Al_2O_3	S	0.21	100
sulfate	$Al_2(SO_4)_3$	S	0.184	50
....	$Al_2(SO_4)_3\cdot 18H_2O$	S	0.254	34
o-Aminobenzoic acid	$NH_2C_6H_4COOH$	S	0.254	85
....	$NH_2C_6H_4COOH$	L	0.435	145
m-Aminobenzoic acid	$NH_2C_6H_4COOH$	S	0.253	120
....	$NH_2C_6H_4COOH$	L	0.435	174
p-Aminobenzoic acid	$NH_2C_6H_4COOH$	S	0.287	128
....	$NH_2C_6H_4COOH$	L	0.444	186

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*See also the table: Specific Heat of Gases and Vapors.

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Ammonia	NH_3	S	0.502	−103 to −188
....	....	L	1.047	−60
....	....	L	1.098	0
....	....	L	1.125	20
....	....	L	1.48	100
Ammonium bromide	NH_4Br	S	0.210	20
chloride	NH_4Cl	S	0.121	−200
....	....	S	0.263	−100
....	....	S	0.357	0
....	....	S	0.389	50
iodide	NH_4I	S	0.111	0
....	....	S	0.118	50
nitrate	NH_4NO_3	S	0.306	−100
....	....	S	0.397	0
....	....	S	0.4146	50
....	....	S	0.428	100
sulfate	$(NH_4)_2SO_4$	S	0.283	−100
....	....	S	0.337	0
....	....	S	0.345	50
prim-Amyl alcohol (d)	$C_5H_{11}OH$	L	0.712	22 to 125
tert-Amyl alcohol	$C_5H_{11}OH$	L	0.753	20 to 99
Amylene	C_5H_{10}	L	0.282	0
Andalusite	Al_2SiO_5	S	0.228	100
Anethole	$C_9H_9OCH_3$	L	0.551	22.5
Aniline	$C_6H_5NH_2$	S	0.741	?
....	....	L	0.478	0
....	....	L	0.521	50
....	....	L	0.547	100
Anisole	$CH_3OC_6H_5$	L	0.483	20 to 152
Anorthite	$CaO\cdot Al_2O_3\cdot (SiO_2)_2$	S	0.205	100
Anthracene	$C_{14}H_{10}$	S	0.308	50
....	....	S	0.350	100
Anthraquinone	$C_6H_4(CO)_2C_6H_4$	S	0.258	0
Antimony	Sb	S	0.0462	−186 to −79
....	....	S	0.0468	−188 to +20
....	....	S	0.0503	20
....	....	S	0.0513	100
....	....	S	0.0520	200
....	....	S	0.0537	300
Antimony trioxide	Sb_2O_3	S	0.934	60
trisulfide	Sb_2S_3	S	0.0829	0
....	....	S	0.884	100
Apiol	$C_{12}H_{14}O_4$	S	0.299	10
Arsenic	As	S	0.0704	−188 to +20
Arsenic, gray cryst.	As	S	0.0822	0 to 100
Arsenic, black amorph.	As	S	0.0861	0 to 100
Arsenic trichloride	$AsCl_3$	L	0.177	56
Arsenous oxide	As_2O_3	S	0.117	0
Asbestos	....	S	0.195	20 to 98
Azobenzene	$(C_6H_5N)_2$	S	0.330	28
Barium	Ba	S	0.068	−185 to +20
Barium carbonate	$BaCO_3$	S	0.0999	0
....	....	S	0.110	100
chlorate	$Ba(ClO_3)_2\cdot H_2O$	S	0.158	32

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g(15°)	Temp.°C
Barium chloride	$BaCl_2$	S	0.08523	0
....	$BaCl_2 \cdot 2H_2O$	S	0.140	0
formate	$Ba(CHO_2)_2$	S	0.137	0
molybdate	$BaMoO_4$	S	0.11	15
nitrate	$Ba(NO_3)_2$	S	0.148	47
sulfate	$BaSO_4$	S	0.111	0
thiosulfate	BaS_2O_3	S	0.162	58
Basalt	....	S	0.20	20 to 100
Benzaldehyde	C_6H_5CHO	L	0.428	22 to 172
Benzene	C_6H_6	S	0.0399	−250
....	....	S	0.124	−200
....	....	S	0.227	−100
....	....	S	0.299	−50
....	....	L	0.389	5
....	....	L	0.406	20
....	....	L	0.444	60
....	....	L	0.473	90
Benzoic acid	C_6H_5COOH	S	0.287	20
Benzonitrile	C_6H_5CN	L	0.441	22 to 186
Benzophenone	$(C_6H_5)_2CO$	S	0.115	−150
....	....	S	0.220	−50
....	....	S	0.275	0
....	....	S	0.303	20
....	....	L	0.383	3 to 40
Benzyl alcohol	$C_6H_5CH_2OH$	L	0.511	20 to 100
chloride	$C_6H_5CH_2Cl$	L	0.323	0
Beryl	$3BeO \cdot Al_2O_3 \cdot 6SiO_2$	S	0.20	57
Beryllium	Be	S	0.397	0 to 46
....	....	S	0.425	0 to 100
....	....	S	0.505	0 to 300
Beryllium oxide	BeO	S	0.260	50
sulfate	$BeSO_4$	S	0.198	50
Betol	$HOC_6H_4COOC_{10}H_7$	S	0.129	−150
....	....	S	0.167	−100
....	....	L	0.356	19 to 63
Bismuth	Bi	S	0.0218	−253 to −196
....	....	S	0.0284	−188 to +20
....	....	S	0.0285	−79 to +17
....	....	S	0.0303	17 to 100
....	....	S	0.0303	18
....	....	S	0.0338	271
....	....	L	0.0363	280 to 360
Bismuth oxide	Bi_2O_3	S	0.0569	50
....	....	S	0.0593	100
sulfide	Bi_2S_3	S	0.0600	50
Borax	$Na_2B_4O_7 \cdot 10H_2O$	S	0.385	35
Boron, amorph.	B	S	0.071	−191 to −78
Boron, cryst.	B	S	0.2518	0 to 100
....	....	S	0.165	−78 to 0
....	....	S	0.307	0 to 100
....	....	S	0.357	0 to 234
Boron nitride	BN	S	0.349	200
Bromine	Br	S	0.070	−191 to −81
....	....	S	0.084	−78 to −20

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp.°C.
Bromine	Br	L	0.107	1 to 32
Bromobenzene	C_6H_5Br	L	0.231	20
o-Bromochlorobenzene	BrC_6H_4Cl	S	0.192	−34
....	....	L	0.215	0
m-Bromochlorobenzene	BrC_6H_4Cl	S	0.150	−52
....	....	L	0.212	0
p-Bromochlorobenzene	BrC_6H_4Cl	S	0.150	−40
....	....	S	0.170	0
o-Bromoiodobenzene	BrC_6H_4I	S	0.143	−50
....	....	L	0.160	5 to 100
m-Bromoiodobenzene	BrC_6H_4I	S	0.143	−75 to −15
....	....	L	0.158	5 to 100
p-Bromoiodobenzene	BrC_6H_4I	S	0.150	−40
α-Bromonaphthalene	$C_{10}H_7Br$	S	0.260	41
Bromophenol	HOC_6H_4Br	L	0.316	18 to 77
Brucite	$MgO \cdot H_2O$	S	0.311	35
n-Butane	C_4H_{10}	L	0.550	0
n-Butyl alcohol	C_4H_9OH	L	0.526	2.3
....	....	L	0.563	19.2
butyrate	$C_3H_7COOC_4H_9$	L	0.459	20
chloride	C_4H_9Cl	L	0.451	20
formate	$HCOOC_4H_9$	L	0.459	20
propionate	$C_2H_5COOC_4H_9$	L	0.459	20
valerate	$C_4H_9COOC_4H_9$	L	0.459	20
n-Butyric acid	C_3H_7COOH	L	0.515	20 to 100
n-Butyronitrile	C_3H_7CN	L	0.547	21 to 113
Cadmium	Cd	S	0.0308	−253 to −196
....	....	S	0.0498	−186 to −79
....	....	S	0.0537	−79 to +18
....	....	S	0.0549	20
....	....	S	0.0566	100
....	....	S	0.0594	200
....	....	S	0.0617	300
Cadmium chloride	$2CdCl_2 \cdot 5H_2O$	S	0.243	0
nitrate	$Cd(NO_3)_2 \cdot 4H_2O$	S	0.260	40
sulfate	$CdSO_4 \cdot 8H_2O$	S	0.195	0
....	....	S	0.200	20
sulfide	CdS	S	0.0882	0
....	....	S	0.0922	50
Calcium	Ca	S	0.0714	−253 to −196
....	....	S	0.157	−185 to +20
....	....	S	0.145	0 to 20
....	....	S	0.149	0 to 100
....	....	S	0.152	0 to 157
....	....	S	0.168	20.4
Calcium carbide	CaC_2	S	0.239	20 to 500
carbonate	$CaCO_3$	S	0.203	0
....	....	S	0.214	100
chloride	$CaCl_2$	S	0.164	61
....	$CaCl_2 \cdot 6H_2O$	S	0.320	0
....	....	S	0.552	33 to 99
fluoride	CaF_2	S	0.204	0
....	....	S	0.212	40
formate	$Ca(HCO_2)_2$	S	0.238	0

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Calcium hydride	CaH_2	S	0.0466	−200
hydroxide	$Ca(OH)_2$	S	0.260	0
....	....	S	0.288	50
molybdate	$CaMoO_4$	S	0.165	15
oxide	CaO	S	0.177	0
....	....	S	0.197	100
silicate	$CaSiO_3$	S	0.195	100
sulfate	$CaSO_4 \cdot 2H_2O$	S	0.265	36
sulfite	$CaSO_3 \cdot 2H_2O$	S	0.272	9
tungstate	$CaWO_4$	S	0.104	15
Calcspar	....	S	0.2005	0 to 100
Camphene	$C_{10}H_{16}$	S	0.380	35
Capric acid	$CH_3(CH_2)_8COOH$	S	0.695	8
Caproic acid	$CH_3(CH_2)_4COOH$	L	0.533	29 to 105
Capronitrile	$C_5H_{11}CN$	L	0.542	18 to 156
Caprylic acid	$CH_3(CH_2)_6COOH$	S	0.628	−2
Carbon, charcoal	C	S	0.165	0 to 24
gas carbon	C	S	0.204	24 to 68
graphite	C	S	0.005	−243
....	....	S	0.0175	−203
....	....	S	0.060	−188 to −78
....	....	S	0.160	11
....	....	S	0.254	138
....	....	S	0.445	642
diamond	C	S	0.0005	−233
....	....	S	0.0025	−185
....	....	S	0.019	−188 to −78
....	....	S	0.079	−78 to +18
....	....	S	0.113	11
....	....	S	0.222	140
....	....	S	0.303	247
....	....	S	0.441	606
Carbon dioxide	CO_2	S	0.124	−225
monoxide	CO	S	0.417	−220
....	....	S	0.457	206
tetrachloride	CCl_4	S	0.0812	−200
....	....	S	0.182	−80
....	....	S	0.201	−40
....	....	L	0.198	0
....	....	L	0.201	20
Carborundum	....	S	0.162	3 to 44
Carvacrol	$C_{10}H_{13}OH$	L	0.577	24 to 233
Catechol	$C_6H_4(OH)_2$	L	0.462	0
Cellulose, dry	....	S	0.37	......
Cement, powder	....	S	0.20	20 to 100
Cerium	Ce	S	0.033	−253 to −196
....	....	S	0.0448	0 to 100
....	....	S	0.0511	20 to 100
Ceric oxide	CeO_2	S	0.0870	0
....	....	S	0.0946	50
Cerous sulfate	$CeSO_4$	S	0.117	50
....	$CeSO_4 \cdot 5H_2O$	S	0.201	50
Cesium	Cs	S	0.048	0 to 26
....	....		0.0587	50

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp.°C.
Cesium bromide	CsBr	S	0.0581	10
chloride	CsCl	S	0.0746	10
fluoride	CsF	S	0.0796	10
iodide	CsI	S	0.0478	10
Chalcopyrite	$FeCuS_2$	S	0.129	48
Chalk	....	S	0.214	20 to 99
Charcoal	....	S	0.16	10
Chloral	CCl_3CHO	L	0.250	17 to 53
Chloral alcoholate	$CCl_3CH(OH)OC_2H_5$	S	0.509	78
hydrate	$CCl_3CH(OH)_2$	S	0.213	32
....	....	L	0.470	55 to 88
Chlorine	Cl	L	0.226	0 to 24
Chloro-acetic acid	$ClCH_2COOH$	S	0.363	60
benzene	C_6H_5Cl	L	0.309	20
benzoic acid (*o*)	ClC_6H_4COOH	L	0.392	0
benzoic acid (*m*)	ClC_6H_4COOH	S	0.232	94
benzoic acid (*p*)	ClC_6H_4COOH	S	0.228	80
....	....	S	0.242	180
....	....	L	0.547	226
phenol (*o*)	ClC_6H_4OH	L	0.401	0 to 20
toluene	$ClC_6H_4CH_3$	L	0.316	0
Chloroform	$CHCl_3$	L	0.232	0
....	....	L	0.226	15
....	....	L	0.234	20
Chromic oxide	Cr_2O_3	S	0.168	0
....	....	S	0.189	50
sulfate	$Cr_2(SO_4)_3$	S	0.172	50
....	$Cr_2(SO_4)_3 \cdot 5H_2O$	S	0.200	50
Chromium	Cr	S	0.0142	−253 to −196
....	....	S	0.0793	−188 to +20
....	....	S	0.098	−79 to +17
....	....	S	0.1039	0
....	....	S	0.110	17 to 100
....	....	S	0.1202	18 to 500
....	....	S	0.112	100
....	....	S	0.133	400
Chrysoberyl	Al_2BeO_4	S	0.20	50
Clay, dry	....	S	0.22	20 to 100
Cobalt	Co	S	0.0207	−253 to −196
....	....	S	0.0827	−188 to +20
....	....	S	0.1041	0 to 100
....	....	S	0.1035	15 to 100
....	....	S	0.1047	15 to 185
....	....	S	0.121	300
....	(at transformation temp.)	S	0.145	508
		S	0.125	
....	....	S	0.160	800
....	....	S	0.184	1000
....	(at transformation temp.)	S	0.270	1112
....		S	0.170	
Cobaltite	CoAsS	S	0.098	58
Cobaltous nitrate	$Co(NO_3)_2 \cdot 6H_2O$	S	0.373	32
sulfate	$CoSO_4 \cdot 7H_2O$	S	0.342	48
Columbium pentoxide	Cb_2O_5	S	0.101	50

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g(15°)	Temp. °C.
Copper	Cu	S	0.0031	−253
....	....	S	0.0245	−253 to −196
....	....	S	0.029	−213
....	....	S	0.047	−193
....	....	S	0.0788	−188 to +20
....	....	S	0.0883	−79 to +18
....	....	S	0.0909	0
....	....	S	0.0912	20
....	....	S	0.09305	15 to 100
....	....	S	0.0928	50
....	....	S	0.0942	100
....	....	S	0.0963	200
....	....	S	0.1259	900
Copper ammonium sulfate	$CuSO_4(NH_4)_2SO_4 \cdot 6H_2O$	S	0.256	0
Copper carbonate	$2CuO \cdot CO_2 \cdot H_2O$	S	0.177	57
sulfate	$CuSO_4$	S	0.166	50
sulfate	$CuSO_4 \cdot H_2O$	S	0.172	0
....	....	S	0.191	50
....	$CuSO_4 \cdot 3H_2O$	S	0.228	9
....	$CuSO_4 \cdot 5H_2O$	S	0.253	0
....	....	S	0.287	50
o-Cresol	$CH_3C_6H_4OH$	L	0.499	0 to 20
m-Cresol	$CH_3C_6H_4OH$	L	0.479	0 to 20
p-Cresyl methyl ether	$CH_3OC_6H_4CH_3$	L	0.405	0
Crotonic acid	$CH_3CHCHCOOH$	S	0.520	38
....	....	L	0.500	71.4
Cryolite	$3NaF \cdot AlF_3$	S	0.2519	43
Cupric chloride	$CuCl_2$	S	0.139	58
oxide	CuO	S	0.125	0
....	....	S	0.144	100
sulfide	CuS	S	0.129	0
....	....	S	0.151	100
Cuprous iodide	CuI	S	0.0658	0
....	....	S	0.0671	50
oxide	Cu_2O	S	0.110	0
....	....	S	0.116	100
selenide	Cu_2Se	S	0.104	60
sulfide	Cu_2S	S	0.148	0
....	....	S	0.166	50
Cyamelide	$(CNOH)_3$	S	0.263	40
Cyanamide	NH_2CN	S	0.547	20
Cyanogen	$(CN)_2$	S	0.167	−188 to +78
Cyanuric acid	$(HNCO)_3$	S	0.318	40
Cyclo-hexanol	$C_6H_{11}OH$	L	0.417	15 to 18
hexanone	$C_6H_{10}O$	L	0.433	15 to 18
Decylene-2	$C_{10}H_{20}$	L	0.469	0 to 50
Dextrose	$C_6H_{12}O_6$	S	0.0155	−250
....	....	S	0.277	0
....	....	S	0.275	20
Dextrin	$(C_6H_{10}O_5)_x$	S	0.292	0 to 90
Diallyl oxalate	$(COOC_3H_5)_2$	L	0.426	20
succinate	$(CH_2COOC_3H_5)_2$	L	0.425	20
Diamylene	$C_{10}H_{20}$	L	0.545	20 to 130
Dibenzyl	$(C_6H_5CH_2)_2$	S	0.363	28

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp.°C.
o-Dibromobenzene	$C_6H_4Br_2$	S	0.249	−36
....	....	L	0.180	0
m-Dibromobenzene	$C_6H_4Br_2$	S	0.134	−25
....	....	L	0.175	0
p-Dibromobenzene	$C_6H_4Br_2$	S	0.139	−50
Dibutyl oxalate	$(COOC_4H_9)_2$	L	0.441	20
Dichloroacetic acid	$Cl_2CHCOOH$	S	0.406	......
....	....	L	0.350	21 to 106
o-Dichlorobenzene	$C_6H_4Cl_2$	S	0.185	−48.5
....	....	L	0.270	0
m-Dichlorobenzene	$C_6H_4Cl_2$	S	0.186	−52
....	....	L	0.270	0
p-Dichlorobenzene	$C_6H_4Cl_2$	S	0.219	−50
....	....	L	0.298	53 to 99
Dicyandiamide	$C_2H_4N_4$	S	0.456	0 to 204
Diethylamine	$(C_2H_5)_2NH$	L	0.518	22.5
Diethylaniline	$C_6H_5N(C_2H_5)_2$	L	0.452	20
Diethyl carbonate	$CO(OC_2H_5)_2$	L	0.464	20 to 100
ketone	$(C_2H_5)_2CO$	L	0.557	20 to 98.5
malate	$C_2H_4O(COOC_2H_5)_2$	L	0.475	24 to 186
malonate	$CH_2(COOC_2H_5)_2$	L	0.433	20
oxalate	$(COOC_2H_5)_2$	L	0.433	20
succinate	$C_2H_4(COOC_2H_5)_2$	L	0.452	20
Dihydronaphthalene	$C_{10}H_{10}$	L	0.346	18 to 28
o-Diiodobenzene	$C_6H_4I_2$	S	0.109	0
....	....	L	0.136	0
m-Diiodobenzene	$C_6H_4I_2$	S	0.100	−52
....	....	L	0.140	34.2 to 99.6
p-Diiodobenzene	$C_6H_4I_2$	S	0.101	−50
Diisoamyl	$C_{10}H_{22}$	L	0.590	21.5 to 155
Diisoamyl oxalate	$(COOC_5H_{11})_2$	L	0.449	20
Diisobutylamine	$(C_4H_9)_2NH$	L	0.571	22 to 130
Dimethylaniline	$C_6H_5N(CH_3)_2$	L	0.418	0 to 20
Dimethyl carbonate	$CO(OCH_3)_2$	L	0.452	19.8 to 88
Dimethyl oxalate	$(COOCH_3)_2$	S	0.212	10
Dimethylpyrone	$(CH_3)_2C_5H_2O_2$	S	0.368	50
....	....	L	0.55	166
o-Dinitrobenzene	$C_6H_4(NO_2)_2$	S	0.252	−160
....	....	L	0.349	0
m-Dinitrobenzene	$C_6H_4(NO_2)_2$	S	0.248	−160
....	....	L	0.405	90
p-Dinitrobenzene	$C_6H_4(NO_2)_2$	S	0.259	119
Diopside	$CaMg(SiO_3)_2$	S	0.193	50
Diphenyl	$(C_6H_5)_2$	S	0.385	40
Diphenylamine	$(C_6H_5)_2NH$	S	0.337	26
....	....	L	0.464	53
Diphenyl oxide	$(C_6H_5)_2O$	L	0.399	30
Dipropylamine	$(C_3H_7)_2NH$	L	0.464	53
Dipropyl ketone	$(C_3H_7)_2CO$	L	0.552	20 to 140
malonate	$CH_2(COOC_3H_7)_2$	L	0.433	20
oxalate	$(COOC_3H_7)_2$	L	0.433	20
succinate	$(CH_2COOC_3H_7)_2$	L	0.452	20
Dodecane	$C_{12}H_{26}$	L	0.500	0 to 50
Dodecylene	$C_{12}H_{24}$	L	0.457	0 to 50

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Dulcitol	$C_6H_8(OH)_6$	S	0.282	20
Ebonite	. . . .	S	0.40	20 to 100
Erbium oxide	Er_2O_3	S	0.065	50
Erythritol	$C_4H_6(OH)_4$	S	0.351	60
Ethyl acetate	$CH_3COOC_2H_5$	L	0.459	20
acetoacetate	$CH_3COCH_2COOC_2H_5$	L	0.477	20 to 100
alcohol (cryst.)	C_2H_5OH	S	0.232	−190
alcohol (vitreous)	C_2H_5OH	S	0.260	−190
. . . .	. . . .	L	0.456	−100
. . . .	. . . .	L	0.535	0
. . . .	. . . .	L	0.581	25
. . . .	. . . .	L	0.824	100
benzene	$C_6H_5C_2H_5$	L	0.409	30
benzoate	$C_6H_5COOC_2H_5$	L	0.389	20
bromide	C_2H_5Br	L	0.216	5 to 10
. . . .	. . . .	L	0.215	15 to 20
butyrate	$C_3H_7COOC_2H_5$	L	0.459	20
chloride	C_2H_5Cl	L	0.368	0
chloroacetate	$ClCH_2COOC_2H_5$	L	0.418	9 to 138
dichloroacetate	$Cl_2CHCOOC_2H_5$	L	0.329	20
ether	$(C_2H_5)_2O$	L	0.517	−50
. . . .	. . . .	L	0.529	0
. . . .	. . . .	L	0.547	30
. . . .	. . . .	L	0.803	120
. . . .	. . . .	L	1.041	180
formate	$HCOOC_2H_5$	L	0.510	14 to 49
iodide	C_2H_5I	L	0.162	0
. . . .	. . . .	L	0.172	60
isobutyrate	$C_3H_7COOC_2H_5$	L	0.459	20
propionate	$C_2H_5COOC_2H_5$	L	0.459	20
sulfide	$(C_2H_5)_2S$	L	0.470	0
. . . .	. . . .	L	0.477	15 to 20
trichloroacetate	$Cl_3CCOOC_2H_5$	L	0.295	10 to 81
valerate	$C_4H_9COOC_2H_5$	L	0.459	20
Ethylene bromide	$C_2H_4Br_2$	L	0.174	20
chloride	$C_2H_4Cl_2$	L	0.2791	−30
. . . .	. . . .	L	0.301	20
. . . .	. . . .	L	0.319	60
Ferric oxide	Fe_2O_3	S	0.148	0
. . . .	. . . .	S	0.182	100
. . . .	. . . .	S	0.263	400
Ferrosoferric oxide (magnetite)	Fe_3O_4	S	0.151	0
. . . .	. . . .	S	0.179	100
Ferrous carbonate	$FeCO_3$	S	0.194	54
sulfate	$FeSO_4$	S	0.167	45
. . . .	$FeSO_4 \cdot 4H_2O$	S	0.284	9
. . . .	$FeSO_4 \cdot 7H_2O$	S	0.325	0
. . . .	. . . .	S	0.337	10
sulfide	FeS	S	0.135	0
Formamide	$HCONH_2$	L	0.551	19
Formic acid	$HCOOH$	S	0.387	−22
. . . .	. . . .	S	0.430	0
. . . .	. . . .	L	0.437	0
. . . .	. . . .	L	0.511	15.5

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Formic acid	HCOOH	L	0.526	20 to 100
Furfural	$(C_4H_3O)CHO$	L	0.418	20 to 100
Gallium	Ga	L	0.080	13 to 110
...	...	S	0.079	12 to 23
Gallium sesqui-oxide	Ga_2O_3	S	0.105	50
Germanium	Ge	S	0.074	0 to 100
...	...	S	0.0773	0 to 211
Germanium oxide	GeO_2	S	0.129	50
Glass, normal thermometer	...	S	0.1988	19 to 100
Glass, crown	...	S	0.161	10 to 50
Glass, flint	...	S	0.117	10 to 50
Glutaric acid	$(CH_2)_3(COOH)_2$	S	0.299	20
Glycerol	$C_3H_5(OH)_3$	S	0.0471	−250
...	...	S	0.115	−200
...	...	S	0.217	−100
...	...	S	0.330	0
...	...	L	0.540	0
...	...	L	0.600	50
...	...	L	0.669	100
Glycol	$(CH_2OH)_2$	S	0.323	−40
...	...	L	0.544	0
...	...	L	0.571	14.9
Gold	Au	S	0.016	−253 to −196
...	...	S	0.0297	−188 to +20
...	...	S	0.0297	−79 to +17
...	...	S	0.0316	0 to 100
...	...	S	0.0312	18
...	...	S	0.031	17 to 100
...	...	S	0.0345	0 to 900
Gold iodide	AuI	S	0.0404	0
...	...	S	0.0432	50
Granite	...	S	0.192	12 to 100
Heptaldehyde	$C_6H_{13}CHO$	L	0.365	0
n-Heptane	C_7H_{16}	L	0.365	0
Heptylene (B. P. 98°)	C_7H_{14}	L	0.488	0 to 50
Heptylic acid	$C_6H_{13}COOH$	L	0.558	9
Hexachloroethane	C_2Cl_6	S	0.174	25
Hexadecane	$C_{16}H_{34}$	S	0.495	19
n-Hexadecane (B. P. 275°)	$C_{16}H_{34}$	L	0.496	0 to 50
Hexadiene (1, 5)	C_6H_{10}	L	0.407	0
o-Hexahydrocresol	$CH_3C_6H_{10}OH$	L	0.418	15 to 18
m-Hexahydrocresol	$CH_3C_6H_{10}OH$	L	0.422	15 to 18
p-Hexahydrocresol	$CH_3C_6H_{10}OH$	L	0.423	15 to 18
n-Hexane	C_6H_{14}	L	0.600	20 to 100
Hexylene	C_6H_{12}	L	0.506	0 to 50
Hydrogen	H	L	6.0	−253
Hydrogen peroxide	H_2O_2	S	0.471	−25
...	...	L	0.578	0
Ice see water	...	....	......	....
India rubber (Para)	...	S	0.481	? to 100
Indium	In	S	0.0263	−186 to −79
...	...	S	0.0303	−79 to +18
...	...	S	0.0323	18 to 100
Indium sesqui-oxide	In_2O_3	S	0.0808	50

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal. /g (15°)	Temp. °C.
Iodine	I	S	0.0361	−253 to −196
....	....	S	0.031	−243
....	....	S	0.043	−193
....	....	S	0.0467	−189 to −76
....	....	S	0.0516	−76 to 0
....	....	S	0.054	9 to 98
....	....	L	0.108	107 to 180
Iodine chloride	ICl	L	0.158	15 to 77
Iodobenzene	C_6H_5I	S	0.191	40
Iridium	Ir	S	0.0099	−253 to −196
....	....	S	0.0263	−186 to −79
....	....	S	0.0302	−79 to +18
....	....	S	0.0323	18 to 100
....	....	S	0.0371	0 to 900
....	....	S	0.0401	0 to 1400
Iron	Fe	S	0.0175	−253 to −196
....	....	S	0.0721	−186 to −79
....	....	S	0.1000	−79 to +18
....	....	S	0.1045	0
....	....	S	0.113	18 to 100
....	....	S	0.1137	97
....	....	S	0.138	300
....	....	S	0.138	0 to 650
....	....	S	0.195	650
....	....	S	0.23	850
Iron, cast	Fe	S	0.1189	20 to 100
Iron, electrolytic	Fe	S	0.1939	0 to 1600
Iron, hard drawn	Fe	S	0.1146	20 to 100
Iron, wrought	Fe	S	0.1152	15 to 100
Iron, diarsenide	$FeAs_2$	S	0.0860	50
Iron disulfide	FeS_2	S	0.128	50
Iron, see also ferrous and ferric	....	....	......	......
Isoamyl acetate	$CH_3COOC_5H_{11}$	L	0.459	20
alcohol	$C_5H_{11}OH$	L	0.502	0
....	....	L	0.535	20
....	....	L	0.688	75.5
amine	$C_5H_{11}NH_2$	L	0.614	22 to 91
butyrate	$C_3H_7COOC_5H_{11}$	L	0.459	20
formate	$HCOOC_5H_{11}$	L	0.459	20
isobutyrate	$C_3H_7COOC_5H_{11}$	L	0.459	20
propionate	$C_2H_5COOC_5H_{11}$	L	0.459	20
succinate	$C_2H_4(COOC_5H_{11})_2$	L	0.449	0
valerate	$C_4H_9COOC_5H_{11}$	L	0.459	20
Isobutane	C_4H_{10}	L	0.550	0
Isobutyl acetate	$CH_3COOC_4H_9$	L	0.459	20
alcohol	C_4H_9OH	L	0.716	21 to 109
butyrate	$C_3H_7COOC_4H_9$	L	0.459	20
succinate	$C_2H_4(COOC_4H_9)_2$	L	0.442	0
Isobutyric acid	C_3H_7COOH	L	0.450	20
Isoheptane	C_7H_{16}	L	0.501	0 to 50
Isopentane	C_5H_{12}	L	0.527	8
Isopropyl alcohol	C_3H_7OH	S	0.0507	−200
Isovaleric acid	C_4H_9COOH	L	0.590	23 to 93
Lactose	$C_{12}H_{22}O_{11}$	S	0.287	20

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Lactose	$C_{12}H_{22}O_{11}\cdot H_2O$	S	0.299	20
Lanthanum	La	S	0.0322	−253 to −196
....	....	S	0.0448	0 to 100
Lanthanum molybdate	$La_2(MoO_4)_3$	S	0.115	15
Lanthanum sesqui-oxide	La_2O_3	S	0.0750	50
Lauric acid	$C_{11}H_{23}COOH$	S	0.430	−30
....	....	L	0.515	57
Lead	Pb	S	0.0120	−253
....	....	S	0.0220	−233
....	....	S	0.0275	−173
....	....	S	0.0293	−192 to +20
....	....	S	0.0291	−186 to −79
....	....	S	0.0292	−100
....	....	S	0.0300	−79 to +18
....	....	S	0.0305	0
....	....	S	0.0305	20 to 100
....	....	S	0.0313	100
....	....	S	0.0338	300
....	....	L	0.0410	360
Lead ammonium chloride	$2PbCl_2\cdot NH_4Cl$	S	0.0865	10
Lead arsenate	$Pb_3As_2O_8$	S	0.0729	55
borate	PbB_2O_4	S	0.0903	57
bromide	$PbBr_2$	S	0.0502	0
....	....	S	0.0530	50
....	....	L	0.0779	550
carbonate	$PbCO_3$	S	0.0800	32
chloride	$PbCl_2$	S	0.0649	0
....	....	S	0.0681	100
....	....	S	0.0741	300
....	....	L	0.121	540
chromate	$PbCrO_4$	S	0.0908	35
dioxide	PbO_2	S	0.0619	0
....	....	S	0.0650	50
fluoride	PbF_2	S	0.0719	9
iodide	PbI_2	S	0.0417	0
....	....	S	0.0437	100
molybdate	$PbMoO_4$	S	0.100	15
monoxide	PbO	S	0.0483	0
....	....	S	0.0509	50
....	....	S	0.0521	100
nitrate	$Pb(NO_3)_2$	S	0.115	45
pyrophosphate	$Pb_2P_2O_7$	S	0.0820	55
silicate	$PbSiO_3$	S	0.0779	60
sulfate	$PbSO_4$	S	0.0839	45
sulfide	PbS	S	0.0502	0
....	....	S	0.0511	100
tetraborate	PbB_4O_7	S	0.10	57
thiosulfate	PbS_2O_3	S	0.0918	58
tungstate	$PbWO_4$	S	0.0769	15
Leather, dry	....	S	0.36	....
Levulose	$C_6H_{12}O_6$	S	0.275	20
Limonite	$2Fe_2O_3\cdot 3H_2O$	S	0.22	60
Lithium	Li	S	0.1924	−253 to −196
....	....	S	0.52	−190 to −80

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Lithium	Li	S	0.5997	−100
....	....	S	0.7951	0
....	....	S	0.9063	50
....	....	S	1.09	0 to 100
....	....	S	1.0407	100
....	....	L	1.3745	190
Lithium chloride	$LiCl$	S	0.282	55
fluoride	LiF	S	0.373	10
hydride	LiH	S	0.980	0
....	....	S	1.07	50
hydroxide	$LiOH$	S	0.327	0
....	....	S	0.356	50
nitrate	$LiNO_3$	S	0.387	210
....	....	L	0.390	280
thiosulfate	$Li_2S_2O_3$	S	0.0920	58
Magnesium	Mg	S	0.0713	−253 to −196
....	....	S	0.189	−186 to −79
....	....	S	0.222	−185 to +20
....	....	S	0.233	−79 to +18
....	....	S	0.248	17 to 100
....	....	S	0.2421	28
....	....	S	0.3235	325
....	....	L	0.4352	625
Magnesium carbonate	$MgCO_3$	S	0.200	25
chloride	$MgCl_2$	S	0.194	48
....	$MgCl_2 \cdot 6H_2O$	S	0.378	44
nitrate	$Mg(NO_3)_2 \cdot 6H_2O$	S	0.887	55
oxide	MgO	S	0.209	0
....	....	S	0.232	50
sulfate	$MgSO_4$	S	0.222	61
....	$MgSO_4 \cdot H_2O$	S	0.239	9
....	$MgSO_4 \cdot 6H_2O$	S	0.349	9
....	$MgSO_4 \cdot 7H_2O$	S	0.361	12
Malachite	$2CuO \cdot CO_2 \cdot H_2O$	S	0.177	57
Malonic acid	$CH_2(COOH)_2$	S	0.275	20
Maltose	$C_{12}H_{22}O_{11}$	S	0.320	20
Manganese	Mn	S	0.0229	−253 to −196
....	....	S	0.093	−188 to +20
....	....	S	0.0979	−100
....	....	S	0.1072	0
....	....	S	0.1143	100
....	....	S	0.1652	500
Manganese dioxide	MnO_2	S	0.152	0
....	....	S	0.163	50
Manganic oxide	Mn_2O_3	S	0.162	58
....	$Mn_2O_3 \cdot 3H_2O$	S	0.177	38
Manganous nitrate	$Mn(NO_3)_2 \cdot 6H_2O$	S	0.373	47
oxide	MnO	S	0.158	58
sulfate	$MnSO_4$	S	0.182	61
sulfide	MnS	S	0.14	60
sulfate	$MnSO_4 \cdot 5H_2O$	S	0.323	32
Mannitol	$C_6H_8(OH)_6$	S	0.313	0
Marble	....	S	0.21	0 to 100
Melamine	$C_3H_6N_6$	S	0.351	40

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Mercuric bromide	$HgBr_2$	S	0.0519	100
chloride	$HgCl_2$	S	0.0640	0
....	....	S	0.0669	100
cyanide	$Hg(CN)_2$	S	0.100	29
iodide (red)	HgI_2	S	0.0404	0
....	....	S	0.0413	50
oxide	HgO	S	0.0485	0
....	....	S	0.0521	50
sulfide	HgS	S	0.0506	0
....	....	S	0.0520	50
Mercurous chloride	$HgCl$	S	0.0499	0
....	....	S	0.0512	50
sulfate	Hg_2SO_4	S	0.0616	0
....	....	S	0.0680	50
Mercury	Hg	S	0.0232	−253 to −196
See also special table				
....	....	S	0.0266	−213
....	....	S	0.0285	−183
....	....	S	0.0315	−78 to −40
....	....	SL	0.032	−185 to +20
....	....	L	0.0334	−35.6 to −3.4
....	....	L	0.03346	0
....	....	L	0.03325	20
....	....	L	0.03308	40
....	....	L	0.03294	60
....	....	L	0.03267	100
....	....	L	0.03196	200
....	....	L	0.0322	250
Mesitylene	$(CH_3)_3C_6H_3$	L	0.393	0
Mesityl oxide	$C_6H_{10}O$	L	0.521	21 to 121
Methyl acetate	CH_3COOCH_3	L	0.468	15
Methylal	$C_3H_8O_2$	L	0.521	15 to 41
Methyl alcohol	CH_3OH	L	0.566	0
....	....	L	0.600	20
aniline	$C_6H_5NHCH_3$	L	0.513	20 to 197
benzoate	$C_6H_5COOCH_3$	L	0.363	0
butyl ketone	$CH_3COC_4H_9$	L	0.553	21 to 127
n-butyrate	$C_3H_7COOCH_3$	L	0.459	20
chloroacetate	$ClCH_2COOCH_3$	L	0.382	20
cyclohexanone (*o*)	$C_7H_{12}O$	L	0.463	15 to 18
cyclohexanone (*m*)	$C_7H_{12}O$	L	0.441	15 to 18
cyclohexanone (*p*)	$C_7H_{12}O$	L	0.441	15 to 18
dichloroacetate	$Cl_2CHCOOCH_3$	L	0.311	20
ethyl ketone	$CH_3COC_2H_5$	L	0.549	20 to 78
ethyl ketoxime	$(CH_3)(C_2H_5)NOH$	L	0.650	22 to 152
formate	$HCOOCH_3$	L	0.516	13 to 29
hexyl ketone	$CH_3COC_6H_{13}$	L	0.552	22 to 168
isobutyl ketone	$CH_3COC_4H_9$	L	0.459	20
isopropyl ketone	$CH_3COC_3H_7$	L	0.525	20 to 91
trichloroacetate	$Cl_3CCOOCH_3$	L	0.267	20
valerate	$C_4H_9COOCH_3$	L	0.459	20
Methylene chloride	CH_2Cl_2	L	0.288	15 to 40
Mica (Mg)	....	S	0.2061	20 to 98
Molybdenum	Mo	S	0.0141	−253 to −196

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g(15°)	Temp. °C.
Molybdenum	Mo	S	0.062	−185 to +20
....	....	S	0.072	15 to 93
....	....	S	0.0722	20 to 550
....	....	S	0.0647	60
....	....	S	0.0750	475
Molybdenum trioxide	MoO_3	S	0.134	54
Myristic acid	$C_{13}H_{27}COOH$	S	0.381	0
....	....	L	0.539	56 to 100
Naphthalene	$C_{10}H_8$	S	0.281	−130
....	....	L	0.402	87.5
α-Naphthol	$C_{10}H_7OH$	S	0.240	50
β-Naphthol	$C_{10}H_7OH$	S	0.252	61
α-Naphthylamine	$C_{10}H_7NH_2$	S	0.270	0
....	....	L	0.475	53.2
Nickel	Ni	S	0.0208	−253 to −196
....	....	S	0.092	−185 to +20
....	....	S	0.0743	−186 to −79
....	....	S	0.0983	−79 to +18
....	....	S	0.1034	0 to 20
....	....	S	0.1089	15 to 100
....	....	S	0.1128	100
....	....	S	0.1140	0 to 200
....	....	S	0.1256	0 to 400
....	....	S	0.131	0 to 800
....	....	S	0.1607	1000
Nickel carbonyl	$Ni(CO)_4$	S	0.165	−188 to −78
nitrate	$Ni(NO_3)_2 \cdot 6H_2O$	S	0.473	80
sulfate	$NiSO_4$	S	0.225	58
....	$NiSO_4 \cdot 6H_2O$	S	0.313	35
sulfide	NiS	S	0.116	0
....	....	S	0.128	100
Nitro-aniline (*o*)	$NO_2C_6H_4NH_2$	S	0.269	−160
....	....	L	0.400	0
aniline (*m*)	$NO_2C_6H_4NH_2$	S	0.275	−160
....	....	L	0.392	0
aniline (*p*)	$NO_2C_6H_4NH_2$	S	0.276	−160
....	....	L	0.427	0
benzene	$C_6H_5NO_2$	L	0.339	30
....	....	L	0.3429	90
....	....	L	0.394	120
benzoic acid (*o*)	$NO_2C_6H_4COOH$	S	0.256	−163
....	....	L	0.314	0
benzoic acid (*m*)	$NO_2C_6H_4COOH$	S	0.247	−160
....	....	L	0.405	0
benzoic acid (*p*)	$NO_2C_6H_4COOH$	S	0.247	−160
....	....	L	0.449	238
methane	CH_3NO_2	L	0.412	17
naphthalene (α)	$C_{10}H_7NO_2$	S	0.236	0
....	....	L	0.365	58.6
Nitrogen	N	L	0.0284	−208 to −196
Nitrogen pentoxide	N_2O_5	S	0.239	−80 to −5
Nonane	C_9H_{20}	L	0.503	0 to 50
Nonylene	C_9H_{18}	L	0.485	0 to 50
n-Octane	C_8H_{18}	L	0.578	20 to 123

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal g(15°)	Temp. °C.
Octylene	C_8H_{16}	L	0.486	0 to 50
Olive oil	....	L	0.471	6.6
Orthoclase	$K_2O \cdot Al_2O_3 \cdot 6SiO_2$	S	0.205	100
Osmium	Os	S	0.0078	−253 to −196
....	....	S	0.0311	19 to 98
Oxalic acid	$(COOH)_2$	S	0.259	−200 to +50
....	$(COOH)_2 \cdot 2H_2O$	S	0.338	0
....	....	S	0.385	50
Oxygen	O	L	0.35	−200 to −183
Palladium	Pd	S	0.0190	−253 to −196
....	....	S	0.0528	−186 to +18
....	....	S	0.0567	−79 to +18
....	....	S	0.0586	18
....	....	S	0.0592	0 to 100
....	....	S	0.0632	0 to 500
....	....	S	0.0672	0 to 900
Palmitic acid	$C_{15}H_{31}COOH$	S	0.167	−180
....	....	S	0.251	−100
....	....	S	0.306	−50
....	....	S	0.382	0
....	....	S	0.430	20
....	....	L	0.653	65 to 104
Paraffin	....	S	0.694	0 to 20
Paraldehyde	$(CH_3CHO)_3$	L	0.436	0
Pentadecane	$C_{15}H_{32}$	L	0.497	0 to 50
Pentadecylene	$C_{15}H_{30}$	L	0.471	0 to 50
Petroleum	....	L	0.511	21 to 58
Phenetole	$C_2H_5OC_6H_5$	L	0.446	20
Phenol	C_6H_5OH	L	0.561	14 to 26
Phosphorus (yellow)	P	S	0.0774	−253 to −196
....	....	S	0.169	−188 to +20
....	....	S	0.178	−186 to +20
....	....	S	0.190	7 to 30
Phosphorus (red)	P	S	0.0431	−253 to −196
....	....	S	0.1829	0 to 51
Phosphorus (liquid)	P	L	0.2045	49 to 98
Phosphorus trichloride	PCl_3	S	0.203	33
Phthalic acid	$C_6H_4(COOH)_2$	S	0.232	20
α-Picoline	C_6H_7N	L	0.4339	22 to 124
Picric acid	$HOC_6H_2(NO_2)_3$	S	0.165	−100
....	....	S	0.240	0
....	....	S	0.263	50
....	....	S	0.297	100
Piperidine	$C_5H_{11}N$	L	0.523	20 to 98
Platinum	Pt	S	0.0135	−253 to −196
....	....	S	0.0293	−180 to +18
....	....	S	0.0307	0 to 10
....	....	S	0.03224	15 to 100
....	....	S	0.0347	0 to 500
....	....	S	0.0275	100
....	....	S	0.0356	500
....	....	S	0.0344	600
....	....	S	0.0369	800
....	....	S	0.0382	1000

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Platinum	Pt	S	0.0398	1200
....	....	S	0.0368	1500
Porcelain	....	S	0.26	19 to 950
Potassium	K	S	0.1280	−253 to −196
....	....	S	0.170	−185 to +20
....	....	S	0.1728	0
....	....	S	0.188	0 to 22
....	....	S	0.192	22 to 56
....	....	L	0.217	78 to 100
....	....	L	0.224	100 to 157
Potassium acetate	$KC_2H_3O_2$	S	0.272	20
acid arsenate	KH_2AsO_4	S	0.174	31
acid sulfate	$KHSO_4$	S	0.244	35
aluminum sulfate (alum)	$K_2SO_4 \cdot Al_2(SO_4)_3 \cdot 24H_2O$	S	0.324	0
bromide	KBr	S	0.104	0
....	....	S	0.108	100
carbonate	K_2CO_3	S	0.210	47
chlorate	$KClO_3$	S	0.191	0
....	....	S	0.205	50
choride	KCl	S	0.162	0
....	....	S	0.168	100
chloroplatinate	K_2PtCl_6	S	0.112	30
chromate	K_2CrO_4	S	0.186	46
dichromate	$K_2Cr_2O_7$	S	0.178	0
....	....	L	0.0335	297
ferricyanide	$K_3Fe(CN)_6$	S	0.232	26
ferrocyanide	$K_4Fe(CN)_6$	S	0.210	0
....	....	S	0.225	50
....	$K_4Fe(CN)_6 \cdot 3H_2O$	S	0.267	0
....	....	S	0.285	50
fluoride	KF	S	0.199	0
....	....	S	0.204	50
metaborate	$K_2B_2O_4$	S	0.225	57
nitrate	KNO_3	S	0.214	0
....	....	S	0.240	100
....	....	L	0.0332	380
perchlorate	$KClO_4$	S	0.189	30
phosphate	KH_2PO_4	S	0.208	33
pyrophosphate	$K_4P_2O_7$	S	0.191	58
sulfate	K_2SO_4	S	0.176	0
....	....	S	0.191	100
thiosulfate	$K_2S_2O_3$	S	0.196	60
tetraborate	$K_2B_4O_7$	S	0.22	57
Propane	C_3H_8	L	0.576	0
Propionaldehyde	C_2H_5CHO	L	0.522	0
Propionic acid	C_2H_5COOH	S	0.726	−33
....	....	L	0.560	20 to 137
Propionitrile	C_2H_5CN	L	0.538	19 to 95
n-Propyl-acetate	$CH_3COOC_3H_7$	L	0.459	20
alcohol	C_3H_7OH	S	0.170	−200
....	....	S	0.497	−130
....	....	L	0.435	−100
....	....	L	0.526	0
....	....	L	0.586	25

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g(15°)	Temp. °C.
n-Propyl benzene	$C_3H_7C_6H_5$	L	0.400	0
benzoate	$C_6H_5COOC_3H_7$	L	0.398	20
butyrate	$C_3H_7COOC_3H_7$	L	0.459	20
chloroacetate	$ClCH_2COOC_3H_7$	L	0.414	20
formate	$HCOOC_3H_7$	L	0.459	20
isobutyrate	$C_3H_7COOC_3H_7$	L	0.459	20
phenyl ether	$C_3H_7OC_6H_5$	L	0.429	0
propionate	$C_2H_5COOC_3H_7$	L	0.459	20
valerate	$C_4H_9COOC_3H_7$	L	0.459	20
Proustite	Ag_3AsS_3	S	0.081	50
Pseudocumene	$(CH_3)_3C_6H_3$	L	0.414	20
Pyrargyrite	Ag_3SbS_3	S	0.076	50
Pyridine	C_5H_5N	L	0.431	21 to 108
Pyrosulfuric acid	$H_2S_2O_7$	L	0.334	35
Pyrotartaric acid	$C_5H_8O_4$	S	0.301	20
Quartz	....	S	0.188	12 to 100
Quinhydrone	$C_{12}H_{10}O_4$	S	0.0165	−250
....	....	S	0.0980	−200
....	....	S	0.256	0
Quinol	$C_6H_4(OH)_2$	S	0.0246	−250
....	....	S	0.268	−150
Quinoline	C_9H_7N	L	0.352	0 to 20
Quinone	$C_6H_4O_2$	S	0.0311	−250
....	....	S	0.113	−200
....	....	S	0.282	−150
Resorcinol	$C_6H_4(OH)_2$	S	0.269	−160
....	....	L	0.452	0
Rhodium	Rh	S	0.0134	−253 to −196
....	....	S	0.0580	10 to 97
Rock salt	....	S	0.219	13 to 45
Rubidium	Rb	S	0.0711	−253 to −196
....	....	S	0.0802	0
....	....	L	0.0908	50
Rubidium bromide	RbBr	S	0.0743	10
carbonate	Rb_2CO_3	S	0.122	33
chloride	RbCl	S	0.101	10
fluoride	RbF	S	0.115	10
iodide	RbI	S	0.0581	10
Ruthenium	Ru	S	0.0109	−253 to −196
....	....	S	0.061	0 to 100
Salicylaldehyde	HOC_6H_4CHO	L	0.382	18
Salol	$HOC_6H_4COOC_6H_5$	S	0.289	32
....	....	L	0.391	44.1
Scandium oxide	Sc_2O_3	S	0.168	−150 to +40
Selenium	Se	S	0.0361	−253 to −196
....	....	S	0.068	−188 to +18
(amorph.)	Se	S	0.095	18 to 38
(cryst.)	Se	S	0.084	22 to 63
Silicon (melted)	Si	S	0.0303	−253 to −196
(cryst.)	Si	S	0.0271	−253 to −196
....	....	S	0.123	−185 to +20
(amorph.)	Si	S	0.091	−190 to −80
....	....	S	0.147	−79 to +17
....	....	S	0.179	3 to 50

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Silicon (cryst.)	Si	S	0.136	−40
....	....	S	0.170	21
....	....	S	0.196	129
Silicon carbide	SiC	S	0.143	0
....	....	S	0.194	100
....	....	S	0.280	600
chloride	$SiCl_4$	S	0.237	−200 to −80
Silver	Ag	S	0.0242	−253 to −196
....	....	S	0.0175	−233
....	....	S	0.040	−193
....	....	S	0.0496	−186 to −70
....	....	S	0.0544	−79 to +18
....	....	S	0.0556	0
....	....	S	0.05625	15 to 100
....	....	S	0.0557	58
....	....	S	0.0581	500
....	....	S	0.076	800
....	....	L	0.0748	907 to 1100
Silver bromide	AgBr	S	0.0695	0
....	....	S	0.0734	100
....	....	L	0.0760	500
chloride	AgCl	S	0.0848	0
....	....	S	0.0906	50
....	....	L	0.129	490
cyanate	AgCNO	S	0.124	40
iodide	AgI	S	0.0548	0
....	....	S	0.0593	100
nitrate	$AgNO_3$	S	0.146	50
....	....	L	0.187	250
selenide	Ag_2Se	S	0.0693	37 to 187
sulfide	Ag_2S	S	0.0719	0
....	....	S	0.0748	50
Sodium	Na	S	0.1519	−253 to −196
....	....	S	0.229	−186
....	....	S	0.253	−185 to +20
....	....	S	0.266	−80
....	....	S	0.279	−40
....	....	S	0.293	0
....	....	S	0.290	27
....	....	L	0.323	100
....	....	L	0.319	140
Sodium acetate	$NaC_2H_3O_2$	S	0.339	38
....	$NaC_2H_3O_2{\cdot}3H_2O$	S	0.344	0
....	$NaC_2H_3O_2{\cdot}3H_2O$	L	0.846	61.8
....	....	S	0.602	40
borate	$Na_2B_2O_4$	S	0.253	57
bromide	NaBr	S	0.118	0
....	....	S	0.124	100
carbonate	Na_2CO_3	S	0.256	45
chlorate	$NaClO_3$	L	0.325	280
chloride	NaCl	S	0.204	0
....	....	S	0.217	100
fluoride	NaF	S	0.258	0
....	....	S	0.279	100

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g(15°)	Temp. °C.
Sodium formate	$NaCHO_2$	S	0.306	46
iodide	NaI	S	0.0829	0
....	....	S	0.0848	50
nitrate	$NaNO_3$	S	0.247	0
....	....	S	0.270	50
....	....	L	0.430	350
phosphate	$Na_2HPO_4{\cdot}7H_2O$	S	0.351	0
....	....	S	0.406	50
....	$Na_2HPO_4{\cdot}12H_2O$	S	0.404	0
....	....	S	0.464	50
phosphite	$NaPO_3$	S	0.217	30
pyrophosphate	$Na_4P_2O_7$	S	0.227	50
sulfate	Na_2SO_4	S	0.202	0
....	....	S	0.220	100
tetraborate	$Na_2B_4O_7$	S	0.234	45
(borax)	$Na_2B_4O_7{\cdot}10H_2O$	S	0.385	35
thiosulfate	$Na_2S_2O_3$	S	0.220	9
....	$Na_2S_2O_3{\cdot}5H_2O$	S	0.346	21
....	....	L	0.570	13 to 98
Stannic chloride	$SnCl_4$	S	0.115	−100
....	....	L	0.148	14 to 98
oxide	SnO_2	S	0.0898	45
sulfide	SnS_2	S	0.119	54
Stannous chloride	$SnCl_2$	S	0.102	60
sulfide	SnS	S	0.0839	56
Stearic acid	$C_{17}H_{35}COOH$	S	0.399	15
....	....	L	0.550	74 to 137
Strontium (impure)	Sr	S	0.0550	−253 to −196
Strontium carbonate	$SrCO_3$	S	0.146	54
chloride	$SrCl_2$	S	0.119	58
molybdate	$SrMoO_4$	S	0.148	15
nitrate	$Sr(NO_3)_2$	S	0.182	32
sulfate	$SrSO_4$	S	0.143	48
Succinic acid	$(CH_2COOH)_2$	S	0.248	0
Sucrose	$C_{12}H_{22}O_{11}$	S	0.299	20
Sulfur	S	S	0.0546	−253 to −196
(rhombic)	S	S	0.1520	−71
....	....	S	0.1728	0 to 54
(monoclinic)	S	S	0.1498	−72
....	....	S	0.1809	0 to 52
....	....	L	0.235	119 to 147
....	....	L	0.331	201 to 233
Sulfur chloride	S_2Cl_2	L	0.220	12 to 70
dioxide	SO_2	S	0.229	−185 to −103
....	....	L	0.313	−20
....	....	L	0.318	0
....	....	L	0.327	20
....	....	L	0.418	100
Sulfuric acid	H_2SO_4	S	0.239	−30
....	....	S	0.270	0
....	....	L	0.339	10
Talc	$Mg_3Si_4O_{11}{\cdot}H_2O$	S	0.208	57
Tantalum	Ta	S	0.033	−185 to +20
....	....	S	0.036	58

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g (15°)	Temp. °C.
Tantalum	Ta	S	0.043	1400
Tartaric acid	$(CHOHCOOH)_2$	S	0.287	36
....	$(CHOHCOOH)_2 \cdot H_2O$	S	0.308	0
....	....	S	0.366	50
Tellurium	Te	S	0.0288	−253 to −196
....	....	S	0.047	−188 to +18
(cryst.)	Te	S	0.0483	15 to 100
....	....	S	0.0490	15 to 300
Tetrachloroethylene	C_2Cl_4	S	0.198	0
....	....	L	0.211	20
Tetradecane	$C_{14}H_{30}$	L	0.497	0 to 50
Tetradecylene	$C_{14}H_{28}$	L	0.453	0 to 50
Tetryl	$C_7H_5N_5O_8$	S	0.212	0
....	....	S	0.236	100
Thallium	Tl	S	0.0235	−253 to −196
....	....	S	0.038	−185 to +20
....	....	S	0.0326	20 to 100
....	....	S	0.0311	28
Thallium bromide	$TlBr$	L	0.080	500
bromide	$TlBr$	S	0.0526	390
chloride	$TlCl$	L	0.059	480
....	....	S	0.0520	0
....	....	S	0.0542	100
Thorium	Th	S	0.0197	−253 to −196
....	....	S	0.0276	0 to 100
Thorium chloride	$ThCl$	S	0.406	30
dioxide	ThO_2	S	0.0571	0
....	....	S	0.0589	50
sulfate	$Th(SO_4)_2$	S	0.0980	50
Thymol	$C_{10}H_{14}O$	S	0.315	0
m-Thymol	$C_{10}H_{14}O$	S	0.0567	50
Tin	Sn	S	0.0286	−253 to −196
....	....	S	0.0486	−186 to −79
....	....	S	0.0518	−79 to +18
....	....	S	0.0536	0
....	....	S	0.0541	20
....	....	S	0.0565	100
....	....	L	0.0608	250 to 350
....	....	L	0.0758	1100
(gray)	Sn	S	0.0589	0 to 18
Titanium	Ti	S	0.0205	−253 to −196
....	....	S	0.036	−185 to +20
....	....	S	0.142	20
....	....	S	0.1125	0 to 100
....	....	S	0.1563	0 to 333
Titanium chloride	$TiCl_4$	S	0.177	−25
....	....	L	0.192	13 to 99
oxide	TiO_2	S	0.168	0
Toluene	$C_6H_5CH_3$	L	0.386	0
....	....	L	0.421	50
....	....	L	0.470	100
o-Toluic acid	$CH_3C_6H_4COOH$	S	0.277	54
m-Toluic acid	$CH_3C_6H_4COOH$	S	0.239	54
p-Toluic acid	$CH_3C_6H_4COOH$	S	0.271	130

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g(15°)	Temp. °C.
p-Toluidine	$CH_3C_6H_4NH_2$	S	0.337	0
....	....	S	0.387	20
Topaz	$2(AlF)O \cdot SiO_2$	S	0.205	52
Trichloroacetic acid	Cl_3CCOOH	S	0.459	......
Trichloroethane	$C_2H_3Ol_3$	L	0.2660	20
Trichloroethylene	C_2HCl_3	L	0.223	20
Tridecane	$C_{13}H_{28}$	L	0.499	0 to 50
Tridecylene	$C_{13}H_{26}$	L	0.457	0 to 50
Trimethyl carbinol	$(CH_3)_3COH$	S	0.559	−4
Trinitrotoluene	$CH_3C_6H_2(NO_2)_3$	S	0.170	−100
....	....	S	0.311	0
....	....	S	0.385	100
....	....	L	0.335	?
Trinitroxylene	$(CH_3)_2C_6H(NO_2)_3$	S	0.423	20 to 50
Triphenylmethane	$(C_6H_5)_3CH$	S	0.189	0
Tungsten	W	S	0.0095	−253 to −196
....	....	S	0.036	−185 to +20
....	....	S	0.034	15 to 93
....	....	S	0.034	20 to 100
....	....	S	0.041	1350
Tungsten trioxide	WO_3	S	0.0743	0
....	....	S	0.0832	50
Turpentine, oil	....	L	0.411	0
Undecane	$C_{11}H_{24}$	L	0.501	0 to 50
Undecylene	$C_{11}H_{22}$	L	0.482	0 to 50
Uranium	U	S	0.0138	−253 to −196
....	....	S	0.028	0 to 98
....	....	S	0.062	11 to 98
Uranium oxide	U_3O_8	S	0.0671	0
....	....	S	0.0750	50
Urea	$(NH_2)_2CO$	S	0.320	20
Valeronitrile	C_4H_9CN	L	0.520	23 to 121
Vanadium	V	S	0.1153	0 to 100
Vulcanite	....	S	0.3312	20 to 100
Water	H_2O	S	0.0361	−250
See also special table				
....	....	S	0.156	−200
....	....	S	0.246	−150
....	....	S	0.332	−100
....	....	S	0.435	−40
....	....	S	0.492	0
....	....	L	1.0000	15
Wood	....	S	0.42	......
o-Xylene	$(CH_3)_2C_6H_4$	L	0.411	30
m-Xylene	$(CH_3)_2C_6H_4$	L	0.387	16 to 35
p-Xylene	$(CH_3)_2C_6H_4$	L	0.397	30
o-Xylene dibromide	$C_8H_8Br_2$	L	0.183	15 to 40
dichloride	$C_8H_8Cl_2$	L	0.2829	15 to 40
tetrachloride	$C_8H_6Cl_4$	L	0.2399	15 to 40
Xylyl ethyl ether (2, 4)	$C_{10}H_{14}O$	L	0.4170	0
Ytterbium oxide	Yb_2O_3	S	0.0650	50
Yttrium oxide	Y_2O_3	S	0.112	57
Zinc	Zn	S	0.0384	−253 to −196
....	....	S	0.0268	−233

SPECIFIC HEAT OF ELEMENTS, COMPOUNDS AND VARIOUS SUBSTANCES

Name	Formula	State	Specific Heat g-cal/g(15°)	Temp. °C.
Zinc	Zn	S	0.063	−193
....	....	S	0.0836	−192 to +20
....	....	S	0.080	−186 to −79
....	....	S	0.0895	−79 to +18
....	....	S	0.0903	1
....	....	S	0.0924	20
....	....	S	0.0951	100
....	....	S	0.1040	300
....	....	S	0.110	419
....	....	L	0.121	419
Zinc acetate	$Zn(C_2H_3O_2)_2$	S	0.270	45
....	$Zn(C_2H_3O_2)_2 \cdot 3H_2O$	S	0.410	85
carbonate	$ZnCO_3$	S	0.142	0
chloride	$ZnCl_2$	S	0.136	60
nitrate	$Zn(NO_3)_2 \cdot 6H_2O$	S	0.318	30
oxide	ZnO	S	0.114	0
....	....	S	0.129	100
....	....	S	0.15	600
sulfate	$ZnSO_4$	S	0.174	50
....	$ZnSO_4 \cdot H_2O$	S	0.194	9
....	$ZnSO_4 \cdot 6H_2O$	S	0.299	9
....	$ZnSO_4 \cdot 7H_2O$	S	0.322	0
sulfide	ZnS	S	0.116	0
....	....	S	0.118	100
Zircon	$ZrO_2 \cdot SiO_2$	S	0.131	36
Zirconium	Zr	S	0.0262	−253 to −196
....	....	S	0.068	0 to 100
Zirconium dioxide	ZrO_2	S	0.103	0

SPECIFIC HEAT OF MERCURY AND WATER

The values are given in gram calories at 15° C. per gram.

Temp. °C.	Mercury	Water
−10	....	0.48*
−6	....	1.0119
−4	....	1.0105
−2	....	1.0097
0	0.03346	1.00874
5	0.03340	1.00477
10	0.03335	1.00184
15	0.03330	1.00000
20	0.03325	0.99859
25	0.03320	0.99765
30	0.03316	0.99745
35	0.03312	0.99743
40	0.03308	0.99761
45	....	0.99790
50	0.03300	0.99829
55	....	0.99873
60	0.03294	0.99934
65	....	1.00001
70	0.03290	1.00077
75	....	1.00158

Temp. °C.	Mercury	Water
80	0.03283	1.00239
85	....	1.00329
90	0.03274	1.00433
95	....	1.00534
100	0.03267	1.00645
110	0.03260	1.0116
120	0.03253	1.0144
130	0.03246	1.0174
140	0.03239	1.0206
150	0.03232	1.0240
160	0.03225	1.0275
170	0.03218	1.0313
180	0.03211	1.0353
190	0.03203	1.0395
200	0.03196	1.0439
220	0.03185	1.0769
240	0.03217	1.0939
260	0.03320	1.1126
280	....	1.1329
300	....	1.1549

* Value for solid state at −10°C.

THERMAL CONDUCTIVITY

In the following tables dealing with heat conductivity, the coefficient λ is given in calories/cm. sec. degree C. This value expresses the quantity of heat in gram calories, transmitted per second through a plate of the material one centimeter thick and one square centimeter in area when the temperature difference between the two sides of the plate is one degree Centigrade. To express λ in English units (B.T.U./inch sec. degree F) multiply the values given below by 0.00560.

THERMAL CONDUCTIVITY OF VARIOUS METALS AND ALLOYS

Metal or Alloy	Temp. °C.	λ
Aluminum, commercial	−188.2	0.454
" "	0	0.461
" 99%	18	0.504
" "	100	0.49
" "	400	0.76
" "	600	1.01
Antimony	−77	0.0628
	0	0.0538
	100	0.0515
20Sb+80Bi	0	0.0152
	100	0.0205
50Sb+50Bi	0	0.0196
	100	0.0229
70Sb+30Bi	0	0.0234
	100	0.0281
33.3Sb+66.7Cd	0	0.0267
50Sb+50Cd	0	0.00519
66.7Sb+33.3Cd	0	0.00299
Bismuth	−77	0.0257
	0	0.0177
	100	0.0164
25Bi+75Pb(Vol.)	44	0.0468
96.5Bi+3.5Pb(Vol.)	44	0.0129
90Bi+10Sn(Vol.)	44	0.0126
50Bi+50Sn	12.5	0.056
25Bi+75Sn	12.5	0.102
Brass, red	0	0.246
" "	100	0.2827
Brass, yellow	0	0.2041
" "	100	0.254
Cadmium	0	0.2213
"	100	0.2045
Constantin, see 60 Cu+40 Ni		
Cobalt, with 0.24%C,+ 1.4Fe+1.1 Ni+0.14Si	30	0.1653
Chromium steel, 5%Cr	30	0.073
" " 10%Cr	30	0.052
" " 15%Cr	30	0.044
Copper	−183	1.111
"	0	0.920
"	100	0.92
60Cu+40Ni	18	0.05401
	100	0.06405
54Cu+46Ni	18	0.0484
99.37Cu+0.63P	30	0.250
98.02Cu+1.98P	30	0.125
89Cu+11Zn	18	0.275
87Cu+13Zn	18	0.301
82Cu+18Zn	18	0.313
68Cu+32Zn	18	0.260
German silver (52Cu, 26Zn, 22Ni)	0	0.0700
	100	0.0887
62Cu+15Ni+22Zn	18	0.0595
Gold	0	0.744
"	97	0.7464
90Au+10Pd	25	0.234
50Au+50Pd	25	0.086
10Au+90Pd	25	0.124
40Au+60Pt	25	0.062
10Au+90Pt	25	0.182
Iridium	17	0.141
Iron, with 0.1%C+ 0.1%Mn+0.2%Si	18	0.1436
	100	0.1420
99Fe+1C	18	0.1085
	100	0.1076
Fe+1.5C+0.19Mn+ 0.05Si+0.03Cu+ 0.01P+0.025S	18	0.119
Bessemer steel	8	0.0985
Lead	18	0.0827
"	100	0.0815
Lithium	0	0.17
"	101.3	0.18
Magnesium	0−100	0.376
Manganin (84Cu+4Ni +12Mn)	18	0.05186
	100	0.0631
Mercury, solid	−269.3	0.40
" "	−44.2	0.0664
" liquid	−37.2	0.0218
" "	0	0.0248
" "	50.4	0.0298
" "	149.4	0.0385
Molybdenum	17	0.346
Nickel, 99%	−160	0.129
	18	0.140
Nickel +2 or 3% Co	300	0.126
	500	0.104
	950	0.065
	1200	0.058
Nickel steel, (30.4Ni+ 0.14Si+0.84Mn+ 0.26C)	29	0.029
	71	0.031
Palladium	18	0.1683

THERMAL CONDUCTIVITY OF VARIOUS METALS AND ALLOYS

Metal or Alloy	Temp. °C.	λ
Palladium	100	0.1817
90Pd+10Pt	25	0.134
50Pd+50Pt	25	0.088
10Pd+90Pt	25	0.103
90Pd+10Ag	25	0.114
50Pd+50Ag	25	0.076
10Pd+90Ag	25	0.337
Platinum	−252.8	0.93
"	−183	0.182
"	0−200	0.167
90Pt+10Ir	17	0.074
90Pt+10Rh	17	0.072
30Pt+70Ag	25	0.074
10Pt+90Ag	25	0.234
Potassium	5.0	0.234
"	20.7	0.232
"	57.6	0.217
62.9K+37.1Na	6.0	0.0549
	42.9	0.0619
Rhodium	17	0.210
Silver, 99.9%	−160	0.998
" "	0	1.096
" "	10−97	0.9628
" 99.98%	18	1.006
" "	100	0.9919
Sodium	5.7	0.321
"	21.2	0.317
"	88.1	0.288
Tantalum	17	0.130
"	1827	0.198
Tin	−170	0.195
"	0	0.1528
"	100	0.1423
30Sn+70Zn (Vol.)	44	0.224
91.1Sn+8.9Zn (Vol.)	44	0.157
Tungsten	0	0.383
"	2227	0.354
Wood's metal	7	0.0319
Zinc	−170	0.280
	18	0.2653
	100	0.2619

THERMAL CONDUCTIVITY OF VARIOUS SOLIDS

Substance	Temp. °C.	$\lambda \times 10^3$
Aluminum oxide (powder)	46.8	1.62
" " (fused)	650-1350	8.0
Asbestos board	20	1.78
Asbestos fabric	20	0.666
Asbestos fiber	0	0.267
" "	100	0.284
Asbestos paper	20	0.345
Asphalt	20	1.78
Basalt	20	5.2
Bauxite	600	1.33
Boiler scale	65.5	3.13
Brick, common	20	1.5
Blotting paper	20	0.15
Cadmium oxide (pressed powder)	46.5	1.63
Carborundum*		
Cardboard	20	0.5
Cement, Portland	89.5	0.71
Chalk	20	2.2
Clay (fire-hardened)	360 to 600	2.09 to 2.21
Coal	<0	0.405
"	1427	20.1
Cobalt oxide (pressed powder)	48.5	1.00
Concrete	20	2.2
Copper oxide (pressed powder)	45.6	2.42
Copper sulfide (pure)	0	1.06
Cork, Sp.G. =0.204	30	0.128
Cork meal	100	0.133
Cotton, Sp.G. =0.081	0	0.136
Diatomaceous earth	20	0.13
Earth's crust, average	20	4.0
Ebonite	0	0.378
Eiderdown	20	0.011
Feathers (with air)	9	0.0574
Feldspar	20	5.6
Felt (dark gray)	40	0.149
Ferric oxide (pressed powder)	200	1.41
Ferrous oxide (pressed powder)	49.8	1.33
Fiber, vegetable (with air)	9	0.0645
" , " (without air)	9	1.42
Fire brick	20	1.1
Flannel	50	0.0355
Flint	20	2.4
Fluorite	0	24.68
"	100	19.10
Gas carbon	20	8.5
" "	100	9.5
Glass, crown	12.5	1.63
" , flint	12.5	1.43
" , Jena	22	2.27
" , soda	20	1.7

*Trade name, see Silicon carbide.

THERMAL CONDUCTIVITY OF VARIOUS SOLIDS

Substance	Temp. °C.	$\lambda \times 10^3$
Glass, soda	100	1.8
Granite	20	8.17
Graphite, Sp.G. =1.58	50	105.5
" ⊥ to axis	142	42.6
" " " "	555	279
Graphite powder, Sp.G. =0.7	40	2.85
Gutta percha	20	0.48
Gypsum	0	3.1
Hair-cloth	<0	0.0402
Horn	<0	0.087
Horse hair, Sp.G. =0.172	20	0.122
Ice	....	5.7
Infusorial earth	100	0.34
" "	300	0.40
Lampblack, Sp.G. =0.165	40	0.156
Lava	16 to 99	2.01
Leather, cowhide	84	0.42
" sole, Sp.G. =1.00	30	0.38
Lime, clayey	20	7.8
Linen	20	0.21
Linoleum, Sp.G. =1.183	20	0.445
Magnesia (MgO) (pressed powder), Sp.G. =0.797	47.6	1.45
Magnesia brick	50 to 1130	2.7 to 7.2
Magnesite	1000	3.98
Marble, white	....	7.8
" black	30	6.85
Mica	41.3	0.860
Mica, pressed plates	60	0.627
Naphthalene	0	0.90
α-Naphthol	35	0.76
β-Naphthol	35	0.80
Nickel oxide (pressed powder, Sp.G. =1.445)	46.2	2.24
Onyx	30	5.56
Paper	20	0.3
Paraffin	0	0.688
Plaster of Paris	20	0.70
Porcelain	95	2.48
Potassium chloride	0	16.6
Potassium iodide	0	12
Quartz, || to axis	0	32.5
" " " "	100	21.5
" ⊥ to axis	0	17.31
" " " "	100	13.33
Quartz glass	0	3.32
" "	100	4.57
Rock salt	0	16.67
" "	100	11.59
Roofing paper	<0	0.453
Rubber, hard, gray	49	0.55
" soft, "	49	0.44
" " red	49	0.34
Sand, dry	20	0.93
Sandstone, Sp.G. =2.259	40	4.39
Sawdust, Sp.G. =0.19	30	0.14
Serpentine	20	2.4
Silica, see Quartz		
Silicon carbide	650–1350	37.2
Silk, Sp.G. =0.101	0	0.122
" " "	50	0.136
Silver bromide	0	2.46
Silver chloride	0	2.6
Slate	20	4.70
Snow, fresh, Sp.G. =0.111	....	2.56
" , old, Sp.G. =0.450	....	0.115
Sodium chlorate	0	2.665
Soil, dry	20	0.33
Sugar, cane	0	1.39
Sulfur, rhombic	0	0.70
" plastic	20 to 100	0.63
Sylvite	0	16.65
"	100	11.76
Thymol	12	0.359
Wadding, Sp.G. =0.01	18	0.93
Wax, bees'	20	0.207
Wood, maple ||to face	20	1.015
Wood, maple, ⊥ to face	50	0.434
Wood, oak, ⊥ to face Sp.G. =0.825	15	0.500
Wood, oak, ||to face Sp.G. =0.819	15	0.834
Wood, pine, ||to face Sp.G. =0.551	20	0.834
Wood, pine, ⊥ to face Sp.G. =0.546	15	0.361
Wood, teak, ||to face Sp.G. =0.604	15	0.903
Wood, teak, ⊥ to face Sp.G. =0.642	15	0.417
Zinc oxide (pressed powder, Sp.G. =2.886)	49.7	1.42

THERMAL CONDUCTIVITY OF VARIOUS LIQUIDS AND SOLUTIONS

Liquid or Solution	Temp. °C.	$\lambda \times 10^3$
Acetic acid	25	0.43
" " , 50%	25	0.85
Acetone	0	0.4228
Ammonia, 26%	18	1.09
Amyl acetate	12	0.302
Amyl alcohol	12	0.328

THERMAL CONDUCTIVITY OF VARIOUS LIQUIDS AND SOLUTIONS

Liquid or Solution	Temp. °C.	$\lambda \times 10^3$
Amyl chloride	12	0.283
Amyl iodide	12	0.203
Aniline	12	0.408
Barium chloride, 21%	32	1.396
Benzene	12	0.333
Bromobenzene	12	0.265
iso-Butyl alcohol	12	0.340
iso-Butyl bromide	12	0.278
iso-Butyl chloride	12	0.278
iso-Butyl iodide	12	0.208
n-Butyric acid	12	0.360
iso-Butyric acid	12	0.340
Calcium chloride, 15%	32	1.383
" " , 30%	32	1.315
iso-Caproic acid	12	0.298
Carbon disulfide	12	0.343
Carbon tetrachloride	12	0.252
Castor oil	....	0.425
Chlorobenzene	12	0.302
Chloroform	12	0.288
Copper sulfate, 18%	32	1.379
Cylinder oil	81	0.290
Cymene	12	0.272
Ethyl acetate	12	0.348
Ethyl alcohol	5.2	0.487
" "	51	0.369
" " , 90%	15	0.4391
" " , 70%	14.1	0.5711
" " , 50%	12.9	0.7461
" " , 30%	12.3	1.002
" " , 10%	11.9	1.247
Ethyl bromide	12	0.247
Ethyl ether	12	0.303
Ethyl formate	12	0.378
Ethyl iodide	12	0.222
Ethyl sulfide	12	0.328
Ethylene glycol	0	0.6353
Formic acid	12	0.648
Glycerol	12	0.670
"	48	0.613
Heptane	4	0.337
Hexane	4	0.364
Hydrochloric acid, 12.5%	32	1.262
" ", 25%	32	1.151
" ", 38%	32	1.052
Magnesium chloride, 11%	32	1.376
" " , 29%	32	1.238
Magnesium sulfate, 22%	32	1.414
Methyl acetate	12	0.385
Methyl alcohol	12	0.495
Methyl butyrate	12	0.335
Methyl valerate	12	0.315
Nitrobenzene	12.5	0.3801
Octane	4	0.375
Olive oil, Sp.G. = 0.911	15.7	0.4515
Paraffin oil	17	0.346

Liquid or Solution	Temp. °C.	$\lambda \times 10^3$
Pentane	−185	0.3955
"	14	0.2856
Petrolatum	20	0.222
Petroleum	13	0.355
Potassium bromide, 40%	32	1.176
Potassium carbonate, 20%	32	1.373
Potassium chlorate, Sp.G. = 1.026	13	1.16
Potassium chloride, 20%	32	1.334
Potassium hydroxide, 21%	32	1.385
" " , 42%	32	1.313
Potassium nitrate, 10%	32	1.409
" " , 20%	32	1.337
Potassium sulfate, 10%	32	1.440
Propionic acid	12	0.390
Propyl acetate	12	0.327
n-Propyl alcohol	12	0.373
iso-Propyl alcohol	0	0.3683
Propyl bromide	12	0.257
Propyl chloride	12	0.283
Propyl formate	12	0.357
Propyl iodide	12	0.220
Sodium bromide, 20%	32	1.348
" " , 40%	32	1.289
Sodium carbonate, 10%	32	1.403
Sodium chloride, 12.5%	32	1.403
" " , 25%	32	1.141
Sodium nitrate, 20%	32	1.376
" " , 44%	32	1.311
Sodium sulfate, 10%	32	1.447
Strontium nitrate, 20%	32	1.398
" " , 40%	32	1.346
Sulfuric acid, 30%	32	1.244
" " , 60%	32	1.047
" " , 90%	32	0.846
" " , Sp.G. = 1.054	20.5	1.26
" " , Sp.G. = 1.18	21	1.30
Thymol	13	0.313
Toluene	0	0.3492
"	12	0.307
Turpentine oil	12	0.260
n-Valeric acid	12	0.325
iso-Valeric acid	12	0.312
Water	4.1	1.29
"	12	1.36
"	40.8	1.555
Wood tar	79.5	0.324
o-Xylene	0	0.3443
" "	33	0.2519
m-Xylene	0	0.3429
Zinc chloride, 17.5%	32	1.327
" " , 35%	32	1.213
Zinc sulfate, 16%	32	1.382
" sulfate, 32%	32	1.327
" " , Sp.G. = 1.134	4.5	1.18
" " , Sp.G. = 1.382	45.2	1.44

THERMAL CONDUCTIVITY OF VARIOUS GASES AND VAPORS

Gas or Vapor	Temp. °C.	$\lambda \times 10^5$
Acetone	0	2.301
"	100	3.96
"	184	5.90
Acetylene	0	4.40
Air	−191.1	1.80
"	−78.4	4.256
"	0	5.572
"	100	7.197
"	531	15.95
Ammonia	−57.6	3.82
"	0	5.135
"	100	7.09
Argon	−182.6	1.42
"	0	3.88
"	100	5.087
Benzene	0	2.094
"	100	4.144
"	212.5	7.08
Butylamine	6.5	3.003
Carbon dioxide	−78.5	2.546
" "	0	3.393
" "	100	5.06
" "	546	14.20
Carbon disulfide	0	1.615
Carbon monoxide	−191	1.650
" "	0	5.425
Carbon tetrachloride	46	1.666
" "	100	2.048
" "	184	2.599
Chlorine	0	1.829
Chloroform	0	1.523
"	100	2.333
"	184	3.103
Ethane	−70.4	2.727
"	0	4.306
"	100	7.673
Ethyl acetate	46	2.88
" "	100	3.862
" "	184	5.69
Ethyl alcohol	20	3.583
" "	100	4.98
Ethyl ether	0	3.101
" "	100	5.278
" "	212.5	8.400
Ethylene	−71.1	2.572
"	0	4.02
"	100	6.36
Helium	−252.2	5.18
"	−191.7	14.84
"	0	33.60
Helium	100	39.85
n-Heptane	100	4.136
n-Hexane	20	2.854
Hexylene	100	4.396
Hydrogen	−252.2	3.22
"	−78.4	30.65
"	0	39.60
"	100	49.94
Hydrogen sulfide	0	3.045
Mercury vapor	203	1.846
Methane	−181.6	2.248
"	−75.6	4.940
"	0	7.200
Methyl alcohol	0	3.357
" "	100	5.161
Methyl bromide	4.6	1.74
Methyl chloride	0	2.216
" "	100	3.841
" "	212.5	6.113
Methyl dichloride	0	1.562
" "	100	2.524
" "	212.5	3.804
Methyl iodide	0	1.098
" "	100	1.804
Neon	−181.4	4.99
"	−74.4	8.79
"	0	10.87
"	105.8	13.44
Nitric oxide, NO	−71.4	4.160
" "	0	5.55
Nitrogen	−191.4	1.829
"	−78.4	4.305
"	0	5.68
"	100	7.18
Nitrogen dioxide	55	8.88
Nitrous oxide, N_2O	−71.8	2.710
" "	0	3.515
" "	100	5.06
Oxygen	−191.4	1.721
"	−78.4	4.292
"	0	5.70
"	100	7.427
n-Pentane	20	3.267
iso-Pentane	0	2.912
" "	100	5.105
" "	184	7.52
Sulfur dioxide	0	1.950
Water vapor	46	4.580
" "	100	5.510

THERMAL CONDUCTIVITY OF COMMERCIAL INSULATORS

(Calculated from the values in Bu. of Standards Letter Circular No. 227.)

In the table below, the materials are divided into eight classes,* as follows:

Class 1—Soft flexible materials in sheet form.
Class 2—Loose materials.
Class 3—Semi-flexible materials in sheet form.
Class 4—Semi-rigid materials in board form.
Class 5—Stiff fibrous materials in board form.
Class 6—Cellular gypsum.
Class 7—Woods, across grain.
Class 8—Miscellaneous building materials.

To convert the specific gravities to pounds per cubic foot, multiply by 62.43. To convert the values for λ, which are given in calories/cm. sec. degree C to B.T.U./hour, square foot, degree F per inch thickness, multiply by 2903.

Material	Composition	Class	Sp. Gr.	$\lambda \times 10^4$
Balsa	Wood, across grain	7	0.1168	1.0
"		7	0.1408	1.15
"		7	0.32	1.76
Balsam Wool	Chemically treated wood fibre	1	0.0352	0.818
Building brick	....	8	......	9 to 18
Building gypsum	....	8	......	about 9
Cabots Quilt	Eel grass between kraft paper	1	0.054	0.76
" "		1	0.074	0.79
Celotex	Sugar cane fiber	5	0.211	1.03
"		5	0.237	1.03
Charcoal	From maple, beech and birch; coarse	2	0.211	1.09
"	6 mesh	2	0.243	1.12
"	20 mesh	2	0.307	1.18
Cinder concrete	....	8	......	6 to 9
Concrete	....	8	......	18 to 27
Corkboard	No added binder; very low density	4	0.0864	0.76
"	No added binder; low density	4	0.112	0.82
"	No added binder; medium density	4	0.170	0.91
"	No added binder; high density	4	0.224	1.03
Cornstalk Pith Board	....	5	......	0.73 to 0.91
Cypress	Wood, across grain	7	0.464	2.03
Dry Zero	Kopak between burlap or paper	1	0.016	0.73
" "		1	0.032	0.76
Eureka	Corkboard with asphaltic binder	4	0.232	0.97
Fibrofelt	Flax and rye fibre	3	0.218	0.97
Flaxlinum	Flax fibre	3	0.208	0.94
Glass	....	8	......	15 to 18
Glass Wool	Pyrex glass, curled	2	0.064	0.88
" "		2	0.160	0.88
Granite	....	8	......	39 to 85
Hair Felt	Felted cattle hair	1	0.176	0.79
" "		1	0.208	0.79
Hairinsul	75% hair, 25% jute	1	0.101	0.82
"	50% hair, 50% jute	1	0.098	0.79
Inso-board	....	5	......	1.0
Insulex or Pyrocell	Cellular Gypsum	6	0.128	1.06
" " "		6	0.192	1.33
" " "		6	0.288	1.79
" " "		6	0.384	2.33
" " "		6	0.480	3.03
Insulite	Wood pulp	5	0.259	1.03
"		5	0.270	1.03
Limestone	....	8	......	12 to 27

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*See also another table in the section on Materials of Construction.

THERMAL CONDUCTIVITY OF COMMERCIAL INSULATORS

Material	Composition	Class	Sp. Gr	$\lambda \times 10^4$
Linofelt	Flax fibres between paper	1	0.0784	0.85
Lith	Board containing rock wool, flax and straw pulp	4	0.229	1.21
Maftex	....	5	......	1.03
Mahogany	Wood, across grain	7	0.544	2.73
Maizewood	....	5	......	1.0 to 1.18
Maple	Wood, across grain	7	0.704	3.3
Marble	....	8	......	43 to 61
Masonite	....	5	......	1.0
Oak	Wood, across grain	7	0.608	3.09
Pine, Virginia	Wood, across grain	7	0.544	2.97
Pine, White	Wood, across grain	7	0.512	2.36
Plaster	....	8	......	6 to 15
Regranulated Cork	Fine particles	2	0.150	0.91
" "	About 3/16 inch particles	2	0.130	0.94
Rock Cork	Rock wool block with binder	4	0.267	1.12
Rock Wool	Fibrous material made from rock, also made in sheet form, felted and confined with wire netting	2	0.096	0.79
" "		2	0.160	0.82
" "		2	0.224	0.85
" "		2	0.288	0.88
Sandstone	....	8	......	24 to 48
Sawdust	Various	2	0.192	1.24
"	Redwood	2	0.174	1.27
Shavings	Various, from planer	2	0.141	1.24
Sil-O-Cel	Powdered diatomaceous earth	2	0.170	0.94
Thermofelt	Jute and asbestos fibers, felted	1	0.160	1.12
"	Hair and asbestos fibers, felted	1	0.125	0.85
Thermofill	Gypsum in powdered form	2	0.416	1.58
"		2	0.544	1.82
Tucork, see Rock Cork				

HEAT OF FUSION OF INORGANIC COMPOUNDS AND ELEMENTS

To convert the values from gram calories per gram into joules per gram, multiply by 4.186; to convert gram calories per gram into BTU per pound multiply by 1.800.

Name	Formula	Melting Point, °C.	Heat of Fusion g. cal. 15°/g.
Aluminum	Al	660	94.55
Aluminum bromide	$AlBr_3$	97.5	10.47
Ammonia	NH_3	−77.7	83.9
Antimony	Sb	630.5	39.2
Antimony tribromide	$SbBr_3$	96.6	9.759
Antimony trichloride	$SbCl_3$	73.4	13.29
Antimony trisulfide	Sb_2S_3	550	17.6
Argon	A	−189.2	6.713
Arsenic tribromide	$AsBr_3$	31	8.93
Barium chloride	$BaCl_2$	962	27.8
Beryllium	Be	1300	318
Bismuth	Bi	271	11.98
Bromine	Br	−7.2	16.2
Cadmium	Cd	320.9	12.9
Cadmium nitrate	$Cd(NO_3)_2 \cdot 4H_2O$	59.4	25.3
Calcium chloride	$CaCl_2$	772	54.2
Calcium chloride	$CaCl_2 \cdot 6H_2O$	29.92	40.7
Calcium nitrate	$Ca(NO_3)_2 \cdot 4H_2O$	42.7	33.9
Carbon dioxide	CO_2	−56.2	45.30
Carbon monoxide	CO	−207	8.00
Cesium	Cs	28.5	3.8
Cesium hydroxide	$CsOH$	272	10.8
Chlorine	Cl	−101.6	23.0
Chromium	Cr	1615	75.6
Cobalt	Co	1480	62.23
Copper	Cu	1083	48.92
Cupric nitrate	$Cu(NO_3)_2 \cdot 6H_2O$	24.4	29.4
Fluorine	F	−223	10.06
Gallium	Ga	30	19.0
Gold	Au	1063	15.36
Hydrogen	H	−259.1	14.0
Hydrogen bromide	HBr	−86	7.67
Hydrogen chloride	HCl	−111	13.9
Hydrogen peroxide	H_2O_2	−1.7	74
Iodine	I	113.5	15.8
Iodine chloride	$ICl(\alpha)$	27.2	16.5
Iron	Fe	1535	48.0
Krypton	Kr	−169	4.3
Lead	Pb	327.5	5.97
Lead chloride	$PbCl_2$	501	18.5
Lead iodide	PbI_2	402	11.5
Lithium	Li	186	158.5
Lithium nitrate	$LiNO_3$	261	88.51
Magnesium	Mg	651	88.81
Magnesium chloride	$MgCl_2 \cdot 6H_2O$	118	41.21
Magnesium nitrate	$Mg(NO_3)_2 \cdot 6H_2O$	95	38.2
Manganese	Mn	1260	62.81
Manganese nitrate	$Mn(NO_3)_2 \cdot 6H_2O$	25.8	28.79
Mercuric bromide	$HgBr_2$	237	12.8
Mercuric iodide	HgI_2	259	9.8
Mercury	Hg	−38.87	2.78
Neon	Ne	−248.67	2.6
Nickel	Ni	1452	71.56
Nickel nitrate	$Ni(NO_3)_2 \cdot 6H_2O$	56.7	36.43

HEAT OF FUSION OF INORGANIC COMPOUNDS AND ELEMENTS

Name	Formula	Melting Point, °C.	Heat of Fusion g. cal. 15°/g.
Nitric acid	HNO_3	−42	9.544
Nitric oxide	NO	−163	18.4
Nitrogen	N	−210	6.09
Nitrogen pentoxide	N_2O_5	29.5	76.7
Nitrogen tetroxide	N_2O_4	−9.3	32.3 to 37.1
Osmium tetroxide	OsO_4	40.1	13.5
Oxygen	O	−218.4	3.30
Palladium	Pd	1555	38.61
Phosphorus	P	44.1	5.034
Phosphorus oxychloride	$POCl_3$	2	19.8
Platinum	Pt	1755	24.07
Potassium	K	62.3	14.68
Potassium chloride	KCl	790	74.1
Potassium dichromate	$K_2Cr_2O_7$	398	29.74
Potassium fluoride	KF	880	108
Potassium hydroxide	KOH	380	28.55
Potassium nitrate	KNO_3	333	25.44
Pyrosulfuric acid	$H_2S_2O_7$	35	18
Radon	Rn	−71	3.50
Rubidium	Rb	38.5	6.10
Rubidium hydroxide	$RbOH$	300	15.8
Selenium, gray	Se	220	6.7
Silicon tetrachloride	$SiCl_4$	−70	10.85
Silver	Ag	960.5	25.02
Silver bromide	$AgBr$	434	12.5
Silver chloride	$AgCl$	455	21.3
Silver nitrate	$AgNO_3$	212	16.7
Sodium	Na	97.5	27.40
Sodium chlorate	$NaClO_3$	248	49.0
Sodium chloride	$NaCl$	804.3	123.5
Sodium chromate	$Na_2CrO_4 \cdot 10H_2O$	20	39.2
Sodium fluoride	NaF	992.2	186
Sodium hydrogen phosphate	$Na_2HPO_4 \cdot 12H_2O$	34.6	66.77
Sodium hydroxide	$NaOH$	318.4	40.02
Sodium nitrate	$NaNO_3$	308	45.27
Sodium sulfate	$Na_2SO_4 \cdot 10H_2O$	32.4	57.1
Stannic bromide	$SnBr_4$	31	6.49
Stannic chloride	$SnCl_4$	−30.2	8.41
Strontium chloride	$SrCl_2$	873	25.6
Sulfur (rhombic)	S	112.8	9.370
Sulfur (monoclinic)	S	118.95	10.4
Sulfuric acid	H_2SO_4	10.49	24.03
Sulfuric acid	$H_2SO_4 \cdot H_2O$	8.62	39.2
Thallium	Tl	303.5	5.04
Thallous bromide	$TlBr$	460	12.7
Thallous chloride	$TlCl$	430	16.6
Tin	Sn	231.8	14.99
Titanium tetrachloride	$TiCl_4$	−30	11.8
Water	H_2O	0	79.67
Xenon	Xe	−140	3.77
Zinc	Zn	419.4	24.40
Zinc nitrate	$Zn(NO_3)_2 \cdot 6H_2O$	36.4	31.1

HEAT OF FUSION OF ORGANIC COMPOUNDS

Name	Formula	Melting Point,°C.	Heat of Fusion g.cal.15°/g.
Acetic acid	CH_3COOH	16.7	43.2
Acetone	CH_3COCH_3	−94.6	23.4
Acrylic acid	C_2H_3COOH	13	37.0
Allocinnamic acid	C_8H_7COOH	68	27.4
o-Aminobenzoic acid	$C_6H_4(NH_2)COOH$	145	35.5
m-Aminobenzoic acid	$C_6H_4(NH_2)COOH$	174	38.0
p-Aminobenzoic acid	$C_6H_4(NH_2)COOH$	188.5	36.5
tert-Amyl alcohol	$C_5H_{11}OH$	−12	12.5
Anethole	$CH_3OC_6H_4C_3H_5$	22.5	25.8
Aniline	$C_6H_5NH_2$	−6.2	21.0
Anthracene	$C_{14}H_{10}$	216.5	38.7
Anthraquinone	$C_{14}H_8O_2$	286	37.5
Azobenzene	$C_6H_5N:NC_6H_5$	68	32.4
Azoxybenzene	$(C_6H_5)_2N_2O$	36	21.6
Benzene	C_6H_6	5.5	30.1
Benzil	$(C_6H_5CO)_2$	94.9	22.2
Benzoic acid	C_6H_5COOH	121.7	33.9
Benzophenone	$(C_6H_5)_2CO$	48.5	23.5
Benzylaniline	$C_6H_5CH_2NHC_6H_5$	37	21.9
Bromal hydrate	$CBr_3CH(OH)_2$	53.5	16.9
Bromocamphor	$C_{10}H_{15}OBr$	77	41.6
o-Bromochlorobenzene	BrC_6H_4Cl	−12.6	15.4
m-Bromochlorobenzene	BrC_6H_4Cl	−21.2	15.3
p-Bromochlorobenzene	BrC_6H_4Cl	67.4	23.4
Bromoform	Br_3CH	7.8	10.9
o-Bromoiodobenzene	BrC_6H_4I	5	12.2
m-Bromoiodobenzene	BrC_6H_4I	−9.3	10.3
p-Bromoiodobenzene	BrC_6H_4I	91	16.6
p-Bromophenol	BrC_6H_4OH	64	20.5
p-Bromotoluene	$BrC_6H_4CH_3$	28.5	20.9
n-Butane	$(C_2H_5)_2$	−135	18.0
n-Butyl alcohol	C_4H_9OH	−79	29.9
tert-Butyl alcohol	$(CH_3)_3COH$	25.5	21.0
n-Butylbenzene	$C_4H_9\cdot C_6H_5$	−88.5	19.5
tert-Butylbenzene	$(CH_3)_3C\cdot C_6H_5$	58.1	14.9
n-Butyric acid	C_3H_7COOH	−4.7	30.1
Camphene	$C_{10}H_{12}$	50	57
Camphor	$C_{10}H_{16}O$	178.4	10.7
n-Capric acid	$CH_3(CH_2)_8COOH$	31.5	38.9
n-Caprylic acid	$CH_3(CH_2)_6COOH$	16.3	35.4
Carbazole	$C_{12}H_9N$	245	42.1
Carbon tetrachloride	CCl_4	−23	4.16
Catechol	$C_6H_4(OH)_2$ (1, 2)	104.3	49.4
Cetyl alcohol	$C_{16}H_{33}OH$	49	33.8
Chloral alcoholate	$CCl_3CHO\cdot C_2H_5OH$	56	24.0
Chloral hydrate	$CCl_3CH(OH)_2$	52	33.2
Chloroacetic acid (α)	$ClCH_2COOH$	61.2	31.1
Chloroacetic acid (β)	$ClCH_2COOH$	56	35.1
p-Chloroaniline	$ClC_6H_4NH_2$	71	37.2
o-Chlorobenzoic acid	ClC_6H_4COOH	140.2	39.3
m-Chlorobenzoic acid	ClC_6H_4COOH	158	36.4
p-Chlorobenzoic acid	ClC_6H_4COOH	242	49.2
m-Chloronitrobenzene	$ClC_6H_4NO_2$	44	29.4
p-Chloronitrobenzene	$ClC_6H_4NO_2$	83	21.4
Cinnamic acid	$C_6H_5\cdot CH:CH\cdot COOH$	133	36.5

HEAT OF FUSION OF ORGANIC COMPOUNDS

Name	Formula	Melting Point, °C.	Heat of Fusion g.cal.15°/g.
Cinnamic anhydride	$(C_8H_7CO)_2O$	136	28.1
p-Cresol	$HOC_6H_4CH_3$	35	26.3
Cyanamide	H_2NCN	44	49.8
Cyclohexane	C_6H_{12}	6.5	7.4
Cyclohexanol	$C_6H_{11}(OH)$	23.9	4.9
Cyclohexene	C_6H_{10}	−104	9.6
p-Cymene	$(CH_3)_2CHC_6H_4CH_3$	−73.5	17.2
n-Decane	$C_{10}H_{22}$	−32	48.3
Dibenzyl	$(C_6H_5CH_2)_2$	51.4	30.7
o-Dibromobenzene	$C_6H_4Br_2$	1.8	12.8
m-Dibromobenzene	$C_6H_4Br_2$	−6.9	13.4
p-Dibromobenzene	$C_6H_4Br_2$	87	20.5
Dibromophenol	$HOC_6H_3Br_2$ (2, 4)	40	14.0
Dichloroacetic acid	$Cl_2CH{\cdot}COOH$	9.7	14.2
o-Dichlorobenzene	$C_6H_4Cl_2$	−17.5	21.0
m-Dichlorobenzene	$C_6H_4Cl_2$	−24.8	20.5
p-Dichlorobenzene	$C_6H_4Cl_2$	52.7	29.7
Δ_2-Dihydronaphthalene	$C_{10}H_{10}$	23.9	22.4
Dihydrophenanthrene	$(C_6H_4CH_2)_2$	94	17.6
o-Diiodobenzene	$C_6H_4I_2$	27	10.2
m-Diiodobenzene	$C_6H_4I_2$	40	11.6
p-Diiodobenzene	$C_6H_4I_2$	129	16.2
Diisobutylene	C_8H_{16}	−101	16.8
Dimethylcyclopentane (1, 2)	C_7H_{14}	−119.0	15.7
Dimethylpentane (2, 2)	C_7H_{16}	−125.0	14.0
Dimethylpentane (2, 4)	C_7H_{16}	−120.6	16.0
Dimethylpentane (3, 3)	C_7H_{16}	−134.9	16.9
d-Dimethyltartrate	$(CH_3)_2C_4H_4O_6$	48	21.5
dl-Dimethyltartrate	$(CH_3)_2C_4H_4O_6$	89	35.1
o-Dinitrobenzene	$C_6H_4(NO_2)_2$	116.9	32.3
m-Dinitrobenzene	$C_6H_4(NO_2)_2$	89.8	24.7
p-Dinitrobenzene	$C_6H_4(NO_2)_2$	173.5	40.0
Dinitrotoluene (2, 4)	$CH_3C_6H_3(NO_2)_2$	70	26.4
Diphenyl	$(C_6H_5)_2$	70	28.8
Diphenylamine	$(C_6H_5)_2NH$	52.9	25.2
Diphenylmethane	$(C_6H_5)_2CH_2$	26	26.4
n-Dodecane	$C_{12}H_{26}$	−12	51.3
Durene	$C_{10}H_{14}$	79.3	37.4
Eicosane	$C_{20}H_{42}$	38	52.0
Elaidic acid	$C_{17}H_{33}COOH$	51	52.1
Ethane	C_2H_6	−172	22.2
Ethyl alcohol	C_2H_5OH	−112	24.9
Ethylbenzene	$C_2H_5{\cdot}C_6H_5$	−92.8	20.6
Ethylpentane (3)	C_7H_{16}	−118.8	22.6
Ethylene	C_2H_4	−169.5	25.0
Ethylene bromide	$(CH_2Br)_2$	10	13.5
Formic acid	$HCOOH$	8.6	58.9
Glutaric acid	$(CH_2)_3(COOH)_2$	97.5	37.4
Glycerol	$C_3H_5(OH)_3$	18	47.5
Glycol	$C_2H_4(OH)_2$	−15	43.3
n-Heptane	C_7H_{16}	−90.6	33.7
Hexamethylbenzene	$(CH_3)_6C_6$	165.5	30.4
Hexamethylethane	$(CH_3)_6C_2$	104	14.9
n-Hexane	C_6H_{14}	−94	36.7
Hydrazobenzene	$(C_6H_5NH)_2$	131	22.9

HEAT OF FUSION OF ORGANIC COMPOUNDS

Name	Formula	Melting Point, °C.	Heat of Fusion g. cal.15°/g.
Hydrocinnamic acid	C_8H_9COOH	48	28.1
p-Iodotoluene	$CH_3C_6H_4I$	35	18.8
Isodurene	$C_{10}H_{14}$	−24.0	23.0
n-Lauric acid	$C_{11}H_{23}COOH$	47	43.7
Levulinic acid	$CH_3CO{\cdot}C_2H_4COOH$	33	19.0
α-Menthol (l)	$C_{10}H_{19}OH$	42	18.6
Methane	CH_4	−184	14.0
Methyl alcohol	CH_3OH	−98	16.4
Methylbutane (2)	$CH_3C_4H_9$	−159	16.9
Methyl cinnamate	$CH_3C_9H_7O_2$	33.4	26.5
Methylcyclohexane	C_7H_{14}	−126.3	16.2
Methylcyclopentane	C_6H_{12}	−140.5	19.5
Methyl fumarate	$(CH_3)_2C_4H_2O_4$	102	57.9
Methylhexane (2)	$CH_3C_6H_{13}$	−119.1	21.2
Methylnaphthalene (2)	$CH_3C_{10}H_7$	35	20.1
Methyl oxalate	$(CH_3)_2C_2O_4$	54	42.7
Methyl phenylpropiolate	$C_6H_5C{:}CCOOCH_3$	18	22.9
Methyl succinate	$(CH_3)_2C_4H_4O_4$	19.5	35.7
Myristic acid	$C_{13}H_{27}COOH$	57	47.5
Naphthalene	$C_{10}H_8$	80.2	36.0
Naphthol (1)	$C_{10}H_7OH$	96	38.9
Naphthol (2)	$C_{10}H_7OH$	122.5	31.3
Naphthylamine (1)	$C_{10}H_7NH_2$	50	24.9
o-Nitroaniline	$NH_2C_6H_4NO_2$	71.5	27.9
m-Nitroaniline	$NH_2C_6H_4NO_2$	114	41.0
p-Nitroaniline	$NH_2C_6H_4NO_2$	147	36.5
Nitrobenzene	$C_6H_5NO_2$	5.7	22.5
o-Nitrobenzoic acid	$NO_2C_6H_4COOH$	147.5	40.1
m-Nitrobenzoic acid	$NO_2C_6H_4COOH$	141.1	27.6
p-Nitrobenzoic acid	$NO_2C_6H_4COOH$	240	52.8
Nitronaphthalene (1)	$C_{10}H_7NO_2$	59	25.4
o-Nitrophenol	$NO_2C_6H_4OH$	44.5	30.9
n-Octane	C_8H_{18}	−56.5	43.2
Palmitic acid	$C_{15}H_{31}COOH$	63	39.2
Paraffin	C_nH_{2n+2} (?)	52	35
Paraldehyde	$(CH_3CHO)_3$	12.6	25.0
Pentacosane	$C_{25}H_{52}$	54	53.6
n-Pentane	C_5H_{12}	−131.5	27.7
Phenanthrene	$C_{14}H_{10}$	99.3	25.0
Phenol	C_6H_5OH	42	29.0
Phenylacetic acid	$C_6H_5CH_2COOH$	76.6	30.0
Phenyl hydrazine	$C_6H_5N_2H_3$	19.6	36.3
Prehnitene	$C_{10}H_{14}$	−4	20.0
iso-Propyl alcohol	C_3H_7OH	−85.8	21.0
Propylene	C_3H_6	−184.9	16.7
Pseudocumene	C_9H_{12}	−57	25.2
Quinol	$C_6H_4(OH)_2$ (1, 4)	170.3	58.8
Quinone	$C_6H_4O_2$	115.7	40.9
Resorcinol	$C_6H_4(OH)_2$ (1, 3)	110.7	46.2
Salol	$C_{13}H_{10}O_3$	43	16.1
Stearic acid	$C_{17}H_{35}COOH$	69	47.6
Stilbene	$(C_6H_5CH)_2$	124	40.0
Succinic anhydride	$(CH_2CO)_2O$	119.6	48.7
Succinic nitrile	$(CH_2CN)_2$	54.5	11.7
Thymol	$C_{10}H_{13}OH$	51.5	27.5

HEAT OF FUSION OF ORGANIC COMPOUNDS

Name	Formula	Melting Point, °C.	Heat of Fusion g.cal.15°/g.
Tolane	$(C_6H_5C)_2$	60	28.7
Trimethylbutane	$C_4H_7(CH_3)_3$ (2, 2, 3,)	−25.4	5.3
o-Toluic acid	$CH_3C_6H_4COOH$	103.7	35.4
m-Toluic acid	$CH_3C_6H_4COOH$	110	27.6
p-Toluic acid	$CH_3C_6H_4COOH$	179.6	39.9
p-Toluidine	$CH_3C_6H_4NH_2$	44.5	39.9
Tribromoaniline	$NH_2C_6H_2Br_3$ (2, 4, 6)	120	16.8
Tribromophenol	$HOC_6H_2Br_3$ (2, 4, 6)	96	13.4
Trichloroacetic acid	Cl_3CCOOH	58	8.6
Trimethylethylene	$(CH_3)_2C:CHCH_3$	−134.2	25.7
Trimethylpentane	$C_5H_9(CH_3)_3$ (2, 2, 4)	−107.8	18.9
Trinitroglycerol (α)	$C_3H_5(ONO_2)_3$	13.3	5.2
Trinitroglycerol (β)	$C_3H_5(ONO_2)_3$	2.0	33.2
Trinitrotoluene	$CH_3C_6H_2(NO_2)_3$ (2, 4, 6)	81	22.3
Triphenylmethane	$(C_6H_5)_3CH$	93	21.1
Triphenyl phosphate	$(C_6H_5)_3PO_4$	49.9	17.6
Tristearin	$(C_{17}H_{35}COO)_3C_3H_5$	56	45.6
n-Undecane	$C_{11}H_{24}$	−26.5	34.1
n-Undecylic acid (α)	$C_{10}H_{21}COOH$	29	32.2
n-Undecylic acid (β)	$C_{10}H_{21}COOH$	....	42.9
Urethane	$NH_2COOC_2H_5$	49.7	40.9
Veratrole	$C_6H_4(OCH_3)_2$ (1, 2)	22.5	27.5
o-Xylene	$C_6H_4(CH_3)_2$	−27	29.3
m-Xylene	$C_6H_4(CH_3)_2$	−53.5	25.8
p-Xylene	$C_6H_4(CH_3)_2$	13.2	38.1

HEAT OF VAPORIZATION OF COMPOUNDS

For elements see special table.

The heat of vaporization (ΔHv) is given in gram-calories (15°) per gram. To convert to: (*a*) joules (abs) per gram multiply by 4.185; (*b*) joules (int) per gram multiply by 4.183; (*c*) btu per pound multiply by 1.8.

Name	Formula	*t*, °C	ΔHv
Acetal	$C_6H_{14}O_2$	102.9	66.2
Acetaldehyde	CH_3CHO	21	136.2
Acetic acid	CH_3CO_2H	118.3	96.8
...	...	140	94.4
...	...	220	81.2
...	...	321.6	0
anhydride	$(CH_3CO)_2O$	137	66.2
Acetone	$(CH_3)_2CO$	0	134.7
...	...	20	131.9
...	...	40	128.1
...	...	56.1	124.5
...	...	80	118.3
...	...	100	112.8
...	...	235	0
Acetonitrile	CH_3CN	80	173.7
Acetophenone	$C_6H_5COCH_3$	203.7	77.2
Acetyl chloride	CH_3COCl	51	78.9
Air	...	...	50.97
Allyl alcohol	C_3H_5OH	96	163
Aluminum bromide	$AlBr_3$	256.4	20.5
chloride	$AlCl_3$	180.2	100.3*
iodide	AlI_3	385.5	18.83
Ammonia†	NH_3	−33.4	327.1
...	...	−20	317.6
...	...	−10	309.7
...	...	0	301.6
...	...	17	296.5
...	...	40	263.1
...	...	55	245.1
Ammonium chloride	NH_4Cl	350	70.9
Amyl alcohol (***n***)	$C_5H_{11}OH$	131	120.2
alcohol (***t***)	$C_5H_{11}OH$	102	105.8
amine (***n***)	$C_5H_{11}NH_2$	95	98.7
bromide (***n***)	$C_5H_{11}Br$	129	48.3
ether (***n***)	$(C_5H_{11})_2O$	170	69.5
iodide (***n***)	$C_5H_{11}I$	155	47.6
Anethole (***p***)	$C_3H_5C_6H_4OCH_3$	232	71.4
Aniline	$C_6H_5NH_2$	183	103.7
Antimony trichloride	$SbCl_3$	219	45.4
trioxide	Sb_2O_3	1425	30.6
Arsenic trichloride	$AsCl_3$	122	41.8
trioxide	As_2O_3	457.2	36.1
Benzaldehyde	C_6H_5CHO	179	86.5
Benzene	C_6H_6	0	107.0
...	...	25	103.6
...	...	40	100.7
...	...	60	97.5
...	...	80.1	94.14
...	...	100	90.6
...	...	120	86.5
...	...	140	82.6
...	...	160	78.5

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* Heat of sublimation for solid to gas.

† See also special table.

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	*t*, °C	ΔHv
Benzene	C_6H_6	220	62.1
		260	43.8
		288.5	0
Benzonitrile	C_6H_5CN	189	87.7
Benzyl alcohol	$C_6H_5CH_2OH$	204.3	112.3
Bismuth bromide	$BiBr_3$	461	40.2
chloride	$BiCl_3$	441	55.0
Boron bromide	BBr_3	91.3	29.1
chloride	BCl_3	10	38.2
fluoride	BF_3	−100.9	68.1
hydride	B_2H_6	−92.4	133.1
hydride	B_3H_{10}	16	152.1
hydride	B_5H_9	58	121.9
hydride	B_5H_{11}	67	130.4
Bromobenzene	C_6H_5Br	155.9	57.6
Butanes:			
n-butane	C_4H_{10}	−0.50	92.09
		10	89.8
		25	86.6
iso-butane	C_4H_{10}	−11.72	87.56
		0	85.1
		10	82.4
		25	78.6
Butenes:			
1-butene	C_4H_8	−6.25	93.36
		25	86.8
cis-2-butene	C_4H_8	3.72	99.46
		25	86.8
trans-2-butene	C_4H_8	0.88	96.94
		25	91.8
iso-butene	C_4H_8	−6.90	94.22
		25	87.7
n-Butyl acetate	$CH_3CO_2C_4H_9$	124.0	73.8
alcohol	C_4H_9OH	116.8	141.3
formate	$HCO_2C_4H_9$	105.1	86.8
iodide	C_4H_9I	129.5	45.9
sec-Butyl alcohol	C_4H_9OH	98.1	134
tert-Butyl alcohol	C_4H_9OH	83	130.5
iso-Butyl acetate	$CH_3CO_2C_4H_9$	115.5	73.8
alcohol	C_4H_9OH	106.9	138.1
n-butyrate	$C_3H_7CO_2C_4H_9$	157	64.5
iso-butyrate	$C_3H_7CO_2C_4H_9$	148	63.3
formate	$HCO_2C_4H_9$	97	78.5
propionate	$C_2H_5CO_2C_4H_9$	137	65.9
n-valerate	$C_4H_9CO_2C_4H_9$	169	57.8
iso-valerate	$C_4H_9CO_2C_4H_9$	169	60.5
n-Butyric acid	$C_3H_7CO_2H$	163.5	114.0
nitrile	C_3H_7CN	117.4	114.9
iso-Butyric acid	$C_3H_7CO_2H$	154	111.6
Cadmium chloride	$CdCl_2$	967	162.9
iodide	CdI_2	796	69.3
oxide	CdO	1559	41.9*
Capronitrile	$C_5H_{11}CN$	156	88.2
Carbon dioxide	CO_2	−60	87.2
		−50	83.4
		−40	79.6

* Heat of sublimation for solid to gas.

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	t, °C	ΔHv
Carbon dioxide	CO_2	−30	71.4
....	....	−20	66.9
....	....	−10	61.4
....	....	0	55.0
....	....	10	46.6
....	....	20	35.1
....	....	30	11.9
disulfide	CS_2	0	89.4
....	....	46.3	84.1
....	....	100	75.5
....	....	140	67.4
monoxide	CO	−192	50.4
oxychloride	$COCl_2$	8.0	60.6
oxysulfide	COS	−50.2	73.6
tetrachloride	CCl_4	0	52.1
tetrafluoride	CF_4	−127.9	35.3
Carvacrol	$C_{10}H_{13}OH$	237	68.1
Cesium bromide	$CsBr$	1300	172.7
chloride	$CsCl$	1303	222.1
fluoride	CsF	1251	228.4
iodide	CsI	1280	140.9
Chloral	CCl_3CHO	......	54
hydrate	$CCl_3CH(OH)_2$	96	131.9
Chlorine dioxide	ClO_2	10.9	105.2
fluoride	ClF_3	11.3	63.7
heptoxide	Cl_2O_7	79	46.4
monoxide	Cl_2O	2.0	72.3
Chlorobenzene	C_6H_5Cl	130.6	77.6
β-Chloroethyl acetate	$CH_3CO_2C_2H_4Cl$	141.5	80.8
alcohol	ClC_2H_4OH	126.5	122.9
Chloroform	$CHCl_3$	0	64.7
....	....	40	60.9
....	....	61.5	59.0
....	....	100	55.2
....	....	263	0
Chlorosulfonic acid	$ClSO_3H$	151	110.2
Chlorotoluene (*o*)	$ClC_6H_4CH_3$	158.1	72.6
(*p*)	$ClC_6H_4CH_3$	160.4	73.1
Chromyl chloride	CrO_2Cl_2	117	53.3
Cobalt chloride	$CoCl_2$	1050	209.2
Cresol (*m*)	$CH_3C_6H_4OH$	202	100.6
Cyanogen	$(CN)_2$	0	103
chloride	$CNCl$	13	135
fluoride	CNF	−72.8	128.4*
iodide	CNI	141	91.4*
Cyclopentane	C_5H_{10}	25	97.1
Cyclohexane	C_6H_{12}	25	93.8
....	....	80.7	85.6
Cyclohexanol	$C_6H_{11}OH$	161.6	108.2
Cyclohexene	C_6H_{10}	81.6	88.7
Cyclohexyl chloride	$C_6H_{11}Cl$	142	74.8
Cymene (*p*)	$C_3H_7C_6H_4CH_3$	176	67.6
n-Decane	$C_{10}H_{22}$	160	60.2
Dichloroacetic acid	Cl_2CHCO_2H	194.4	77.2
Dichlorodifluoromethane	CCl_2F_2	−29.8	40.4
Diethyl amine	$(C_2H_5)_2NH$	58	91.0

* Heat of sublimation for solid to gas.

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	t, °C	ΔHv
Diethyl carbonate	$(C_2H_5)_2CO_3$	126	73.1
ketone	$(C_2H_5)_2CO$	101	90.8
oxalate	$(CO_2C_2H_5)_2$	185	67.6
Dibutylamine (***iso***)	$(C_4H_9)_2NH$	134	65.7
Dimethyl aniline	$C_6H_5N(CH_3)_2$	193	80.8
carbonate	$(CH_3)_2CO_3$	90	88.2
Dimethylcyclohexane (1,1)	C_8H_{16}	25	80.9
....	....	119.5	70.7
(1,2) (cis)	C_8H_{16}	25	84.6
....	....	129.7	72.9
(1,2) (trans)	C_8H_{16}	25	81.7
....	....	123.4	71.1
(1,3) (cis)	C_8H_{16}	25	83.5
....	....	124.5	72.1
(1,3) (trans;	C_8H_{16}	25	81.4
....	....	120.1	70.9
(1,4) (cis)	C_8H_{16}	25	83.1
....	....	124.3	71.9
(1,4) (trans)	C_8H_{16}	25	80.7
....	....	119.4	70.4
Dimethylcyclopentane (1,1)	C_7H_{14}	25	82.5
....	....	87.5	74.6
(1,2) (cis)	C_7H_{14}	25	86.4
....	....	99.3	77.0
(1,2) (trans)	C_7H_{14}	25	83.9
....	....	91.9	75.5
(1,3) (cis)	C_7H_{14}	......	......
....	....	......	......
(1,3) (trans)	C_7H_{14}	25	83.6
....	....	90.8	75.3
Dipropylamine (***n***)	$(C_3H_7)_2NH$	108	75.7
Ethane	C_2H_6	−88.9	116.9
....	....	−40	97.5
....	....	−20	87.0
....	....	0	75.0
Ethyl acetate	$CH_3CO_2C_2H_5$	0	102.0
alcohol	C_2H_5OH	78.3	204.3
amine	$C_2H_5NH_2$	15	14.6
benzene	$C_6H_5C_2H_5$	25	95.1
....	....	136.2	81.0
benzoate	$C_6H_5CO_2C_2H_5$	213	64.5
bromide	C_2H_5Br	38.4	59.9
n-butyrate	$C_3H_7CO_2C_2H_5$	118.4	74.7
caprylate	$C_7H_{15}CO_2C_2H_5$	207	60.5
chloride	C_2H_5Cl	4.7	92.9
....	....	15	92.5
....	....	20	92.2
....	....	25	92.0
cyclohexane	C_8H_{16}	25	86.2
....	....	131.8	73.9
cyclopentane	C_7H_{14}	25	88.6
....	....	103.5	78.3
ether	$(C_2H_5)_2O$	34.6	83.9
formate	$HCO_2C_2H_5$	53.3	97.2
iodide	C_2H_5I	71.2	45.6
nonylate	$C_8H_{17}CO_2C_2H_5$	227	58.1

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	t, °C	$\Delta H v$
Ethyl propionate	$C_2H_5CO_2C_2H_5$	97.6	80.1
n-propyl ether	$C_2H_5OC_3H_7$	60.0	82.7
n-valerate	$C_4H_9CO_2C_2H_5$	98	77.2
iso-valerate	$C_4H_9CO_2C_2H_5$	144	67.9
Ethylene	C_2H_4	−103.7	115.4
bromide	$(CH_2Br)_2$	130.8	46.2
chloride	$(CH_2Cl)_2$	0	85.3
....	....	82.3	77.3
chlorohydrin	$ClCH_2CH_2OH$	126.5	123.9
glycol	$(CH_2OH)_2$	197	191.1
oxide	$(CH_2)_2O$	13	138.6
Ethylidene chloride	CH_3CHCl_2	0	76.7
....	....	60	67.1
Fluorine oxide	F_2O	−144.8	49.1
Formic acid	HCO_2H	101	119.9
Furane	$(CH)_4O$	31	95.3
Furfural	C_4H_3OCHO	160.5	107.5
Germanium bromide	$GeBr_4$	189	21.8
chloride	$GeCl_4$	84	32.8
hydride	GeH_4	−89.1	46.7
....	Ge_2H_6	31.4	39.0
....	Ge_3H_8	110.6	33.4
tetramethyl	$Ge(CH_3)_4$	44	48.7
Heptanes:			
n-heptane	C_7H_{16}	25	87.2
....	....	98.4	76.5
2-Me-hexane	C_7H_{16}	25	83.0
....	....	90.1	73.4
3-Me-hexane	C_7H_{16}	25	83.7
....	....	92	74.1
3-Et-pentane	C_7H_{16}	25	84.0
....	....	93.5	74.3
2,2-DiMe-pentane	C_7H_{16}	25	77.4
....	....	79.2	69.7
2,3-DiMe-pentane	C_7H_{16}	25	81.7
....	....	89.8	72.9
2,4-DiMe-pentane	C_7H_{16}	25	78.4
....	....	80.5	70.9
3,3-DiMe-pentane	C_7H_{16}	25	78.8
....	....	86.1	70.6
2,2,3-TriMe-butane	C_7H_{16}	25	76.4
....	....	80.9	69.3
Heptyl alcohol (*n*)	$C_7H_{15}OH$	176	104.9
Hexanes:			
n-hexane	C_6H_{14}	0	89.1
....	....	25	87.5
....	....	68.7	80.5
2-Me-pentane	C_6H_{14}	25	82.8
....	....	60.3	76.9
3-Me-pentane	C_6H_{14}	25	84.0
....	....	63.3	78.4
2,2-DiMe-butane	C_5H_{14}	25	76.8
....	....	49.7	73.8
2,3-DiMe-butane	C_6H_{14}	25	80.8
....	....	58.0	76.5
Hexene	C_6H_{12}	0	92.8

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	*t*, °C	ΔHv
Hydrogen bromide	HBr	−66.7	52.0
chloride	HCl	−85	105.9
cyanide	HCN	20	210.2
fluoride	HF	19.4	360
iodide	HI	−37.2	33.9
peroxide	H_2O_2	158	302.1
selenide	H_2Se	−41.3	60.1
sulfide	H_2S	−61.4	131.9
telluride	H_2Te	−2.2	43.6
Iodine fluoride	IF_7	4	28.7*
Iron carbonyl	$Fe(CO)_5$	105	45.9
chloride (ous)	$FeCl_2$	1026	236.7
Lead bromide	$PbBr_2$	916	76.8
chloride	$PbCl_2$	954	106.4
fluoride	PbF_2	1292	160.7
iodide	PbI_2	872	53.9
oxide	PbO	1472	229.9
Limonene	$C_{10}H_{16}$	165	69.5
Lithium bromide	$LiBr$	1310	410.1
chloride	$LiCl$	1382	876.4
fluoride	LiF	1681	1967.9
iodide	LiI	1171	304.5
Magnesium chloride	$MgCl_2$	1418	343.4
Manganese chloride	$MnCl_2$	1190	235.5
Mercuric bromide	$HgBr_2$	319	39.1
chloride	$HgCl_2$	304	51.9
iodide	HgI_2	354	31.4
Mesityl oxide	$C_6H_{10}O$	128	85.8
Methane	CH_4	−161.6	121.9
Methyl acetate	$CH_3CO_2CH_3$	0	114.0
....	....	56.3	98.1
alcohol	CH_3OH	0	284.3
....	....	64.7	262.8
n-amyl ketone	$CH_3COC_5H_{11}$	149.2	82.7
aniline	$C_6H_5NHCH_3$	194	95.6
n-butyl ketone	$CH_3COC_4H_9$	127	82.4
n-butyrate	$C_3H_7CO_2CH_3$	102.6	79.8
iso-butyrate	$C_3H_7CO_2CH_3$	91.1	78.1
chloride	CH_3Cl	−23.8	102.3
....	....	15	96.0
....	....	25	94.6
cyclohexane	C_7H_{14}	25	86.1
....	....	100.9	76.9
cyclopentane	C_6H_{12}	25	89.8
....	....	71.8	83.2
2-Et-benzene (1)	C_9H_{12}	25	94.9
....	....	165.2	77.3
3-Et-benzene (1)	C_9H_{12}	25	93.3
....	....	161.3	76.6
4-Et-benzene (1)	C_9H_{12}	25	92.7
....	....	162.1	76.4
ethyl ketone	$CH_3COC_2H_5$	78.2	106.0
ethyl ketoxime	C_4H_8NOH	182	115.9
formate	HCO_2CH_3	31.3	112.4
hexyl ketone	$CH_3COC_6H_{13}$	173	74.1
iodide	CH_3I	42	45.9

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* Heat of sublimation for solid to gas.

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	t, °C	ΔHv
Methyl phenyl ether	$CH_3OC_6H_5$	153	81.5
propionate	$C_2H_5CO_2CH_3$	79.0	87.6
iso-propyl ketone	$CH_3COC_3H_7$	92	89.8
n-valerate	$C_4H_9CO_2CH_3$	116	70.0
iso-valerate	$C_4H_9CO_2CH_3$	116	72.4
Methylal	$C_3H_8O_2$	42	89.8
Methylene chloride	CH_2Cl_2	40.5	78.6
Molybdenum fluoride	MoF_6	36	28.6
Naphthalene	$C_{10}H_8$	218	75.5
Nickel carbonyl	$Ni(CO)_4$	42.5	41.0
chloride	$NiCl_2$	987	373.2[*]
Nitric acid	HNO_3	86.0	114.9
oxide	NO	−151.7	110.2
Nitrobenzene	$C_6H_5NO_2$	210	79.1
Nitromethane	CH_3NO_2	99.9	135.0
Nitrogen fluoride	NF_3	−129.0	42.3
oxychloride	$NOCl$	−6.4	93.7
pentoxide	N_2O_5	50	44.8
Nitrous oxide	N_2O	−88.5	89.8
....	....	−20	66.9
....	....	0	59.7
....	....	20	43.7
....	....	35	13.5
Nonanes:			
n-nonane	C_9H_{20}	25	86.5
....	....	150.8	70.4
2-Me-octane	C_9H_{20}	25	83.2
....	....	143.3	68.3
3-Me-octane	C_9H_{20}	25	83.4
....	....	144.8	68.5
4-Me-octane	C_9H_{20}	25	83.4
....	....	142.5	68.2
3-Et-heptane	C_9H_{20}	25	83.5
....	....	143	68.5
4-Et-heptane	C_9H_{20}	25	83.5
....	....	142	68.3
2,2-DiMe-heptane	C_9H_{20}	25	78.8
....	....	130.5	64.8
2,3-DiMe-heptane	C_9H_{20}	25	81.6
....	....	140.7	67.3
2,4-DiMe-heptane	C_9H_{20}	25	79.9
....	....	133	65.9
2,5-DiMe-heptane	C_9H_{20}	25	79.9
....	....	136	66.4
2,6-DiMe-heptane	C_9H_{20}	25	79.8
....	....	135.2	66.2
3,3-DiMe-heptane	C_9H_{20}	25	79.5
....	....	137.3	65.8
3,4-DiMe-heptane	C_9H_{20}	25	81.7
....	....	143	67.8
3,5-DiMe-heptane	C_9H_{20}	25	80.1
....	....	136	66.4
4,4-DiMe-heptane	C_9H_{20}	25	79.5
....	....	138	65.9
2-Me-3-Et-hexane	C_9H_{20}	25	81.7
....	....	139	67.1

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[*] Heat of sublimation for solid to gas.

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	t, °C	ΔHv
2-Me-4-Et-hexane	C_9H_{20}	25	80.1
...	...	136	66.4
3-Me-3-Et-hexane	C_9H_{20}	25	80.2
...	...	143	66.6
3-Me-4-Et-hexane	C_9H_{20}	25	81.9
...	...	143	67.8
2,3,3-TriMe-hexane	C_9H_{20}	25	78.1
...	...	134	64.8
2,2,4-Tri-Me-hexane	C_9H_{20}	25	75.6
...	...	126.5	63.4
2,2,5-TriMe-hexane	C_9H_{20}	25	74.9
...	...	124.1	62.9
2,3,3-TriMe-hexane	C_9H_{20}	25	78.7
...	...	138	65.2
2,3,4-TriMe-hexane	C_9H_{20}	25	80.0
...	...	140	66.5
2,3,5-TriMe-hexane	C_9H_{20}	25	77.2
...	...	131.4	64.9
2,2,4-TriMe-hexane	C_9H_{20}	25	76.1
...	...	131	63.9
3,3,4-TriMe-hexane	C_9H_{20}	25	78.8
...	...	139	65.5
3,3-DiEt-pentane	C_9H_{20}	25	80.8
...	...	146.5	67.1
2,2-DiMe-3-Et-pentane	C_9H_{20}	25	78.3
...	...	133.8	64.9
2,3-DiMe-3-Et-pentane	C_9H_{20}	25	79.3
...	...	142	65.8
2,4-DiMe-3-Et-pentane	C_9H_{20}	25	80.0
...	...	136.7	66.0
2,2,3,3-TetraMe-pentane	C_9H_{20}	25	76.4
...	...	140.2	65.7
2,2,3,4-TetraMe-pentane	C_9H_{20}	25	76.4
...	...	133.0	63.9
2,2,4,4-TetraMe-pentane	C_9H_{20}	25	71.0
...	...	122.3	61.2
2,3,3,4-TetraMe-pentane	C_9H_{20}	25	77.8
...	...	141.5	65.1
Octanes:			
n-octane	C_8H_{18}	25	86.8
...	...	125.7	73.2
2-Me-heptane	C_8H_{18}	25	83.0
...	...	117.6	70.3
3-Me-heptane	C_8H_{18}	25	83.4
...	...	118.9	71.3
4-Me-heptane	C_8H_{18}	25	83.0
...	...	117.7	70.9
3-Et-hexane	C_8H_{18}	25	83.0
...	...	118.5	71.7
2,2-DiMe-hexane	C_8H_{18}	25	78.0
...	...	106.8	67.7
2,3-DiMe-hexane	C_8H_{18}	25	81.2
...	...	115.6	70.2
2,4-DiMe-hexane	C_8H_{18}	25	79.0
...	...	109.4	68.5
2,5-DiMe-hexane	C_8H_{18}	25	79.2

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	*t*, °C	ΔH_v
2,5-DiMe-hexane	....	109.1	68.6
3,3-DiMe-hexane	C_8H_{18}	25	78.5
....	....	112.0	68.5
3,4-DiMe-hexane	C_8H_{18}	25	81.6
....	....	117.7	70.2
2-Me-3-Et-pentane	C_8H_{18}	25	80.6
....	....	115.7	69.7
3-Me-3-Et-pentane	C_8H_{18}	25	79.5
....	....	118.3	69.3
2,2,3-TriMe-pentane	C_8H_{18}	25	77.2
....	....	109.8	67.3
2,2,4-TriMe-pentane	C_8H_{18}	25	73.5
....	....	99.2	64.9
2,3,3-TriMe-pentane	C_8H_{18}	25	77.9
....	....	114.8	68.1
2,3,4-TriMe-pentane	C_8H_{18}	25	78.9
....	....	113.5	68.4
2,2,3,3-TetraMe-butane	C_8H_{18}	25	89.6*
....	....	106.3	66.2
Octyl alcohol (*n*)	$C_8H_{17}OH$	196	97.5
alcohol (*sec*) (*dl*)	$C_8H_{17}OH$	180	94.4
Osmium tetroxide	OsO_4	130	37.2
Pentanes:			
n-pentane	C_5H_{12}	25	87.5
....	....	36.1	85.4
iso-pentane	C_5H_{12}	25	81.5
....	....	27.9	81.0
2,2-DiMe-propane	C_5H_{12}	9.5	75.4
....	....	25	72.2
Phosphine	PH_3	−87.7	102.6*
Phosphorus oxychloride	$POCl_3$	105.1	54.6
pentoxide	P_2O_5	591	72.8
trichloride	PCl_3	78	51.4
trioxide	P_2O_3	174	47.2
Picoline (*α*)	$C_5H_4NCH_3$	129	90.8
Piperidine	$C_5H_{11}N$	106	89.4
Potassium bromide	KBr	1376	321.0
chloride	KCl	1417	542
fluoride	KF	1505	721.2
hydroxide	KOH	1324	579.3
iodide	KI	1330	224.1
Propane	C_3H_8	−42.1	101.8
....	....	−20	95.3
....	....	0	89.6
....	....	20	83.4
Propionic acid	$C_2H_5CO_2H$	139.4	98.8
Propionitrile	C_2H_5CN	97	134.3
n-Propyl acetate	$CH_3CO_2C_3H_7$	100.4	80.3
alcohol	C_3H_7OH	97.2	164.4
benzene	$C_6H_5C_3H_7$	25	91.9
....	....	159.2	76.0
n-butyrate	$C_3H_7CO_2C_3H_7$	143.6	68.3
iso-butyrate	$C_3H_7CO_2C_3H_7$	134	63.8
formate	$HCO_2C_3H_7$	80	88.1
propionate	$C_2H_5CO_2C_3H_7$	120.6	74.9
iso-valerate	$C_4H_9CO_2C_3H_7$	156	64.5

* Heat of sublimation for solid to gas.

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	t, °C	ΔHv
iso-Propyl alcohol	C_3H_7OH	82.3	159.4
benzene (cumene)	$C_6H_5C_3H_7$	25	89.8
....	....	152.4	74.6
Propylene	C_3H_6	−47.7	104.6
Pyridine	C_5H_5N	114.1	107.4
Rhenium heptoxide	Re_2O_7	362.4	372.7
Rubidium bromide	$RbBr$	1352	224.4
chloride	$RbCl$	1381	305.3
fluoride	RbF	1408	378.1
iodide	RbI	1304	169.3
Salicylaldehyde	C_6H_5OCHO	196	74.8
Selenium oxide	SeO_2	317	188.3*
Silicochloroform	$SiHCl_3$	31.8	47.0
Silicon bromohydride	SiH_3Br	2.4	50.9
chlorotrifluoride	SiF_3Cl	−70.1	37.0
dibromohydride	SiH_2Br_2	70.5	36.0
dichlorodifluoride	SiF_2Cl_2	−31.5	37.1
hydride (silane)	SiH_4	−111.6	92.2
hydride (silicoethane)	Si_2H_6	−14.3	82.2
hydride (trisilane)	Si_3H_8	53.1	73.5
hydride (tetrasilane)	Si_4H_{10}	100	72.7
oxychloride	Si_2OCl_6	135.6	31.0
tetrachloride	$SiCl_4$	57	36.1
tetrafluoride	SiF_4	−94.8	58.9*
trifluoride	Si_2F_6	−18.9	61.1*
Silver chloride	$AgCl$	1564	296.7
iodide	AgI	1506	146.7
Sodium bromide	$NaBr$	1392	368.8
chloride	$NaCl$	1465	697.6
cyanide	$NaCN$	1500	760.8
fluoride	NaF	1704	1268.1
hydroxide	$NaOH$	1388	787.5
iodide	NaI	1300	262.8
Sulfur chloride	S_2Cl_2	138	49.5
dioxide	SO_2	−10.8	94.9
....	....	0	91.3
....	....	10	87.7
....	....	20	84.1
....	....	30	80.8
....	....	40	71.2
....	....	50	73.8
....	....	60	70.3
hexafluoride	SF_6	−63.5	38.3*
pentoxy dichloride	$SO_3 \cdot SO_2Cl_2$	140	61.2
trioxide	SO_3	53	118.5
Sulfuric acid	H_2SO_4	326	122.1
Sulfuryl chloride	SO_2Cl_2	69.1	49.4
Tetrachloroethane	$(CHCl_2)_2$	145.0	55.1
Tetrachloroethylene	$(CCl_2)_2$	120.7	50.1
Tellurium hexafluoride	TeF_6	−38.6	27.7*
tetrachloride	$TeCl_4$	392	62.5
Thallium bromide	$TlBr$	819	83.7
chloride	$TlCl$	807	101.8
iodide	TlI	823	75.6
Thionyl bromide	$SOBr_2$	139.5	47.7
chloride	$SOCl_2$	82	54.5

* Heat of sublimation for solid to gas.

HEAT OF VAPORIZATION OF COMPOUNDS

Name	Formula	t, °C	ΔH_v
Tin chloride (ous)	$SnCl_2$	623	109.4
chloride (ic)	$SnCl_4$	100	31.8
		110	31.2
		120	30.5
		200	24.6
		280	15.6
hydride	SnH_4	−52.3	36.0
tetramethyl	$Sn(CH_3)_4$	78.3	40.9
Titanium tetrachloride	$TiCl_4$	136	44.0
Toluene	$C_6H_5CH_3$	25	98.6
		110.6	86.8
Toluidine (***o***)	$C_7H_7NH_2$	198	95.1
Trichloroethylene	C_2HCl_3	85.7	57.3
TriMe-benzene (1,2,3)	$C_6H_3(CH_3)_3$	25	97.6
		176.2	79.6
(1,2,4) (pseudocumene)	$C_6H_3(CH_3)_3$	25	95.3
		169.3	78.0
(1,3,5) (mesitylene)	$C_6H_3(CH_3)_3$	25	94.4
		164.7	77.6
Tungsten fluoride	WF_6	17.3	21.3
Turpentine	$C_{10}H_{16}$	156	68.6
Uranium hexafluoride	UF_6	55.1	28.4*
Valeric acid (***n***)	$C_4H_9CO_2H$	184.6	103.2
acid (***iso***)	$C_4H_9CO_2H$	176.3	101.1
Valeronitrile (***n***)	C_4H_9CN	129	96.3
Water†	H_2O	0	595.9
		10	590.4
		20	584.9
		30	579.5
		40	574.0
		50	568.5
		60	563.2
		70	557.5
		80	551.5
		90	545.8
		100	539.55
		110	532.9
		120	525.7
		130	518.5
		140	511.1
		150	503.5
		160	495.6
		170	487.2
		180	478.6
Water, heavy	D_2O	101.4	496.5
Xylene (***o***)	$C_6H_4(CH_3)_2$	25	97.8
		144.4	82.9
(***m***)	$C_6H_4(CH_3)_2$	25	96.0
		139.1	82.0
(***p***)	$C_6H_4(CH_3)_2$	25	95.4
		138.4	81.2
Zinc chloride	$ZnCl_2$	732	210.6
diethyl	$Zn(C_2H_5)_2$	118	72.6
Zirconium bromide	$ZrBr_4$	357	62.8*
chloride	$ZrCl_4$	311	108.5*
iodide	ZrI_4	431	48.5*

* Heat of sublimation for solid to gas.

† See also steam table.

LOGARITHM OF EQUILIBRIUM CONSTANT, $\log_{10} K$

Source: Table Oy, American Petroleum Institute Research Project 44, at Natl. Bu. Stand., Washington, D. C.

1. K_f for formation from the elements; e.g., in the formation of water: $H_2+\frac{1}{2}O_2 \rightarrow H_2O$; $K_f=(H_2O)/(H_2)(\sqrt{O_2})$.
2. K_p for the combustion gas reactions where CO or CO_2 are formed:

(a) $C+H_2O \rightarrow CO+H_2$
(b) $CO_2+C \rightarrow 2CO$
(c) $CO+H_2O \rightarrow CO_2+H_2$
(d) $C+2H_2O \rightarrow CO_2+2H_2$
(e) $CO+\frac{1}{2}O_2 \rightarrow CO_2$

For example, in equation *a*, $K_f=(CO)(H_2)/(C)(H_2O)$; thus, at 900°K, $K_p=\log K_f(CO)+\log K_f(H_2)-\log K_f(C)-\log K_f(H_2O)$ $=11.1254+0-0-11.4978= -0.3724$

$\log_{10} K_f$ represents the logarithm (to the base 10) of the equilibrium constant for the reaction of forming the given compound in the gaseous state from the elements with all the reactants and products in the gaseous state and at the temperature indicated. $\log_{10} K_f= -\Delta Ff°/2.302585\ RT= -\Delta Ff°/0.004575651\ T$; $\Delta Ff°$ in kcal/mole, T in °K.

The value of $\log_{10} K_f$ at all temperatures for the elements hydrogen, nitrogen, oxygen (all in gaseous state) and for carbon (as solid graphite) is zero. For all substances listed in the table the value of $\log_{10} K_f$ at 0°K is infinite. Interpolation to other temperatures in the interval 298.16° to 1500°K may be made by appropriate graphical or analytical methods. For temperatures below 298.16°K, values may be estimated by extrapolating to lower temperatures the values for 298.16°, 500°, and 700°K.

The values in this table are given to more significant figures than are warranted by the absolute accuracy of the individual values in order to retain the internal consistency of the several thermodynamic functions of a single substance, and also to retain the significance of the increments with temperature of a given thermodynamic function.

Compound	log *K*						
	Temperature in °K						
	298.16°	500°	700°	900°	1100°	1300°	1500°
Water, H_2O	40.0470	22.8857	15.5834	11.4978	8.8830	7.0637	5.7256
Carbon monoxide, CO	24.0477	16.2526	12.9646	11.1254	9.9443	9.1174	8.5043
" " (*a*)	−15.9993	−6.6331	−2.6188	−0.3724	1.0613	2.0537	2.7787
" " (*b*)	−20.9961	−8.7528	−3.5737	−0.7155	1.0860	2.3185	3.2100
Carbon dioxide, CO_2	69.0915	41.2580	29.5029	22.9663	18.8026	15.9163	13.7986
" " (*c*)	4.9968	2.1197	0.9549	0.3431	−0.0247	−0.2648	−0.4313
" " (*d*)	−11.0025	−4.5134	−1.6639	−0.0293	1.0366	1.7889	2.3474
" " (*e*)	45.0438	25.0054	16.5383	11.8409	8.8583	6.7989	5.2943
Methane, CH_4	8.8985	3.4273	0.9529	−0.4881	−1.4345	−2.1006	−2.5923
Ethane, C_2H_6	5.7613	−0.5105	−3.4019	−5.1004	−6.2147	−6.9972	−7.5744
Propane, C_3H_8	4.1150	−3.5973	−7.1584	−9.2395	−10.5966	−11.5457	−12.2499

LOGARITHM OF EQUILIBRIUM CONSTANT, $\log_{10} K$

Compound	log K						
	Temperature in °K						
	298.16°	500°	700°	900°	1100°	1300°	1500°
Butanes, C_4H_{10}:							
n-Butane	2.7516	−6.4987	−10.7697	−13.2552	−14.8746	−16.0130	−16.8445
iso-Butane	3.1489	−6.5949	−11.0660	−13.6680	−15.3610	−16.5404	−17.4026
Pentanes, C_5H_{12}:							
n-Pentane	1.4366	−9.4282	−14.4304	−17.3406	−19.2342	−20.5603	−21.5270
iso-Pentane	2.5655	−8.8687	−14.1088	−17.1487	−19.1190	−20.4914	−21.4949
2,2-DiMe-propane	2.6681	−9.5680	−15.1298	−18.3313	−20.4005	−21.8346	−22.8747
Hexanes, C_6H_{14}:							
n-Hexane	−0.037	−12.440	−18.149	−21.466	−23.623	−25.130	−26.232
2-Me-pentane	0.704	−12.147	−18.071	−21.493	....	....	....
3-Me-pentane	0.213	−12.457	−18.302	−21.668	....	....	....
2,2-DiMe-butane	1.723	−11.933	−18.199	−21.784	....	....	....
2,3-DiMe-butane	0.535	−12.532	−18.539	−21.993	....	....	....
Heptanes, C_7H_{16}:							
n-Heptane	−1.532	−15.469	−21.880	−25.602	−28.018	−29.704	−30.944
2-Me-hexane	−0.718	−15.124	−21.752	−25.577	....	....	....
3-Me-hexane	−0.806	−15.036	−21.608	−25.398	....	....	....
3-Et-pentane	−1.898	−15.963	−22.498	−26.272	....	....	....
2,2-DiMe-pentane	−0.066	−15.277	−22.270	−26.269	....	....	....
2,3-DiMe-pentane	−0.117	−14.818	−21.618	−25.541	....	....	....
2,4-DiMe-pentane	−0.528	−15.421	−22.283	−26.223	....	....	....
3,3-DiMe-pentane	−0.462	−15.307	−22.142	−26.066	....	....	....
2,2,3-TriMe-butane	−0.557	−15.626	−22.554	−26.524	....	....	....
Octanes, C_8H_{18}:							
n-Octane	−3.035	−18.498	−25.611	−29.735	−32.413	−34.278	−35.654
2-Me-heptane	−2.243	−18.174	−25.486	−29.691	....	....	....
3-Me-heptane	−2.412	−18.139	−25.386	−29.548	....	....	....
4-Me-heptane	−2.932	−18.629	−25.876	−30.033	....	....	....
3-Et-hexane	−2.895	−18.529	−25.801	−29.970	....	....	....
2,2-DiMe-hexane	−1.876	−18.445	−26.063	−30.405	....	....	....
2,3-DiMe-hexane	−3.101	−18.865	−26.113	−30.264	....	....	....
2,4-DiMe-hexane	−2.052	−18.236	−25.701	−29.973	....	....	....

Compound	log *K*						
	Temperature in °K						
	298.16°	500°	700°	900°	1100°	1300°	1500°
Octanes (cont.):							
2,5-DiMe-hexane	−1.832	−18.249	−25.817	−30.160	....	....	....
3,3-DiMe-hexane	−2.324	−18.577	−26.060	−30.337	....	....	....
3,4-DiMe-hexane	−3.643	−19.350	−26.575	−30.716	....	....	....
2-Me-3-Et-pentane	−3.724	−19.337	−26.526	−30.648	....	....	....
3-Me-3-Et-pentane	−3.489	−19.363	−26.688	−30.852	....	....	....
2,2,3-TriMe-pentane	−2.998	−19.223	−26.707	−30.978	....	....	....
2,2,4-TriMe-pentane	−2.294	−18.804	−26.407	−30.745	....	....	....
2,3,3-TriMe-pentane	−3.313	−19.267	−26.632	−30.835	....	....	....
2,3,4-TriMe-pentane	−3.167	−19.184	−26.572	−30.801	....	....	....
2,2,3,3-TetraMe-butane	−3.577	−20.189	−27.777	−32.100	....	....	....
Ethene, C_2H_4	−11.9345	−8.4119	−7.0797	−6.3996	−5.9918	−5.7206	−5.5249
Propene, C_3H_6	−10.9685	−9.7870	−9.5156	−9.4490	−9.4391	−9.4426	−9.4455
Butenes, C_4H_8:							
1-Butene	−12.6199	−12.8637	−13.2403	−13.5442	−13.7707	−13.9358	−14.0537
cis-2-Butene	−11.7330	−12.5224	−13.1803	−13.6636	−14.0119	−14.2670	−14.4516
trans-2-Butene	−11.2316	−12.2872	−13.0314	−13.5553	−13.9273	−14.1950	−14.3898
2-Me-propene	−10.6826	−11.9996	−12.8344	−13.3989	−13.7940	−14.0782	−14.2836
Pentenes, C_5H_{10}:							
1-Pentene	−13.7704	−15.6377	−16.7617	−17.4898	−17.9911	−18.3556	−18.6070
cis-2-Pentene	−12.7574	−15.1876	−16.5825	−17.4833	−18.0971	−18.5415	−18.8518
trans-2-Pentene	−12.1495	−14.8045	−16.2717	−17.2066	−17.8393	−18.2874	−18.6119
2-Me-1-butene	−11.3680	−14.3451	−15.9408	−16.9409	−17.6130	−18.0943	−18.4355
3-Me-1-butene	−13.1017	−15.5156	−16.8408	−17.6825	−18.2545	−18.6621	−18.9408
2-Me-2-butene	−10.4572	−13.9086	−15.7414	−16.8936	−17.6701	−18.2218	−18.6222
Hexenes, C_6H_{12}:							
1-Hexene	−15.2491	−18.6647	−20.4918	−21.6299	−22.3959	−22.9410	−23.3230
cis-2-Hexene	−14.2249	−18.1511	−20.2382	−21.5337	....	....	....
trans-2-Hexene	−13.5291	−17.7155	−19.8900	−21.2278	....	....	....
cis-3-Hexene	−14.7494	−18.6730	−20.7418	−22.0259	....	....	....
trans-3-Hexene	−13.8262	−18.0179	−20.1803	−21.5110	....	....	....
2-Me-1-pentene	−12.8135	−17.2955	−19.5871	−20.9840	....	....	....

LOGARITHM OF EQUILIBRIUM CONSTANT, $\log_{10} K$

Compound	log *K*						
	Temperature in °K						
	298.16°	500°	700°	900°	1100°	1300°	1500°
Hexenes (cont.):							
3-Me-1-pentene	−14.8655	−18.5657	−20.4888	−21.6720	....	....	....
4-Me-1-pentene	−14.5865	−18.5063	−20.5432	−21.7932	....	....	....
2-Me-2-pentene	−12.1480	−17.0859	−19.5911	−21.1236	....	....	....
cis-3-Me-2-pentene	−12.6171	−17.3656	−19.7909	−21.2790	....	....	....
trans-3-Me-2-pentene	−12.6171	−17.3656	−19.7909	−21.2790	....	....	....
cis-4-Me-2-pentene	−13.8377	−18.2302	−20.4724	−21.8462	....	....	....
trans-4-Me-2-pentene	−13.0261	−17.6895	−20.0378	−21.4740	....	....	....
2-Et-1-butene	−13.5690	−17.8819	−20.1003	−21.4611	....	....	....
2,3-DiMe-1-butene	−12.7782	−17.5844	−19.9712	−21.4175	....	....	....
3,3-DiMe-1-butene	−13.9578	−18.5922	−20.9860	−22.3805	....	....	....
2,3-DiMe-2-butene	−12.1073	−17.3503	−20.0122	−21.6491	....	....	....
Acetylene, C_2H_2	−36.6490	−20.6290	−13.8925	−10.1702	−7.8158	−6.1956	−5.0134
Propyne, C_3H_4	−33.9469	−21.0781	−15.7228	−12.8007	−10.9660	−9.7072	−8.7879
1-**Butyne,** C_4H_6	−35.5616	−24.0341	−19.3627	−16.8427	−15.2680	−14.1910	−13.4030
2-**Butyne,** C_4H_6	−32.7823	−22.5629	−18.4752	−16.2932	−14.9409	−14.0186	−13.3462
1-**Pentyne,** C_5H_8	−36.7712	−26.8440	−22.9082	−20.8084	−19.5046	−18.6227	−17.9662
2-**Pentyne,** C_5H_8	−34.0177	−25.2377	−21.8297	−20.0457	−18.9519	−18.2095	−17.6668
3-**Me-1-butyne,** C_5H_8	−36.0061	−26.6495	−22.9486	−20.9810	−19.7622	−18.9315	−18.3115

HEAT OF COMBUSTION OF VARIOUS SUBSTANCES

In the table below, gaseous products of combustion are to be assumed unless otherwise stated. See special tables for foods, coals, gases, and organic compounds. To convert gram-calories per gram to B.T.U. per pound, multiply the values below by 1800.

Substance	kg.-cal. per gram
Asphalt	9.532
Castor oil	8.850
Cod liver oil	9.40
Cottonseed oil	9.40
Dynamite (75%)	1.29
Graphite	α 7.840; β 7.856
Guncotton	1.0563
Hemoglobin	5.89
Hydrogen (to H_2O, liq.)	34.18
Hydrogen (to H_2O, steam)	29.15
Linseed oil	9.41
Mining powder	0.5088
Paraffin	10.34
Paraffin oil	9.80

Substance	kg.-cal. per gram
Petroleum	10.30 to 10.33
Pitch	8.4
Rape-seed oil	9.45
Sawdust, pressed	4.065
Spermaceti	9.95
Sulfur, monoclinic (to SO_2)	2.241
Sulfur, rhombic (to SO_2)	2.221
Whale oil	9.47
Wood, beech (13% H_2O)	4.168
Wood, birch (11.8% H_2O)	4.207
Wood, oak (13.3% H_2O)	3.990
Wood, pine (12.2% H_2O)	4.422

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

(Kharasch, *Bu. Stand. Jour. Research*, Vol. 2, p. 359 (1929))

The heat of combustion is expressed in kilogram calories per gram formula weight of the compound as given in the table; the values are based upon a combustion at atmospheric pressure and at 20°C, the final combustion products consisting of liquid water, gaseous carbon dioxide and gaseous nitrogen. To convert to British Thermal Units (B.T.U.) multiply the value in kg-cal. by 3.9685.

Name	Formula	Physical state	Heat of combustion in kg. cal.
Acetaldehyde	CH_3CHO	liq.	279.0
Acetamide	CH_3CONH_2	solid	282.6
Acetanilide	$C_6H_5NHCOCH_3$	solid	1010.4
Acetic acid	CH_3COOH	liq.	209.4
Acetic anhydride	$(CH_3CO)_2O$	liq.	431.9
Acetone	CH_3COCH_3	liq.	426.8
Acetonitrile	CH_3CN	liq.	302.4
Acetophenone	$CH_3COC_6H_5$	solid	988.9
Acetylacetone	$CH_3COCH_2COCH_3$	liq.	615.9
Acetylene	C_2H_2	gas	312.0
Acrolein	$CH_2{:}CHCHO$	liq.	389.6
Acrylic acid	$CH_2{:}CHCOOH$	liq.	327.5
Adipic acid	$HOOC.(CH_2)_4.COOH$	solid	669.0
Alanine	$CH_3CH(NH_2)COOH$	solid	387.7
Aldol	$CH_3CHOHCH_2CHO$	liq.	546.6
Alizarin	$C_{14}H_6O_2(OH)_2-(1,2)$	solid	1448.9
Allylacetic acid	$C_3H_5.CH_2COOH$	liq.	641.6
Allyl alcohol	$CH_2{:}CHCH_2OH$	liq.	442.4
Allylamine	$CH_2{:}CHCH_2NH_2$	gas	528.1
Allyldiethyl carbinol	$C_3H_5(C_2H_5)_2COH$	liq.	1207
Allyldimethyl carbinol	$C_3H_5(CH_3)_2COH$	liq.	886.5
Allylene	$CH_3C{:}CH$	gas	465.1
p-Aminoazobenzene	$C_6H_5N_2C_6H_4NH_2$	solid	1574.0
p-Aminophenol	$HOC_6H_4NH_2$	solid	760.0
Amygdalin	$C_{20}H_{27}O_{11}N$	solid	2348.4

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
Amylacetate	$C_4H_9COOC_2H_5$	liq.	1042.5
Amyl alcohol (ferm.)	$C_4H_9.CH_2OH$	liq.	793.7
Amylpropargyl alcohol	$C_8H_{13}OH$	liq.	1192
Amylene	C_5H_{10}	liq.	803.4
Anethole	$C_{10}H_{12}O$	solid	1324.4
Angelic acid	$C_4H_7.COOH$	solid	634.8
Aniline	$C_6H_5NH_2$	liq.	811.7
p-Anisidine	$CH_3OC_6H_4NH_2$	solid	924.0
Anisole	$CH_3OC_6H_5$	liq.	905.1
Anthracene	$C_6H_4:(CH)_2:C_6H_4$	solid	1700.4
Anthraquinone	$C_6H_4:(CO)_2:C_6H_4$	solid	1544.5
Arabinose	$C_5H_{10}O_5$	solid	559.9
Arabitol	$C_5H_{12}O_5$	solid	661.2
Arachidic acid	$C_{20}H_{40}O_2$	solid	3025.9
Asparagine	$C_4H_8N_2O_3$	solid	463.3
Atropic acid	$CH_2:C(C_6H_5).COOH$	solid	1044
Azelaic acid	$(CH_2)_7(COOH)_2$	solid	1141.7
Azobenzene	$C_6H_5N:NC_6H_5$	solid	1555.2
Azoxybenzene	$(C_6H_5N)_2O$	solid	1534.5
Behenic acid	$C_{22}H_{44}O_2$	solid	3338.4
Benzalacetone	$CH_3COCH:CHC_6H_5$	solid	1257.4
Benzaldehyde	C_6H_5CHO	liq.	841.3
Benzamide	$C_6H_5CONH_2$	solid	847.6
Benzanilide	$C_6H_5CONHC_6H_5$	solid	1575.5
Benzene	C_6H_6	liq.	782.3
Benzenediazonium nitrate	$C_6H_5N_2NO_3$	solid	782.6
Benzidine	$NH_2C_6H_4.C_6H_4NH_2$	solid	1560.9
Benzil	$C_6H_5CO.COC_6H_5$	solid	1624.6
Benzilic acid	$C_{14}H_{12}O_3$	solid	1618
*Benzoic acid	C_6H_5COOH	solid	771.2
Benzoic anhydride	$(C_6H_5CO)_2O$	solid	1555.1
Benzoin	$C_6H_5COCHOHC_6H_5$	solid	1671.4
Benzonitrile	C_6H_5CN	liq.	865.5
Benzophenone	$C_6H_5COC_6H_5$	solid	1556.5
Benzoyl chloride	C_6H_5COCl	liq.	782.8
Benzoyl peroxide	$(C_6H_5CO)_2O_2$	solid	1551.7
Benzyl alcohol	$C_6H_5CH_2OH$	liq.	894.3
Benzyl amine	$C_6H_5CH_2NH_2$	liq.	969.4
Benzyl carbylamine	$C_6H_5CH_2NC$	liq.	1046.5
Benzyl chloride	$C_6H_5CH_2Cl$	liq.	886.4
Benzyl cyanide	$C_6H_5CH_2CN$	liq.	1023.5
Benzylethylamine	$C_6H_5CH_2NHC_2H_5$	liq.	1290
Bicyclohexane (0, 1, 3)	C_6H_{10}	liq.	912.5
Borneo camphene	$C_{10}H_{16}$	liq.	1470.2
Borneol	$C_{10}H_{18}O$	liq.	1469.6
Brucine	$C_{23}H_{26}O_4N_2$	solid	2933.0
n-Butyl alcohol	C_4H_9OH	liq.	638.6
tert.-Butyl alcohol	$(CH_3)_3COH$	liq.	629.3
n-Butylamine	$C_4H_9NH_2$	liq.	710.6
sec.-Butylamine	$(C_2H_5)(CH_3):CHNH_2$	liq.	713.0
tert.-Butylamine	$(CH_3)_3CNH_2$	liq.	716.0
tert.-Butyl benzene	$(CH_3)_3C.C_6H_5$	liq.	1400.4
n-Butyramide	$C_2H_5.CH_2CONH_2$	solid	596.0
n-Butyric acid	$C_2H_5.CH_2COOH$	liq.	524.3
n-Butyronitrile	$C_2H_5.CH_2CN$	liq.	613.3

* Accepted value by International Union of Pure and Applied Chemistry, Lyons, 1923.

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
Caffeine	$C_8H_{10}O_2N_4$	solid	1014.2
Camphene	$C_{10}H_{16}$	solid	1468.8
Camphor	$C_{10}H_{16}O$	solid	1411.0
Cane sugar	$C_{12}H_{22}O_{11}$	solid	1349.6
Capric acid	$C_{10}H_{20}O_2$	solid	1458.1
Caproic acid	$CH_3(CH_2)_4COOH$	liq.	831.0
Carbon disulfide	CS_2	liq.	246.6
Carbon tetrachloride	CCl_4	liq.	37.3
Carbonyl sulfide	COS	gas	130.5
Carvacrol	$C_{10}H_{13}OH$	liq.	1354.5
Cetyl alcohol	$C_{16}H_{33}OH$	solid	2504.5
Cetyl palmitate	$C_{15}H_{31}CO_2C_{16}H_{33}$	solid	4872.8
Chloroacetic acid	$CH_2Cl.COOH$	solid	171.0
o-Chlorobenzoic acid	$ClC_6H_4 \cdot COOH$	solid	734.5
Chloroform	$CHCl_3$	liq.	89.2
Chrysene	$C_{18}H_{12}$	solid	2139.1
Cinnamic acid (*trans*)	$C_6H_5CH:CHCOOH$	solid	1040.2
Cinnamic aldehyde	$C_6H_5CH:CHCHO$	liq.	1112.3
Cinnamic anhydride	$(C_6H_5CH:CHCO)_2O$	solid	2091.3
d-Citrene	$C_{10}H_{16}$	liq.	1473.0
Citric acid (anhydrous)	$H_3C_6H_5O_7$	solid	474.5
Codeine	$C_{18}H_{21}O_3N \cdot H_2O$	solid	2327.6
Coniine	$C_8H_{17}N$	liq.	1275.5
Creatine (anhydrous)	$C_4H_9O_2N_3$	solid	559.8
Creatinine	$C_4H_7ON_3$	solid	563.4
o-Cresol	$CH_3.C_6H_4OH$	solid	879.5
o-Cresol	$CH_3.C_6H_4OH$	liq.	882.6
m-Cresol	$CH_3.C_6H_4OH$	liq.	880.5
p-Cresol	$CH_3.C_6H_4OH$	solid	880.0
p-Cresol	$CH_3.C_6H_4OH$	liq.	882.5
m-Cresol methylether	$CH_3.C_6H_4OCH_3$	liq.	1057.0
Crotonaldehyde	$CH_3.CH:CHCHO$	liq.	542.1
Crotonic acid	$CH_3.CH:CHCOOH$	solid	477.7
Cyanacetic acid	$CH_2(CN).COOH$	solid	298.8
Cyanogen	$(CN)_2$	gas	258.3
Cyclobutyl carbinol	$C_4H_7.CH_2OH$	liq.	748
Cycloheptanol	$CH_2(CH_2)_5CHOH$	liq.	1050.2
Cyclohexanol	$CH_2(CH_2)_4CHOH$	liq.	890.7
Cycloheptene	C_7H_{12}	liq.	1049.9
Cycloheptane	$(CH_2)_7$	liq.	1087.3
Cyclohexane	$(CH_2)_6$	liq.	937.8
Cyclohexene	C_6H_{10}	liq.	891.9
Cyclopentane	$(CH_2)_5$	liq.	783.6
Cyclopropane	$(CH_2)_3$	gas	496.8
Cymene (*p*)	$CH_3.C_6H_4.C_3H_7$	liq.	1402.8
Decahydronaphthalene (*cis*)	$C_{10}H_{18}$	liq.	1502.5
Decahydronaphthalene (*trans*)	$C_{10}H_{18}$	liq.	1499.5
Decane	$C_{10}H_{22}$	liq.	1610.2
Dextrose	$C_6H_{12}O_6$	solid	673.0
Diallyl	$(CH_3CH:CH_2)_2$	vapor	903.4
Diamyl ether	$(C_5H_{11})_2O$	liq.	1609.3
Diamylene	$C_{10}H_{20}$	liq.	1582.2
Dibenzyl	$(C_6H_5CH_2)_2$	solid	1810.6

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
Dibenzylamine	$(C_6H_5CH_2)_2NH$	solid	1853.0
o-Dichlorobenzene	$C_6H_4Cl_2$	liq.	671.8
Diethylacetic acid	$(C_2H_5)_2CH.COOH$	liq.	830.8
Diethylamine	$(C_2H_5)_2NH$	liq.	716.9
Diethyl aniline	$C_6H_5N(C_2H_5)_2$	liq.	1451.6
Diethyl carbonate	$(C_2H_5O)_2CO$	liq.	647.9
Diethyl ether	$(C_2H_5)_2O$	liq.	651.7
Diethyl ketone	$(C_2H_5)_2CO$	liq.	735.6
Diethyl malonate	$CH_2(COOC_2H_5)_2$	liq.	860.4
Diethyl oxalate	$(COOC_2H_5)_2$	liq.	716.0
Diethyl succinate	$(CH_2COOC_2H_5)_2$	liq.	1007.3
Dihydrobenzene	C_6H_8	liq.	847.8
Δ_1-Dihydronaphthalene	$C_{10}H_{10}$	liq.	1296.3
Δ_1-Dihydronaphthalene	$C_{10}H_{10}$	solid	1298.3
Dihydroxyanthraquinone (1, 2)	$(HO)_2C_{14}H_6O_2$	solid	1448.9
Diisoamyl	$(C_5H_{11})_2$	liq.	1615.8
Diisobutylene	$(C_4H_8)_2$	liq.	1252.4
Diisopropyl	$(C_3H_7)_2$	vapor	993.9
Diisopropyl ketone	$(C_3H_7)_2CO$	liq.	1045.5
Dimethylamine	$(CH_3)_2NH$	liq.	416.7
Dimethyl aniline	$C_6H_5N(CH_3)_2$	liq.	1142.7
Dimethyl carbonate	$(CH_3O)_2CO$	liq.	340.8
Dimethyl ether	$(CH_3)_2O$	gas	347.6
Dimethylethyl carbinol	$(CH_3)_2C_2H_5COH$	liq.	784.6
Dimethyl fumarate	$(CHCOOCH_3)_2$	solid	664.3
Dimethyl hexane (2, 5)	C_8H_{18}	liq.	1303.3
Dimethyl hexane (3, 4)	C_8H_{18}	liq.	1303.7
Dimethyl maleate	$(CHCOOCH_3)_2$	solid	669.2
Dimethyl malonic acid	$(CH_3)_2C(COOH)_2$	solid	515.1
Dimethyl oxalate	$(COOCH_3)_2$	solid	401.9
Dimethyl pentane (2, 2)	C_7H_{16}	liq.	1148.9
Dimethyl pentane (2, 3)	C_7H_{16}	liq.	1148.9
Dimethyl pentane (2, 4)	C_7H_{16}	liq.	1148.9
Dimethyl pentane (3, 3)	C_7H_{16}	liq.	1147.9
Dimethyl phthalate	$C_6H_4(COOCH_3)_2$	liq.	1119.7
α, β-Dimethyl styrene	$C_{20}H_{16}$	solid	1357.2
Dimethyl succinate	$(CH_2COOCH_3)_2$	solid	703.3
m-Dinitrobenzene	$C_6H_4(NO_2)_2$	solid	696.8
Dinitrophenol (2, 4)	$(HO)C_6H_3(NO_2)_2$	solid	648.0
Dinitrotoluene (2, 4)	$CH_3.C_6H_3(NO_2)_2$	solid	852.8
Diphenyl	$C_6H_5.C_6H_5$	solid	1493.6
Diphenylamine	$(C_6H_5)_2NH$	solid	1536.2
Diphenyl carbinol	$(C_6H_5)_2CHOH$	solid	1615.4
Diphenyl methane	$(C_6H_5)_2CH_2$	solid	1655.0
Diphenylnitrosamine	$(C_6H_5)_2N.NO$	solid	1532.6
Diphenylstyrene	$C_{20}H_{16}$	solid	2496
Dipropargyl	$(CH{\vdots}C.CH_2)_2$	vapor	882.9
Dipropyl ketone	$(C_3H_7)_2CO$	liq.	1050.5
Dulcitol	$C_6H_{14}O_6$	solid	729.1
Durene (1, 2, 4, 5)	$(CH_3)_4C_6H_2$	solid	1393.6
Eicosane	$C_{20}H_{42}$	solid	3183.1
Erythritol	$C_4H_{10}O_4$	solid	504.1
Ethane	$CH_3.CH_3$	gas	368.4
Ethyl acetate	$CH_3COOC_2H_5$	liq.	536.9
Ethyl acetoacetate	$CH_3COCH_2COOC_2H_5$	liq.	690.8

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
Ethyl alcohol	C_2H_5OH	liq.	327.6
Ethylamine	$C_2H_5NH_2$	liq.	408.5
Ethyl aniline	$C_6H_5NHC_2H_5$	liq.	1121.5
Ethylbenzene	$C_2H_5.C_6H_5$	liq.	1091.2
Ethyl benzoate	$C_6H_5COOC_2H_5$	liq.	1098.7
Ethyl bromide	C_2H_5Br	vapor	340.5
Ethyl *n*-butyrate	$C_2H_5.CH_2COOC_2H_5$	liq.	851.2
Ethyl carbylamine	C_2H_5NC	liq.	477.1
Ethyl chloride	C_2H_5Cl	vapor	316.7
Ethyl cycloheptane	$C_7H_{13}.C_2H_5$	liq.	1406.8
Ethyl formate	$HCOOC_2H_5$	liq.	391.7
Ethyl hexane (3)	$C_3H_7.CH(C_2H_5)_2$	liq.	1302.3
Ethyl iodide	C_2H_5I	liq.	356.0
Ethyl isobutyrate	$(CH_3)_2CH.COOC_2H_5$	liq.	845.7
Ethyl isocyanate	C_2H_5NCO	liq.	424.5
Ethyl mercaptan	C_2H_5SH	gas	452.0
Ethyl mercaptan	C_2H_5SH	liq.	517.2
Ethyl nitrate	$C_2H_5ONO_2$	vapor	322.4
Ethyl nitrite	C_2H_5ONO	vapor	332.6
Ethylpentane (3)	$(C_2H_5)_3CH$	liq.	1149.9
Ethyl propionate	$C_2H_5COOC_2H_5$	liq.	690.8
Ethyl salicylate	$HOC_6H_4COOC_2H_5$	liq.	1051.2
Ethylsuccinic anhydride	$C_6H_8O_3$	liq.	684.8
Ethyl thiocyanate	C_2H_5CNS	liq.	613.8
Ethylurea	$C_2H_5NHCONH_2$	solid	472
Ethyl valerate	$C_4H_9COOC_2H_5$	liq.	1017.5
Ethylene	C_2H_4	gas	331.6
Ethylene chloride	$ClCH_2.CH_2Cl$	vapor	271.0
Ethylene diamine	$(CH_2NH_2)_2$	liq.	452.6
Ethylene glycol	$HOCH_2.CH_2OH$	liq.	281.9
Ethylene iodide	$ICH_2.CH_2I$	solid	324.8
Ethylene oxide	$O.CH_2.CH_2$	liq.	302.1
Ethylidene chloride	$CH_3.CHCl_2$	liq.	267.1
Eugenol	$C_{10}H_{12}O_2$	liq.	1286.6
Fenchane	$C_{10}H_{18}$	liq.	1502.6
Fluorene	$CH_2:(C_6H_4)_2$	solid	1584.9
Fluorobenzene	C_6H_5F	liq.	747.2
Formaldehyde	CH_2O	gas	134.1
Formamide	$HCONH_2$	solid	134.9
Formanilide	$HCONHC_6H_5$	solid	861.0
Formic acid	$HCOOH$	liq.	62.8
l-Fructose	$C_6H_{12}O_6$	solid	675.6
Fucose	$C_6H_{12}O_5$	solid	712.0
Fumaric acid (*trans*)	$(CHCOOH)_2$	solid	320.0
Furfural	$C_4H_3O.CHO$	liq.	559.5
Galactose	$C_6H_{12}O_6$	solid	670.7
Gallic acid	$(HO)_3C_6H_2COOH$	solid	633.7
Geranic acid	$C_{10}H_{16}O_2$	liq.	1379
l-Glucosan	$C_6H_{10}O_5$	solid	678
d-Glucose	$C_6H_{12}O_6$	solid	673.0
Glutamic acid	$C_5H_9O_4N$	solid	542.4
Glutaric acid	$(CH_2)_3(COOH)_2$	solid	514.9
Glutaric anhydride	$C_5H_6O_3$	solid	528.0
Glycerol	$C_3H_5(OH)_3$	liq.	397.0

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
Glyceryl tributyrate	$C_{15}H_{26}O_6$	liq.	1941.1
Glycine	$H_2N.CH_2COOH$	solid	234.5
Glycogen	$1/x(C_6H_{10}O_5)_x$	solid	4186.8
Glycol	$(CH_2OH)_2$	liq.	281.9
Glycolic acid	$HOCH_2COOH$	solid	166.6
Glycolic nitrile	$HOCH_2CN$	liq.	256.7
Glycylglycine	$C_4H_8O_3N_2$	solid	470.7
Guanine	$C_5H_5ON_5$	solid	586
n-Heptaldehyde	$C_6H_{13}CHO$	liq.	1062.4
n-Heptane	C_7H_{16}	liq.	1149.9
Heptine (1)	$CH:C(CH_2)_4CH_3$	liq.	1091.2
n-Heptyl alcohol	$C_6H_{13}CH_2OH$	liq.	1104.9
Heptylamine	$C_7H_{15}NH_2$	liq.	1178.9
Heptylic acid	$C_6H_{13}COOH$	liq.	986.1
n-Hexane	C_6H_{14}	liq.	989.8
Hexachlorobenzene	C_6Cl_6	solid	509.0
Hexachloroethane	C_2Cl_6	solid	110.0
Hexadecane	$C_{16}H_{34}$	solid	2559.1
Hexahydrobenzoic acid	$C_6H_{11}COOH$	liq.	934
Hexahydronaphthalene	$C_{10}H_{14}$	liq.	1419.3
Hexamethylbenzene	$C_6(CH_3)_6$	solid	1711.9
Hexamethylenetetramine	$(CH_2)_6N_4$	solid	1006.7
Hexamethylethane	$(CH_3)_3C.C(CH_3)_3$	solid	1301.8
Hexylamine	$C_6H_{13}NH_2$	liq.	1022.2
Hexylene	C_6H_{12}	liq.	952.6
Hippuric acid	$C_6H_5CONHCH_2COOH$	solid	1012.4
Hydantoic acid	$C_3H_6O_3N_2$	solid	308.6
Hydrazobenzene	$C_6H_5NH.NHC_6H_5$	solid	1597.3
Hydrobenzoin	$C_{14}H_{14}O_2$	solid	1723
α, β-Hydromuconic acid	$C_6H_8O_4$	solid	628.8
Hydrosorbic acid	$C_6H_{10}O_2$	liq.	795
Hydroquinol	$C_6H_4(OH)_2$ (1, 4)	solid	683.7
Hydroquinoldimethyl ether	$C_6H_4(OCH_3)_2$	solid	1014.7
p-Hydroxyazobenzene	$C_6H_5N_2C_6H_4OH$	solid	1502.0
o-Hydroxybenzaldehyde	$(HO)C_6H_4.CHO$	liq.	796.0
m-Hydroxybenzaldehyde	$(HO)C_6H_4.CHO$	solid	788.7
p-Hydroxybenzaldehyde	$(HO)C_6H_4.CHO$	solid	792.7
m-Hydroxybenzoic acid	$(HO)C_6H_4.COOH$	solid	726.1
p-Hydroxybenzoic acid	$(HO)C_6H_4.COOH$	solid	725.4
β-Hydroxybutyraldehyde	$CH_3CHOHCH_2CHO$	liq.	546.6
Indigo	$C_{16}H_{10}O_2N_2$	solid	1815.0
Indole	C_8H_7N	solid	1022.2
Inositol	$C_6H_6(OH)_6$	solid	662.1
Iodoform	CHI_3	solid	161.9
Isatin	$C_8H_5O_2N$	solid	868
Isoamylamine	$C_5H_{11}NH_2$	liq.	866.8
Isobutane	$(CH_3)_3CH$	gas	683.4
Isobutyl alcohol	$C_3H_7.CH_2OH$	liq.	638.2
Isobutylamine	$C_3H_7.CH_2NH_2$	liq.	713.6
Isobutyl chloride	$C_3H_7.CH_2Cl$	solid	635.5
Isobutylene	$CH_2:C(CH_3)_2$	gas	647.2
Isobutyraldehyde	$(CH_3)_2CH.CHO$	vapor	596.8
Isobutyramide	$(CH_3)_2CHCONH_2$	solid	595.9
Isobutyric acid	$(CH_3)_2CH.COOH$	liq.	517.4
Isoeugenol	$C_{10}H_{12}O_2$	liq.	1277.6

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
Isopentane	C_5H_{12}	gas	843.5(?)
Isopentane	C_5H_{12}	liq.	838.3(?)
Isophthalic acid	$C_6H_4(COOH)_2$ (1, 3)	solid	768.3
Isopropyl alcohol	$(CH_3)_2CHOH$	liq.	474.8
Isopropylbenzene	$C_6H_5.CH(CH_3)_2$	liq.	1247.3
Isopropyl iodide	$(CH_3)_2CHI$	liq.	509.1
Isopropyltoluene	$CH_3.C_6H_4.CH(CH_3)_2$ (1, 3)	liq.	1409.5
Isopropyltoluene	$CH_3.C_6H_4.CH(CH_3)_2$ (1, 4)	liq.	1402.8
Isosafrole	$C_{10}H_{10}O_2$	liq.	1233.9
Isostilbene	$C_{14}H_{12}$	liq.	1770.9
Lactic acid	$CH_3CHOH.COOH$	liq.	326.0
Lactose (anhydrous)	$C_{12}H_{22}O_{11}$	solid	1350.8
Lactose octoacetate	$C_{28}H_{38}O_{19}$	solid	3029.3
Lauric acid	$C_{12}H_{24}O_2$	solid	1771.7
Laurolene	C_8H_{14}	liq.	1192.7
Leucine	$C_6H_{13}O_2N$	solid	855.6
d-Limonene	$C_{10}H_{16}$	liq.	1471.2
l-Limonene	$C_{10}H_{16}$	liq.	1457.2
Maleic acid (*cis*)	$(CHCOOH)_2$	solid	326.1
Maleic anhydride	$(CHCO)_2O$	solid	333.9
l-Malic acid	$C_2H_3OH:(COOH)_2$	solid	320.1
Malonamide	$CH_2(CONH_2)_2$	solid	359
Malonic acid	$CH_2(COOH)_2$	solid	207.2
Malononitrile	$CH_2(CN)_2$	solid	394.8
Maltose	$C_{12}H_{22}O_{11}$	solid	1350.2
Mandelic acid	$C_6H_5CHOHCOOH$	solid	890.3
d-Mannitol	$C_6H_{14}O_6$	solid	727.6
Menthene	$C_{10}H_{18}$	liq.	1523.2
Menthol	$C_{10}H_{20}O$	solid	1508.8
Mesitylene	$C_6H_3(CH_3)_3$(1, 3, 5)	liq.	1243.6
Mesityl oxide	$CH_3COCH:C(CH_3)_2$	liq.	846.7
Mesotartaric acid	$(CHOH)_2(COOH)_2$	solid	276.0
Methane	CH_4	gas	210.8
Methyl acetate	CH_3COOCH_3	liq.	381.2
Methylal	$C_3H_8O_2$	liq.	462.8
Methyl alcohol	CH_3OH	liq.	170.9
Methylamine	CH_3NH_2	liq.	256.1
Methyl aniline	$C_6H_5NHCH_3$	liq.	973.5
Methyl benzoate	$C_6H_5COOCH_3$	liq.	943.5
Methyl bromide	CH_3Br	vapor	184.0
Methylbutyl ketone	$CH_3COC_4H_9$	liq.	895.2
Methyl *tert*-butyl ketone	$CH_3COC(CH_3)_3$	solid	891.8
Methyl butyrate	$C_3H_7COOCH_3$	liq.	692.8
Methyl carbylamine	CH_3NC	liq.	320.1
Methyl chloride	CH_3Cl	gas	164.2
Methyl cinnamate	$C_6H_5CH:CHCOOCH_3$	solid	1213.0
Methylcyclobutane	$CH_3\underline{CHCH_2CH_2CH_2}$	liq.	784.2
Methylcycloheptane	$C_7H_{13}.CH_3$	liq.	1244.5
Methylcyclohexane	$C_6H_{11}.CH_3$	liq.	1091.8
Methylcyclopentane	$CH_3\underline{CHCH_2CH_2CH_2CH_2}$	liq.	937.9
Methyldiethyl carbinol	$(CH_3)(C_2H_5)_2COH$	liq.	927.0
Methylene chloride	CH_2Cl_2	vapor	106.8
Methylene iodide	CH_2I_2	liq.	178.4

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
Methylethyl ether	$CH_3OC_2H_5$	vapor	503.4
Methylethyl ketone	$CH_3COC_2H_5$	liq.	582.3
Methyl formate	$HCOOCH_3$	liq.	233.1
Methylheptane (2)	$CH_3.C_7H_{18}$	liq.	1306.1
Methylhexane (2)	$CH_3.C_6H_{13}$	liq.	1148.9
Methylhexane (3)	$CH_3.C_6H_{13}$	liq.	1148.9
Methylhexyl ketone	$CH_3COC_6H_{13}$	liq.	1205.1
Methyl iodide	CH_3I	liq.	194.7
Methyl isobutyrate	$(CH_3)_2CHCOOCH_3$	liq.	694.2
Methyl isocyanate	CH_3NCO	liq.	269.4
Methylisopropyl ketone	$CH_3COCH(CH_3)_2$	liq.	733.9
Methyl lactate	$CH_3CHOHCOOCH_3$	liq.	497.2
Methyl mercaptan	CH_3SH	gas	297.6
Methyl propionate	$C_2H_5COOCH_3$	vapor	552.3
Methylpropyl ketone	$CH_3COC_3H_7$	liq.	735.6
Methyl salicylate	$HOC_6H_4COOCH_3$	liq.	898.3
Milk sugar	$C_{12}H_{22}O_{11}$	solid	1350.8
Methyl tetryl	$C_8H_7O_8N_5$	solid	1009
Methyl thiocyanate	CH_3CNS	liq.	453.1
Morphine	$C_{17}H_{19}O_3N.H_2O$	solid	2146.3
Mucic acid	$C_6H_{10}O_8$	solid	483.6
Myristic acid	$C_{14}H_{28}O_2$	solid	2085.8
Naphthalene	$C_{10}H_8$	solid	1232.5
Naphthalic acid	$C_{10}H_6(COOH)_2$	solid	1244
α-Naphthoic acid	$C_{10}H_7COOH$	solid	1231.8
β-Naphthoic acid	$C_{10}H_7COOH$	solid	1227.6
α-Naphthol	$C_{10}H_7OH$	solid	1185.4
β-Naphthol	$C_{10}H_7OH$	solid	1187.2
α-Naphthonitrile	$C_{10}H_7CN$	solid	1326.2
β-Naphthonitrile	$C_{10}H_7CN$	solid	1321.0
α-Naphthoquinone	$C_{10}H_6O_2$	solid	1100.8
β-Naphthoquinone	$C_{10}H_6O_2$	solid	1106.4
α-Naphthylamine	$C_{10}H_7NH_2$	solid	1263.5
β-Naphthylamine	$C_{10}H_7NH_2$	solid	1261.0
Narceine	$C_{23}H_{27}O_8N.2H_2O$	solid	2802.9
Narcotine	$C_{22}H_{23}O_7N$	solid	2644.5
Nicotine	$C_{10}H_{14}N_2$	liq.	1427.7
m-Nitroacetanilide	$NO_2.C_6H_4NHCOCH_3$	solid	970
o-Nitroaniline	$NO_2.C_6H_4NH_2$	solid	765.8
p-Nitroaniline	$NO_2.C_6H_4NH_2$	solid	761.0
m-Nitroaniline	$NO_2.C_6H_4NH_2$	solid	765.2
m-Nitrobenzaldehyde	$NO_2.C_6H_4CHO$	solid	800.4
Nitrobenzene	$C_6H_5NO_2$	liq.	739.2
m-Nitrobenzoic acid	$NO_2.C_6H_4COOH$	solid	729.1
Nitroethane	$CH_3.CH_2NO_2$	liq.	322.2
Nitroglycerine	$C_3H_5(NO_3)_3$	liq.	432.4
Nitromethane	CH_3NO_2	liq.	169.4
p-Nitromethylaniline	$NO_2.C_6H_4NHCH_3$	solid	924
p-Nitrophenetole	$NO_2.C_6H_4OC_2H_5$	liq.	1006
o-Nitrophenol	$NO_2.C_6H_4OH$	solid	689.1
m-Nitrophenol	$NO_2.C_6H_4OH$	solid	684.4
p-Nitrophenol	$NO_2.C_6H_4OH$	solid	688.8
Nitropropane	$C_2H_5.CH_2NO_2$	liq.	477.9
o-Nitrotoluene	$NO_2.C_6H_4CH_3$	liq.	897.0
p-Nitrotoluene	$NO_2C_6H_4CH_3$	solid	888.6

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
Octahydronaphthalene	$C_{10}H_{16}$	liq.	1461.7
n-Octane	C_8H_{18}	liq.	1302.7
Octyl alcohol	$C_8H_{17}OH$	liq.	1262.0
Oleic acid	$C_{17}H_{33}COOH$	liq.	2657.0
Opianic acid	$C_{10}H_{10}O_5$	solid	1090
Oxamic acid	$H_2NCO.COOH$	solid	130
Oxalic acid	$(COOH)_2$	solid	60.2
Oxamide	$(CONH_2)_2$	solid	203.2
Palmitic acid	$C_{15}H_{31}COOH$	solid	2398.4
Papaverine	$C_{20}H_{21}O_4N$	solid	2478.1
Paraformaldehyde	$1/n(CH_2O)n$	solid	122
Pentamethylbenzene	$(CH_3)_5C_6H$	solid	1554.0
n-Pentane	C_5H_{12}	gas	838.3
n-Pentane	C_5H_{12}	liq.	833.4
Phenacetin	$C_2H_5OC_6H_4NHCOCH_3$	solid	1285.2
Phenanthraquinone	$C_{14}H_8O_2$	solid	1544.0
Phenanthrene	$C_{14}H_{10}$	solid	1692.5
Phenetole	$C_2H_5OC_6H_5$	liq.	1060.3
Phenol	C_6H_5OH	solid	732.2
Phenylacetic acid	$C_6H_5CH_2COOH$	solid	930.2
Phenylacetylene	$C_6H_5C:CH$	liq.	1024.2
Phenylalanine	$C_9H_{11}O_2N$	solid	1111.3
Phenylbutene	$C_6H_5CH_2CH:CHCH_3$	liq.	1361.2
p-Phenylenediamine	$C_6H_4(NH_2)_2$	solid	843.4
Phenylglycine	$C_6H_5NHCH_2COOH$	solid	955.1
Phenylhydrazine	$C_6H_5NH.NH_2$	solid	875.4
Phenylhydroxylamine	C_6H_5NHOH	liq.	803.7
Phenyl iodide	C_6H_5I	liq.	770.7
Phloroglucinol	$C_6H_3(OH)_3$	solid	635.7
Phthalic acid	$C_6H_4(COOH)_2$	solid	771.0
Phthalide	$C_8H_6O_2$	solid	884
Phthalic anhydride	$C_6H_4(CO)_2O$	solid	783.4
Phthalimide	$C_8H_5O_2N$	solid	849.5
Picric acid	$HOC_6H_2(NO_2)_3$ (1, 2, 4, 6)	solid	611.8
Pinacol	$C_6H_{14}O_2$	solid	897.6
Pinacoline	$(CH_3)_3CCOCH_3$	solid	891.8
Piperidine	$C_5H_{11}N$	liq.	826.6
Piperonal	$C_8H_6O_3$	solid	870.7
Piperonylic acid	$C_8H_6O_4$	solid	803.5
Propane	C_3H_8	gas	526.3
Propine	$HC:CCH_3$	gas	465.1
Propionaldehyde	C_2H_5CHO	liq.	434.2
Propionamide	$C_2H_5CONH_2$	solid	439.9
Propionic acid	C_2H_5COOH	liq.	367.2
Propionic anhydride	$(C_2H_5CO)_2O$	liq.	746.6
Propionitrile	C_2H_5CN	liq.	456.4
n-Propyl alcohol	$C_2H_5CH_2OH$	liq.	480.5
Propylamine	$C_3H_7NH_2$	liq.	558.3
n-Propylbenzene	$C_6H_5.C_3H_7$	liq.	1246.4
Propyl bromide	C_3H_7Br	vapor	497.3
Propyl carbylamine	C_3H_7NC	liq.	639.6
Propyl chloride	C_3H_7Cl	vapor	478.3
Propylene	$CH_2:CHCH_3$	gas	490.2
Propylene glycol	$CH_3CHOHCH_2OH$	liq.	431.0
n-Propyl iodide	C_3H_7I	liq.	514.3

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
n-Propyltoluene (1, 3)	$CH_3.C_6H_4.C_3H_7$	liq.	1405.4
Pseudocumene (1, 2, 4)	$(CH_3)_3C_6H_3$	liq.	1241.7
Pyridine	C_5H_5N	liq.	658.5
Pyrocatechol (1, 2)	$C_6H_4(OH)_2$	solid	684.8
Pyrogallol (1, 2, 3)	$C_6H_3(OH)_3$	solid	638.7
Pyromellitic acid	$C_{10}H_6O_8$	solid	776.8
Pyrrole	C_4H_5N	liq.	567.7
Quercitol	$C_6H_7(OH)_5$	solid	704.2
Quinoline	C_9H_7N	liq.	1123.5
Quinone	$O:C_6H_4:O$	solid	656.6
Raffinose	$C_{18}H_{32}O_6$	solid	2025.5
Retene	$C_{18}H_{18}$	solid	2306.8
Resorcinol (1, 3)	$C_6H_4(OH)_2$	solid	683.0
Resorcinol dimethylether	$C_6H_4(OCH_3)_2$	liq.	1022.6
Rhamnose	$C_6H_{12}O_5$	solid	718.3
Rhamnose triacetate	$C_{12}H_{18}O_8$	solid	1351
Saccharic acid lactone	$C_6H_{10}O_5$	solid	656.6
Safrole	$C_{10}H_{10}O_2$	liq.	1244.1
Salicylaldehyde	HOC_6H_4CHO	liq.	796.0
*Salicylic acid	HOC_6H_4COOH	solid	723.1
Sarcosine	CH_3NHCH_2COOH	solid	401.1
Sebacic acid	$HOOC.(CH_2)_8COOH$	solid	1297.3
Skatole	$CH_3.C_8H_6N$	liq.	1170.5
d-Sorbose	$C_6H_{12}O_6$	solid	668.3
Starch	$1/x(C_6H_{10}O_5)_x$	solid	677.5
Stearic acid	$C_{17}H_{35}COOH$	solid	2711.8
Stearolic acid	$C_{18}H_{32}O_2$	solid	2629
Stilbene	$C_{14}H_{12}$	solid	1765
Strychnine	$C_{21}H_{22}O_2N_2$	solid	2685.7
Styrene	$C_6H_5CH:CHC_6H_5$	liq.	1047.1
Suberic acid	$HOOC.(CH_2)_6COOH$	solid	985.2
Succinamide	$(CH_2CONH_2)_2$	solid	509.2
Succinic acid	$(CH_2COOH)_2$	solid	357.1
Succinic acid nitrile	$(CH_2CN)_2$	liq.	545.7
Succinic anhydride	$(CH_2CO)_2O$	solid	369.6
Succinimide	$(CH_2CO)_2NH$	solid	437.9
Sucrose	$C_{12}H_{22}O_{11}$	solid	1349.6
Sylvestrene	$C_{10}H_{16}$	liq.	1464.7
d-Tartaric acid	$(CHOH)_2(COOH)_2$	solid	275.1
dl-Tartaric acid (anhydrous)	$(CHOH)_2(COOH)_2$	solid	278.4
Taurine	$C_2H_7O_3NS$	solid	382.9
Terephthalic acid (1, 4)	$C_6H_4(COOH)_2$	solid	770.4
Terpin hydrate	$C_{10}H_{22}O_3$	solid	1451.0
Terpineol	$C_{10}H_{18}O_2$	solid	1469.5
Tetrachloroquinone	$O:C_6Cl_4:O$	solid	517.7
Tetrahydrobenzene	C_6H_{10}	liq.	891.9
Tetrahydronaphthalene	$C_{10}H_{12}$	liq.	1352.4
Tetrahydroquinaldine	$C_{10}H_{13}N$	liq.	1382
Tetramethylmethane	$(CH_3)_4C$	gas	842.6
Tetrolic acid	$C_4H_4O_2$	solid	452.4
Tetryl	$C_7H_5N_5O_8$	solid	842.3
Thebaine	$C_{19}H_{21}O_3N$	solid	2441.3
Thialdine	$C_6H_{13}NS_2$	solid	1264
Thiophene	C_4H_4S	liq.	670.5
Thiourea	$CS(NH_2)_2$	solid	342.8

*Recommended as a secondary thermochemical standard.

HEAT OF COMBUSTION OF ORGANIC COMPOUNDS

Name	Formula	Physical state	Heat of combustion in kg. cal.
Thujane	$C_{10}H_{18}$	liq.	1506.4
Thymol	$C_{10}H_{14}O$	liq.	1353.4
Thymol	$C_{10}H_{14}O$	solid	1349.7
Thymoquinone	$C_{10}H_{12}O_2$	solid	1271.3
Toluene	$C_6H_5.CH_3$	liq.	934.2
o-Toluic acid	$CH_3.C_6H_4.COOH$	solid	928.9
m-Toluic acid	$CH_3.C_6H_4.COOH$	solid	928.6
p-Toluic acid	$CH_3.C_6H_4.COOH$	solid	926.9
o-Toluidine	$CH_3.C_6H_4.NH_2$	liq.	964.3
m-Toluidine	$CH_3.C_6H_4.NH_2$	liq.	965.3
p-Toluidine	$CH_3.C_6H_4.NH_2$	solid	958.4
o-Tolunitrile	$CH_3.C_6H_4CN$	liq.	1030.3
Toluquinone	$C_7H_6O_2$	solid	803.2
Triaminotriphenyl carbinol	$(H_2NC_6H_4)_3COH$	solid	2483.5
Tribenzylamine	$(C_6H_5CH_2)_3N$	solid	2762.1
Trichloroacetic acid	$Cl_3C.COOH$	solid	92.8
Triethylamine	$(C_2H_5)_3N$	liq.	1036.8
Triethyl carbinol	$(C_2H_5)_3COH$	liq.	1080.0
Triisoamylamine	$(C_5H_{11})_3N$	liq.	2459.3
Triisobutylamine	$(C_4H_9)_3N$	liq.	1973.6
Trimesic acid	$C_9H_6O_6$	solid	767
Trimethylamine	$(CH_3)_3N$	liq.	578.6
Trimethylbutane (2, 2, 3)	$(CH_3)_3C_4H_7$	liq.	1147.9
Trimethyl carbinol	$(CH_3)_3COH$	liq.	629.3
Trimethylene	$\underbrace{CH_2CH_2CH_2}$	gas	496.8
Trimethylene nitrile	C_4H_5N	liq.	581
Trimethylethylene	$(CH_3)_2C{:}CH.CH_3$	liq.	796.0
Trimethylethylene	$(CH_3)_2C{:}CH.CH_3$	vapor	803.6
Trimethylpentane (2, 2, 4)	$(CH_3)_3C_5H_9$	liq.	1303.9
Trimethyl succinic acid	$C_7H_{12}O_4$	solid	829.9
Trinitrobenzene (1, 3, 5)	$C_6H_3(NO_2)_3$	solid	663.7
Trinitroglycerol	$C_3H_5(NO_3)_3$	liq.	432.4
Trinitrotoluene (1, 2, 4, 6)	$CH_3.C_6H_2(NO_2)_3$	solid	820.7
Triphenylamine	$(C_6H_5)_3N$	solid	2267.8
Triphenylbenzene (1, 3, 5)	$(C_6H_5)_3C_6H_3$	solid	2936.7
Triphenyl carbinol	$(C_6H_5)_3COH$	solid	2340.8
Triphenylmethane	$(C_6H_5)_3CH$	solid	2388.7
Triphenyl methyl	$(C_6H_5)_3C$	solid	2378.5
Tyrosine	$C_9H_{11}O_3N$	solid	1070.2
Undecolic acid	$C_{11}H_{18}O_2$	solid	1538
Undecylenic acid	$C_{11}H_{20}O_2$	solid	1580
Undecylic acid	$C_{11}H_{22}O_2$	solid	1615.9
Urea	$CO(NH_2)_2$	solid	151.6
Urethane	$NH_2COOC_2H_5$	solid	397.2
Uric acid	$C_5H_4O_3N_4$	solid	460.2
Uvitic acid	$C_9H_8O_4$	solid	928.3
n-Valeric acid	C_4H_9COOH	liq.	681.6
Vanillin (1, 2, 4)	$HOC_6H_3(OCH_3).CHO$	solid	914.1
Veronal	$C_8H_{12}N_2O_3$	solid	983
o-Xylene	$C_6H_4(CH_3)_2$	liq.	1091.7
m-Xylene	$C_6H_4(CH_3)_2$	liq.	1088.4
p-Xylene	$C_6H_4(CH_3)_2$	liq.	1089.1
Xylose	$C_5H_{10}O_5$	solid	561.5

HEAT OF FORMATION OF ORGANIC COMPOUNDS

The heat of formation of an organic compound can be calculated since this value is equal to the sum of the heats of formation of the products of combustion less the heat of combustion (see table: Heat of Combustion of Organic Compounds) of the compound. A negative value indicates an evolution of heat during formation.

The heat of formation of the usual products of combustion of an organic compound are:

Free elements		0 kg-cal.
CO_2	(gas)	−94.05 kg-cal.
$\frac{1}{2}H_2O$	(liquid; from one atom of hydrogen)	−34.19 kg-cal.
SO_2	(gas)	−70.92 kg-cal.
H_2SO_4	(in dilute aqueous solution)	−211.84 kg-cal.
HBr	(in dilute aqueous solution)	−28.55 kg-cal.
HCl	(in dilute aqueous solution)	−39.53 kg-cal.
HF	(in dilute aqueous solution)	−75.56 kg-cal.
HNO_3	(in dilute aqueous solution)	−49.11 kg-cal.

EXAMPLES

Thus, to calculate the heat of formation of acetaldehyde and where the combustion is represented by the following equation:

$CH_3CHO + 2\frac{1}{2}O_2 = 2CO_2 + 2H_2O$

Heat of combustion of acetaldehyde	−279.0
Heat of formation of CO_2	−94.05
Heat of formation of $\frac{1}{2}H_2O$	−34.19

then, the heat of formation of acetaldehyde = $2(-94.05)+4(-34.19)-(-279) = -45.86$ kg-cal. for 44 grams (the gram formula weight) of acetaldehyde.

To calculate the heat of formation of acetylene from its heat of combustion where the combustion is represented by the equation:

$C_2H_2 + 2\frac{1}{2}O_2 = 2CO_2 + H_2O$

Heat of combustion of acetylene	−312.0
Heat of formation of CO_2	−94.05
Heat of formation of $\frac{1}{2}H_2O$	−34.19

then, the heat of formation of acetylene = $2(-94.05)+2(-34.19)-(-312) = +55.52$ kg-cal. for 26 grams (the gram formula weight) of acetylene.

To calculate the heat of formation of methylamine from the heat of combustion of methylamine when the combustion is represented by the equation:

$CH_3NH_2 + 4\frac{1}{2}O = CO_2 + 2\frac{1}{2}H_2O + \frac{1}{2}N_2$

Heat of combustion of methylamine	−256.1
Heat of formation of CO_2	−94.05
Heat of formation of $\frac{1}{2}H_2O$	−34.19

then, the heat of formation of methylamine = $-94.05+5(-34.19)+0(\text{nitrogen})-(-256.1) = -8.90$ kg-cal. for 31 grams (the gram formula weight) of methylamine.

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

In this table the heat of formation, ΔH at 18°C, is expressed in kg-cal per mol. When ΔH is negative, heat is evolved in the process, and, when positive, heat is absorbed. The increment in the free energy, ΔF at 25°C, is expressed in kg-cal per mol and is for the reaction of forming the given compound in its standard state from the elements in their standard states. These standard states are: for a gas, fugacity (approximately equal to the pressure) of 1 atm; for a pure liquid or solid, the substance at a pressure of 1 atm; for a substance in aqueous solution, the hypothetical solution of unit molality, which has all the properties of the infinitely dilute solution except the property of concentration.

The physical state is given by: *c*, crystal (solid); *l*, liquid; *g*, gas; *gls*, glass or supercooled liquid; *amor*, amorphous; *aq*, in aqueous solution. When no number follows the symbol *aq* the solution is dilute; a number following this symbol indicates the number of mols of water per mol of solute and applies only to the value of ΔH (not to ΔF).

The heat of solution in water of a given compound is given by the difference in the value for the heat of formation of the compound in the solid, liquid, or gaseous state and its heat of formation in aqueous solution. For example, for NaCl (*c*) ΔH is −98.33 kg-cal per mol, and for NaCl (*aq*, 400) is −97.11 kg-cal per mol. The numerical difference in these two values shows ΔH equal to 1.22 kg-cal per mol (the energy absorbed) for the reaction of dissolving sodium chloride in 400 mols of water. The free energy of solution may be calculated in the same general manner.

To convert kg-cal to international (National Bureau of Standards) joules multiply by 4183.3. To convert kg-cal to British thermal units (Btu) multiply by 3.9685.

For a more complete listing of compounds and an explanation of many useful ways in which the values can be utilized see the references quoted below from which most of the values recorded in this table were selected.

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HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

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Name	Formula	State	ΔH	ΔF
Aluminum	Al	*c*	0.00	0.00
		g	......	57.79
bromide	Al, Br_3	*c*	−126.7	......
		aq	−212.0	−189.2
carbide	Al_4, C_3	*c*	60	......
chloride	Al, Cl_3	*c*	−166.8	......
		aq, 600	−244.7	−209.5
fluoride	Al, F_3	*c*	−329	......
		aq	−360.2	−312.6
hydroxide	Al, O_3, H_3	*c*	−304.9	−272.9
	$Al_2O_3, 3H_2O$	*c*	−388.92	......
iodide	Al, I_3	*c*	−77.2	......
		aq	−166.2	−152.5
nitride	Al, N	*c*	−80.0	......
oxide	Al_2, O_3	*c*	−380	......
silicate, sililmanite	Al_2, Si, O_5	*c*	−623.7	......
" , disthene	Al_2, Si, O_5	*c*	−617.4	......
" , andalusite	Al_2, Si, O_5	*c*	−617.0	......
" , mullite	Al_6, Si_2, O_{13}	*c*	−1804	......
"	Al_2, Si_2, O_7	*c*	−767.5	......
	Al_2, Si_2, O_9, H_4	*c*	−927.42	......
sulfate	Al_2, S_3, O_{12}	*c*	−770	......
		aq	−896	−759.3
"	$Al_2, S_3, O_{12}, 18(H_2, O)$	*c*	−2120	......
sulfide	Al_2, S_3	*c*	−140.5	......
Ammonia	N, H_3	*g*	−11.00	−3.94
		aq, 200	−19.35	−6.33
Ammonium acetate	N, H_7, C_2, O_2	*c*	−148.1	......
		aq, 400	−148.41	−108.26
bromide	N, H_4, Br	*c*	−64.58	......
		aq	−60.13	−43.54
"	NH_3, HBr	*c*	−45.0	......
carbonate	N_2, C, H_8, O_3	*aq*	−223.2	−164.1
" , acid	N, H_5, C, O_3	*c*	−203	......
chlorate	N, H_4, O_4, Cl	*c*	−78.1	......
		aq	−71.7	−29.66
chloride	N, H_4, Cl	*c*	−74.95	−47.81
		aq, 400	−71.06	−50.29
"	NH_3, HCl	*c*	−41.9	......
chromate	N_2, H_8, O_4, Cr	*c*	−276.9	......
		aq	−271.1	−209.3
cyanate	N_2, H_4, C, O	*c*	−73.5	......
		aq	−67.3	......
cyanide	N_2, H_4, C	*c*	−0.7	......
		aq	3.7	20.4
"	NH_3, HCN	*c*	−20.6	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Ammonium				
fluoride	N, H_4, F	*c*	−111.6	......
		aq	−110.1	−84.7
"	NH_3, HF	*c*	−37.3	......
fluosilicate	N_2, H_8, Si, F_6	*c*	−621.6	......
hydroxide	N, H_5, O	*c*	−87.72	−62.99
iodide	N, H_4, I	*c*	−48.39	......
		aq	−44.83	−31.3
"	NH_3, HI	*c*	−43.5	......
nitrate	N_2, H_4, O_3	*c*	−87.13	......
		aq, 500	−80.71	−45.21
"	NH_3, HNO_3	*c*	−34.8	......
nitrite	N_2, H_4, O_2	*c*	−61.5	......
oxalate	N_2, C_2, H_8, O_4	*c*	−266.3	......
		aq	−258.3	−196.2
persulfate	N_2, H_8, S_2, O_8	*c*	−395.4	......
phosphate	N_3, H_{12}, P, O_4	*aq*	−397.5	......
" (di-basic)	N_2, H_9, P, O_4	*aq*	−360	......
sulfate	N_2, H_8, S, O_4	*c*	−281.46	......
		aq	−279.08	−214.02
" , acid	N, H_5, S, O_4	*c*	−244.6	......
		aq	−245.1	......
sulfide	N_2, H_8, S	*c*	−66.2	......
		aq, 400	−55.0	−14.50
" , acid	N, H_5, S	*c*	−38.9	......
sulfite	N_2, H_8, S, O_3	*c*	−212.3	......
thiocyanate	N_2, H_4, C, S	*c*	−17.8	......
		aq	−12.1	4.4
Antimony	Sb	*c*	0.00	0.00
		g	......	44.0
bromide	Sb, Br_3	*c*	−60.0	......
chloride (tri)	Sb, Cl_3	*c*	−91.4	−77.8
" (penta)	Sb, Cl_5	*c*	−107.3	......
fluoride	Sb, F_3	*c*	−216.6	......
		aq	−214.9	......
hydride (stibine)	Sb, H_3	*g*	−34	35.3
iodide	Sb, I_3	*c*	−22.8	......
		aq	−22.0	......
oxide (tri)	Sb_2, O_3	*c*	−165.4	−149.0
" (penta)	Sb_2, O_5	*c*	−230.0	−195.5
oxychloride	Sb, O, Cl	*c*	−89.2	......
sulfide	Sb_2, S_3	*c*	−35.7	−35.7
Antimonic acid	$Sb_2, O_5, 3H_2O$	*c*	−228.78	......
Antimonous acid	H, Sb, O_2	*aq*	......	−97.5
" "	$Sb_2, O_3, 3H_2O$	*c*	−167.42	......
Arsenic	As	*c*	0.00	0.00
		g	......	20.4
bromide	As, Br_3	*c*	−45.9	......
chloride	As, Cl_3	*l*	−71.5	−65.2
hydride (arsine)	As, H_3	*g*	43.6	37.7
iodide	As, I_3	*c*	−13.6	......
oxide (tri)	As_2, O_3	*c*	−154.1	−137.7
" (penta)	As_2, O_5	*c*	−217.9	......
		aq	−223.9	......
sulfide	As_2, S_3	*c*	−20	−20

Name	Formula	State	ΔH	ΔF
Arsenic				
Arsenic acid	H_3, As, O_4	*c*	−214.9	......
		aq	−214.5	−183.93
Arsenous acid	H, As, O_2	*aq*	......	−96.35
" "	H_3, As, O_3	*aq*	−175.3	−153.4
Auric *cf.* gold				
Barium	Ba	*c*	0.00	0.00
acetate	Ba, C_4, H_6, O_4	*c*	−358.5	......
arsenate	Ba_3, As_2, O_8	*c*	−817.7	......
bromide	Ba, Br_2	*c*	−180.41	......
		aq, 400	−185.39	−183.0
carbonate	Ba, C, O_3	*c*	−290.9	−271.4
"	BaO, CO_2	*c*	−63.44	......
" , acid	Ba, H, C, O_3	*aq*	−459.1	−414.4
chlorate	Ba, Cl_2, O_6	*c*	−176.6	......
		aq, 1600	−169.9	−134.4
chloride	Ba, Cl_2	*c*	−205.28	......
		aq, 400	−207.35	−196.5
chloroplatinate	Ba, Pt, Cl_6	*c*	−284.9	......
chromate	Ba, Cr, O_4	*c*	−342.2	......
cyanate	Ba, C_2, N_2, O_2	*c*	−212.1	......
		aq	−197.1	−180.7
cyanide	Ba, C_2, N_2	*c*	−56.5	......
		aq	−58.0	−55.6
dithionate	Ba, S_2, O_6	*aq*	−408.7	......
"	Ba, S_2, O_6, $2H_2O$	*c*	−552.4	......
fluoride	Ba, F_2	*c*	−287.9	......
		aq, 1600	−284.4	−265.3
hydride	Ba, H_2	*c*	−40.8	−31.5
hydroxide	Ba, O_2, H_2	*c*	−225.9	......
		aq, 400	−237.43	−209.02
hypobromite	Ba, Br_2, O_2	*aq*	−176	......
hypochlorite	Ba, Cl_2, O_2	*aq*	−180	......
hypophosphite	Ba, H_2, P_2, O_4	*aq*	−414	......
iodate	Ba, I_2, O_6	*c*	−246.5	......
		aq	−237.4	−198.4
iodide	Ba, I_2	*c*	−144.6	......
		aq, 400	−154.86	−158.52
molybdate	Ba, Mo, O_4	*c*	−370	......
nitrate	Ba, N_2, O_6	*c*	−236.9	......
		aq	−227.27	−186.35
nitride	Ba_3, N_2	*c*	−90.7	......
nitrite	Ba, N_2, O_4	*c*	−184.6	......
		aq	−178.9	−150.75
oxide	Ba, O	*c*	−133	......
perchlorate	Ba, Cl_2, O_8	*c*	−210.2	......
		aq, 800	−208.2	−155.3
peroxide	Ba, O_2	*c*	−152.4	−138.0
"	BaO, O	*c*	−18.6	......
persulfate	Ba, S_2, O_8	*aq*	−451.7	......
phosphate (tri)	Ba_3, P_2, O_8	*c*	−992	......
" (di)	Ba, H, P, O_4	*aq*	−432	......
" (mono)	Ba, H_4, P_2, O_8	*aq*	−743	......
selenide	Ba, Se	*c*	−81.3	......
silicate	Ba, Si, O_3	*c*	−363	......

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Name	Formula	State	ΔH	ΔF
Barium				
sulfate	Ba, S, O_4	*c*	−349.4	......
sulfide	Ba, S	*c*	−111.2	......
		aq	−118.4	......
sulfite	Ba, S, O_3	*c*	−282.5	......
tungstate	Ba, W, O_4	*c*	−402	......
Beryllium	Be	*c*	0.00	0.00
bromide	Be, Br_2	*c*	−79.4	......
		aq	−142	−127.9
chloride	Ba, Cl_2	*c*	−112.6	......
		aq	−163.7	−141.4
hydroxide	Be, O_2, H_2	*c*	−206.8	......
iodide	Be, I_2	*c*	−39.4	......
		aq	−112	−103.4
oxide	Be, O	*c*	−135	......
sulfate	Be, S, O_4	*c*	−281	......
		aq	−299.1	−254.8
Bismuth	Bi	*c*	0.00	0.00
		g	......	38.5
chloride	Bi, Cl_3	*c*	−90.6	−76.4
		aq	−84.5	......
hydroxide	Bi, O_3, H_3	*c*	−171.1	......
"	Bi_2O_3, $3H_2O$	*c*	−137.7	......
iodide	Bi, I_3	*c*	−24	......
		aq	−27	......
oxide	Bi, O	*c*	−49.5	−43.2
"	Bi_2, O_3	*c*	−137.1	−116.6
oxychloride	Bi, O, Cl	*c*	−89.8	−77.0
sulfate	Bi_2, S_3, O_{12}	*c*	−408.0	......
sulfide	Bi_2, S_3	*c*	−26.0	......
Boron	B	*c*	0.00	0.00
bromide	B, Br_3	*l*	−42.8	......
		g	−35.0	......
chloride	B, Cl_3	*l*	−94.6	......
		g	−88.3	......
fluoride	B, F_3	*g*	−256.9	......
oxide	B_2, O_3	*gls*	−279.9	......
		aq	−287.2	......
sulfide	B_2, S_3	*c*	−40	......
Boric acid	H_3, B, O_3	*c*	−251.6	−220.6
Bromine	Br_2	*l*	0.00	0.00
chloride	Br, Cl	*l*	−0.70	......
		g	3.51	−0.53
Bromic acid	H, Br, O_3	*aq*	−11.63	5.00
Hydrobromic acid	H, Br	*g*	−8.65	......
		aq, 400	−28.76	−24.58
Hypobromous acid	H, Br, O	*aq*	−25.2	−19.90
Cadmium	Cd	*c*	0.00	0.00
		g	......	18.49
bromide	Cd, Br_2	*c*	−75.8	......
		aq, 400	−76.2	−67.6
carbonate	Cd, C, O_3	*c*	−178.2	−163.2
chloride	Cd, Cl_2	*c*	−93.0	......
		aq, 400	−96.06	−81.2

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Cadmium				
cyanide	Cd, C_2, N_2	*c*	36.2	......
fluoride	Cd, F_2	*aq*	−172.5	......
hydroxide	Cd, O_2, H_2	*c*	−133.6	−112.7
iodide	Cd, I_2	*c*	−48.40	......
		aq, 400	−47.44	−43.22
nitrate	Cd, N_2, O_6	*aq*, 400	−115.67	−71.05
"	$Cd, N_2, O_6, 3(H_2, O)$	*c*	−179.9	......
"	$Cd, N_2, O_6, 4(H_2, O)$	*c*	−394.2	......
"	Cd, N_2, O_6, H_2O	*c*	−113.3	......
"	$Cd, N_2, O_6, 4H_2O$	*c*	−121.2	......
oxide	Cd, O	*c*	−65.2	......
selenide	Cd, Se	*c*	−25	......
sulfate	Cd, S, O_4	*c*	−222.22	......
		aq, 400	−232.91	−194.65
sulfide	Cd, S	*c*	−34.6	−33.1
telluride	Cd, Te	*c*	−16	......
Calcium	Ca	*c*	0.00	0.00
		g	......	34.5
acetate	Ca, C_4, H_6, O_4	*c*	−356.3	......
		aq	−363.9	−311.3
aluminate	CaO, Al_2O_3	*c*	−620	......
"	$2CaO, Al_2O_3$	*c*	−857	......
	$3CaO, Al_2O_3$	*c*	−1098	......
aluminum silicate	$3CaO, Al_2O_3, 6SiO_2$	*c*	−1292	......
arsenate	Ca_3, As_2, O_8	*c*	−794.0	......
borate	CaO, B_2O_3	*c*	−462.7	......
"	$CaO, 2B_2O_3$	*c*	−751.5	......
"	$2CaO, B_2O_3$	*c*	−632.2	......
"	$3CaO, B_2O_3$	*c*	−797.8	......
bromide	Ca, Br_2	*c*	−162.22	......
		aq, 400	−186.72	−181.86
carbide	Ca, C_2	*c*	−14.5	......
carbonate	Ca, C, O_3	*c*	−289.1	−207.22
chloride	Ca, Cl_2	*c*	−190.6	......
		aq	−208.69	−195.36
cyanamide	Ca, C, N_2	*c*	−85	......
cyanide	Ca, C_2, N_2	*aq*	−59.3	−54.0
fluoride	Ca, F_2	*c*	−290.2	......
		aq	−286.1	−264.1
hydride	Ca, H_2	*c*	−46	−35.7
hydroxide	Ca, O_2, H_2	*c*	−236.0	−214.8
		aq	−238.7	−207.9
iodide	Ca, I_2	*c*	−128.48	......
		aq, 400	−156.18	−157.37
magnesium carbonate	Ca, Mg, C_2, O_6	*c*	−558.8	......
nitrate	Ca, N_2, O_6	*c*	−224.04	......
		aq, 400	−227.98	−185.20
nitride	Ca, N_3	*c*	−109.5	......
oxalate	Ca, C_2, O_4	*c*	−332.2	......
oxide	Ca, O	*c*	−151.7	......
peroxide	Ca, O_2	*c*	−156.4	−142.0
phosphate	Ca_3, P_2, O_8	*c*	−983	......
selenide	Ca, Se	*c*	−81.8	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Calcium				
silicate (II)	Ca, Si, O_3	*c*	−377.9	......
" (I)	Ca, Si, O_3	*c*	−983	......
"	CaO, SiO_2	*c*	−17.4	......
sulfate	Ca, S, O_4	*c*	−340.7	......
		aq, 1600	−344.8	−308.8
"	$Ca, S, O_4, \frac{1}{2}(H_2, O)$	*c*	−376.1	......
"	$Ca, S, O_4, 2(H_2, O)$	*c*	−482.5	......
sulfide	Ca, S	*c*	−113.4	......
tungstate	Ca, W, O_4	*c*	−387	......
Carbon	C (graphite)	*c*	0.00	0.00
	C (diamond)	*c*	0.45	0.69
Acetaldehyde	C_2, H_4, O	*l*	......	−31.88
		g	−16.1	−32.0
Acetic acid	C_2, H_4, O_2	*l*	−116.8	−94.1
		g	......	−91.2
		aq, 400	−117.16	−96.8
" anhydride	C_4, H_6, O_3	*l*	......	−104.20
Acetone	C_3, H_6, O	*l*	......	−37.22
		g	......	−36.50
Acetylene	C_2, H_2	*g*	54.19	50.0
Amyl acetate (*n*)	C_7, H_{14}, O_2	*l*	......	−77.90
" alcohol (*n*)	C_5, H_{12}, O	*l*	−86.06	−39.10
" " (*tert*)	C_5, H_{12}, O	*l*	−96.46	−47.60
" butyrate (*n*)	C_9, H_{18}, O_2	*l*	......	−74.90
Aniline	C_6, H_7, N	*l*	7.34	35.40
Anthracene	C_{14}, H_{10}	*c*	27.60	64.80
l-Asparagine	C_4, H_8, O_3, N_2	*c*	−187.10	−125.20
" hydrate	C_4, H_{10}, O_4, N_2	*c*	−259.10	−183.30
l-Aspartic acid	C_4, H_7, O_4, N	*c*	−231.34	−173.50
Benzene	C_6, H_6	*l*	11.63	29.40
		g	19.82	30.99
Benzoic acid	C_7, H_6, O_2	*c*	−93.21	−60.10
		l	......	−59.16
		aq	......	−57.95
Benzophenone	C_{13}, H_{10}, O	*c*	−10.00	31.40
Benzoquinone	C_6, H_4, O_2	*c*	......	−21.41
1, 3-Butadiene	C_4, H_6	*l*	21.629	......
		g	26.748	......
Butane (*n*)	C_4, H_{10}	*g*	−29.812	−3.754
2-Me-propane	C_4, H_{10}	*g*	−31.452	−4.296
1-Butene	C_4, H_8	*g*	0.280	17.22
2-Butene (*cis*)	C_4, H_8	*g*	−1.36	16.05
" (*trans*)	C_4, H_8	*g*	−2.405	15.32
2-Me-propene	C_4, H_8	*g*	−3.34	14.58
Butyl acetal (*n*)	C_{10}, H_{22}, O_2	*l*	......	−56.40
" alcohol (*n*)	C_4, H_{10}, O	*l*	−79.61	−40.40
" " (*tert*)	C_4, H_{10}, O	*l*	......	−45.00
" benzene (*n*)	C_{10}, H_{14}	*l*	−18.67	27.50
" " (*tert*)	C_{10}, H_{14}	*l*	−20.17	29.00
" bromide (*iso*)	C_4, H_9, Br	*l*	......	−4.60
" " (*tert*)	C_4, H_9, Br	*l*	......	−5.6
Butyric acid (*n*)	C_4, H_8, O_2	*l*	−128.80	−91.50
Carbon dioxide	C, O_2	*g*	−94.052	−94.260
		aq	......	−92.3

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Name	Formula	State	ΔH	ΔF
Carbon				
" disulfide	C, S_2	*l*	15.4	17.15
		g	22	17.6
" monoxide	C, O	*g*	−26.416	−32.808
" tetrachloride	C, Cl_4	*l*	−33.8	−15.60
		g	−25.9	......
Carbonic acid	C, H_2, O_3	*aq*	−167.15	−149.2
Carbonyl chloride	C, O, Cl_2	*g*	−52.5	−48.96
" sulfide	C, O, S	*g*	−35	−39.80
Chlorobenzene	C_6, H_5, Cl	*l*	......	27.80
Cyanic acid	C, H, O, N	*aq*	......	−28.98
Creatinine	C_4, H_7, O, N_3	*c*	−52.80	−2.9
Cyanogen	C_2, N_2	*g*	71.9	67.78
" iodide	C, N, I	*c*	......	42.55
Cyclohexane	C_6, H_{12}	*l*	−36.70	6.80
		g	......	8.03
Cyclohexanol	C_6, H_{12}, O	*l*	−85.60	−34.30
Cyclohexene	C_6, H_{10}	*l*	−15.29	18.20
p-Cymene	C_{10}, H_{14}	*l*	−22.57	24.60
Decane (*n*)	C_{10}, H_{22}	*l*	−78.61	−2.90
		g	−59.67	8.23
1-Decene	C_{10}, H_{20}	*g*	−31.53	25.90
Dibenzoyl-ethane	C_{16}, H_{14}, O_2	*c*	−65.30	−2.50
" -ethylene	C_{16}, H_{12}, O_2	*c*	−32.40	21.50
Dibenzyl	C_{14}, H_{14}	*c*	9.47	60.80
Dimethyl-acetal	C_4, H_{10}, O_2	*l*	......	−55.60
1, 2- " -cyclopentane	C_7, H_{14}	*l*	−47.65	1.00
" ether	C_2, H_6, O	*g*	......	−26.35
Dinitrobenzene (*o*)	C_6, H_4, O_4, N_2	*c*	1.00	49.40
" (*m*)	C_6, H_4, O_4, N_2	*c*	−5.20	42.90
Diphenyl	C_{12}, H_{10}	*c*	20.87	57.40
		l	......	57.90
" carbinol	C_{13}, H_{12}, O	*c*	−20.38	30.70
" -methane	C_{13}, H_{12}	*c*	19.72	63.60
Dodecane (*n*)	C_{12}, H_{26}	*l*	−90.45	3.90
		g	−69.52	12.33
Dulcitol	C_6, H_{14}, O_6	*c*	−317.71	−223.10
Durene	C_{10}, H_{14}	*c*	−32.57	19.00
		l	......	19.70
" (*iso*)	C_{10}, H_{14}	*l*	−31.07	15.90
Eicosane (*n*)	C_{20}, H_{42}	*g*	−108.93	28.71
dl-Erythritol	C_4, H_{10}, O_4	*c*	−214.81	−149.40
Ethane	C_2, H_6	*g*	−20.236	−7.860
Ethene	C_2, H_4	*g*	12.50	16.28
Ether	C_4, H_{10}, O	*l*	......	−28.30
		g	......	−28.09
Ethyl-acetal	C_6, H_{14}, O_2	*l*	......	−55.80
" acetate	C_2, H_8, O_2	*l*	......	−77.60
		g	......	−76.36
" alcohol	C_2, H_6, O	*l*	−66.28	−40.20
		g	......	−38.69
		aq, 1 *M*	......	−41.85
" benzene	C_8, H_{10}	*g*	7.12	31.21
" bromide	C_2, H_5, Br	*l*	......	−6.18
" *n*-butyrate	C_6, H_{12}, O_2	*l*	......	−76.00

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Carbon				
Ethyl mercaptan	C_2, H_6, S	*l*	......	8.00
" sulfide	C_4, H_{10}, S	*l*	......	5.30
Ethylene glycol	C_2, H_6, O_2	*l*	−111.61	−80.20
" iodide	C_2, H_4, I_2	*c*	......	9.83
Formaldehyde	C, H_2, O	*g*	......	−26.10
		aq	......	−31.02
Formic acid	C, H_2, O_2	*l*	−96.6	−84.94
		g	......	−82.52
		aq, 200	−99.76	−87.90
Fumaric acid	C_4, H_4, O_4	*c*	−194.28	−156.70
		aq	......	−154.80
α-*d*-Galactose	C_6, H_{12}, O_6	*c*	......	−219.60
d-Glucose	C_6, H_{12}, O_6	*aq*	......	−217.02
" (α)	C_6, H_{12}, O_6	*c*	......	−215.80
" (β)	C_6, H_{12}, O_6	*c*	......	−215.40
d-Glutamic acid	C_5, H_9, O_4, N	*c*	−236.60	−170.40
Glycerol	C_3, H_8, O_3	*l*	−159.16	−113.60
Glycine	C_2, H_5, O_2, N	*c*	−125.46	−87.80
Heptadecane (*n*)	C_{17}, H_{36}	*g*	−94.15	22.56
Heptane (*n*)	C_7, H_{16}	*l*	−56.76	−3.0
		g	−44.89	2.09
2-Me-hexane	C_7, H_{16}	*l*	−57.76	−3.00
		g	−46.60	0.98
3-Me-hexane	C_7, H_{16}	*l*	−57.76	−2.60
		g	−45.96	1.10
3-Et-pentane	C_7, H_{16}	*l*	−56.76	−1.80
		g	−45.34	2.59
2, 2-DiMe-pentane	C_7, H_{16}	*l*	−58.76	−1.80
		g	−49.29	0.09
2, 3- " "	C_7, H_{16}	*l*	−57.76	−2.10
		g	−47.62	0.16
2, 4- " "	C_7, H_{16}	*l*	−57.76	−1.30
		g	−48.30	0.72
3, 3- " "	C_7, H_{16}	*l*	−58.76	−2.40
		g	−48.17	0.63
2, 2, 3-Tri-Me-butane	C_7, H_{16}	*l*	−58.76	−0.80
		g	−48.96	0.76
1-Heptene	C_7, H_{14}	*g*	−15.500	21.545
Hexadecane	C_{16}, H_{34}	*g*	−89.23	20.52
Hexamethyl-benzene	C_{12}, H_{18}	*c*	−41.17	25.20
		l	......	26.90
" -ethane	C_8, H_{18}	*c*	−67.41	1.20
		l	......	−1.50
Hexane (*n*)	C_6, H_{14}	*l*	−53.41	−7.00
		g	−39.96	0.05
2-Me-pentane	C_6, H_{14}	*g*	−41.66	−0.96
3- " "	C_6, H_{14}	*g*	−41.02	−0.29
2, 2-DiMe-butane	C_6, H_{14}	*g*	−44.35	−2.35
2, 3- " "	C_6, H_{14}	*g*	−42.49	−0.73
1-Hexene	C_6, H_{12}	*g*	−10.16	20.09
2- " (*cis*)	C_6, H_{12}	*g*	−11.70	19.09
2- " (*trans*)	C_6, H_{12}	*g*	−12.70	18.26
3- " (*cis*)	C_6, H_{12}	*g*	−11.70	19.09
3- " (*trans*)	C_6, H_{12}	*g*	−12.70	18.26

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Carbon				
2-Me-1-pentene	C_6, H_{12}	g	−13.60	17.84
3-Me-1- "	C_6, H_{12}	g	−11.90	19.54
4-Me-1- "	C_6, H_{12}	g	−11.90	19.54
2-Me-2- "	C_6, H_{12}	g	−15.20	16.78
3-Me-2- " *(cis)*	C_6, H_{12}	g	−15.20	16.78
3-Me-2- " *(trans)*	C_6, H_{12}	g	−15.20	16.78
4-Me-2- " *(cis)*	C_6, H_{12}	g	−13.50	18.48
4-Me-2- " *(trans)*	C_6, H_{12}	g	−14.50	17.66
2, 3-DiMe-1-butene	C_6, H_{12}	g	−15.70	16.93
3, 3-DiMe-1- "	C_6, H_{12}	g	−14.50	19.06
2, 3-DiMe-2- "	C_6, H_{12}	g	−17.10	15.59
2-Et-1-butene	C_6, H_{12}	g	−13.60	17.84
Hexyl alcohol (*n*)	C_6, H_{14}, O	l	−92.41	−38.10
Hydrogen cyanide	H, C, N	g	31.1	27.94
		aq, 100	24.3	26.55
Hydroquinone	C_6, H_6, O_2	c	−87.57	−52.70
dl-Lactic acid	C_3, H_6, O_3	l	−161.65	−124.40
α-Lactose	$C_{12}, H_{22}, O_{11}, (H_2, O)$	c	......	−418.20
β- "	C_{12}, H_{22}, O_{11}	c	......	−373.70
Maleic acid	C_4, H_4, O_4	c	−187.48	−149.40
l-Malic acid	C_4, H_6, O_5	c	......	−211.45
		aq	......	−213.57
β-Maltose	$C_{12}, H_{22}, O_{11}, (H_2, O)$	c	......	−412.60
Mannitol	C_6, H_{14}, O_6	c	−316.51	−222.20
Methane	C, H_4	g	−17.889	−12.140
Methyl alcohol	C, H_4, O	l	−57.02	−39.96
		g	......	−38.89
" -cyclohexane	C_7, H_{14}	l	−46.55	3.6
" -cyclopentane	C_6, H_{12}	l	−37.80	2.70
" formate	C_2, H_4, O_2	l	......	−71.01
		g	......	−70.85
" nitrite	C, H_3, O_2, N	g	......	0.20
Naphthalene	C_{10}, H_8	c	15.96	45.20
		l	......	45.90
Nitro-aniline (*o*)	C_6, H_6, O_2, N_2	c	−4.60	41.40
" " (*m*)	C_6, H_6, O_2, N_2	c	−5.60	40.40
" " (*p*)	C_6, H_6, O_2, N_2	c	−9.60	36.40
" -benzene	C_6, H_5, O_2, N	l	......	36.40
" -benzoic acid (*o*)	C_7, H_5, O_4, N	c	−95.60	−48.40
" " " (*m*)	C_7, H_5, O_4, N	c	−101.60	−54.20
" " " (*p*)	C_7, H_5, O_4, N	c	−102.60	−55.50
Nonadecane (*n*)	C_{19}, H_{40}	g	−104.00	26.66
Nonane (*n*)	C_9, H_{20}	g	−54.74	6.18
Nonene-1	C_9, H_{18}	g	−26.19	24.45
Octadecane (*n*)	C_{18}, H_{38}	g	−99.08	24.61
Octane (*n*)	C_8, H_{18}	l	−64.21	−3.00
		g	−49.82	4.14
2-Me-heptane	C_8, H_{18}	g	−51.50	3.06
3-Me- "	C_8, H_{18}	g	−50.82	3.29
4-Me- "	C_8, H_{18}	g	−50.69	4.00
3-Et-hexane	C_8, H_{18}	g	−50.40	3.95
2, 2-DiMe-hexane	C_8, H_{18}	g	−53.71	2.56
2, 3-DiMe- "	C_8, H_{18}	g	−51.13	4.23
2, 4-DiMe- "	C_8, H_{18}	g	−52.44	2.80

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Carbon				
2, 5-DiMe-hexane	C_8, H_{18}	*g*	−53.21	2.50
3, 3-DiMe- "	C_8, H_{18}	*g*	−52.61	3.17
3, 4-DiMe- "	C_8, H_{18}	*g*	−50.91	4.97
2-Me-3-Et-pentane	C_8, H_{18}	*g*	−50.48	5.08
3-Me-3-Et- "	C_8, H_{18}	*g*	−51.38	4.76
2, 2, 3-TriMe- "	C_8, H_{18}	*g*	−52.61	4.09
2, 2, 4-TriMe- "	C_8, H_{18}	*l*	−65.31	−0.80
		g	−53.57	3.13
2, 3, 3-TriMe- "	C_8, H_{18}	*g*	−51.73	4.52
2, 3, 4-TriMe- "	C_8, H_{18}	*g*	−51.97	4.32
2, 2, 3, 3-TetraMe-butane	C_8, H_{18}	*g*	−53.99	4.88
Octene-1	C_8, H_{16}	*g*	−20.84	23.00
2, 4, 4-TriMe-1-pentene	C_8, H_{16}	*g*	−29.10	19.24
2, 4, 4-TriMe-2-pentene	C_8, H_{16}	*g*	−30.70	18.18
Octyl alcohol (*n*)	C_8, H_{18}, O	*l*	......	−35.10
Oxalic acid	C_2, H_2, O_4	*c*	−196.7	−165.90
		aq, 300	−194.4	−165.64
Palmitic acid	C_{16}, H_{32}, O_2	*c*	−215.80	−80.00
		l	......	78.56
Pentacosane	C_{25}, H_{32}	*c*	−190.56	13.40
		l	......	15.00
Pentadecane	C_{15}, H_{32}	*g*	−84.31	18.47
1, 4-Pentadiene	C_5, H_8	*g*	......	40.22
Pentamethylbenzene	C_{11}, H_{16}	*c*	−35.92	21.90
Pentane (*n*)	C_5, H_{12}	*l*	−47.96	−8.60
		g	−35.00	−1.96
2-Me-butane	C_5, H_{12}	*l*	−43.06	−3.30
		g	−36.92	−3.50
2, 2-DiMe-propane	C_5, H_{12}	*g*	−39.67	−3.64
1-Pentene	C_5, H_{10}	*g*	−5.00	18.79
2- " (*cis*)	C_5, H_{10}	*g*	−6.71	17.17
2- " (*trans*)	C_5, H_{10}	*g*	−7.59	16.58
2-Me-1-butene	C_5, H_{10}	*g*	−8.68	15.51
3-Me-1- "	C_5, H_{10}	*g*	−6.92	17.87
2-Me-2- "	C_5, H_{10}	*l*	−17.05	13.07
		g	−10.17	14.27
Phenanthrene	C_{14}, H_{10}	*c*	23.10	60.00
Phenol	C_6, H_6, O	*c*	−38.37	−11.00
Picric acid	C_6, H_3, O_7, N_3	*c*	......	10.00
Prehnitene	C_{10}, H_{14}	*l*	−28.17	20.20
Propane	C_3, H_8	*g*	−24.82	−5.61
Propene	C_3, H_6	*g*	4.88	14.99
Propyl-acetal (*n*)	C_8, H_{18}, O_2	*l*	......	−57.20
" " (*iso*)	C_8, H_{18}, O_2	*l*	......	−61.90
" alcohol (*n*)	C_3, H_8, O	*l*	−72.86	−40.90
" " (*iso*)	C_3, H_8, O	*l*	−76.86	−44.00
Pseudocumene	C_9, H_{12}	*l*	−18.22	21.00
Pyrocatechol	C_6, H_6, O_2	*c*	−85.57	−51.40
Quinhydrone	C_{12}, H_{10}, O_4	*c*	......	−77.19
Resorcinol	C_6, H_6, O_2	*c*	−87.57	−53.20
l-Sorbose	C_6, H_{12}, O_6	*c*	......	−217.10

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Carbon				
Stilbene	C_{14}, H_{12}	*c*	32.38	75.80
Styrene	C_8, H_8	*l*	24.72	......
		g	35.11	......
Succinic acid	C_4, H_6, O_4	*c*	−224.99	−178.80
		aq	......	−178.51
Sucrose	C_{12}, H_{22}, O_{11}	*c*	......	−371.60
Tetradecane	C_{14}, H_{30}	*g*	−79.38	16.42
Tetraphenylmethane	C_{25}, H_{20}	*c*	62.20	137.70
Thiocyanic acid	H, C, N, S	*aq*	−19.1	17.80
Thiophene	C_4, H_4, S	*l*	......	26.30
Toluene	C_7, H_8	*g*	11.95	29.23
Tridecane	C_{13}, H_{28}	*g*	−74.45	14.37
Triphenyl-amine	C_{18}, H_{15}, N	*c*	58.70	120.50
" -bromomethane	C_{19}, H_{15}, Br	*c*	......	107.70
" -carbinol	C_{19}, H_{16}, O	*c*	3.96	69.70
" -chloromethane	C_{19}, H_{15}, Cl	*c*	......	100.60
" -ethylene	C_{20}, H_{16}	*c*	64.22	123.00
" -methane	C_{19}, H_{16}	*c*	41.76	101.40
Undecane (*n*)	C_{11}, H_{24}	*g*	−65.60	10.28
Urea	C, H_4, O, N_2	*c*	......	−47.12
		aq	......	−48.72
Xylene (*o*)	C_8, H_{10}	*g*	4.54	29.18
" (*m*)	C_8, H_{10}	*g*	4.12	28.41
" (*p*)	C_8, H_{10}	*g*	4.29	28.95
Cerium	Ce	*c*	0.00	0.00
chloride	Ce, Cl_3	*c*	−261.5	......
oxide	Ce, O_2	*c*	−233.4	......
sulfate (ous)	Ce_2, S_3, O_{12}	*aq*	−977	......
" (ic)	Ce, S_2, O_8	*c*	−424	......
Cesium	Cs	*c*	0.00	0.00
		g	......	12.23
bromide	Cs, Br	*c*	−97.65	......
		aq, 400	−90.74	−94.86
carbonate	Cs_2, C, O_3	*c*	−271.90	......
"	Cs_2O, CO_2	*c*	−97.53	......
" , acid	Cs, H, C, O_3	*c*	−230.6	......
		aq, 2000	−226.4	−210.56
chloride	Cs, Cl	*c*	−106.32	......
		aq, 400	−101.73	−101.61
fluoride	Cs, F	*c*	−131.68	......
		aq, 400	−140.20	−135.98
hydride	Cs, H	*c*	−12	−7.30
hydroxide	Cs, O, H	*c*	−100.2	......
		aq, 200	−116.7	−107.87
"	Cs_2O, H_2O	*aq*	−80.6	......
iodide	Cs, I	*c*	−83.90	......
		aq, 400	−75.46	−82.61
oxide	Cs_2, O	*c*	−82.1	......
"	Cs_2, O_4	*c*	−163.5	......
sulfate	Cs_2, S, O_4	*c*	−344.85	......
		aq	−339.94	−316.66
sulfide	Cs_2, S	*c*	−344.85	......
Chlorine	Cl_2	*g*	0.00	0.00
fluoride	Cl, F	*g*	−25.7	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Chlorine				
oxide (mono)	Cl_2, O	*g*	21.4	......
"	Cl, O	*g*	33	......
" (di)	Cl, O_2	*g*	26.3	28.6
Chloric acid	H, Cl, O_3	*aq*	−20.8	−0.25
Chlorous acid	H, Cl, O_2	*aq*	−14.0	−0.60
Hydrochloric acid	H, Cl	*g*	−22.06	−27.78
		aq, 400	−39.86	−31.33
Hypochlorous acid	H, Cl, O	*aq*, 400	−28.18	−19.11
Perchloric acid	H, Cl, O_4	*aq*	−39.6	−10.70
Chromium	Cr	*c*	0.00	0.00
		g	......	78.63
bromide	Cr, Br_3	*aq*	−149.9	−122.7
carbide	Cr, C_2	*c*	−140	......
chloride (ous)	Cr, Cl_2	*c*	−103.1	......
		aq	−121.7	−102.1
" (ic)	Cr, Cl_3	*aq*	−183.0	−143.0
fluoride (ous)	Cr, F_2	*c*	−152	......
" (ic)	Cr, F_3	*c*	−231	......
hydroxide	Cr, O_3, H_3	....	......	−202.8
iodide (ous)	Cr, I_2	*c*	−63.7	......
		aq	−69.4	−64.1
oxide (tri)	Cr, O_3	*c*	−139.3	......
" (ic)	Cr_2, O_3	*c*	−273	......
sulfate	Cr_2, S_3, O_{12}	*aq*	−753.4	−626.3
Chromic acid	H_2, Cr, O_4	*aq*	−210.2	......
Cobalt	Co	*c*	0.00	0.00
bromide	Co, Br_2	*c*	−55.0	......
		aq	−73.43	−61.96
carbide	Co_3, C	*c*	−11.3	......
carbonate	Co, C, O_3	*c*	−172.37	−155.36
chloride (ous)	Co, Cl_2	*c*	−76.9	......
		aq, 400	−95.4	−75.46
fluoride	Co, F_2	*aq*	−172.80	−144.2
hydroxide (ous)	Co, O_2, H_2	*c*	−131.5	−108.9
" (ic)	Co, O_3, H_3	*c*	−177.0	−142.0
iodide	Co, I_2	*c*	−24.2	......
		aq	−42.97	−37.4
nitrate	Co, N_2, O_6	*c*	−102.8	......
		aq	−114.7	−65.3
"	$Co, N_2, O_6, 6H_2O$	*c*	−219.32	......
oxide	Co, O	*c*	−57.5	......
"	Co_3, O_4	*c*	−196.5	......
selenide	Co, Se	*c*	−12	......
sulfate	Co, S, O_4	*c*	−216.7	......
		aq, 400	−231.7	-188.9
sulfide	Co, S	*c*	−22.3	−19.8
"	Co_2, S_3	*c*	−40.0	......
telluride	Co, Te	*c*	−11	......
Columbium	Cb	*c*	0.00	0.00
oxide	Cb_2, O_5	*c*	−442	425.8
Copper	Cu	*c*	0.00	0.00
		g	......	71.7
acetate	Cu, C_4, H_6, O_4	*c*	−216.4	......
bromide (ous)	Cu, Br	*c*	−26.7	−23.8

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Copper				
bromide (ic)	Cu, Br_2	*aq*	−42.2	−33.25
carbonate	Cu, C, O_3	....	−142.8	−123.9
chlorate	Cu, Cl_2, O_6	*aq*, 400	−24.3	15.4
chloride (ous)	Cu, Cl	*c*	−34.3	−28.5
" (ic)	Cu, Cl_2	*c*	−53.4	......
		aq, 400	−64.5	−46.75
cyanide (ous)	Cu, C, N	*c*	28.0	......
dithionate	Cu_2, S_2, O_6, 5(H_2, O)	*c*	−611.19	......
fluoride	Cu, F_2	*aq*	−141.7	......
hydroxide	Cu, O_2, H_2	*c*	−106.8	−85.5
iodide (ous)	Cu, I	*c*	−17.8	−16.66
" (ic)	Cu, I_2	*c*	−4.8	......
		aq	−11.7	−8.76
nitrate	Cu, N_2, O_6	*c*	−73.1	......
		aq, 200	−83.4	−36.6
oxide (ous)	Cu_2, O	*c*	−42.5	−35.15
" (ic)	Cu, O	*c*	−38.5	−30.4
perchlorate (ous)	Cu, Cl, O_4	*aq*	−28.2	1.34
" (ic)	Cu, Cl_2, O_8	*aq*	−64.9	−5.5
selenide (ous)	Cu_2, Se	*c*	−14.5	......
" (ic)	Cu, Se	*c*	−19.0	......
sulfate	Cu, S, O_4	*c*	−184.7	......
		aq, 800	−200.64	−160.19
sulfide (ous)	Cu_2, S	*c*	−18.97	−20.2
" (ic)	Cu, S	*c*	−11.6	−11.76
telluride (ous)	Cu_2, Te	*c*	−6.0	......
Erbium	Er	*c*	0.00	0.00
hydroxide	Er, O_3, H_3	*c*	−326.8	......
Fluorine	F_2	*g*	0.00	0.00
oxide	F_2, O	*g*	5.5	9.5
Hydrofluoric acid	H, F	*g*	−64.2	......
		aq, 200	−75.70	−65.70
Gallium	Ga	*c*	0.00	0.00
chloride	Ga, Cl_3	*aq*	−143	−130
hydroxide	Ga, O_3, H_3	....	......	−198.3
oxide	Ga_2, O_3	*c*	−256	−235
Germanium	Ge	*c*	0.00	0.00
oxide	Ge, O_2	*c*	......	−142.0
Gold	Au	*c*	0.00	0.00
bromide (ous)	Au, Br	*c*	−3.4	......
" (ic)	Au, Br_3	*c*	−14.5	......
		aq	−10.8	24.47
chloride (ous)	Au, Cl	*c*	−8.3	......
" (ic)	Au, Cl_3	*c*	−28.3	......
		aq	−32.75	4.21
hydroxide (ic)	Au, O_3, H_3	*c*	−100.6	......
iodide (ous)	Au, I	*c*	0.2	−0.76
oxide (ic)	Au_2, O_3	*c*	11.0	18.71
Auribromic acid	H, Au, Br_4	*aq*	−47.1	......
Aurichloric acid	H, Au, Cl_4	*aq*	−76.7	......
Hafnium	Hf	*c*	0.00	0.00
oxide	Hf, O_2	*c*	−271.5	−258.2
Hydrogen	H_2	*g*	0.00	0.00

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Hydrogen				
oxide (water)	H_2, O	*l*	−68.372	−56.693
		g	−57.798	−54.635
” , per	H_2, O_2	*l*	−45.20	−28.23
		g	−33.59	−24.73
		aq, 200	−45.66	−31.47
” (heavy water)	D_2, O	*l*	......	−58.2
		g	......	−56.06
Indium	In	*c*	0.00	0.00
bromide	n, Br_3	*c*	−97.2	......
		aq	−112.7	−97.2
chloride	In, Cl_3	*c*	−128.5	......
		aq	−145.4	−117.5
iodide	In, I_3	*c*	−56.5	......
		aq	−67.0	−60.5
oxide	In_2, O_3	*c*	-240	−21.8
Iodine	I_2	*c*	0.00	0.00
bromide	I, Br	*l*	−2.5	......
chloride	I, Cl	*c* (α)	−8.38	−4.0
		c (β)	−8.15	......
		l	−6.06	......
” (tri)	I, Cl_3	*c*	−21.1	−21.15
oxide	I_2, O_5	*c*	−42.34	......
Hydriodic acid	H, I	*g*	6.20	......
		aq, 400	−13.25	−12.33
Hypoiodous acid	H, I, O	*aq*	−38	−23.33
Iodic acid	H, I, O_3	*c*	−57.03	......
		aq	−54.6	−32.25
Iridium	Ir	*c*	0.00	0.00
chloride	Ir, Cl	*c*	−20.5	−16.9
” (di)	Ir, Cl_2	*c*	−40.6	−32.0
” (tri)	Ir, Cl_3	*c*	−60.5	−46.5
fluoride	Ir, F_6	*l*	−130	......
oxide	Ir, O_2	*c*	40	−28
Iron	Fe	*c* (α)	0.00	0.00
acetate (ic)	Fe, C_6, H_9, O_6	*aq*	−359.4	......
ammonium sulfate (ic)	Fe, S_2, N, H_4, O_8	*aq*	−466.2	......
bromide (ous)	Fe, Br_2	*c*	−60.0	......
		aq	−78.0	−69.47
” (ic)	Fe, Br_3	*aq*	−95.2	−76.26
carbide	Fe_3, C	*c*	5.2	......
carbonate	Fe, C, O_3	*c*	−172.4	−161.05
carbonyl	Fe, C_5, O_5	*l*	−187.6	......
chloride (ous)	Fe, Cl_2	*c*	−81.9	......
		aq	−99.8	−83.0
” (ic)	Fe, Cl_3	*c*	−96.4	......
		aq, 100	−128.1	−96.5
ferrocyanide (ic)	Fe_7, C_{18}, N_{18}	*c*	319.0	......
fluoride	Fe, F_2	*aq*, 1200	−177.0	−151.7
hydroxide (ous)	Fe, O_2, H_2	*c*	−135.9	−115.7
” (ic)	Fe, O_3, H_3	*c*	−197.3	−166.3
iodide (ous)	Fe, I_2	*c*	−24.2	......
		aq	−47.5	−45
” (ic)	Fe, I_3	*aq*	−49.5	−39.5

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Iron				
nitrate (ous)	Fe, N_2, O_6	*aq*	−118.8	−72.8
" (ic)	Fe, N_3, O_9	*aq*	−156.3	−81.3
oxide (ous)	Fe, O	*c*	−64.3	......
" (ic)	Fe_2, O_3	*c*	−198.5	......
" (ous, ic)	Fe_3, O_4	*c*	−266.9	......
selenide	Fe, Se	*c*	−13.2	......
silicate	Fe_2, Si, O_4	*c*	......	−324.8
"	Fe, Si, O_3	*c*	−273.5	......
sulfate (ous)	Fe, S, O_4	*c*	−221.3	......
		aq, 400	−236.0	−196.4
" (ic)	Fe_2, S_3, O_{12}	*aq*, 400	−653.0	−533.4
sulfide (ous)	Fe, S	*c*	−23.1	−22.9
telluride	Fe, Te	*c*	−8	......
Lanthanum	La	*c*	0.00	0.00
chloride	La, Cl_3	*c*	−253.1	......
		aq	−284.4	......
hydride	La_3, H_8	*c*	−160	......
hydroxide	La, O_3, H_3	....	......	−303.8
sulfate	La_2, S_3, O_{12}	*aq*	−972	......
sulfide	La, S_2	*c*	−148.3	......
Lead	Pb	*c*	0.00	0.00
acetate	Pb, C_4, H_6, O_4	*c*	−232.6	......
		aq, 400	−234.0	−184.40
bromide	Pb, Br_2	*c*	−66.27	−62.06
		aq	−56.2	−54.97
carbonate	Pb, C, O_3	*c*	−167.6	−149.5
chloride	Pb, Cl_2	*c*	−85.71	−75.04
		aq	−82.3	−68.47
fluoride	Pb, F_2	*c*	−159.5	......
hydroxide	Pb, O_2, H_2	*c*	−123.0	−102.2
iodide	Pb, I_2	*c*	−41.77	−41.47
nitrate	Pb, N_2, O_6	*c*	−106.89	......
		aq, 400	−99.28	−58.3
oxalate	Pb, C_2, O_4	*c*	−205.3	......
oxide	Pb, O	*c*, red	−52.45	−45.10
		c, yel.	−52.06	−44.96
" (di)	Pb, O_2	*c*	−65.0	−52.0
" (red)	Pb_3, O_4	*c*	−172.4	−142.2
" (sub)	Pb_2, O	*c*	−51.5	......
oxybromide	Pb_2, O, Br_2	*c*	−119.8	......
"	Pb_3, O_2, Br_2	*c*	−171.4	......
"	Pb_4, O_3, Br_2	*c*	−223.4	......
oxychloride	Pb_2, O, Cl_2	*c*	−142.7	......
"	Pb_3, O_2, Cl_2	*c*	−195.9	......
"	Pb_4, O_3, Cl_2	*c*	−247.9	......
phosphite	Pb, H, P, O_3	*c*	−231.7	......
selenide	Pb, Se	*c*	−20	......
sulfate	Pb, S, O_4	*c*	−218.5	−159.5
sulfide	Pb, S	*c*	−22.3	−21.9
telluride	Pb, Te	*c*	−6.0	......
thiosulfate	Pb, S_2, O_3	*c*	−151.1	......
Lithium	Li	*c*	0.00	0.00
acetate	Li, C_2, H_3, O_2	*aq*	−183.7	−160.0
bromate	Li, Br, O_3	*aq*	−77.8	−65.70

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Name	Formula	State	ΔH	ΔF
Lithium				
bromide	Li, Br	*c*	−83.76	......
		aq, 400	−95.20	−95.28
bromite	Li, Br, O	*aq*	−87.9	......
carbide	Li$_2$, C$_2$	*c*	−13.0	......
carbonate	Li$_2$, C, O$_3$	*c*	−289.7	......
		aq, 2000	−293.1	−267.58
" , acid	Li, H, C, O$_3$	*aq*, 2000	−231.0	−210.98
chlorate	Li, Cl, O$_3$	*aq*	−87.4	−70.95
chloride	Li, Cl	*c*	−97.65	......
		aq, 400	−106.18	−102.03
chlorite	Li, Cl, O	*aq*	−92.5	......
cyanate	Li, C, N, O	*aq*	−101.1	−94.12
cyanide	Li, C, N	*aq*	−31.3	−31.35
fluoride	Li, F	*c*	−145.57	......
		aq, 400	−144.68	−136.40
fluosilicate	Li$_2$, Si, F$_6$	*c*	−677.3	......
hydride	Li, H	*c*	−21.6	−16.90
hydroxide	Li, O, H	*c*	−116.55	......
		aq, 400	−121.15	−108.29
iodate	Li, I, O$_3$	*aq*	−121.1	−102.95
iodide	Li, I	*c*	−65.08	......
		aq, 400	−79.92	−83.03
nitrate	Li, N, O$_3$	*c*	−115.35	......
		aq, 400	−115.71	−96.95
nitride	Li$_3$, N	*c*	−46.4	......
oxide	Li$_2$, O	*c*	−142.3	......
" , per	Li$_2$, O$_2$	*c*	−151.9	−138.0
		aq	−159	......
perchlorate	Li, Cl, O$_4$	*aq*	−106.1	−81.4
selenide	Li$_2$, Se	*c*	−84.9	......
		aq	−95.3	−105.64
silicate	Li$_2$, Si, O$_3$	*gls*	−374	......
sulfate	Li$_2$, S, O$_4$	*c*	−342.35	......
		aq, 400	−348.59	−317.50
Magnesium	Mg	*c*	0.00	0.00
acetate	Mg, C$_4$, H$_6$, O$_4$	*aq*	−344.4	−286.4
arsenate	Mg$_3$, As$_2$, O$_8$	*c*	−731.3	......
		aq	−749	−630.14
bromide	Mg, Br$_2$	*c*	−123.9	......
		aq, 400	−167.2	−156.9
carbonate	Mg, C, O$_3$	*c*	−267.6	−246.42
chloride	Mg, Cl$_2$	*c*	−151.6	......
		aq, 400	−189.3	−170.4
cyanamide	Mg, C, N$_2$	*c*	−61	......
cyanide	Mg, C$_2$, N$_2$	*aq*	−39.5	−29.1
dithionate	Mg, S$_2$, O$_6$	*aq*	−309.1	......
fluoride	Mg, F$_2$	*c*	−263.8	......
hydroxide	Mg, O$_2$, H$_2$	*ppt*	−218.7	......
" (brucite)	Mg, O$_2$, H$_2$	*c*	−223.9	−193.3
iodide	Mg, I$_2$	*c*	−86.8	......
		aq, 400	−136.61	−132.45
molybdate	Mg, Mo, O$_4$	*c*	−329.9	......
nitrate	Mg, N$_2$, O$_6$	*aq*, 400	−208.27	−160.28
nitride	Mg$_3$, N$_2$	*c*	−116	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Magnesium				
oxide	Mg, O	*c*	−146.1	−136.37
phosphate	Mg_3, P_2, O_8	*ppl*	−915.8	......
silicate	Mg, Si, O_3	*c*	−347.5	......
sulfate	Mg, S, O_4	*c*	−304.95	......
		aq, 400	−325.25	−283.88
sulfide	Mg, S	*c*	−82.2	......
		aq	−108	−84.8
sulfite	Mg, S, O_3	*c*	−240.0	......
tungstate	Mg, W, O_4	*c*	−345.2	......
Manganese	Mn	*c*	0.00	0.00
acetate	Mn, C_4, H_6, O_4	*c*	−270.3	......
		aq	−282.5	−227.2
bromide	Mn, Br_2	*c*	−91	......
		aq	−106	−97.8
carbide	Mn_3, C	*c*	−23	......
carbonate	Mn, C, O_3	*c*	−218	......
		ppl	−207.8	......
chloride	Mn, Cl_2	*c*	−112.7	......
		aq	−128.7	−111.3
fluoride (ous)	Mn, F_2	*aq*, 1200	−205.9	−180.0
" (ic)	Mn, F_3	*aq*	−260.5	......
hydroxide (ous)	Mn, O_2, H_2	*c*	−163.4	−143.1
" (ic)	Mn, O_3, H_3	*c*	−221	−190
iodide	Mn, I_2	*c*	−49.8	......
		aq	−76.0	−73.3
nitrate	Mn, N_2, O_6	*c*	−134.9	......
		aq, 400	−147.8	−101.1
oxalate	Mn, C_2, O_4	*c*	−240.9	......
oxide	Mn, O	*c*	−96.5	−91.22
" (di)	Mn, O_2	*c*	−123	−102.9
" (ic)	Mn_2, O_3	*c*	−233	......
" (ous, ic)	Mn_3, O_4	*c*	−345	......
phosphate	Mn_3, P_2, O_8	*c*	−736	......
selenide	Mn, Se	*c*	−26.3	−22.67
silicate	Mn, Si, O_3	*c*	−301.3	−282.10
sulfate	Mn, S, O_4	*c*	−251.2	......
		aq, 400	−265.0	−224.7
sulfide	Mn, S	*c*	−47.0	−46.0
Permanganic acid	H, Mn, O_4	*aq*	−122.3	......
Mercury	Hg	*l*	0.00	0.00
acetate (ous)	Hg, C_2, H_3, O_2	*c*	−101.05	......
" (ic)	Hg, C_4, H_6, O_4	*c*	−196.3	......
		aq	−192.3	−139.2
azide	Hg_2, N_6	*c*	100	......
bromide (ous)	Hg_2, Br_2	*c*	−48.78	−42.7
" (ic)	Hg, Br_2	*c*	−40.70	−38.8
		aq	−38.3	−9.74
carbonate (ous)	Hg_2, C, O_3	*c*	......	−111.2
chloride (ous)	Hg_2, Cl_2	*c*	−63.15	−50.3
" (ic)	Hg, Cl_2	*c*	−53.4	−42.2
		aq	−50.1	−23.25
cyanide	Hg, C_2, N_2	*c*	62.7	......
		aq	65.7	118.1
fulminate (ic)	Hg, O_2, N_2, C_2	*c*	64.1	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Mercury				
iodide (ous)	Hg_2, I_2	*c*	−28.87	−26.53
" (ic)	Hg, I_2	*c*, red	−25.3	−24.0
nitrate (ous)	Hg_2, N_2, O_6	*aq*	−58.3	−15.65
" (ic)	Hg, N_2, O_6	*aq*	−56.6	−13.09
oxalate	Hg, C_2, O_4	*c*	−159.3	......
oxide (ous)	Hg_2, O	*c*	−21.5	−12.80
" (ic)	Hg, O	*c*, red	−21.7	−13.94
		ppt, yel.	−20.8	......
selenide (ic)	Hg, Se	*ppt*	−8.0	......
sulfate (ous)	Hg_2, S, O_4	*c*	−176.5	......
" (ic)	Hg, S, O_4	*c*	−166.6	......
sulfide	Hg, S	*c*, black	−10.7	−8.80
thiocyanate	Hg, C_2, N_2, S_2	*c*	52.0	......
Molybdenum	Mo	*c*	0.00	0.00
oxide (di)	Mo, O_2	*c*	−130	−118.0
" (tri)	Mo, O_3	*c*	−176.5	−157.6
sulfide	Mo, S_2	*c*	......	53.96
Molybdic acid	H_2, Mo, O_4	*c*	−247.07	−227.0
Neodymium	Nd	*c*	0.00	0.00
chloride	Nd, Cl_3	*c*	−246.7	......
iodide	Nd, I_3	*c*	−155.4	......
oxide	Nd_2, O_3	*c*	−435.1	......
sulfate	Nd_2, S_3, O_{12}	*c*	−931.5	......
sulfide	Nd_2, S_3	*c*	−262.7	......
Nickel	Ni	*c*	0.00	0.00
acetate	Ni, C_4, H_6, O_4	*aq*	−249.4	−190.1
bromide	Ni, Br_2	*c*	−53.4	......
		aq	−72.4	−60.7
carbide	Ni, C_3	*c*	9.2	......
chloride	Ni, Cl_2	*c*	−75.0	......
		aq, 400	−94.17	−74.19
cyanide	Ni, C_2, N_2	*aq*	231.1	66.3
fluoride	Ni, F_2	*c*	−157.5	......
		aq	−171.4	−142.9
hydroxide (ous)	Ni, O_2, H_2	*c*	−129.8	−105.6
" (ic)	Ni, O_3, H_3	*c*	−163.2	......
iodide	Ni, I_2	*c*	−22.4	......
		aq	−41.8	−36.2
nitrate	Ni, N_2, O_6	*c*	−101.5	......
		aq, 200	−113.3	−64.0
oxide	Ni, O	*c*	−58.4	−53.03
selenide	Ni, Se	*c*	−14	......
sulfate	Ni, S, O_4	*c*	−216	......
		aq, 200	−231.1	−187.6
sulfide	Ni, S	*c*	−20.4	......
telluride	Ni, Te	*c*	−10.8	......
Nitrogen	N_2	*g*	0.00	0.00
oxide (ous)	N_2, O	*g*	19.65	24.93
" (ic)	N, O	*g*	21.53	20.66
" (tri)	N_2, O_3	*g*	20.0	......
" (tetra)	N_2, O_4	*g*	2.24	23.44
		l	12.2	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Nitrogen				
" (penta)	N_2, O_5	*g*	0.6	......
		c	−13.1	......
" (per)	N, O_2	*g*	7.96	12.27
oxybromide	N, O, Br	*l*	11.6	19.26
oxychloride	N, O, Cl	*g*	12.8	16.02
selenide	N, Se	*c*	42.3	......
sulfide	N, S	*c*	31.9	......
Hydrazine	N_2, H_4	*aq*	4.5	29.80
Hydrazoic acid	N_3, H	*aq*	54.6	......
Hydroxylamine	N, H_3, O	*l*	−25.5	......
		aq	−21.7	......
Nitric acid	H, N, O_3	*l*	−41.66	......
		g	−34.4	......
		aq, 400	−49.11	−26.25
Nitrous acid	H, N, O_2	*aq*	−28.5	−13.02
See also ammonium				
Osmium	Os	*c*	0.00	0.00
oxide	Os, O_4	*c*	......	−69.40
Oxygen	O_2	*g*	0.00	0.00
Ozone	O_3	*g*	34.5	39.4
Palladium	Pd	*c*	0.00	0.00
bromide (ous)	Pd, Br_2	*c*	−24.9	......
chloride (ous)	Pd, Cl_2	*c*	−44.2	......
cyanide	Pd, C_2, N_2	*c*	51.7	......
hydride	Pd_2, H	*c*	−8.86	......
hydroxide (ous)	Pd, O_2, H_2	*c*	−90.7	−70.50
iodide (ous)	Pd, I_2	*c*	−15.1	......
"	$Pd, I_2, (H_2, O)$	*ppt*	−86.5	......
Phosphorus	P	*c*, white	0.00	0.00
		c, red	−4.22	−1.80
bromide (tri)	P, Br_3	*l*	−45	......
" (penta)	P, Br_5	*c*	−60.6	......
chloride (tri)	P, Cl_3	*l*	−76.9	−63.3
		g	−70.0	......
" (penta)	P, Cl_5	*c*	−106.5	......
hydride (phosphine)	P, H_3	*g*	−2.3	1.08
iodide	P, I_3	*c*	−10.9	......
oxide (penta)	P_2, O_5	*c*	−360.0	......
		amor	−367.0	......
		gls	−371.7	......
oxybromide	P, O, Br_3	*c*	−106.9	......
oxychloride	P, O, Cl_3	*l*	−147.1	......
nitride	P_3, N_5	*c*	−75.03	......
Phosphonium bromide	P, H_4, Br	*c*	−34.2	......
" chloride	P, H_4, Cl	*c*	−67.8	......
" iodide	P, H_4, I	*c*	−20.6	......
Phosphorous acid (hypo)	H_3, P, O_2	*c*	−141.36	......
		aq, 450	−141.4	−120.0
" " (ortho)	H_3, P, O_3	*c*	−228.93	......
		aq	−228.8	−204.0
" " (pyro)	H_4, P_2, O_5	*aq*	−384.3	......
Phosphoric acid (meta)	H, P, O_3	*c*	−224.8	......
" " (ortho)	H_3, P, O_4	*c*	−303.37	......
		aq, 400	−306.16	−270.0

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Name	Formula	State	ΔH	ΔF
Phosphorus				
Phosphoric acid (pyro)	H_4, P_2, O_7	c	−513.7	......
		l	−529.4	......
Platinum	Pt	c	0.00	0.00
bromide (ic)	Pt, Br_4	c	−40.6	......
		aq	−50.4	......
chloride (ous)	Pt, Cl_2	c	−34	......
" (ic)	Pt, Cl_4	c	−62.6	......
		aq	−82.0	......
iodide (ic)	Pt, I_4	c	−18	......
hydroxide	Pt, O_2, H_2	c	−87.5	−67.9
sulfide (ous)	Pt, S	c	−16	−17.25
sulfide (ic)	Pt, S_2	c	−21	−21.0
Bromoplatinic acid	H_2, Pt, Br_6	aq	−115.4	......
Chloroplatinous acid	H_2, Pt, Cl_4	aq	−121.9	......
Chloroplatinic acid	H_2, Pt, Cl_6	aq	−165.6	......
Potassium	K	c	0.00	0.00
acetate	K, C_2, H_3, O_2	c	−173.81	......
		aq, 400	−177.21	−156.73
aluminum sulfate	$K_2, Al_2, S_4, O_{16}, 24(H_2, O)$	c	−2496.2	......
" silicate	K_2, Al_2, Si_4, O_{12}	c*	−1379.6	......
		gls	−1368.2	......
" "	K_2, Al_2, Si_6, O_{16}	c†	−1810.6	......
		c‡	−1784.4	......
		gls	−1747	......
arsenate	K_3, As, O_4	aq	−390.0	−355.7
arsenite	K_3, As, O_3	aq	−322.7	......
bromate	K, Br, O_3	c	−81.60	......
		aq, 400	−71.63	−62.43
bromide	K, Br	c	−94.07	−90.45
		aq, 400	−88.92	−92.0
bromoplatinate	K_2, Pt, Br_6	c	−248.2	......
		aq	−236.1	......
bromoplatinite	K_2, Pt, Br_4	c	−221.3	......
		aq	−210.7	......
carbonate	K_2, C, O_3	c	−274.03	......
		aq, 400	−280.66	−261.04
" , acid	K, H, C, O_3	c	−229.8	......
		aq, 2000	−224.67	−207.71
chlorate	K, Cl, O_3	c	−91.33	......
		aq	−81.16	−67.68
chloride	K, Cl	c	−104.36	−97.56
		aq, 400	−99.90	−98.76
chloroplatinate	K_2, Pt, Cl_6	c	−299.6	......
		aq	−286.2	......
chloroplatinite	K_2, Pt, Cl_4	c	−254.7	......
		aq	−242.4	−226.5
chlorostannate	K_2, Sn, Cl_6	c	−360.21	......
		aq	−356.80	......
chromate	K_2, Cr, O_4	c	−333.4	......
		aq, 400	−328.0	......

* Leucite. † Adularia. ‡ Microcline.

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Potassium				
cyanate	K, C, N, O	*c*	−99.6	......
		aq	−94.4	−90.85
cyanide	K, C, N	*c*	−28.1	......
		aq, 200	−25.1	−28.08
dichromate	K_2, Cr_2, O_7	*c*	−488.5	......
		aq, 400	−471.8	−440.9
ferricyanide	K_3, Fe, C_6, N_6	*c*	−48.5	......
		aq	−34.1	......
ferrocyanide	K_4, Fe, C_6, N_6	*c*	−131.9	......
		aq	−119.5	......
fluoride	K, F	*c*	−134.51	......
		aq, 400	−138.37	−133.13
fluosilicate	K_2, Si, F_6	*c*	−681	......
hydride	K, H	*c*	−10	−5.3
hydroxide	K, O, H	*c*	−102.02	......
		aq, 400	−114.82	−105.0
hypobromite	K, Br, O	*aq*	−81.6	......
hypochlorite	K, Cl, O	*aq*	−89.35	......
hyponitrite	K_2, N_2, O_2	*aq*	−117.0	......
iodate	K, I, O_3	*c*	−121.70	......
		aq, 400	−115.00	−99.68
iodide	K, I	*c*	−78.87	......
		aq, 400	−73.63	−79.76
molybdate	K_2, Mo, O_4	*aq*, 880	−364.0	−342.9
nitrate	K, N, O_3	*c*	−118.09	......
		aq, 400	−109.55	−93.68
nitrite	K, N, O_2	*aq*	−85.8	−75.9
oxalate	K_2, C_2, O_4	*c*	−319.9	......
		aq, 400	−315.3	−293.1
oxide	K_2, O	*c*	−86.2	......
" (tri)	K_2, O_3	*c*	−126	......
" (tetra)	K_2, O_4	*c*	−135	......
perchlorate	K, Cl, O_4	*c*	−112.71	......
		aq, 400	−100.97	−78.13
periodate	K, I, O_4	*aq*	−97.9	......
permanganate	K, Mn, O_4	*c*	−192.9	......
		aq	−182.5	−168.03
persulfate	K_2, S_2, O_8	*c*	−457.5	......
		aq	−443.8	......
phosphate (mono)	K, H_2, P, O_4	*c*	−362.7	......
		aq	−367.27	......
" (di)	K_2, H, P, O_4	*aq*	−425.6	......
" (tri)	K_3, P, O_4	*aq*	−478.4	−443.3
phosphite (ortho)	K_3, P, O_3	*aq*	−397.2	......
" (hypo)	K, H_2, P, O_2	*aq*	−202.8	......
pyrosulfate	K_2, S_2, O_7	*c*	−475.4	......
		aq	−471.6	......
selenate	K_2, Se, O_4	*aq*	−266.9	−240.0
selenide	K_2, Se	*c*	−74.4	......
		aq	−83.2	−99.10
sulfate	K_2, S, O_4	*c*	−342.66	......
		aq, 400	−336.24	−310.96
sulfide	K_2, S	*c*	−121.5	......
		aq, 400	−110.54	−111.44

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Potassium				
sulfide (tetra)	K_2, S_4	*c*	−114.1	......
sulfite	K_2, S, O_3	*c*	−267.7	......
		aq	−269.5	−251.3
" (meta)	K_2, S_2, O_5	*c*	−361.1	......
thiocyanate	K, C, N, S	*c*	−47.0	......
		aq, 400	−40.93	−44.08
thionate (di)	K_2, S_2, O_6	*c*	−413.7	......
" (tri)	K_2, S_3, O_6	*c*	−411.2	......
" (tetra)	K_2, S_4, O_6	*c*	−406.0	......
" (penta)	K_2, S_5, O_6	*c*	−398.09	......
thiosulfate	K_2, S_2, O_3	*c*	−270.5	......
		aq	−266	......
Praseodymium	Pr	*c*	0.00	0.00
chloride	Pr, Cl_3	*c*	−254.9	......
oxide (di)	Pr, O_2	*c*	−231.5	......
" (tri)	Pr_2, O_3	*c*	−439.4	......
Rhodium	Rh	*c*	0.00	0.00
chloride (mono)	Rh, Cl	*c*	......	−12.6
" (di)	Rh, Cl_2	*c*	......	−31.4
" (tri)	Rh, Cl_3	*c*	......	−46.0
oxide (mono)	Rh, O	*c*	......	−19.3
" (tri)	Rh_2, O_3	*c*	......	−60.5
Rubidium	Rb	*c*	0.00	0.00
bromide	Rb, Br	*c*	−95.83	......
		aq, 400	−89.72	−93.38
carbonate	Rb_2, C, O_3	*c*	−273.23	......
		aq, 220	−282.36	−263.78
" , acid	Rb, H, C, O_3	*c*	−230.01	......
		aq, 2000	−225.41	−209.07
chloride	Rb, Cl	*c*	−105.08	......
		aq, 400	−100.70	−100.13
fluoride	Rb, F	*c*	−133.24	......
		aq, 400	−139.17	−134.5
hydride	Rb, H	*c*	......	−7.3
hydroxide	Rb, O, H	*c*	−101.3	......
		aq, 200	−115.7	−106.39
iodide	Rb, I	*c*	−81.03	......
		aq, 400	−74.43	−81.13
oxide	Rb_2, O	*c*	−82.9	......
" (per)	Rb_2, O_2	*c*	−107	......
nitrate	Rb, N, O_3	*c*	−119.24	......
		aq, 400	−110.34	−95.05
sulfate	Rb_2, S, O_4	*c*	−344.48	......
sulfide	Rb_2, S	*c*	−87.7	......
thiocyanate	Rb, C, N, S	*c*	−56	......
Ruthenium	Ru	*c*	0.00	0.00
chloride	Ru, Cl_3	*c*	......	−49.2
oxide	Ru, O_2	*c*	......	−40.5
Selenium	Se	*c*, hex.	0.00	0.00
		c, mon.	0.2	......
chloride	Se_2, Cl_2	*l*	−22.13	−13.73
" (tetra)	Se, Cl_4	*c*	−46.12	......
fluoride	Se, F_6	*g*	−246	−219.0

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Selenium				
hydride	H_2, Se	g	18.5	15.30
		aq	16.1	16.72
nitride	Se, N	c	42.3	......
oxide (di)	Se, O_2	c	−56.36	......
Selenic acid	H_2, Se, O_4	c	−130.25	......
		aq, 400	−143.2	......
Selenious acid	H_2, Se, O_3	c	−119.7	......
		aq	−123.8	−101.36
Silicon	Si	c	0.00	0.00
bromide	Si, Br_4	l	−93.6	......
carbide	Si, C	c	−28	−27.2
chloride	Si, Cl_4	l	−150.1	−134.1
		g	−142.5	......
fluoride	Si, F_4	g	−360.1	−351.0
hydride	Si, H_4	g	−8.7	−3.3
iodide	Si, I_4	c	−29.8	......
oxide (quartz)	Si, O_2	c	−203.34	−190.4
sulfide	Si, S_2	c	− 32.02	......
Silicic acid (ortho)	H_4, Si, O_4	c	−330.1	......
" " (meta)	H_2, Si, O_3	c	−267.8	−247.9
Silver	Ag	c	0.00	0.00
acetate	Ag, C_2, H_3, O_2	c	−95.9	......
		aq	−91.5	−70.86
bromide	Ag, Br	c	−23.81	−22.90
carbide	Ag_2, C_2	c	84.5	......
carbonate	Ag_2, C, O_3	c	−119.5	−104.39
chlorate	Ag, Cl, O_3	c	−1.8	......
chloride	Ag, Cl	c	−30.30	−26.22
cyanate	Ag, C, N, O	c	−23.66	......
cyanide	Ag, C, N	c	33.8	38.70
dithionate	Ag_2, S_2, O_6, (H_2, O)	c	−377.1	......
fluoride	Ag, F	c	−48.7	......
		aq, 400	−53.0	−47.26
" , acid	Ag, H, F_2	aq	−130.6	......
fulminate	Ag, O, N, C	c	−42.8	......
iodate	Ag, I, O_3	c	......	−24.08
iodide	Ag, I	c	−14.94	−15.81
nitrate	Ag, N, O_3	c	−29.4	4.96
		aq, 200	−23.96	−7.81
nitride	Ag, N_3	c	−67.3	......
nitrite	Ag, N, O_2	c	−11.6	......
		aq	−2.8	9.99
" (hypo)	Ag_2, N_2, O_2	c	−29.1	......
oxalate	Ag_2, C_2, O_4	c	−158.7	......
oxide	Ag_2, O	c	−6.95	−2.59
" (per)	Ag_2, O_2	c	−5.95	......
potassium bromide	K, Ag, Br_2	c	−117.5	......
" cyanide	K, Ag, C_2, N_2	c	−6.9	......
" iodide	K, Ag, I_2	c	−92.0	......
" "	K_3, Ag, I_4	c	−250.7	......
selenide	Ag_2, Se	c	−0.96	......
sulfate	Ag_2, S, O_4	c	−170.1	−145.94
		aq	−165.6	−139.22
sulfide	Ag_2, S	c	−5.5	−9.50

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Silver				
thiocyanate	Ag, C, N, S	*c*	21.8	......
Sodium	Na	*c*	0.00	0.00
acetate	Na, C_2, H_3, O_2	*c*	−171.34	......
		aq, 400	−175.28	−152.31
aluminate	Na, Al, O_2	*c*	−271.7	......
aluminum silicate	Na_2, Al_2, Si_4, O_{12}	*c*	−1365.9	......
″ ″	Na_2, Al_2, Si_3, O_{12}	*c**	−1179.9	......
amide	Na, N, H_2	*c*	−32	......
antimonate	Na_3, Sb, O_4	*c*	−349	......
arsenate (mono)	Na, H_2, As, O_4	*aq*	−273.7	......
″ (tri)	Na_3, As, O_4	*c*	−366	......
		aq, 500	−381.65	−341.17
arsenite (di)	Na_2, H, As, O_3	*aq*	−271.7	......
″ (tri)	Na_3, As, O_3	*aq*, 500	−314.30	......
bismuthate	Na_3, Bi, O_4	*c*	−284	......
borate (tetra)	Na_2, B_4, O_7	*c*	−742.6	......
″ (borax)	$Na_2, B_4, O_7, 10(H_2, O)$	*c*	−1453.1	......
″ (meta)	Na, B, O_2	*aq*	−231.5	......
bromate	Na, Br, O_3	*aq*, 400	−68.72	−57.59
bromide	Na, Br	*c*	−86.73	......
		aq, 400	−86.10	−87.17
bromoplatinate	Na_2, Pt, Br_6	*c*	−221.3	......
carbonate	Na_2, C, O_3	*c*	−269.46	−250.59
		aq, 400	−275.09	−251.36
″ , acid	Na, H, C, O_3	*c*	−226.0	......
		aq	−221.9	−202.87
chlorate	Na, Cl, O_3	*c*	−83.60	......
		aq, 400	−78.25	−62.84
chloride	Na, Cl	*c*	−98.33	−91.70
		aq, 400	−97.11	−93.92
chloropalladite	Na_2, Pd, Cl_4	*aq*	−242.3	......
chlorplatinate	Na_2, Pt, Cl_6	*c*	−272.1	......
		aq	−280.6	......
chloroplatinite	Na_2, Pt, Cl_4	*aq*	−237.0	−216.78
chromate	Na_2, Cr, O_4	*c*	−319.8	......
		aq, 800	−322.3	−296.58
cyanate	Na, C, N, O	*c*	−96.3	......
		aq	−91.6	−86.00
cyanide	Na, C, N	*c*	−22.52	......
		aq, 200	−22.15	−23.24
dichromate	Na_2, Cr_2, O_7	*aq*, 1200	−465.6	−431.18
fluoride	Na, F	*c*	−135.95	......
		aq, 400	−135.57	−128.29
″ , acid	Na, H, F_2	*c*	−216.75	......
fluosilicate	Na_2, Si, F_6	*c*	−669	......
		aq	−658.31	......
formate	Na, C, H, O_2	*c*	−157.7	......
hydride	Na, H	*c*	−14	−9.30
hydroxide	Na, O, H	*c*	−101.96	−90.48
		aq, 400	−112.05	−100.18
hypobromite	Na, Br, O	*aq*	−78.8	......
hypochlorite	Na, Cl, O	*aq*	−83.36	......

*Natrolite

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Sodium				
iodate	Na, I, O_3	*aq*, 400	−112.13	−94.84
iodide	Na, I	*c*	−69.28	......
		aq, 400	−70.81	−74.92
iodoplatinate	Na_2, Pt, I_6	*aq*	−167.0	......
manganate	Na_2, Mn, O_4	*c*	−270.0	......
molybdate	Na_2, Mo, O_4	*c*	−364	......
		aq	−358.5	−333.18
nitrate	Na, N, O_3	*c*	−111.72	......
		aq, 400	−106.68	−88.84
nitrite	Na, N, O_2	*c*	−86.6	......
		aq	−83.0	−71.04
oxalate	Na_2, C_2, O_4	*c*	−313.8	......
		aq, 600	−309.68	−283.42
" , acid	Na, H, C_2, O_4	*c*	−257.7	......
oxide	Na_2, O	*c*	−99.45	......
" (per)	Na_2, O_2	*c*	−119.2	−105.0
perchlorate	Na, Cl, O_4	*c*	−101.13	......
		aq, 400	−98.05	−73.29
phosphate (mono)	Na, H_2, P, O_4	*aq*	−364.6	......
" (di)	Na_2, H, P, O_4	*c*	−414.85	......
" (tri)	Na_3, P, O_4	*c*	−457	......
		aq, 400	−471.6	−428.74
" (pyro)	Na_4, P_2, O_7	*c*	−755.2	......
phosphite (mono)	Na, H_2, P, O_3	*c*	−286.42	......
		aq	−344.6	......
" (di)	Na_2, H, P, O_3	*c*	−335.33	......
" (tri)	Na_3, P, O_3	*aq*, 100	−388.8	......
" (hypo)	Na_2, H, P, O_2	*aq*	−243.8	......
selenide	Na_2, Se	*c*	−59.1	......
		aq, 440	−77.9	−89.42
" , acid	Na, H, Se	*aq*	−31	......
selenate	Na_2, Se, O_4	*c*	−254	......
		aq, 800	−261.3	−230.30
" , acid	Na, H, Se, O_4	*aq*	−201.84	......
selenite	Na_2, Se, O_3	*aq*	−238.4	......
silicate	Na_2, Si, O_3	*c*	−371.2	......
stannate	Na_4, Sn, O_4	*aq*	−453.6	......
sulfate	Na_2, S, O_4	*c*	−330.48	......
		aq, 400	−330.74	−301.28
"	Na_2, S, O_4, 10(H_2, O)	*c*	-1033.20	......
" , acid	Na, H, S, O_4	*c*	−269.04	......
sulfide	Na_2, S	*c*	−89.8	......
		aq, 400	−104.96	−101.76
" (tri)	Na_2, S_3	*aq*	−107.2	......
" (tetra)	Na_2, S_4	*c*	−99.8	......
" , acid	Na, H, S,	*aq*	−61.3	......
sulfite	Na_2, S, O_3	*c*	−261.2	......
		aq, 800	−263.9	−241.58
" , acid	Na, H, S, O_3	*aq*	−206.5	......
thiocyanate	Na, C, N, S	*c*	−39.93	......
		aq, 400	−38.09	−39.24
thionate (di)	Na_2, S_2, O_6	*c*	−401.0	......
" (tri)	Na_2, S_3, O_6	*aq*	−392	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Sodium				
thionate (tri)	$Na_2, S_3, O_6, 3(H_2, O)$	*c*	−606.7	......
" (tetra)	Na_2, S_4, O_6	*aq*	−387.3	......
thiosulfate	Na_2, S_2, O_3	*c*	−258.5	......
"	$Na_2, S_2, O_3, 5(H_2, O)$	*c*	−613	......
tungstate	Na_2, W, O_4	*c*	−391	......
		aq	−381.3	−345.18
uranate	Na_2, U, O_4	*c*	−500	−475.0
vanadate	Na_3, V, O_4	*c*	−450	......
zincate	Na_2, Zn, O_2	*c*	−187	......
Strontium	Sr	*c*	0.00	0.00
acetate	Sr, C_4, H_6, O_4	*c*	−358.0	......
		aq	−364.2	−311.80
arsenate	Sr_3, As_2, O_8	*c*	−795.7	......
bromide	Sr, Br_2	*c*	−171.0	......
		aq, 400	−187.06	−182.36
carbonate	Sr, C, O_3	*c*	−290.0	−271.7
" , acid	Sr, H_2, C_2, O_6	*aq*	−458.9	−413.76
chloride	Sr, Cl_2	*c*	−197.87	......
		aq	−209.02	−195.86
cyanide	Sr, C_2, N_2	*aq*	−59.3	−54.50
fluoride	Sr, F_2	*c*	−289.0	......
formate	Sr, C_2, H_2, O_4	*c*	−328.0	......
hydride	Sr, H_2	*c*	−42.06	−32.80
hydroxide	Sr, O_2, H_2	*c*	−228.7	......
		aq, 800	−239.2	−208.27
"	$Sr, O_2, H_2, 8(H_2, O)$	*c*	−800.48	......
iodide	Sr, I_2	*c*	−136.1	......
		aq, 400	−156.52	−157.87
nitrate	Sr, N_2, O_6	*c*	−233.2	......
		aq, 400	−228.52	−185.70
"	$Sr, N_2, O_6, 4(H_2, O)$	*c*	−514.3	......
nitride	Sr_3, N_2	*c*	−92.23	......
"	Sr, N_6	*c*	48.98	......
oxalate	$Sr, C_2, O_4, 2\frac{1}{2}(H_2, O)$	*c*	−503.5	......
oxide	Sr, O	*c*	−140.8	......
" (per)	Sr, O_2	*c*	−153.3	−139.0
phosphate	Sr_3, P_2, O_8	*c*	−980	......
		aq	−985	−881.54
selenide	Sr, Se	*c*	−83.4	......
silicate	Sr, Si, O_3	*gls*	−364	......
sulfate	Sr, S, O_4	*c*	−345.3	......
		aq, 400	−344.8	−309.30
sulfide	Sr, C	*c*	−113.1	......
		aq	−120.3	−109.78
thionate (di)	$Sr, S_2, O_6, 4(H_2, O)$	*c*	−693.0	......
tungstate	Sr, W, O_4	*c*	−393	......
Sulfur	S	*c*, rhom.	0.00	0.00
		c, mon.	−0.075	0.018
bromide	S_2, Br_2	*l*	−4	......
chloride (mono)	S_2, Cl_2	*l*	−14.3	−5.90
		g	−5.65	......
" (di)	S_2, Cl_4	*l*	−24.1	......
" (tetra)	S, Cl_4	*l*	−13.7	......
fluoride	S, F_6	*g*	−262	−235.0

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Sulfur				
oxide (di)	S, O_2	*l*	−77.0	......
		g	−70.92	−71.74
		aq	−79	......
" (tri)	S, O_3	*c*	−105.2	......
		l	−104.2	......
		g	−93.9	......
" (hepta)	S_2, O_7	*c*	−193.4	......
oxychloride (ous)	S, O, Cl_2	*l*	−50.2	......
		g	−42.7	......
" (ic)	S, O_2, Cl_2	*g*	−86.2	−73.60
"	S_2, O_5, Cl_2	*l*	−166.5	......
Hydrogen sulfide	H_2, S	*g*	−4.8	−7.87
		aq	−9.4	−6.52
" " (per)	H_2, S_2	*l*	0.4	......
Sulfuric acid	H_2, S, O_4	*c*	−196.34	......
		l	−193.75	......
		aq, 400	−211.84	......
" " (per)	H_2, S_2, O_8	*aq*	−318.5	......
" " (pyro)	H_2, S_2, O_7	*l*	−299.6	......
Sulfurous acid	H_2, S, O_3	*aq*, 200	−146.74	−128.54
Tantalum	Ta	*c*	0.00	0.00
oxide	Ta_2, O_5	*c*	−499	−447.2
Tellurium	Te	*c*	0.00	0.00
bromide	Te, Br_4	*c*	−49.3	......
chloride	Te, Cl_4	*c*	−77.4	−57.4
fluoride	Te, F_6	*g*	−15	......
hydride	H_2, Te	*g*	34.2	31.0
oxide	Te, O_2	*c*	−77.58	−64.53
Telluric acid	H_2, Te, O_4	*aq*	−165.3	......
" "	$H_2, Te, O_4, 2(H_2, O)$	*c*	−305.4	......
Tellurous acid	H_2, Te, O_3	*c*	−145.0	......
		aq	−145.0	−115.7
Thallium	Tl	*c*	0.00	0.00
acetate	Tl, C_2, H_3, O_2	*aq*	−116.6	......
bromide (ous)	Tl, Br	*c*	−41.5	−39.75
		aq	−27.9	−32.34
" (ic)	Tl, Br_3	*aq*	−58.1	......
chloride (ous)	Tl, Cl	*c*	−48.62	−44.19
		aq	−38.3	−39.09
" (ic)	Tl, Cl_3	*c*	−82.4	......
		aq	−90.8	−44.25
fluoride	Tl, F	*aq*	−77.5	−73.46
" , acid	Tl, H, F_2	*aq*	−152.6	......
fulminate	Tl, O, N, C	*c*	25.7	......
hydroxide (ous)	Tl, O, H	*c*	−56.95	−45.54
		aq	−53.8	−45.35
" (ic)	Tl, O_3, H_3	*c*	−145.07	−123.0
iodide (ous)	Tl, I	*c*	−31.1	−29.98
		aq	−12.6	−20.09
nitrate	Tl, N, O_3	*c*	−58.2	......
		aq	−48.2	−34.01
nitride	Tl, N_3	*c*	54.72	......
oxide (ous)	Tl_2, O	*c*	−42.3	......
" (ic)	Tl_2, O_3	*c*	−120	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Thallium				
selenide	Tl_2, Se	*c*	−18	......
sulfate	Tl_2, S, O_4	*c*	−221.8	......
		aq, 800	−213.9	−191.62
sulfide	Tl_2, S	*c*	−22	......
telluride	Tl_2, Te	*c*	−7.17	......
Thorium	Th	*c*	0.00	0.00
bromide	Th, Br_4	*c*	−281.5	......
		aq	−351.7	−295.31
carbonate	Th, C_2, O_6	*c*	−855.2	......
chloride	Th, Cl_4	*c*	−335	......
		aq	−392	−322.32
hydride	Th, H_4	*c*	42.77	−61.5
hydroxide	Th, O_4, H_4	*c*	−336.1	......
iodide	Th, I_4	*aq*	−291.7	−246.33
oxide	Th, O_2	*c*	−293	−280.1
oxybromide	Th, O, Br_2	*c*	−319.0	......
oxychloride	Th, O, Cl_2	*c*	−336.0	......
oxyiodide	Th, O, I_2	*c*	−289.5	......
sulfate	Th, S_2, O_8	*c*	−632	......
		aq	−667.9	−549.2
Tin	Sn	*c*, tetr.	0.00	0.00
		c, gray	0.6	......
bromide (ous)	Sn, Br_2	*c*	−61.4	......
		aq	−59.8	−55.43
" (ic)	Sn, Br_4	*c*	−94.8	......
		aq	−110.3	−97.66
chloride (ous)	Sn, Cl_2	*c*	−81.1	......
		aq	−81.5	−68.94
" (ic)	Sn, Cl_4	*l*	−127.4	−110.60
		g	−118.4	......
		aq	−157.3	−124.67
hydroxide (ous)	Sn, O_2, H_2	*c*	−136.2	−115.95
" (ic)	Sn, O_4, H_4	*c*	−268.9	−226.00
iodide	Sn, I_2	*c*	−38.9	......
		aq	−33.1	−30.95
oxide (ous)	Sn, O	*c*	−67.7	......
" (ic)	Sn, O_2	*c*	−138.1	......
sulfide	Sn, S	*c*	−22.7	−21.25
Titanium	Ti	*c*	0.00	0.00
carbide	Ti, C	*c*	−110	......
chloride	Ti, Cl_4	*l*	−181.4	......
oxide (rutile)	Ti, O_2	*c*	−218.0	−205.3
		amor	−214.1	−201.4
"	Ti_2, O_3	*c*	......	−340.8
Tungsten	W	*c*	0.00	0.00
oxide (di)	W, O_2	*c*	−130.5	−118.3
" (tri)	W, O_3	*c*	−195.7	−171.4
" (sesqui)	W_2, O_3	*c*	......	−293.0
" (penta)	W_2, O_5	*c*	−324	......
sulfide	W, S_2	*c*	−84	......
Tungstic acid	H_2, W, O_4	*c*	−284.5	......
		aq	−284.4	......
Uranium	U	*c*	0.00	0.00
carbide	U, C_2	*c*	−29	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Uranium				
chloride (tri)	U, Cl_3	*c*	−213	......
" (tetra)	U, Cl_4	*c*	−251	......
oxide (di)	U, O_2	*c*	−256.6	−242.2
" (tri)	U, O_3	*c*	−291.6	......
" (tetra)	$U, O_4, 2(H_2, O)$	*c*	−426	......
" (octa)	U_3, O_8	*c*	−845.2	......
Uranyl acetate	U, O_2, C_4, H_6, O_4	*aq*	−479.1	......
" "	$U, O_2, C_4, H_6, O_4, 2(H_2, O)$	*c*	−620.7	......
" chloride	U, O_2, Cl_2	*aq*	−321.8	......
" "	$U, O_2, Cl_2, (H_2, O)$	*c*	−384.0	......
" chromate	U, O_2, Cr, O_4	*aq*	−450.5	......
" "	$U, O_2, Cr, O_4, 5\frac{1}{2}(H_2, O)$	*c*	−832.8	......
" nitrate	U, O_2, N_2, O_6	*c*	−322.2	......
		aq	−341.0	......
" sulfate	U, O_2, S, O_4	*aq*	−455.0	......
" "	$U, O_2, S, O_4, 3(H_2, O)$	*c*	−655.6	......
Vanadium	V	*c*	0.00	0.00
chloride (di)	V, Cl_2	*c*	−147	......
" (tri)	V, Cl_3	*l*	−187	......
" (tetra)	V, Cl_4	*l*	−165	......
oxide (di)	V_2, O_2	*c*	−195	......
" (tri)	V_2, O_3	*c*	−330	−311
" (tetra)	V_2, O_4	*c*	−383	......
" (penta)	V_2, O_5	*c*	−437	−406
Vanadyl chloride	V, O, Cl_3	*l*	−200	......
Zinc	Zn	*c*	0.00	0.00
acetate	Zn, C_4, H_6, O_4	*c*	−259.4	......
		aq, 400	−269.2	−214.4
"	$Zn, C_4, H_6, O_4, 2(H_2, O)$	*c*	−490.2	......
bromide	Zn, Br_2	*c*	−78.4	......
		aq, 400	−93.4	−84.3
carbonate	Zn, C, O_3	*c*	−192.9	−174.6
chloride	Zn, Cl_2	*c*	−99.55	......
		aq, 400	−115.27	−92.84
cyanide	Zn, C_2, N_2	*c*	17.06	......
dithionate	$Zn, S_2, O_6, 6(H_2, O)$	*c*	−729.5	......
ethyl	Zn, C_4, H_{10}	*l*	−10.0	......
fluoride	Zn, F_2	*aq*	−192.7	−166.6
formate	Zn, C_2, H_2, O_4	*c*	−231.3	......
hydroxide	Zn, O_2, H_2	*c*	−155.8	−132.6
iodide	Zn, I_2	*c*	−49.8	......
		aq	−61.4	−59.8
nitrate	Zn, N_2, O_6	*aq*, 400	−134.7	−87.7
nitride	Zn, N_6	*c*	50.8	......
oxalate	$Zn, C_2, O_4, 2(H_2, O)$	*c*	−373.2	......
oxide	Zn, O	*c*	−83.5	......
selenide	Zn, Se	*c*	−34	......
silicate	Zn, Si, O_3	*c*	−282.6	......
sulfate	Zn, S, O_4	*c*	−233.4	......
		aq, 400	−251.95	−211.28
"	$Zn, S, O_4, 7(H_2, O)$	*c*	−734.8	......
sulfide	Zn, S	*c*	−44	−43.2
telluride	Zn, Te	*c*	−33.21	......

HEAT AND FREE ENERGY OF FORMATION OF COMPOUNDS

Name	Formula	State	ΔH	ΔF
Zirconium	Zr	c	0.00	0.00
carbide	Zr, C	c	−44	......
chloride	Zr, Cl_4	c	−268.9	......
hydroxide	Zr, O_4, H_4	c	−411.0	......
"	Zr, O, 2(O, H)	c	−337	−307.6
oxide	Zr, O_2	c, mon.	−258.1	−245.4

SURFACE TENSIONS OF METALS AND FUSED SALTS

The table below gives the surface tension of various metals and fused salts in contact with an atmosphere as indicated; temperature °C.

Formula		Surface Tension in Dynes per Centimeter		
Ag	−air	800^{970°	....	....
AgBr	−air	121.4^{434°	....	....
AgCl	−air	125.5^{452°	121.6^{494°	112.8^{573°
Au	−air	$(580\text{-}1000)^{1070^\circ}$	....	....
$BaCl_2$	−air	171^{962°	....	....
Bi	$-H_2$	388^{300°	354^{583°	....
$BiCl_3$	$-N_2$	66.2^{271°	58.1^{331°	52.0^{382°
$CaCl_2$	−air	152^{772°	....	....
Cd	$-H_2$	621.5^{450°	618.3^{500°	....
CsBr	$-N_2$	81.8^{658°	71.6^{808°	62.7^{971°
CsCl	$-N_2$	89.2^{664°	73.7^{881°	56.3^{1080°
CsF	$-N_2$	104.5^{723°	92.3^{877°	78.9^{1100°
CsI	$-N_2$	73.1^{654°	62.5^{821°	51.1^{1030°
$CsNO_3$	$-N_2$	91.8^{426°	83.7^{511°	72.5^{686°
Cs_2SO_4	$-N_2$	111.3^{1036°	97.3^{1221°	83.0^{1530°
Cu	$-H_2$	1103^{1131°	....	....
Ga	$-CO_2$	358^{30°	....	....
Hg	−Vac.	480.3^{0°	467.1^{60°	....

SURFACE TENSIONS OF METALS AND FUSED SALTS

Formula		Surface Tension in Dynes per Centimeter		
Hg	— air	487^{15°	....	....
Hg	— H_2	470^{19°	....	....
Hg	— CO_2	465^{15°	....	....
K	— CO_2	411^{62°		
KBO_2	— N_2	123.5^{992°	112.3^{1036°	96.6^{1142°
KBr	— N_2	85.7^{775°	82.0^{826°	75.4^{920°
KCN	— air	$96.1^{634.5^\circ}$	....	....
KCl	— N_2	95.8^{800°	82.2^{986°	69.6^{1167°
$K_2Cr_2O_7$	— N_2	140.1^{420°	138.4^{480°	135.0^{535°
KF	— N_2	138.4^{913°	119.9^{1147°	104.9^{1310°
KI	— N_2	75.2^{737°	69.2^{812°	66.5^{873°
K_2MoO_4	— N_2	150.5^{931°	135.5^{1189°	112.5^{1522°
KNO_3	— N_2	110.4^{380°	95.2^{578°	80.2^{772°
KPO_3	— N_2	155.5^{897°	136.8^{1167°	100.3^{1536°
K_2SO_4	— N_2	143.7^{1070°	126.2^{1347°	106.8^{1656°
K_2WO_4	— N_2	161.0^{925°	124.6^{1284°	105.6^{1520°
$LiBO_2$	— N_2	261.8^{879°	243.6^{1150°	192.4^{1520°
LiCl	— N_2	137.8^{614°	123.2^{814°	104.8^{1075°
LiF	— N_2	$249.5^{868.5^\circ}$	229.8^{1065°	201.1^{1270°
$LiNO_3$	— N_2	111.5^{359°	106.0^{445°	96.2^{609°
Li_2SO_4	— N_2	223.8^{860°	211.0^{1057°	200.3^{1214°
Li_2SiO_3	— N_2	374.6^{1254°	356.2^{1421°	346.6^{1601°
Na	— CO_2	294^{90°	....	....
Na	— Vac.	222^{100°	211^{250°	....
$NaBO_2$	— N_2	193.7^{1016°	159.7^{1234°	126.2^{1441°
NaBr	— N_2	105.8^{761°	92.9^{942°	78.0^{1166°
NaCl	— N_2	113.8^{803°	106.4^{908°	88.0^{1172°
NaF	— N_2	199.5^{1010°	180.5^{1189°	162.9^{1357°
NaI	— N_2	85.6^{706°	80.5^{816°	77.6^{861°
Na_2MoO_4	— N_2	214^{699°	199^{859°	174.6^{1212°
$NaNO_3$	— N_2	119.7^{322°	108.9^{513°	93.7^{738°
$NaPO_3$	— N_2	197.5^{827°	181.6^{1099°	147.5^{1517°
Na_2SO_4	— N_2	194.8^{900°	188.2^{990°	184.7^{1077°
Na_2WO_4	— N_2	203.3^{710°	178.3^{1081°	142.6^{1595°
Pb	— H_2	453^{350°	423^{750°	....
$PbCl_2$	— air	138^{490°	131^{539°	126^{614°
Pt	— air	1819^{2000°	....	....
RbBr	— N_2	87.7^{729°	77.2^{884°	60.6^{1121°
RbCl	— N_2	95.7^{750°	81.1^{923°	61.4^{1150°
RbF	— N_2	127.2^{803°	113.0^{936°	102.2^{1085°
RbI	— N_2	79.4^{673°	65.1^{869°	55.4^{1016°
$RbNO_3$	— N_2	107.5^{327°	92.5^{527°	77.7^{726°
Rb_2SO_4	— N_2	132.5^{1086°	118.9^{1289°	108.9^{1545°
Sb	— H_2	350^{640°	....	....
Sn	— H_2	526^{253°	508^{878°	....
$SnCl_2$	— N^2	97^{307°	89.0^{405°	81.6^{480°
$TlNO_3$	— N_2	117.3^{210°	109.8^{312°	99.5^{430°
Zn	— H_2	753^{477°	747^{543°	....

SURFACE TENSIONS OF VARIOUS LIQUIDS

The table below gives the surface tension of various liquids in dynes per centimeter. The nature of the gas in contact with the surface of the liquid is given in parenthesis following the name of the compound. The temperature in degrees centigrade is indicated by the superscript which accompanies the value in each case.

The value k_E (Eötvös constant) $= \dfrac{d\Gamma}{dt} = \dfrac{d(M/d)^{2/3}\gamma}{dt}$, where d is the density of the substance, M is the gram formula weight, t the temperature and γ is the surface tension in dynes per centimeter.

Name	Surface Tension in Dynes per Centimeter			k_E
Acetal (air)	$23.2^{5\circ}$	$21.65^{20\circ}$	$13.5^{100\circ}$	....
Acetaldehyde	$22.4^{10\circ}$	$21.2^{20\circ}$	$17.0^{50\circ}$	1.8
Acetaldoxime	$30.1^{35\circ}$	$25.1^{80\circ}$	$17.8^{145\circ}$	1.5
Acetamide	$39.3^{85\circ}$	$37.3^{105\circ}$	$35.7^{120\circ}$	1.2
Acetic acid (air)	$28.6^{10\circ}$	$27.6^{20\circ}$	$22.2^{75\circ}$	1.3
Acetic acid (vapor)	$28.8^{10\circ}$	$27.8^{20\circ}$	$22.3^{75\circ}$	....
Acetic anhydride	$33.3^{15\circ}$	$32.7^{20\circ}$	$18.6^{140\circ}$	2.2
Acetone (air or vapor)	$26.2^{0\circ}$	$23.7^{20\circ}$	$18.6^{60\circ}$	1.9
Acetonitrile (air)	$30.6^{10\circ}$	$29.3^{20\circ}$	$20.2^{90\circ}$	1.5
Acetonitrile (vapor)	$30.6^{10\circ}$	$29.3^{20\circ}$	$20.2^{90\circ}$	....
Acetophenone (air or vapor)	$39.8^{20\circ}$	$33.3^{75\circ}$	$22.8^{175\circ}$	2.2
Acetylene (vapor)	$18^{-77.4}$	$16^{-70.5\circ}$	$14^{-62.4\circ}$	2.4
Allyl alcohol (air or vapor)	$27.6^{0\circ}$	$25.8^{20\circ}$	$19.2^{95\circ}$	1.5
Anethole (air)	$37.6^{10\circ}$	$36.5^{20\circ}$	$19.6^{200\circ}$	2.3
Aniline (air)	$44.0^{10\circ}$	$42.9^{20\circ}$	$24.4^{180\circ}$	2.1
Anisole (air)	$36.4^{10\circ}$	$35.2^{20\circ}$	$28.0^{80\circ}$	2.3
Ammonia	$23^{11.1\circ}$	$18^{34.1\circ}$	$13^{59\circ}$	1.3
iso-Amyl acetate (air)	$26.6^{0\circ}$	$24.7^{20\circ}$	$17.1^{100\circ}$	2.3
iso-Amyl alcohol (air)	$25.3^{0\circ}$	$23.8^{20\circ}$	$17.7^{100\circ}$	1.90
Argon (vapor)	$13.2^{-188\circ}$	$11.9^{-183\circ}$	....	2.0
Benzene (air)	$31.6^{0\circ}$	$28.9^{20\circ}$	$21.3^{80\circ}$	2.22
Benzene (vapor)	$31.7^{0\circ}$	$29.02^{20\circ}$	$18.8^{100\circ}$	....
Benzonitrile (air or vapor)	$40.2^{10\circ}$	$39.1^{20\circ}$	$29.9^{100\circ}$	2.1
Benzylamine	$39.5^{20\circ}$	$36.5^{45\circ}$	$33.1^{75\circ}$	2.1
Bromine (air or vapor)	$45.0^{0\circ}$	$41.5^{20\circ}$	$36.2^{50\circ}$	2.0
Bromobenzene (air)	$37.7^{10\circ}$	$36.5^{20\circ}$	$27.2^{100\circ}$	2.19
p-Bromotoluene (air)	$32^{43\circ}$	$26^{100\circ}$	$20^{164\circ}$	....
iso-Butyl acetate (air)	$24.7^{5\circ}$	$23.3^{20\circ}$	$14.9^{110\circ}$	2.32
n-Butyl alcohol (air or vapor)	$26.2^{0\circ}$	$24.6^{20\circ}$	$17.8^{100\circ}$	1.91
iso-Butyl alcohol (air)	$24.4^{0\circ}$	$22.8^{20\circ}$	$20.5^{50\circ}$	1.94
n-Butyric acid (air)	$28.8^{0\circ}$	$26.8^{20\circ}$	$19.5^{100\circ}$	1.6
iso-Butyric acid (air or vapor)	$27.1^{0\circ}$	$25.2^{20\circ}$	$17.9^{100\circ}$	1.6
n-Butyronitrile (air)	$28.7^{10\circ}$	$27.6^{20\circ}$	$18.2^{110\circ}$	1.7
Carbon dioxide	$4.5^{0\circ}$	$1.16^{20\circ}$	$0.06^{30\circ}$	....
Carbon disulfide (air or vapor)	$35.3^{0\circ}$	$32.3^{20\circ}$	$26.5^{60\circ}$	2.1
Carbon monoxide (vapor)	$12.1^{-203\circ}$	$9.8^{-193\circ}$	$8.7^{-188\circ}$	2.0
Carbon tetrachloride (air)	$28.0^{10\circ}$	$26.8^{20\circ}$	$20.2^{75\circ}$	2.21
Carbon tetrachloride (vapor)	$28.2^{10\circ}$	$27.0^{20\circ}$	$17.3^{100\circ}$	....
Chloral	$30^{20\circ}$	$20^{97\circ}$	....	2.2
Chlorine	$31^{-60\circ}$	$18^{20\circ}$	$13^{50\circ}$	2.1
Chlorobenzene (air)	$34.4^{10\circ}$	$33.2^{20\circ}$	$24.0^{100\circ}$	2.21
Chlorobenzene (vapor)	$34.8^{10\circ}$	$33.6^{20\circ}$	$30.0^{50\circ}$	....
p-Chlorobromobenzene (air)	$33^{70\circ}$	$27^{132\circ}$	$21^{194\circ}$	....
Chloroform (air)	$28.5^{10\circ}$	$27.1^{20\circ}$	$21.7^{60\circ}$	2.1
p-Chlorotoluene (air or vapor)	$32^{25\circ}$	$26^{79\circ}$	$19^{151\circ}$	....
o-Cresol (air or vapor)	$39.8^{10\circ}$	$30.4^{100\circ}$	$22.0^{180\circ}$	2.0
m-Cresol (air or vapor)	$38.4^{10\circ}$	$37.4^{20\circ}$	$22.2^{180\circ}$	1.8

SURFACE TENSIONS OF VARIOUS LIQUIDS

Name	Surface Tension in Dynes per Centimeter			k_E
p-Cresol	$36.7^{20\circ}$	$34.0^{50\circ}$	$29.3^{100\circ}$	1.7
Cyclohexane (air)	$27^{10\circ}$	$25.3^{20\circ}$	$15.7^{80\circ}$	2.25
Dibenzylamine	$41.1^{20\circ}$	$38.4^{45\circ}$	$35.1^{75\circ}$	2.9
p-Dichlorobenzene (air)	$31^{68\circ}$	$25^{117\circ}$	$20^{170\circ}$	....
Diethyl ketone (air)	$26.9^{0\circ}$	$25.3^{15\circ}$	$22.2^{45\circ}$	....
Diethyl oxalate (air or vapor)	$33.2^{10\circ}$	$32.0^{20\circ}$	$26.6^{70\circ}$	....
Diethyl sulfate (air)	$34.6^{13\circ}$	$32.5^{32.5\circ}$	$28.6^{70\circ}$	....
Diethylaniline	$34.7^{15\circ}$	$34.2^{20\circ}$	$24.9^{110\circ}$	....
Dimethyl sulfate (air)	$40.1^{18\circ}$	$35.5^{55\circ}$	$31.0^{93\circ}$	....
Dimethylamine (N_2)	$25.2^{-78\circ}$	$20.2^{-23\circ}$	$17.7^{5\circ}$	....
Dimethylaniline (air)	$37.7^{10\circ}$	$36.56^{20\circ}$	$27.6^{100\circ}$	2.4
Ethyl acetate (air)	$26.5^{0\circ}$	$23.9^{20\circ}$	$17.4^{75\circ}$	2.3
Ethyl acetate (vapor)	$26.9^{0\circ}$	$24.3^{20\circ}$	$14.4^{100\circ}$	2.3
Ethyl acetoacetate (air or vapor)	$34.8^{0\circ}$	$32.5^{20\circ}$	$25.0^{90\circ}$	....
Ethyl alcohol (air)	$24.05^{0\circ}$	$22.27^{20\circ}$	$18.22^{70\circ}$	1.0
Ethyl alcohol (vapor)	$22.75^{20\circ}$	$20.14^{50\circ}$	$15.47^{100\circ}$	1.3
Ethyl benzoate	$37.5^{0\circ}$	$35.5^{20\circ}$	$30.0^{75\circ}$	....
Ethyl bromide (air or vapor)	$25.5^{10\circ}$	$24.2^{20\circ}$	$21.5^{40\circ}$	2.12
Ethyl *n*-butyrate (air)	$26.1^{5\circ}$	$24.54^{20\circ}$	$20.6^{60\circ}$	2.42
Ethyl *iso*-butyrate (air or vapor)	$24.8^{5\circ}$	$23.25^{20\circ}$	$13.85^{110\circ}$	2.39
Ethyl ether	$17.0^{20\circ}$	$13.5^{50\circ}$	$7.97^{100\circ}$	2.25
Ethyl formate (air or vapor)	$26.2^{0\circ}$	$23.6^{20\circ}$	$16.0^{80\circ}$	2.1
Ethyl iodide (air or vapor)	$30.6^{10\circ}$	$29.4^{20\circ}$	$22.4^{75\circ}$	2.2
Ethyl mercaptan (air or vapor)	$25.4^{0\circ}$	$24.0^{10\circ}$	$22.5^{20\circ}$	2.1
Ethyl propionate (air or vapor)	$25.9^{5\circ}$	$24.2^{20\circ}$	$15.5^{100\circ}$	2.3
Ethylamine (N_2)	$28.9^{-74\circ}$	$23.2^{-21.5\circ}$	$20.3^{9.9\circ}$	1.25
Ethylbenzene (air)	$31.4^{0\circ}$	$29.2^{20\circ}$	$24.9^{60\circ}$	....
Ethylene bromide (air or vapor)	$40.05^{10\circ}$	$38.75^{20\circ}$	$28.4^{100\circ}$	2.2
Ethylene chloride (air)	$33.6^{10\circ}$	$32.2^{20\circ}$	$24.0^{80\circ}$	....
Ethylene oxide (vapor)	$35.8^{-50\circ}$	$29.2^{-10\circ}$	$24.3^{20\circ}$	1.8
Formic acid (air)	$38.7^{10\circ}$	$37.6^{20\circ}$	$29.0^{100\circ}$	0.9
Furfural (air or vapor)	$43.5^{20\circ}$	$40.9^{40\circ}$	$25.4^{160\circ}$	....
Glycerol (air)	$63^{20\circ}$	$59^{90\circ}$	$52^{150\circ}$	....
Glycol (air or vapor)	$49^{0\circ}$	$47.7^{20\circ}$	$42.3^{80\circ}$	....
Guaiacol (air)	$38.66^{19.6\circ}$	$31.9^{78\circ}$	$21.3^{201\circ}$	2.2
Helium (vapor)	$0.353^{-271.6\circ}$	$0.239^{-270.1\circ}$	$0.098^{-268.9}$	1.0
n-Hexane (air)	$20.5^{0\circ}$	$18.4^{20\circ}$	$13.4^{68\circ}$	2.26
Hydrogen (vapor)	$2.88^{-258.4\circ}$	$2.32^{-255.1}$	$1.91^{-252.7}$	1.36
Hydrogen cyanide (air)	$19.1^{10\circ}$	$18.2^{17\circ}$	$17.2^{25\circ}$	1.1
Iodobenzene (air)	$40.3^{15\circ}$	$39.7^{20\circ}$	$30.6^{100\circ}$	2.18
Mesitylene (air)	$30.1^{5\circ}$	$28.5^{20\circ}$	$20.6^{100\circ}$	2.2
Methyl acetate (air or vapor)	$27.4^{0\circ}$	$24.6^{20\circ}$	$16.6^{80\circ}$	2.2
Methyl alcohol (air)	$24.5^{0\circ}$	$22.6^{20\circ}$	$15.7^{100\circ}$	1.0
Methyl *n*-butyrate (air or vapor)	$26.15^{10\circ}$	$25.0^{20\circ}$	$16.1^{100\circ}$	2.3
Methyl *iso*-butyrate (air or vapor)	$24.9^{10\circ}$	$23.8^{20\circ}$	$17.6^{75\circ}$	2.3
Methyl chloride	$19.5^{0\circ}$	$17.8^{10\circ}$	$16.2^{20\circ}$	2.00
Methyl ether (vapor)	$21^{-40\circ}$	$18^{-20\circ}$	$16^{-10\circ}$	2.0
Methyl ethyl ketone (air or vapor)	$26.9^{0\circ}$	$24.6^{20\circ}$	$18.4^{75\circ}$	....
Methyl formate (air)	$28.0^{0\circ}$	$25.0^{20\circ}$	$23.5^{30\circ}$	2.09
Methyl formate (vapor)	$28.3^{0\circ}$	$25.1^{20\circ}$	$13.04^{100\circ}$	2.09
Methyl propionate (air or vapor)	$26.1^{10\circ}$	$24.9^{20\circ}$	$17.6^{80\circ}$	2.2
Methylamine (N_2)	$29.2^{-70\circ}$	$23.6^{-20\circ}$	$22.2^{-12\circ}$	1.2
Naphthalene (air or vapor)	$28.8^{127\circ}$	$24.0^{170\circ}$	$21.8^{190\circ}$	....
Neon (vapor)	$5.90^{-249\circ}$	$5.15^{-247\circ}$	$4.45^{-245\circ}$	2.0
Nitrobenzene (air or vapor)	$46.4^{0\circ}$	$43.9^{20\circ}$	$34.4^{100\circ}$	2.2
Nitroethane (air or vapor)	$33.4^{10\circ}$	$32.3^{20\circ}$	$22.5^{100\circ}$	1.7

SURFACE TENSIONS OF VARIOUS LIQUIDS

Name	Surface Tension in Dynes per Centimeter			k_E
Nitrogen (vapor)	10.5^{-203°	8.3^{-193°	6.2^{-183°	2.0
Nitromethane (air)	39.8^{0°	36.8^{20°	26.1^{100°	....
Nitrosyl chloride (vapor)	34.5^{-33°	33^{-22°	$30^{-5.5^\circ}$	1.46
Nitrous oxide	10.1^{-25°	3.4^{10°	1.75^{20°	....
n-Octane (air or vapor)	23.8^{0°	21.8^{20°	17.9^{60°	2.3
Oxygen (vapor)	18.3^{-203°	15.7^{-193°	13.2^{-183°	1.92
Paraldehyde (air)	27.5^{5°	25.9^{20°	14.5^{124°	2.6
Phenetole (air)	32.7^{20°	24.2^{100°	16.8^{170°	2.4
Phenol (air or vapor)	40.9^{20°	34.4^{80°	26.8^{150°	1.85
Phenyl isothiocyanate (air or vapor)	42.5^{13°	41.6^{20°	32.4^{100°	2.4
Phosphorus oxychloride (air or vapor)	33.4^{10°	32.2^{20°	24.1^{85°	2.2
Piperidine (air)	32.6^{50°	30.2^{20°	20.4^{105°	2.1
Propionic acid (air or vapor)	27.7^{10°	26.7^{20°	20.8^{80°	1.5
Propionitrile (air or vapor)	28.3^{10°	27.2^{20°	19.4^{90°	1.6
n-Propyl acetate (air or vapor)	26.6^{0°	24.3^{20°	15.6^{100°	2.3
n-Propyl alcohol (air)	25.9^{-5°	23.8^{20°	20.5^{60°	1.3
iso-Propyl alcohol (air or vapor)	22.8^{5°	21.7^{20°	17.0^{80°	1.1
n-Propyl formate (air or vapor)	26.8^{0°	24.5^{20°	15.5^{100°	2.2
n-Propylamine (air)	23.5^{10°	22.4^{20°	19.4^{45°	1.9
p-*iso*-Propyltoluene (air)	29.5^{5°	28.1^{20°	20.7^{100°	2.3
Pyridine (air)	40.8^{0°	38.0^{20°	26.4^{100°	2.3
Quinoline (air)	45.0^{20°	35.8^{100°	25.1^{200°	2.4
Thiophene (air)	36.2^{0°	33.1^{20°	24.3^{80°	2.04
Thiophenol (air)	41.0^{10°	39.8^{20°	31.3^{90°	2.0
Toluene (air)	30.74^{0°	28.43^{20°	19.39^{100°	2.2
Toluene (vapor)	28.5^{20°	25.0^{50°	16.3^{130°	2.2
o-Toluidine (air or vapor)	42.3^{0°	40.0^{20°	31.2^{100°	....
Triethylamine (air)	22.9^{0°	20.9^{20°	13.7^{90°	2.37
Trimethylamine (N_2)	24.8^{-73°	20.2^{-32°	17.4^{-4°	1.65
Tripalmitin (air)	$29.5^{55.7^\circ}$	$27.2^{87.6^\circ}$	$25.3^{115.3^\circ}$	5.4
Triphenylmethane	$33.8^{108.7^\circ}$	$24.5^{208.2^\circ}$	$15.4^{335.5^\circ}$	2.1to1.5
iso-Valeric acid (air or vapor)	26.16^{15°	25.33^{20°	20.4^{80°	1.7
Water (see special table)				
m-Xylene (air or vapor)	31.15^{0°	28.90^{20°	20.46^{100°	2.25
p-Xylene (air)	29.92^{5°	28.37^{20°	24.2^{60°	....

SURFACE TENSION OF WATER

Temperature in Degrees C.

Surface Tension in Dynes/cm.	
76.96^{-8° (air)	73.05^{18°
76.42^{-5°	72.90^{19°
75.64^{0°	72.75^{20°
74.92^{5°	72.59^{21°
74.22^{10°	72.44^{22°
74.07^{11°	72.28^{23°
73.93^{12°	72.13^{24°
73.78^{13°	71.97^{25°
73.64^{14°	71.82^{26°
73.49^{15°	71.66^{27°
73.34^{16°	71.50^{28°
73.19^{17°	71.35^{29°

Surface Tension in Dynes/cm.	
71.18^{30°	52.84^{130°
70.38^{35°	k_E
69.56^{40°	1.03^{25°
68.74^{45°	1.07^{70°
67.91^{50°	1.18^{100°
66.18^{60°	1.27^{120°
64.42^{70°	
62.61^{80°	
60.75^{90°	
58.85^{100°	
56.89^{110° (vapor)	
54.89^{120°	

SURFACE TENSION OF AQUEOUS IN-

The table below gives values for the surface tension of various inorganic aqueous solutions of different concentrations. The concentrations are shown in the super-

	Formula	Surface Tension in Dynes per Centimeter		
1	$AgNO_3$ (20°)	$73.39^{0.5M}$	$73.98^{1.0M}$	$75.06^{2.0M}$
2	$BaCl_2$ (20°)	$72.94^{0.05M}$	$73.08^{0.1M}$	$73.53^{0.25M}$
3	$CaCl_2$ (25°)	$72.32^{0.1M}$	$73.49^{0.5M}$	$75.17^{1.0M}$
4	$CdCl_2$ (20°)	$73.65^{0.5M}$	$74.45^{1.0M}$	$76.85^{2.5M}$
5	$CuSO_4$ (20°)	$73.12^{0.2M}$	$73.67^{0.5M}$	$74.58^{1.0M}$
6	HCl (20°)	$72.59^{0.5M}$	$72.47^{1.0M}$	$72.27^{2.0M}$
7	HNO_3 (20°)	$72.1^{0.7M}$	$71.6^{1.5M}$	$70.9^{2.8M}$
8	H_2O_2 (18°)	$73.37^{4.3M}$	$73.82^{9.5M}$	$74.28^{15.0M}$
9	KBr (20°)	$73.42^{0.5M}$	$74.07^{1.0M}$	$74.74^{1.5M}$
10	K_2CO_3 (20°)	$74.21^{0.5M}$	$75.73^{1.0M}$	$79.07^{2.0M}$
11	KI (20°)	$73.17^{0.5M}$	$73.60^{1.0M}$	$74.01^{1.5M}$
12	KNO_3 (20°)	$72.78^{0.02M}$	$72.86^{0.1M}$	$73.26^{0.5M}$
13	KOH (18°)	$73.94^{0.5M}$	$74.83^{1.0M}$	$75.72^{1.5M}$
14	$LiCl$ (20°)	$73.56^{0.5M}$	$74.38^{1.0M}$	$75.18^{1.5M}$
15	$MgCl_2$ (20°)	$72.92^{0.05M}$	$73.07^{0.1M}$	$73.53^{0.25M}$
16	$MgSO_4$ (20°)	$72.83^{0.025M}$	$72.90^{0.05M}$	$73.01^{0.1M}$
17	$MnCl_2$ (18°)	$74.54^{0.5M}$	$76.02^{1.0M}$	$78.97^{2.0M}$
18	NH_4Cl (20°)	$72.91^{0.1M}$	$73.46^{0.5M}$	$74.14^{1.0M}$
19	NH_4NO_3 (20°)	$73.25^{0.5M}$	$73.75^{1.0M}$	$74.65^{2.0M}$
20	NH_4OH (18°)	$71.8^{0.5M}$	$70.8^{1.0M}$	$67.9^{3.0M}$
21	$(NH_4)_2SO_4$ (20°)	$73.84^{0.5M}$	$74.92^{1.0M}$	$77.10^{2.0M}$
22	Na_2CO_3 (20°)	$73.40^{0.25M}$	$74.03^{0.5M}$	$75.40^{1.0M}$
23	$NaCl$ (20°)	$72.92^{0.1M}$	$73.57^{0.5M}$	$74.39^{1.0M}$
24	Na_2CrO_4 (30°)	$72.6^{0.51M}$	$77.3^{1.95M}$	$82.6^{3.31M}$
25	$NaNO_3$ (20°)	$72.87^{0.1M}$	$73.35^{0.5M}$	$73.95^{1.0M}$
26	$NaOH$ (18°)	$74.4^{0..7M}$	$75.9^{1.5M}$	$83.1^{5.0M}$
27	$Na_2S_2O_3$ (40°)	$71.1^{0.49M}$	$72.4^{1.0M}$	$78.9^{3.04M}$
28	$SrCl_2$ (20°)	$72.93^{0.05M}$	$73.10^{0.1M}$	$73.57^{0.25M}$
29	$Zn(NO_3)_2$ (40°)	$71.1^{0.6M}$	$72.6^{1.1M}$	$77.4^{2.8M}$
30	$ZnSO_4$ (20°)	$73.25^{0.25M}$	$73.73^{0.5M}$	$74.71^{1.0M}$

FORMULAS RELATING SURFACE TENSION

In the following table, γ is the surface temperature in degrees absolute; T_c is the

Benzene: γ (vapor) $= 71.926 \left(1 - \frac{T}{561.6}\right)^{1.23} \pm 0.2$, from 0°C. to T_c

***p*-Bromotoluene:** γ (air) $= 66.46 \left(1 - \frac{T}{694}\right)^{1.2}$

Carbon dioxide: $\gamma = 75 \left(1 - \frac{T}{T_c}\right)^{1.25}$

Carbon tetrachloride: γ (vapor) $= 67.671 \left(1 - \frac{T}{556.25}\right)^{1.23} \pm 0.2$, from 10°C. to 270°C.

Chlorine: $\gamma = 72 \left(1 - \frac{T}{T_c}\right)^{1.13}$

***p*-Chloroaniline:** γ (air) $= 81.37 \left(1 - \frac{T}{787}\right)^{1.2}$

Chlorobenzene: γ (vapor) $= 72.20 \left(1 - \frac{T}{632.3}\right)^{1.23} \pm 0.2$, from 10°C. to 333°C.

***p*-Chlorobromobenzene:** γ (air) $= 71.83 \left(1 - \frac{T}{722}\right)^{1.2}$

***p*-Chloroiodobenzene:** γ (air) $= 74.71 \left(1 - \frac{T}{767}\right)^{1.2}$

***p*-Chloronitrobenzene:** γ (air) $= 78.68 \left(1 - \frac{T}{768}\right)^{1.2}$

***p*-Chlorotoluene:** γ (air or vapor) $= 66.65 \left(1 - \frac{T}{653}\right)^{1.2}$

ORGANIC SOLUTIONS AGAINST AIR

script and are expressed in moles per kilogram of water. The temperature in degrees Centigrade is given in parenthesis after the formula.

Surface Tension in Dynes per Centimeter					
76.03$^{3.0M}$	77.70$^{5.0M}$	78.60$^{6.2M}$	....	....	1
74.26$^{0.5M}$	75.72$^{1.0M}$	77.77$^{1.7M}$	....	....	2
78.87$^{2.0M}$	86.92$^{4.0M}$	90.37$^{5.0M}$	97.07$^{7.0M}$	106.97$^{11.2M}$	3
79.15$^{4.0M}$	81.55$^{5.8M}$	....	....	....	4
74.95$^{1.2M}$	....	....	....	....	5
71.90$^{4.0M}$	71.50$^{6.0M}$	70.55$^{9.0M}$	65.95$^{17.7M}$	....	6
68.3$^{8.5M}$	....	....	....	....	7
74.88$^{20.5M}$	75.82$^{30.6M}$	....	....	....	8
76.72$^{3.0M}$	79.06$^{4.8°}$	....	....	....	9
82.85$^{3.0M}$	87.15$^{4.0M}$	96.95$^{6.0M}$	102.55$^{7.0M}$	110.75$^{8.3M}$	10
75.26$^{3.0M}$	76.10$^{4.0M}$	77.95$^{6.2M}$	....	....	11
73.78$^{1.0M}$	74.30$^{1.5M}$	74.80$^{2.0M}$	75.25$^{2.5M}$	76.45$^{3.9M}$	12
76.58$^{2.0M}$	79.75$^{3.8M}$	....	....	....	13
76.01$^{2.0M}$	79.45$^{4.0M}$	86.28$^{8.0M}$	93.52$^{13.0M}$	100.76$^{19.4M}$	14
74.27$^{0.5M}$	75.79$^{1.0M}$	79.10$^{2.0M}$	82.98$^{3.0M}$	85.70$^{3.65M}$	15
73.28$^{0.25M}$	73.78$^{0.5M}$	74.85$^{1.0M}$	77.32$^{2.0M}$	79.27$^{2.7M}$	16
81.95$^{3.0M}$	84.89$^{4.0M}$	87.25$^{4.8M}$	....	....	17
75.4$^{2.0M}$	76.5$^{3.0M}$	77.6$^{4.0M}$	78.6$^{5.0M}$	80.4$^{6.7M}$	18
76.33$^{4.0M}$	77.82$^{6.0M}$	79.15$^{8.0M}$	80.30$^{10.0M}$	82.12$^{14.0M}$	19
65.3$^{6.0M}$	63.0$^{10.0M}$	61.1$^{15.0M}$	59.7$^{20.0M}$	57.1$^{34.0M}$	20
79.25$^{3.0M}$	81.42$^{4.0M}$	83.13$^{4.8M}$	....	....	21
76.75$^{1.5M}$	....	....	....	....	22
76.03$^{2.0M}$	77.65$^{3.0M}$	79.29$^{4.0M}$	80.92$^{5.0M}$	82.55$^{6.0M}$	23
90.9$^{5.10M}$	96.5$^{6.12M}$	98.6$^{6.99M}$	....	....	24
75.12$^{2.0M}$	77.4$^{4.0M}$	80.3$^{7.0M}$	82.7$^{10.0M}$	84.1$^{12.2M}$	25
87.8$^{7.0M}$	95.9$^{11.0M}$	100.7$^{14.0M}$	....	....	26
85.9$^{5.04M}$	93.5$^{8.34M}$	96.6$^{9.73M}$	98.4$^{11.18M}$	....	27
74.37$^{0.5M}$	76.00$^{1.0M}$	77.75$^{1.5M}$	79.51$^{2.0M}$	81.62$^{2.6M}$	28
81.1$^{4.2M}$	83.3$^{5.2M}$	84.9$^{6.3M}$	....	....	29
77.1$^{2.0M}$	78.1$^{2.4M}$	79.1$^{2.75M}$	84.5$^{5.25M}$	....	30

AND TEMPERATURE OF VARIOUS SUBSTANCES

tension in dynes per centimeter; T is the critical temperature in degrees absolute.

p-Dichlorobenzene: γ (air) $= 71.45 \left(1 - \frac{T}{675}\right)^{1.2}$

Ethyl alcohol: $\gamma = 230.564 \left(1 - \frac{T}{516.2}\right)^{1.45} - 304.339 \left(1 - \frac{T}{516.2}\right)^{2} + 139.756 \left(1 - \frac{T}{516.2}\right)^{3} \pm$ 0.3, from 10°C. to 240°C.

Ethyl ether: γ (vapor) $= 57.358 \left(1 - \frac{T}{466.9}\right)^{1.23} \pm 0.2$, from 20°C. to 193°C.

p-Iodotoluene: γ (air) $= 69.28 \left(1 - \frac{T}{734}\right)^{1.2}$

Methyl alcohol: $\gamma = 173.245 \left(1 - \frac{T}{513.1}\right)^{1.33} - 243.042 \left(1 - \frac{T}{513.1}\right)^{2} + 146.344 \left(1 - \frac{T}{513.1}\right)^{3} \pm$ 0.2, from 70°C. to 235°C.

Methyl chloride: $\gamma = 72 \left(1 - \frac{T}{T_c}\right)^{1.22}$

Methyl formate: $\gamma = 77.83 \left(1 - \frac{T}{487.1}\right)^{1.23} \pm 0.2$, from 50°C. to 214°C.

p-Nitrotoluene: γ (air) $= 74.06 \left(1 - \frac{T}{754}\right)^{1.2}$

Nitrous oxide: $\gamma = 86 \left(1 - \frac{T}{T_c}\right)^{1.33}$

SURFACE TENSION OF AQUEOUS

The table below gives values for the surface tension of various organic aqueous solutions of different concentrations. The concentration is indicated directly below

	Formula	Surface Tension in Dynes per Centimeter		
1	Acetic acid (30°C)	67.98 1.000%	60.11 5.001%	54.56 10.01%
2	Acetone (25°C)	55.45 5%	48.94 10%	41.11 20%
3	*iso*-Amyl alcohol (15°C)	57.0 0.249%	49.3 0.5%	41.1 0.99%
4	*n*-Butyl alcohol (20°C)	72.8 0.0244%	72.4 0.0487%	67.2 0.1954%
5	*iso*-Butyl alcohol (15°C)	65.6 0.249%	53.0 0.99%	45.4 1.96%
6	*n*-Butyric acid (25°C)	69 0.14%	65 0.31%	60 0.73%
7	*iso*-Butyric acid (25°C)	69.6 0.10%	62.6 0.43%	49.6 1.92%
8	*n*-Caproic acid (19°C)	70 0.00212ML	63 0.0064ML	56 0.0128ML
9	*iso*-Caproic acid (18°C)	71 0.0016ML	67 0.0036ML	60 0.0081ML
10	Chloroacetic acid (25°C)	66.40 3.35%	61.22 7.70%	58.91 10.09%
11	Ethyl alcohol (25°C)	60.79 2.72%	54.87 5.21%	46.03 11.10%
12	Formic acid (30°C)	70.07 1.00%	66.20 5.00%	62.78 10.00%
13	Glycerol (18°C)	72.90 5%	72.85 10%	72.40 20%
14	Glycol (15°C)	73.27 0.125ML	73.02 0.25ML	72.36 0.5ML
15	Maleic acid (20°C)	72.6 0.169%	72.4 0.338%	72.0 0.673%
16	Malic acid (20°C)	72.6 0.154%	72.4 0.320%	72.1 0.645%
17	Methyl alcohol (30°C)	68.44 1.011%	65.32 2.500%	54.60 9.994%
18	Methyl propionate (15°C)	71.72 0.0078ML	70.29 0.0156ML	67.75 0.0313ML
19	Octyl alcohol (20°C)	72.8 1.009%	71.8 1.998%	69.0 2.96%
20	Phenol (20°C)	72.6 0.024%	71.3 0.118%	66.5 0.471%
21	Propionic acid (25°C)	64.5 0.988%	59.8 1.914%	49.1 5.84%
22	*n*-Propyl alcohol (15°C)	70.76 0.0313ML	68.64 0.0625ML	65.08 0.125ML
23	*iso*-Propyl alcohol (15°C)	70.77 0.0313ML	68.56 0.0625ML	65.21 0.125ML
24	Propylamine (15°C)	70.39 0.03125ML	68.43 0.0625ML	64.09 0.125ML
25	Pyrocatechol (20°C)	72.1 0.03ML	71.7 0.05ML	66.8 0.20ML
26	Pyrogallol (20°C)	71.7 0.1ML	70.4 0.2ML	65.7 0.5ML
27	Resorcinol (20°C)	72.1 0.03ML	70.6 0.10ML	66.8 0.40ML
28	Succinic acid (20°C)	72.5 0.0922%	72.4 0.184%	72.2 0.369%
29	Sucrose (20°C)	73.30 10%	73.75 20%	74.15 30%
30	*n*-Valeric acid (25°C)	65.0 0.11%	58.7 0.22%	53.5 0.38%
31	*iso*-Valeric acid (25°C)	63.7 0.15%	56.9 0.34%	45.3 1.03%

ORGANIC SOLUTIONS AGAINST AIR

the corresponding surface tension. These concentrations are expressed in percents when so designated, or in moles per liter of solution in which case they are marked *ML*.

Surface Tension in Dynes per Centimeter				
47.72 20.09%	40.68 40.11%	34.26 69.91%	26.58 100%	1
35.98 30%	30.38 50%	26.75 75%	23.04 100%	2
36.0 1.48%	32.3 1.96%	23.0 100%	....	3
56.0 0.772%	48.1 1.538%	40.4 3.105%	28.6 5.927%	4
40.3 2.91%	34.0 4.76%	28.0 7.41%	22.9 100%	5
42 3.83%	33 8.63%	28 24.96%	27 79.38%	6
37.3 5.65%	29.8 11.69%	27.3 18.95%	26.5 69.93%	7
49 0.0212ML	40 0.0425ML	34 0.068ML	31 0.085ML	8
51 0.0183ML	41 0.0411ML	36 0.0616ML	31 0.0924ML	9
50.34 31.54%	47.68 49.97%	46.81 60.01%	45.09 72.11%	10
37.53 20.50%	29.63 40.00%	23.64 87.92%	22.03 100%	11
57.92 20.00%	51.97 40.00%	42.09 80.01%	36.51 100%	12
69.9 50%	65.8 85%	63.8 98%	63.4 100%	13
70.94 1.0ML	....	....	....	14
71.4 1.338%	70.5 2.641%	69.1 5.13%	66.8 9.67%	15
71.5 1.28%	70.7 2.54%	69.3 4.92%	67.1 9.29%	16
46.05 20.00%	36.09 39.98%	26.03 80.03%	21.76 100%	17
63.87 0.0625ML	58.39 0.125ML	51.28 0.25ML	41.61 0.5ML	18
67.1 3.89%	58.6 7.46%	50.5 13.6%	41.8 21.9%	19
61.1 0.941%	54.0 1.881%	46.0 3.755%	42.3 5.623%	20
43.9 9.82%	36.4 21.71%	29.7 73.92%	25.6 99.99%	21
59.34 0.25ML	51.94 0.5ML	43.59 1.0ML	....	22
60.37 0.25ML	53.66 0.5ML	46.58 1.0ML	....	23
59.55 0.25ML	53.03 0.5ML	46.68 0.1ML	....	24
62.4 0.40ML	59.7 0.60ML	55.7 1.0ML	51.6 2.0ML	25
62.4 0.75ML	60.0 1.00ML	56.1 1.50ML	53.8 2.00ML	26
64.4 0.75ML	61.1 1.5ML	58.6 3.0ML	57.1 6.0ML	27
71.7 0.732%	71.0 1.45%	69.7 2.86%	68.1 5.55%	28
74.85 40%	76.45 55%	....	....	29
42.0 0.83%	32.1 2.34%	25.4 87.04%	26.5 98.91%	30
34.6 2.54%	29.2 4.24%	24.6 89.37%	24.9 99.77%	31

INTERFACIAL TENSIONS

The table below gives values for the interfacial tensions (γ_i) in dynes per centimeter, between various compounds and either water or mercury. The temperature in degrees Centigrade is indicated in each case by a superscript.

Name	$\gamma_i, \frac{\text{dynes}}{\text{cm}}$
iso-Amyl alcohol—H_2O	5.0^{18°
iso-Amyl butyrate—H_2O	23.0^{20°
iso-Amyl chloride—H_2O	15.44^{20°
Aniline—H_2O	5.77^{20°
Aniline—Hg	341^{20°
Anisole—H_2O	25.82^{20°
Benzaldehyde—H_2O	15.51^{20°
Benzene—H_2O	35.00^{20°
Benzene—Hg	357.2^{20°
Benzyl alcohol—H_2O	$4.75^{22.5^\circ}$
Bromobenzene—H_2O	39.82^{20°
o-Bromotoluene—H_2O	41.15^{20°
iso-Butyl alcohol—H_2O	2.1^{18°
iso-Butyl alcohol—Hg	342.7^{20°
iso-Butyl chloride—H_2O	24.43^{20°
tert.-Butyl chloride—H_2O	23.75^{20°
Butyronitrile—H_2O	10.38^{20°
Carbon disulfide—H_2O	48.36^{20°
Carbon disulfide—Hg	336^{20°
Carbon tetrachloride—H_2O	45^{20°
Chlorobenzene—H_2O	37.41^{20°
Chloroform—H_2O	32.8^{20°
α-Chloronaphthalene—H_2O	40.74^{20°
p-Cymene—H_2O	34.61^{20°
Diethyl carbonate—H_2O	12.86^{20°
Dipropylamine—H_2O	1.66^{20°
Ethyl alcohol—Hg	364^{20°
Ethyl bromide—H_2O	31.20^{20°
Ethyl ether—H_2O	10.7^{20°
Ethyl ether—Hg	379^{20°
Ethyl mercaptan—H_2O	26.12^{20°
Ethyl oleate—H_2O	21.34^{20°
Ethyl propyl ketone—H_2O	13.58^{20°
Ethylbenzene—H_2O	$31.35^{17.5^\circ}$

Name	$\gamma_i, \frac{\text{dynes}}{\text{cm}}$
Ethylene bromide—H_2O	36.54^{20°
Ethylene bromide—Hg	326^{20°
n-Hexane—H_2O	51.1^{20°
n-Hexane—Hg	378^{20°
Iodobenzene—H_2O	41.84^{20°
Mercury—H_2O	375^{20°
Mesitylene—H_2O	38.7^{20°
Methyl iodide—Hg	304^{20°
Methylene chloride—H_2O	28.31^{20°
Methylene chloride—Hg	342.5^{20°
Nitrobenzene—H_2O	25.66^{20°
Nitrobenzene—Hg	350.5^{20°
Nitroethane—Hg	378^{20°
Nitromethane—H_2O	9.66^{20°
o-Nitrotoluene—H_2O	27.19^{20°
n-Octane—H_2O	50.8^{20°
n-Octane—Hg	374.7^{20°
n-Octyl alcohol—H_2O	8.5^{20°
sec.-Octyl alcohol—Hg	359.0^{20°
Oleic acid—H_2O	15.6^{20°
Oleic acid—Hg	322^{20°
iso-Pentane—H_2O	49.64^{20°
Phenetole—H_2O	29.4^{20°
n-Propyl alcohol—Hg	368^{20°
Styrene—H_2O	35.48^{19°
Toluene—H_2O	36.1^{25°
Toluene—Hg	359^{20°
iso-Valeric acid—H_2O	2.73^{20°
o-Xylene—H_2O	36.06^{20°
p-Xylene—H_2O	37.77^{20°
o-Xylene—Hg	359^{20°
m-Xylene—Hg	357^{20°
p-Xylene—Hg	361^{20°

VISCOSITY

The viscosity of a substance is the shearing resistance of a liquid film which separates two horizontal plates, one of which is being moved across the other. The absolute viscosity of a substance is the force in dynes which will move one square centimeter of a plane surface with a speed of one centimeter per second relative to another parallel plane surface from which it is separated by a layer of the substance one centimeter thick. This may be expressed by the following formula:

$$\text{viscosity} = \frac{\text{force} \times \text{film thickness}}{\text{area of plate} \times \text{velocity}}.$$

The unit of absolute viscosity is the poise which is equal to one dyne second per square centimeter. That is, when two plates have a shearing area of 1 square centimeter and a film thickness of 1 centimeter, if a force of one dyne is required to maintain a velocity of 1 centimeter per second, the fluid is said to have a viscosity of 1 poise. Since the poise (η) is such a large unit it is generally more convenient to use the millipoise (1/1000 poise) or, in the case of gases, the micropoise (1/1,000,000 poise). Frequently the viscosity of a liquid is expressed in terms of specific viscosity, which is its absolute viscosity compared with that of water at the same temperature. If the temperature in question is 20°C. the specific viscosity equals the viscosity in centipoises (1/100 poise) since the viscosity of water at 20°C. is approximately 1 centipoise.

The kinematic viscosity of a substance is the ratio of the absolute viscosity to the density of the substance at the temperature of measurement. The unit of kinematic viscosity is the stoke and is equal to that possessed by a fluid which has a viscosity of one poise and a density of one gram per cubic centimeter.

Of special importance in the field of lubrication are the so-called kinematic viscosimeters which measure the time in seconds for a given volume of liquid to flow through a definite orifice at some specified temperature. See special table for conversion of kinematic viscosity in centistokes to Saybolt, Redwood, and Engler viscosimeter values.

VISCOSITY OF VARIOUS LIQUIDS

In the table below is given the viscosity of various liquids in millipoises (1000η) at the temperature in degrees Centigrade as indicated by the superscript.

Values in millipoises may be converted to centistokes by dividing by $10d^t$, where d^t is the density of the substance at the same temperature t.

Name	1000η
Acetaldehyde	$2.751^{0°}$
	$2.521^{10°}$
	$2.307^{20°}$
Acetamide	$13.2^{105°}$
	$10.6^{120°}$
Acetanilide	$22.2^{120°}$
	$19.0^{130°}$
Acetic acid	$12.22^{20°}$
	$10.396^{30°}$
	$7.956^{50°}$
	$4.244^{110°}$
Acetic anhydride	$12.448^{0°}$
	$9.065^{20°}$
	$6.991^{40°}$
	$3.079^{130°}$

Name	1000η
Acetone	$4.013^{0°}$
	$3.311^{20°}$
	$2.561^{50°}$
Allyl alcohol	$21.453^{0°}$
	$13.632^{20°}$
	$4.137^{90°}$
Allyl bromide	$6.258^{0°}$
	$5.037^{20°}$
	$4.192^{40°}$
	$3.279^{70°}$
Allyl chloride	$4.127^{0°}$
	$3.374^{20°}$
	$2.825^{40°}$

VISCOSITY OF VARIOUS LIQUIDS

Name	1000η
Allyl iodide	$9.358^{0\circ}$
	$7.338^{20\circ}$
	$5.972^{40\circ}$
	$3.652^{100\circ}$
Ammonia	$2.66^{-33.5\circ}$
Amyl acetate	$8.055^{45\circ}$
Amyl alcohol	$89.22^{0\circ}$
	$62.34^{10\circ}$
	$40.04^{23\circ}$
Aniline	$60.23^{12\circ}$
	$44.67^{20\circ}$
	$29.3^{32\circ}$
	$15.55^{60\circ}$
Anisole	$10.89^{20\circ}$
	$7.409^{45\circ}$
Benzene	$9.00^{0\circ}$
	$7.57^{10\circ}$
	$6.47^{20\circ}$
	$5.61^{30\circ}$
	$4.36^{50\circ}$
	$3.502^{70\circ}$
Benzotrichloride	$30.7^{10\circ}$
	$25.5^{17\circ}$
Benzyl acetate	$13.99^{45\circ}$
Benzyl alcohol	$55.82^{20\circ}$
	$30.08^{45\circ}$
Benzyl benzoate	$84.54^{25\circ}$
Bismuth	$16.20^{283\circ}$
	$15.25^{330\circ}$
	$14.55^{365\circ}$
Bromine	$12.541^{0.56\circ}$
	$10.466^{16.16\circ}$
	$9.46^{26\circ}$
	$7.211^{56.41\circ}$
Bromobenzene	$15.66^{-0.1\circ}$
	$11.23^{21.9\circ}$
	$8.53^{43.6\circ}$
	$3.85^{142.5\circ}$
iso-Butyl acetate	$7.04^{20\circ}$
	$3.66^{78.1\circ}$
	$2.163^{130.9\circ}$
	$1.426^{183.8\circ}$
n-Butyl alcohol	$51.856^{0\circ}$
	$29.48^{20\circ}$
	$17.816^{40\circ}$
	$4.602^{110\circ}$
iso-Butyl alcohol	$80.384^{0\circ}$
	$39.068^{20\circ}$
	$21.223^{40\circ}$
	$5.270^{100\circ}$
tert.-Butyl alcohol	$58.88^{22.4\circ}$
	$23.69^{37.2\circ}$
	$6.49^{77.1\circ}$
iso-Butyl bromide	$8.277^{0\circ}$
	$6.433^{20\circ}$
	$5.179^{40\circ}$
	$3.260^{90\circ}$
iso-Butyl chloride	$5.878^{0\circ}$
	$4.617^{20\circ}$
	$3.729^{40\circ}$
	$3.090^{60\circ}$
Butyl formate	$6.91^{20\circ}$
iso-Butyl iodide	$11.664^{0\circ}$
	$8.753^{20\circ}$
	$6.970^{40\circ}$
	$3.496^{120\circ}$
n-Butyric acid	$22.855^{0\circ}$
	$15.402^{20\circ}$
	$11.205^{40\circ}$
	$3.230^{160\circ}$
iso-Butyric acid	$18.868^{0\circ}$
	$13.175^{20\circ}$
	$9.804^{40\circ}$
	$3.258^{150\circ}$
Caproic acid	$32.01^{20\circ}$
Carbon dioxide	$0.925^{5\circ}$
(Under the pressure	$0.852^{10\circ}$
of its saturated vapor)	$0.784^{15\circ}$
	$0.712^{20\circ}$
	$0.625^{25\circ}$
	$0.539^{29\circ}$
	$0.321^{31.1\circ}$
	$4.362^{0.4\circ}$
Carbon disulfide	$3.763^{19.94\circ}$
	$3.167^{45.96\circ}$
	$3.367^{0.6\circ}$
Carbon tetrachloride	$9.578^{21.21\circ}$
	$7.928^{35.21\circ}$
	$4.056^{99.6\circ}$
Castor oil	$32950^{6.5\circ}$
	$10272^{19.6\circ}$
	$2245^{40.6\circ}$
Chlorobenzene	$10.50^{0.3\circ}$
	$8.03^{20.1\circ}$
	$6.37^{40.2\circ}$
	$3.20^{123.6\circ}$
Chloroform	$7.86^{-10\circ}$
	$6.99^{0\circ}$
	$5.63^{20\circ}$
	$4.64^{40\circ}$
	$3.89^{60\circ}$
o-Chlorophenol	$22.50^{45\circ}$
m-Chlorophenol	$47.22^{45\circ}$
p-Chlorophenol	$60.18^{45\circ}$
Copal lac	$4800^{22.2\circ}$
o-Cresol	$35.06^{45\circ}$
m-Cresol	$184.23^{20\circ}$
	$50.57^{45\circ}$
p-Cresol	$56.07^{45\circ}$
Cyclohexane	$10.3^{17\circ}$
	$9.3^{22\circ}$
	$8.6^{27\circ}$
	$7.5^{35\circ}$

VISCOSITY OF VARIOUS LIQUIDS

Name	1000η
Decane	$7.75^{22.3°}$
Diallyl	$3.415^{0.37°}$
	$2.75^{20°}$
	$2.436^{36.06°}$
	$2.059^{56.2°}$
Diethyl ketone	$5.990^{0°}$
	$4.705^{20°}$
	$3.854^{40°}$
	$2.349^{100°}$
Diethylamine	$8.236^{-33.5°}$
	$3.67^{25°}$
Diethylaniline	$19.5^{25°}$
Dimethylamine	$4.368^{-33.5°}$
Dimethylaniline	$12.85^{25°}$
Diphenylamine	$46.60^{55°}$
	$10.4^{130°}$
Dipropyl ether	$5.4^{0.59°}$
	$4.25^{20°}$
	$2.241^{88°}$
Dipropyl ketone	$7.36^{20°}$
Dodecane	$12.57^{23.3°}$
Ethyl acetate	$5.825^{0°}$
	$4.546^{20°}$
	$3.668^{40°}$
	$2.786^{70°}$
Ethyl alcohol	$17.716^{0°}$
	$14.510^{10°}$
	$11.943^{20°}$
	$8.309^{40°}$
	$5.098^{70°}$
Ethyl benzene	$8.769^{0°}$
	$6.687^{20°}$
	$5.311^{40°}$
	$2.512^{130°}$
Ethyl benzoate	$22.42^{20°}$
	$20.14^{25°}$
Ethyl bromide	$4.866^{0°}$
	$4.407^{10°}$
	$4.020^{20°}$
	$3.678^{30°}$
Ethyl butyrate	$6.68^{20°}$
Ethyl ether	$2.950^{0°}$
	$2.681^{10°}$
	$2.448^{20°}$
	$2.230^{30°}$
Ethyl formate	$5.103^{0°}$
	$4.085^{20°}$
	$3.356^{40°}$
	$3.077^{50°}$
Ethyl iodide	$7.269^{0°}$
	$5.925^{20°}$
	$4.951^{40°}$
	$3.914^{70°}$
Ethyl propionate	$6.967^{0°}$
	$5.367^{20°}$
	$4.282^{40°}$
	$2.705^{90°}$
Ethyl propyl ether	$4.007^{0.35°}$
	$3.231^{20.33°}$
	$2.248^{60.18°}$
Ethyl salicylate	$17.72^{45°}$
Ethyl sulfide	$5.619^{0.21°}$
	$4.292^{24.64°}$
	$2.49^{88°}$
Ethyl valerate	$8.47^{20°}$
Ethylaniline	$20.4^{25°}$
	$10.81^{55°}$
Ethylene bromide	$24.38^{0°}$
	$17.21^{20°}$
	$12.86^{40°}$
	$5.309^{130°}$
Ethylene chloride	$11.322^{0°}$
	$8.385^{20°}$
	$6.523^{40°}$
	$4.357^{80°}$
Ethylidene chloride	$6.282^{0°}$
	$4.983^{20°}$
	$3.731^{50°}$
Eugenol	$69.31^{25°}$
Fluorobenzene	$7.52^{0.2°}$
	$5.85^{19.9°}$
	$3.25^{80.9°}$
Formamide	$7.68^{105°}$
	$6.59^{120°}$
Formanilide	$16.5^{120°}$
Formic acid	$22.469^{10°}$
	$17.844^{20°}$
	$12.190^{40°}$
	$5.492^{100°}$
Glycerol	$42200^{2.8°}$
	$10690^{20°}$
	$7776^{20.9°}$
Glycol	$173.3^{25°}$
Heptane	$5.236^{0°}$
	$4.163^{20°}$
	$3.410^{40°}$
	$2.239^{90°}$
Heptyl alcohol	$70.14^{20°}$
Heptylic acid	$43.56^{20°}$
Hexadecane	$35.91^{22.2°}$
Hexane	$4.012^{0°}$
	$3.258^{20°}$
	$2.708^{40°}$
	$2.288^{60°}$
Iodobenzene	$21.94^{4.6°}$
	$17.74^{17.4°}$
	$4.88^{148.8°}$
Isoprene	$2.664^{0.35°}$
	$2.234^{20.41°}$
	$2.037^{32.02°}$
Lactic acid	$403.3^{25°}$
Lead bromide	$101.9^{372°}$
	$69.70^{412°}$
	$40.73^{492°}$

VISCOSITY OF VARIOUS LIQUIDS

Name	1000η
Lead chloride	$55.32^{498\circ}$
	$40.20^{538\circ}$
	$29.56^{608\circ}$
Lithium nitrate	$55.9^{259\circ}$
	$45.0^{284\circ}$
	$29.4^{344\circ}$
Menthol	$68.9^{34.9\circ}$
Mercury	$18.68^{-21.4\circ}$
	$16.84^{0\circ}$
	$15.47^{20\circ}$
	$14.83^{40\circ}$
	$13.60^{62.9\circ}$
	$12.99^{79.4\circ}$
	$12.60^{98\circ}$
	$11.71^{124\circ}$
	$10.92^{154\circ}$
	$10.18^{196.7\circ}$
	$9.86^{237.8\circ}$
	$9.615^{262.5\circ}$
	$9.183^{314.7\circ}$
Methyl acetate	$4.837^{0\circ}$
	$3.880^{20\circ}$
	$3.202^{40\circ}$
	$2.929^{50\circ}$
Methyl alcohol	$8.08^{0\circ}$
	$6.90^{10\circ}$
	$5.93^{20\circ}$
	$4.49^{40\circ}$
	$3.49^{60\circ}$
Methyl benzoate	$20.59^{20\circ}$
Methyl *n*-butyrate	$7.625^{0\circ}$
	$5.795^{20\circ}$
	$4.585^{40\circ}$
	$2.647^{100\circ}$
Methyl *iso*-butyrate	$6.764^{0\circ}$
	$5.228^{20\circ}$
	$4.190^{40\circ}$
	$2.648^{90\circ}$
Methyl ethyl ketone	$5.429^{0\circ}$
	$4.284^{20\circ}$
	$3.490^{40\circ}$
	$2.482^{80\circ}$
Methyl formate	$4.355^{0\circ}$
	$3.548^{20\circ}$
	$3.253^{30\circ}$
Methyl iodide	$6.055^{0\circ}$
	$5.001^{20\circ}$
	$4.240^{40\circ}$
Methyl propionate	$5.866^{0\circ}$
	$4.597^{20\circ}$
	$3.748^{40\circ}$
	$2.861^{70\circ}$
Methyl propyl ketone	$6.477^{0\circ}$
	$5.056^{20\circ}$
	$4.096^{40\circ}$
	$2.465^{100\circ}$
Methyl sulfide	$3.599^{0.27\circ}$
	$3.008^{20.19\circ}$
	$2.649^{35.81\circ}$
Methyl valerate	$7.13^{20\circ}$
Methylaniline	$20.2^{25\circ}$
	$10.84^{55\circ}$
Methylene chloride	$5.40^{0.46\circ}$
	$4.414^{20.53\circ}$
	$3.802^{37.51\circ}$
Nitric acid	$22.75^{0\circ}$
	$17.70^{10\circ}$
Nitrobenzene	$28.2^{10\circ}$
	$19.8^{20\circ}$
	$15.5^{35\circ}$
Nitrogen dioxide	$5.349^{0\circ}$
	$4.766^{10\circ}$
	$4.275^{20\circ}$
o-Nitrophenol	$23.43^{45\circ}$
Nonane	$6.19^{22.3\circ}$
Nonylic acid	$83.19^{20\circ}$
Octane	$7.060^{0\circ}$
	$6.159^{10\circ}$
	$5.419^{20\circ}$
	$4.828^{30\circ}$
	$4.328^{40\circ}$
	$3.551^{60\circ}$
	$2.971^{80\circ}$
	$2.160^{120\circ}$
Octyl alcohol	$89.47^{20\circ}$
Octylic acid	$57.49^{20\circ}$
Olive oil	$1008^{15.6\circ}$
	$377^{37.9\circ}$
	$154^{65.7\circ}$
	$70^{100\circ}$
Paraffin oil	$1018^{18\circ}$
Pentadecane	$28.14^{22\circ}$
Pentane	$2.894^{0\circ}$
	$2.395^{20\circ}$
	$2.200^{30\circ}$
Phenetole	$12.62^{20\circ}$
	$8.249^{45\circ}$
Phenol	$127.44^{18.3\circ}$
	$60.24^{35\circ}$
	$34.21^{50\circ}$
	$13.14^{91\circ}$
Phenyl acetate	$17.99^{45\circ}$
Phenyl ethane	$6.076^{25\circ}$
Potassium dichromate	$133.9^{397\circ}$
	$93.8^{457\circ}$
	$66.4^{507\circ}$
Potassium nitrate	$29.70^{333\circ}$
	$24.42^{373\circ}$
	$20.07^{413\circ}$
Propionic acid	$15.214^{0\circ}$
	$11.022^{20\circ}$
	$8.451^{40\circ}$
	$3.308^{140\circ}$

VISCOSITY OF VARIOUS LIQUIDS

Name	1000η
Propyl acetate	7.734^{0°
	5.854^{20°
	4.604^{40°
	2.587^{100°
n-Propyl alcohol	38.827^{0°
	22.563^{20°
	14.050^{40°
	5.310^{90°
iso-Propyl alcohol	45.646^{0°
	23.702^{20°
	13.311^{40°
	5.249^{80°
n-Propyl bromide	6.509^{0°
	5.241^{20°
	4.334^{40°
	3.379^{70°
iso-Propyl bromide	6.106^{0°
	4.894^{20°
	4.028^{40°
	3.680^{50°
Propyl *n*-butyrate	8.31^{20°
Propyl *iso*-butyrate	7.41^{20°
n-Propyl chloride	4.416^{0°
	3.589^{20°
	2.990^{40°
iso-Propyl chloride	4.080^{0°
	3.292^{20°
	2.993^{30°
n-Propyl formate	6.720^{0°
	5.210^{20°
	4.171^{40°
	2.883^{80°
iso-Propyl formate	5.12^{20°
n-Propyl iodide	9.435^{0°
	7.438^{20°
	6.067^{40°
	3.714^{100°
iso-Propyl iodide	8.841^{0°
	6.971^{20°
	5.676^{40°
	4.005^{80°
Propyl propionate	6.73^{20°
Propyl valerate	10.53^{20°
n-Propylamine	3.53^{25°
Pyridine	$8\ 775^{25^\circ}$
Rape oil	$1118^{15.6^\circ}$
	$422^{37.9^\circ}$
	$177^{65.7^\circ}$
	80^{100°
Rosin	$(1.0\times10^{21})^{7.1^\circ}$
	$(6\times10^{18})^{20^\circ}$
Safrol	22.94^{25°
iso-Safrol	39.81^{25°
Salicylaldehyde	16.69^{45°
Silver bromide	18.63^{609°
	14.87^{688°
	11.92^{803°

Name	1000η
Silver chloride	16.06^{603°
	13.72^{669°
	11.86^{734°
Silver iodide	30.26^{605°
	21.23^{730°
	15.56^{827°
Silver nitrate	37.2^{244°
	30.5^{275°
	23.0^{342°
Sodium bromide	14.2^{762°
	13.5^{766°
	12.8^{780°
Sodium chloride	13.0^{841°
	12.0^{850°
	10.1^{896°
	9.7^{924°
Sodium nitrate	29.19^{308°
	26.61^{328°
	24.39^{348°
	22.37^{368°
	20.57^{388°
	18.28^{418°
Sperm oil	$420^{15.6^\circ}$
	$185^{37.9^\circ}$
	$85^{65.7^\circ}$
	46^{100°
Succinonitrile	$27.6^{58.7^\circ}$
	$23.6^{69.4^\circ}$
	$18.1^{83.0^\circ}$
Sulfur	109.4^{123°
	$86.6^{135.5^\circ}$
	$70.9^{149.5^\circ}$
	$71.9^{156.3^\circ}$
	$75.9^{158.2^\circ}$
	$94.8^{159.2^\circ}$
	$144.5^{159.5^\circ}$
	$228.3^{160.0^\circ}$
Sulfur	$773.2^{160.3^\circ}$
	$5000^{165.0^\circ}$
	$45000^{171.0^\circ}$
	215000^{200°
	205000^{210°
	186000^{222°
Sulfuric acid (100%)	618^{0°
	269.4^{15°
	191.5^{25°
	172^{33°
	106^{50°
	63.5^{70°
	42.5^{90°
Tallow	$176^{65.7^\circ}$
	78^{100°
Tetrachloroethylene	$11.384^{0.43^\circ}$
	$8.759^{22.3^\circ}$
	$6.539^{52.68^\circ}$
	$4.034^{117.09^\circ}$

VISCOSITY OF VARIOUS LIQUIDS

Name	1000η
Tetradecane	$21.31^{21.9^\circ}$
Thiophene	$8.71^{20.24^\circ}$
	$6.432^{22.5^\circ}$
	$3.528^{82.53^\circ}$
Tin	16.78^{280°
	16.64^{296°
	14.21^{357°
	13.11^{389°
Toluene	7.719^{0°
	5.903^{20°
	4.713^{40°
	3.874^{60°
	2.588^{110°
Tridecane	$15.50^{23.3^\circ}$
Triethylamine	$7.726^{-33.5^\circ}$
	3.63^{25°
Trimethylamine	$3.208^{-33.5^\circ}$
Turpentine	22.48^{0°
	17.83^{10°
	14.87^{20°
	12.72^{30°
	10.71^{40°
	8.21^{60°
	6.71^{80°

Name	1000η
Undecane	$9.47^{22.7^\circ}$
Urethane	9.16^{105°
	7.15^{120°
n-Valeric acid	22.36^{20°
	12.5^{50°
n-Valeric acid	9.79^{70°
iso-Valeric acid	24.11^{20°
Water (see special table)	....
Wool fat, neutral	$1672^{65.7^\circ}$
	314^{100°
o-Xylene	11.049^{0°
	8.102^{20°
	6.270^{40°
	4.168^{80°
	2.626^{140°
m-Xylene	8.059^{0°
	6.200^{20°
	4.970^{40°
	3.455^{80°
	2.418^{130°
p-Xylene	7.385^{10°
	6.475^{20°
	5.134^{40°
	3.519^{80°
	2.424^{130°

VISCOSITY OF GASES AND VAPORS

In the table below is given the viscosity of various gases and vapors in micropoises ($\eta \times 10^6$) at the temperature in degrees Centigrade as indicated in each case by the superscript.

Name	$\eta \times 10^6$
Acetone	72.5^{0°
	78.0^{18°
	94.27^{100°
	$125.7^{212.5^\circ}$
Acetylene	94.3^{0°
Air	24^{-145°
	87^{-98°
	$147^{-49.7^\circ}$
	170.9^{0°
	175.9^{10°
	180.8^{20°
	185.6^{30°
	190.4^{40°
	195.1^{50°
	199.7^{60°
	208.8^{80°
	217.5^{100°
	238.5^{150°
	258.2^{200°
	277.0^{250°
	294.6^{300°
	311.3^{350°
	327.7^{400°

Name	$\eta \times 10^6$
Air	343.3^{450°
	358.3^{500°
Ammonia	$67.2^{-78.5^\circ}$
	92.6^{0°
	108.0^{20°
	130.3^{100°
Argon	$73.56^{-183.2^\circ}$
	$138.0^{-104.4^\circ}$
	$169.7^{-60.2^\circ}$
	210.4^{0°
	$216.8^{12.3^\circ}$
	221.0^{23°
	$270.2^{99.6^\circ}$
	323.1^{183°
Arsine	145.8^{0°
	198.1^{100°
Benzene	70.9^{0°
	$75.9^{16.8^\circ}$
	$100.7^{70.1^\circ}$
	117.6^{100°
	$124.7^{212.5^\circ}$
Bromine	$151.1^{12.8^\circ}$
	$170.5^{65.7^\circ}$

VISCOSITY OF GASES AND VAPORS

Name	$\eta \times 10^6$
Bromine	$188.5^{99.7^\circ}$
	$207.9^{139.7^\circ}$
	$227.3^{179.7^\circ}$
	287.4^{302°
n-Butane	$84.04^{14.7^\circ}$
	$84.13^{16.0^\circ}$
	109.2^{100°
iso-Butane	75.5^{23°
iso-Butyl acetate	$76.4^{16.1^\circ}$
	112.0^{100°
iso-Butyl formate	$83.0^{17.7^\circ}$
	$97.2^{63.6^\circ}$
	$114.2^{99.9^\circ}$
n-Butylamine	$82^{99.8^\circ}$
iso-Butylamine	$88^{99.8^\circ}$
Carbon dioxide	$103.3^{-78.4^\circ}$
	$129.4^{-20.7^\circ}$
	138.0^{0°
	143.6^{12°
	160.0^{20°
	197.2^{100°
	$214.3^{162.4^\circ}$
	238.5^{222°
	268.2^{302°
pressure 1 atm.	148^{20°
	153^{30°
	156^{35°
	157^{40°
pressure 20 atm.	156^{20°
	159^{30°
	163^{35°
pressure 40 atm.	166^{20°
	168^{30°
	176^{40°
pressure 80 atm.	565^{30°
	528^{32°
	361^{35°
	218^{40°
Carbon disulfide	91.1^{0°
	$96.4^{14.2^\circ}$
Carbon monoxide	$56.5^{-191.6^\circ}$
	$86.8^{-149.2^\circ}$
	$128^{-78.4^\circ}$
	$148^{-42.3^\circ}$
	167^{0°
	$175^{11.4^\circ}$
	184^{20°
	210^{100°
Carbon oxysulfide	119^{15°
	154^{100°
Chlorine	$129.7^{12.7^\circ}$
	147.0^{20°
	$168.8^{99.1^\circ}$
	189.7^{146°
Chloroform	94.4^{0°
	$98.9^{14.2^\circ}$
	$102.9^{17.4^\circ}$
Chloroform	130.7^{100°
	$166^{212.5^\circ}$
Cyanogen	93.5^{0°
	107^{20°
	128.1^{100°
Diethylamine	$92^{99.9^\circ}$
Ethane	$63.4^{-78.5^\circ}$
	84.8^{0°
Ethyl acetate	68.4^{0°
	94.3^{100°
	$126^{212.5^\circ}$
Ethyl alcohol	82.7^{0°
	$88.5^{16.8^\circ}$
	108.8^{100°
	$141.7^{212.5^\circ}$
Ethyl chloride	93.5^{0°
	105.0^{20°
	$144.0^{157.3^\circ}$
	$171.4^{240.6^\circ}$
Ethyl ether	68.4^{0°
	71.6^{10°
	$73.5^{18.9^\circ}$
	$75.5^{25.8^\circ}$
	$79.3^{36.5^\circ}$
	95.5^{100°
	$123.4^{212.5^\circ}$
Ethyl formate	$92^{99.8^\circ}$
Ethyl propionate	$75.0^{16.1^\circ}$
	$105.4^{68.6^\circ}$
	$116.1^{99.9^\circ}$
Ethylene	$69.93^{-75.7^\circ}$
	$76.85^{-44.08^\circ}$
	$85.1^{-21.5^\circ}$
	$90.66^{-0.05^\circ}$
	101.6^{15°
	109.0^{20°
	$127.8^{99.25^\circ}$
	$153.0^{182.4^\circ}$
	$182.6^{302.6^\circ}$
Helium	$29.46^{-258.1^\circ}$
	$81.54^{-198.0^\circ}$
	$139.2^{-102.6^\circ}$
	$158.7^{-60.9^\circ}$
	$178.8^{-22.8^\circ}$
	187.6^{0°
	$191.4^{9.8^\circ}$
	196.0^{15°
	$199.4^{21.4^\circ}$
	234.1^{100°
	$269.9^{184.6^\circ}$
Hydrogen	$5.7^{-257.7^\circ}$
	$9.9^{-251.6^\circ}$
	$31.93^{-202.2^\circ}$
	$36.9^{-191.8^\circ}$
	$60.93^{-102.9^\circ}$
	$71.03^{-60.2^\circ}$
	$81.9^{-20.6^\circ}$

VISCOSITY OF GASES AND VAPORS

Name	$\eta \times 10^6$
Hydrogen	84.9^{0°
	92.3^{15°
	93.1^{20°
	$97.6^{53.4^\circ}$
	$104.6^{100.5^\circ}$
	$121.5^{182.4^\circ}$
	139.2^{302°
Hydrogen bromide	$181.9^{18.7^\circ}$
	$234.4^{100.2^\circ}$
Hydrogen chloride	137.9^{0°
	156.0^{20°
	182.2^{100°
Hydrogen iodide	$185.7^{20.6^\circ}$
	$238.3^{100.2^\circ}$
Hydrogen sulfide	116.6^{0°
	124.1^{17°
	158.7^{100°
Iodine	184.3^{124°
	203.8^{170°
	$219.8^{205.4^\circ}$
	$239.7^{247.1^\circ}$
Krypton	233.4^{0°
	$240.5^{10.6^\circ}$
	$245.9^{16.3^\circ}$
	306.3^{100°
Mercury	494^{273°
	551^{313°
	641^{369°
	654^{380°
Methane	$35.1^{-181.6^\circ}$
	$76.7^{-78.4^\circ}$
	103.5^{0°
	120.1^{20°
	136.3^{100°
Methyl acetate	101.5^{100°
	$135.9^{212.5^\circ}$
Methyl bromide	103.6^{0°
Methyl chloride	$93.6^{-15.3^\circ}$
	102.5^{0°
	116^{20°
	$138.4^{99.1^\circ}$
	$170.6^{182.4^\circ}$
	213.9^{302°
Methyl *iso*-butyrate	75.4^{24°
	$99.9^{65.5^\circ}$
	112.2^{100°
Methyl ether	90.5^{0°
	102^{20°
	$109.2^{99.85^\circ}$
Methyl ethyl ether	102.9^{100°
Methyl formate	92.3^{20°
	135.2^{100°
Methyl propionate	$94^{99.8^\circ}$
Neon	298.1^{0°
	$308^{13.8^\circ}$
	365.2^{100°
Nitric oxide	178^{0°
Nitric oxide	186^{20°
Nitrogen (chemical)	$56^{-191.5^\circ}$
	$156.3^{-21.5^\circ}$
	167.4^{0°
	$173.7^{13.9^\circ}$
	184^{20°
	$189.4^{53.5^\circ}$
	212^{100°
	$246^{182.7^\circ}$
Nitrogen (atm.)	169.5^{0°
	174.4^{15°
	$213.4^{101.1^\circ}$
	246.4^{183°
Nitrous oxide	$124.9^{-21.5^\circ}$
	136.2^{0°
	149.8^{25°
	$160.6^{53.6^\circ}$
	$173.9^{75.8^\circ}$
	$182.9^{100.3^\circ}$
	$216.1^{183.1^\circ}$
	$261.0^{289.9^\circ}$
	$307.3^{413.6^\circ}$
Oxygen	$65^{-191.1^\circ}$
	$112.8^{-129.8^\circ}$
	$145^{-78.7^\circ}$
	$169.3^{-39.5^\circ}$
	192^{0°
	201.4^{15°
	206^{20°
	$216^{53.5^\circ}$
	$248.5^{99.74^\circ}$
	$288.5^{185.8^\circ}$
iso-Pentane	88.5^{100°
	$116.4^{212.5^\circ}$
Phosphine	106.1^{0°
	112.0^{15°
	143.8^{100°
Propionic acid	$118^{139.8^\circ}$
Propyl acetate	74.3^{15°
	$95.4^{77.8^\circ}$
	109.6^{100°
n-Propyl alcohol	$93^{99.9^\circ}$
iso-Propyl alcohol	$109^{99.8^\circ}$
n-Propyl ether	$78.89^{100.1^\circ}$
iso-Propyl ether	$84.24^{100.2^\circ}$
Propyl formate	$92^{99.9^\circ}$
Radon (Niton)	212.4^{0°
Silane (SiH_4)	112.4^{15°
	142.4^{100°
Sulfur dioxide	117^{0°
	124.2^{18°
	161.6^{100°
Water vapor	90.4^{0°
	$97.5^{20.6^\circ}$
	$100.6^{28.9^\circ}$
	127^{100°
	$145^{151.2^\circ}$

VISCOSITY OF GASES AND VAPORS

Name	$\eta \times 10^6$
Water vapor	$168^{207.1°}$
	$190^{261.3°}$
Xenon	$210.7^{0°}$

Name	$\eta \times 10^6$
Xenon	$218^{10.9°}$
	$222.2^{15.3°}$
	$282.7^{100.1°}$

VISCOSITY OF AQUEOUS SOLUTIONS AT 20° C

Formula	Viscosity in millipoises				
	1.0 Molar	0.5 Molar	0.25 Molar	0.125 Molar	0.0625 Molar
$BaCl_2$	13.156	11.530	10.800	10.467	10.310
$Ba(NO_3)_2$	......	......	10.661	10.388	......
$CaCl_2$	13.320	11.660	10.843	10.500	......
$Ca(NO_3)_2$	13.062	11.536	10.786	10.402	......
KCl	10.095	10.116	10.135	10.138	10.140
KNO_3	10.056	10.104	10.127	10.130	......
$MgCl_2$	13.503	11.785	10.925	10.530	......
$Mg(NO_3)_2$	13.896	11.910	11.016	10.588	......
$NaCl$	11.225	10.620	10.385	10.261	10.201
$NaNO_3$	11.200	10.583	10.334	10.226	......
$SrCl_2$	13.300	11.628	10.831	10.481	......
$Sr(NO_3)_2$	12.876	11.389	10.740	10.400	......

SPECIFIC VISCOSITY OF AQUEOUS SOLUTIONS AT 25° C

In the table below are given the specific viscosities of aqueous solutions of different concentrations. To convert these values to absolute viscosities multiply by the viscosity of water at 25°C. See special table for viscosity of water.

Name	1.0 Molar	0.5 Molar	0.25 Molar	0.125 Molar
Acetic acid	1.1131	1.0596	1.0304	1.0171
Aluminum sulfate	1.4064	1.1782	1.0825	1.0381
Ammonia	1.0245	1.0105	1.0058	1.0030
Ammonium chloride	0.9884	0.9976	0.9990	0.9999
Ammonium nitrate	0.9722	0.9862	0.9908	0.9958
Ammonium sulfate	1.1114	1.0552	1.0302	1.0148
Arsenic acid, ortho	1.2707	1.1291	1.0595	1.0309
Barium chloride	1.1228	1.0572	1.0263	1.0128
Barium nitrate	1.0893	1.0437	1.0214	1.0084
Beryllium sulfate	1.3600	1.1620	1.0749	1.0151
n-Butyric acid	1.2803	1.1317	1.0637	1.0308
iso-Butyric acid	1.2728	1.1287	1.0661	1.0322
Cadmium chloride	1.1342	1.0631	1.0310	1.0202
Cadmium nitrate	1.1648	1.0742	1.0385	1.0177
Cadmium sulfate	1.3476	1.1574	1.0780	1.0335
Calcium chloride	1.1563	1.0764	1.0362	1.0172
Calcium nitrate	1.1172	1.0553	1.0218	1.0076
Cesium chloride	0.9775	......	......	......
Chloric acid	1.0520	1.0255	1.0145	1.0059
Cobalt chloride	1.2041	1.0975	1.0482	1.0232
Cobalt nitrate	1.1657	1.0754	1.0318	1.0180
Cobalt sulfate	1.3543	1.1598	1.0766	1.0402
Copper chloride	1.2050	1.0977	1.0470	1.0268
Copper nitrate	1.1792	1.0802	1.0400	1.0179
Copper sulfate	1.3580	1.1603	1.0802	1.0384
Dichloroacetic acid	1.2649	1.1318	1.0640	1.0287
Dimethylamine	1.3044	1.1440	1.0632	1.0300
Ferric chloride	1.2816	1.1334	1.0602	1.0302

SPECIFIC VISCOSITY OF AQUEOUS SOLUTIONS AT 25° C

Name	1.0 Molar	0.5 Molar	0.25 Molar	0.125 Molar
Formic acid	1.0312	1.0169	1.0092	1.0049
Hydrogen bromide	1.0320	1.0164	1.0095	1.0068
Hydrogen chloride	1.0671	1.0338	1.0166	1.0095
Lactic acid	1.2499	1.1192	1.0585	1.0319
Lead nitrate	1.1010	1.0418	1.0174	1.0066
Lithium chloride	1.1423	1.0665	1.0314	1.0116
Lithium sulfate	1.2905	1.1372	1.0655	1.0320
Magnesium chloride	1.2015	1.0940	1.0445	1.0206
Magnesium nitrate	1.1706	1.0824	1.0396	1.0198
Magnesium sulfate	1.3673	1.1639	1.0784	1.0320
Manganese chloride	1.2089	1.0982	1.0481	1.0230
Manganese nitrate	1.1831	1.0867	1.0426	1.0235
Manganese sulfate	1.3640	1.1690	1.0761	1.0366
Mercuric chloride	1.0460	......	1.0116	1.0042
Methylamine	1.1554	1.0821	1.0340	1.0170
Nickel chloride	1.2055	1.0968	1.0443	1.0210
Nickel nitrate	1.1800	1.0840	1.0422	1.0195
Nickel sulfate	1.3615	1.1615	1.0751	1.0323
Nitric acid	1.0266	1.0115	1.0052	1.0027
Perchloric acid	1.0118	1.0032	0.9998	0.9992
Phosphoric acid, ortho	1.2871	1.1331	1.0656	1.0312
Potassium carbonate	1.1667	1.0784	1.0391	1.0192
Potassium chloride	0.9872	0.9874	0.9903	0.9928
Potassium chromate	1.1133	1.0528	1.0224	1.0116
Potassium dichromate	......	1.0061	1.0034	0.9999
Potassium ferricyanide	1.0610	1.0211	1.0108	1.0182
Potassium ferrocyanide	1.1124	1.0514	1.0228	1.0116
Potassium hydroxide	1.1294	1.0637	1.0313	1.0130
Potassium nitrate	0.9753	0.9822	0.9870	0.9921
Potassium sulfate	1.1051	1.0486	1.0206	1.0078
Propionic acid	1.1968	1.0991	1.0471	1.0264
Rubidium chloride	0.9846	......	......	......
Silver nitrate	1.1150	1.0491	1.0240	1.0114
Sodium acetate	1.3915	1.1806	1.0889	1.0439
Sodium benzoate	1.6498	1.2788	1.1303	1.0633
Sodium bromide	1.0639	1.0299	1.0148	1.0078
Sodium *n*-butyrate	1.6773	1.2933	1.1363	1.0659
Sodium *iso*-butyrate	1.6845	1.2997	1.1428	1.0707
Sodium carbonate	.....	1.2847	1.1367	1.0610
Sodium chlorate	1.0901	1.0421	1.0219	1.0117
Sodium chloride	1.0973	1.0471	1.0239	1.0126
Sodium citrate	1.3856	1.1730	1.0847	1.0470
Sodium formate	1.2069	1.0947	1.0447	1.0231
Sodium hydroxide	1.2355	1.1087	1.0560	1.0302
Sodium lactate	1.4988	1.2232	1.1043	1.0512
Sodium nitrate	1.0655	1.0259	1.0122	1.0069
Sodium oxalate	.....	.....	1.0573	1.0282
Sodium perchlorate	1.0462	1.0183	1.0096	1.0028
Sodium phthalate	1.4905	1.2246	1.1111	1.0614
Sodium propionate	1.5380	1.2352	1.1122	1.0548
Sodium succinate	1.3899	1.1792	1.0849	1.0448
Sodium sulfate	1.2291	1.1058	1.0522	1.0235
Sodium tartrate	1.3365	1.1502	1.0724	1.0300
Strontium chloride	1.1411	1.0674	1.0338	1.0141
Strontium nitrate	1.1150	1.0491	1.0240	1.0114
Sulfuric acid	1.0898	1.0433	1.0216	1.0082
Thallous nitrate	0.9471	......	0.9865	0.9932

SPECIFIC VISCOSITY OF AQUEOUS SOLUTIONS AT 25° C

Name	1.0 Molar	0.5 Molar	0.25 Molar	0.125 Molar
Trimethylamine	1.6838	1.2992	1.1430	1.0677
iso-Valeric acid	......	......	1.0750	1.0375
Zinc chloride	1.1890	1.0959	1.0526	1.0238
Zinc nitrate	1.1642	1.0857	1.0390	1.0186
Zinc sulfate	1.3671	1.1726	1.0824	1.0358

VISCOSITY OF AQUEOUS SUCROSE SOLUTIONS

The values are expressed in centipoises according to the tables of Bingham and Jackson, *Bur. Standards Bull.* 14, 59 (1918).

t° C	Per cent by weight of sucrose			t° C	Per cent by weight of sucrose		
	20	40	60		20	40	60
0	3.804	14.77	238	55	0.884	2.219	11.67
5	3.154	11.56	156	60	0.808	1.982	9.83
10	2.652	9.794	109.8	65	0.742	1.778	8.34
15	2.267	7.468	74.6	70	0.685	1.608	7.15
20	1.960	6.200	56.5	75	0.635	1.462	6.20
25	1.704	5.187	43.86	80	0.590	1.334	5.40
30	1.504	4.382	33.78	85	0.550	1.221	4.73
35	1.331	3.762	26.52	90	.....	1.123	4.15
40	1.193	3.249	21.28	95	.....	1.037	3.72
45	1.070	2.847	17.18	100	.....	0.960	3.34
50	0.970	2.497	14.01				

VISCOSITY OF AQUEOUS ETHYL ALCOHOL SOLUTIONS

The values are expressed in centipoises according to the tables of Bingham and Jackson, *Bur. Standards Bull.* 14, 59 (1918).

% by wt. % by vol.	10 12.36	20 24.09	30 35.23	40 45.83	50 55.93	60 65.56	70 74.80	80 83.59	90 92.01	100 100
t° C.										
0	3.311	5.319	6.94	7.14	6.58	5.75	4.762	3.690	2.732	1.773
5	2.577	4.065	5.29	5.59	5.26	4.63	3.906	3.125	2.309	1.623
10	2.179	3.165	4.05	4.39	4.18	3.77	3.268	2.710	2.101	1.466
15	1.792	2.618	3.26	3.53	3.44	3.14	2.770	2.309	1.802	1.332
20	1.538	2.183	2.71	2.91	2.87	2.67	2.370	2.008	1.610	1.200
25	1.323	1.815	2.18	2.35	2.40	2.24	2.037	1.748	1.424	1.096
30	1.160	1.553	1.87	2.02	2.02	1.93	1.767	1.531	1.279	1.003
35	1.006	1.332	1.58	1.72	1.72	1.66	1.529	1.355	1.147	0.914
40	0.907	1.160	1.368	1.482	1.409	1.447	1.344	1.203	1.035	0.834
45	0.812	1.015	1.189	1.289	1.294	1.271	1.189	1.081	0.939	0.764
50	0.734	0.907	1.050	1.132	1.155	1.127	1.062	0.968	0.848	0.702
55	0.663	0.814	0.929	0.998	1.020	0.997	0.943	0.867	0.764	0.644
60	0.609	0.736	0.834	0.893	0.913	0.902	0.856	0.789	0.704	0.592
65	0.554	0.666	0.752	0.802	0.818	0.806	0.766	0.711	0.641	0.551
70	0.514	0.608	0.683	0.727	0.740	0.729	0.695	0.650	0.589	0.504
75	0.476	0.559	0.624	0.663	0.672	0.663	0.636	0.600	0.546	0.471
80	0.430	0.505	0.567	0.601	0.612	0.604				

VISCOSITY OF WATER

IN CENTIPOISES FROM 0° TO 100° C.

Calculated by the formula: $\eta = 2.1482[(t - 8.435) + \sqrt{8078.4 + (t - 8.435)^2}] - 120$. Bingham and Jackson, *Bur. Standards Bull.* **14,** 75 (1918); Bingham, "Fluidity and Plasticity," p. 340, McGraw-Hill, New York (1922).

t° C	η	t° C	η	t° C	η
0	1.7921	34	0.7371	69	0.4117
1	1.7313	35	0.7225	70	0.4061
2	1.6728	36	0.7085	71	0.4006
3	1.6191	37	0.6947	72	0.3952
4	1.5674	38	0.6814	73	0.3900
5	1.5188	39	0.6685	74	0.3849
6	1.4728	40	0.6560	75	0.3799
7	1.4284	41	0.6439	76	0.3750
8	1.3860	42	0.6321	77	0.3702
9	1.3462	43	0.6207	78	0.3655
10	1.3077	44	0.6097	79	0.3610
11	1.2713	45	0.5988	80	0.3565
12	1.2363	46	0.5883	81	0.3521
13	1.2028	47	0.5782	82	0.3478
14	1.1709	48	0.5683	83	0.3436
15	1.1404	49	0.5588	84	0.3395
16	1.1111	50	0.5494	85	0.3355
17	1.0828	51	0.5404	86	0.3315
18	1.0559	52	0.5315	87	0.3276
19	1.0299	53	0.5229	88	0.3239
20	1.0050	54	0.5146	89	0.3202
20.20	1.0000	55	0.5064	90	0.3165
21	0.9810	56	0.4985	91	0.3130
22	0.9579	57	0.4907	92	0.3095
23	0.9358	58	0.4832	93	0.3060
24	0.9142	59	0.4759	94	0.3027
25	0.8937	60	0.4688	95	0.2994
26	0.8737	61	0.4618	96	0.2962
27	0.8545	62	0.4550	97	0.2930
28	0.8360	63	0.4483	98	0.2899
29	0.8180	64	0.4418	99	0.2868
30	0.8007	65	0.4355	100	0.2838
31	0.7840	66	0.4293		
32	0.7679	67	0.4233		
33	0.7523	68	0.4174		

IN CENTIPOISES FROM −10° TO 0°C. AND FROM 100° TO 150°C.*

t° C	η	t° C	η	t° C	η
−10	2.60	−2	1.91	120	2.32
−8	2.40	0	1.79	130	2.12
−6	2.22	+100	2.84	140	1.96
−4	2.05	+110	2.56	150	1.84

* At the pressure of the saturated vapor at the indicated temperature.

ABSOLUTE VISCOSITIES OF AQUEOUS GLYCEROL SOLUTIONS

M. L. Sheeley, *Ind. Eng. Chem. 24, 1060 (1932)*.

Aqueous solutions of glycerol are suitable liquids for use as standards in calibrating technical viscosimeters. By means of an accurate specific gravity determination the percentage of glycerol concentration can be determined within ±0.02 per cent. (See special table of density of aqueous glycerol solutions.)

% Glycerol by Weight	Absolute Viscosity in Centipoises			% Glycerol by Weight	Absolute Viscosity in Centipoises		
	20°C.	25°C.	30°C.		20°C.	25°C.	30°C.
0.00	1.005	0.893	0.800	55.00	7.997	6.582	5.494
1.00	1.029	0.912	0.817	56.00	8.482	6.963	5.816
2.00	1.055	0.935	0.836	57.00	9.018	7.394	6.148
3.00	1.083	0.959	0.856	58.00	9.586	7.830	6.495
4.00	1.112	0.984	0.877	59.00	10.25	8.312	6.870
5.00	1.143	1.010	0.900	60.00	10.96	8.823	7.312
6.00	1.175	1.037	0.924	61.00	11.71	9.428	7.740
7.00	1.207	1.064	0.948	62.00	12.52	10.11	8.260
8.00	1.239	1.092	0.972	63.00	13.43	10.83	8.812
9.00	1.274	1.121	0.997	64.00	14.42	11.57	9.386
10.00	1.311	1.153	1.024	65.00	15.54	12.36	10.02
11.00	1.350	1.186	1.052	66.00	16.73	13.22	10.68
12.00	1.390	1.221	1.082	67.00	17.96	14.18	11.45
13.00	1.431	1.256	1.112	68.00	19.40	15.33	12.33
14.00	1.473	1.292	1.143	69.00	21.07	16.62	13.27
15.00	1.517	1.331	1.174	70.00	22.94	17.96	14.32
16.00	1.565	1.370	1.207	71.00	25.17	19.53	15.56
17.00	1.614	1.411	1.244	72.00	27.56	21.29	16.88
18.00	1.664	1.453	1.281	73.00	30.21	23.28	18.34
19.00	1.715	1.495	1.320	74.00	33.04	25.46	19.93
20.00	1.769	1.542	1.360	75.00	36.46	27.73	21.68
21.00	1.829	1.592	1.403	76.00	40.19	30.56	23.60
22.00	1.892	1.644	1.447	77.00	44.53	33.58	25.90
23.00	1.957	1.699	1.494	78.00	49.57	37.18	28.68
24.00	2.025	1.754	1.541	79.00	55.47	41.16	31.62
25.00	2.095	1.810	1.590	80.00	62.0	45.86	34.92
26.00	2.167	1.870	1.641	81.00	69.3	51.02	38.56
27.00	2.242	1.934	1.695	82.00	77.9	56.90	42.92
28.00	2.324	2.008	1.752	83.00	87.9	64.2	47.90
29.00	2.410	2.082	1.812	84.00	99.6	72.2	53.63
30.00	2.501	2.157	1.876	85.00	112.9	81.5	60.05
31.00	2.597	2.235	1.942	86.00	129.6	92.6	68.1
32.00	2.700	2.318	2.012	87.00	150.4	106.1	77.5
33.00	2.809	2.407	2.088	88.00	174.5	122.6	88.8
34.00	2.921	2.502	2.167	89.00	201.4	141.8	101.1
35.00	3.040	2.600	2.249	90.00	234.6	163.6	115.3
36.00	3.169	2.706	2.335	90.50	255.0	175.6	124.3
37.00	3.300	2.817	2.427	91.00	278.4	189.3	134.4
38.00	3.440	2.932	2.523	91.50	302.8	204.0	145.0
39.00	3.593	3.052	2.624	92.00	328.4	221.8	156.5
40.00	3.750	3.181	2.731	92.50	356.2	241.2	169.3
41.00	3.917	3.319	2.845	93.00	387.7	262.9	182.8
42.00	4.106	3.466	2.966	93.50	421.3	285.7	196.2
43.00	4.307	3.624	3.094	94.00	457.7	308.7	212.0
44.00	4.509	3.787	3.231	94.50	498.5	335.6	229.0
45.00	4.715	3.967	3.380	95.00	545	366.0	248.8
46.00	4.952	4.165	3.540	95.50	601	397.8	271.4
47.00	5.206	4.367	3.706	96.00	661	435.0	296.7
48.00	5.465	4.571	3.873	96.50	731	476.8	324.3
49.00	5.730	4.787	4.051	97.00	805	522.9	354.0
50.00	6.050	5.041	4.247	97.50	885	571	387.4
51.00	6.396	5.319	4.467	98.00	974	629	424.0
52.00	6.764	5.597	4.709	98.50	1080	698	465.3
53.00	7.158	5.910	4.957	99.00	1337	856	564
54.00	7.562	6.230	5.210	100.00	1499	945	624

COMPRESSIBILITY OF WATER

In the table below are given the relative volumes of water at various temperatures and pressures. The volume at 0°C. and one normal atmosphere (760 mm of Hg) is taken as unity.

P, atm	−10°C.	0°C.	10°C.	20°C.	40°C.	60°C.	80°C.
1	1.0017	1.0000	1.0001	1.0016	1.0076	1.0168	1.0287
500	0.9788	0.9767	0.9778	0.9804	0.9867	0.9967	1.0071
1000	0.9581	0.9566	0.9591	0.9619	0.9689	0.9780	0.9884
1500	0.9399	0.9394	0.9424	0.9456	0.9529	0.9617	0.9717
2000	0.9223	0.9241	0.9277	0.9312	0.9386	0.9472	0.9568
2500	0.9083	0.9112	0.9147	0.9183	0.9257	0.9343	0.9437
3000	0.8962	0.8993	0.9028	0.9065	0.9139	0.9225	0.9315
3500	0.8852	0.8884	0.8919	0.8956	0.9030	0.9115	0.9203
4000	0.8751	0.8783	0.8818	0.8855	0.8931	0.9012	0.9097
4500	0.8658	0.8692	0.8725	0.8762	0.8838	0.8919	0.9001
5000	0.8573	0.8606	0.8639	0.8675	0.8752	0.8832	0.8913
6000	......	0.8452	0.8481	0.8517	0.8595	0.8674	0.8752
7000	......	......	0.8340	0.8374	0.8456	0.8534	0.8610
8000	......	......	......	0.8244	0.8330	0.8408	0.8483
9000	......	......	......	0.8128	0.8219	0.8297	0.8371
10000	......	......	......	0.8027	0.8119	0.8196	0.8268
11000	......	......	......	......	0.8023	0.8101	0.8172
12000	......	......	......	......	0.7931	0.8009	0.8080

COEFFICIENTS OF COMPRESSIBILITY OF VARIOUS LIQUIDS AND AQUEOUS SOLUTIONS

In the table below are given values of β_t (the compressibility coefficient of a liquid at t°_{1}.) to be used with the formula

$$\beta_t = \frac{1}{V_1}\left(\frac{V_1 - V_2}{P_2 - P_1}\right)$$

where V_1 is the volume of a liquid under a pressure of P_1 in atmospheres at t°C., and V_2 is the volume at some other pressure P_2, at the same temperature.

Liquid	t °C.	Pressure Range, atm.	β_t $\times 10^6$
Acetic acid	25	at 92.5	81.4
" "	25	at 218.5	72.6
" "	25	at 494	57.1
Acetone	14.2	8.90 to 36.51	111
"	0	100 to 500	82
"	0	500 to 1000	59
"	0	1000 to 1500	47
"	0	1500 to 2000	40
"	25	at 82.5	111.8
Allyl alcohol	9.6	1 to 500	69
" "	9.6	500 to 1000	51
" "	9.5	1000 to 1500	43
" "	9.6	1500 to 2000	36
Ammonia, 2.29%	0	up to 10	50.9
" , 17.58%	0	up to 10	41.6
" , 21.58%	15	up to 10	36.5
Amyl alcohol	17.75	at 8	83.5
" "	13.8	8.5 to 37.12	88.2
Aniline	25	at 85.5	43.2
"	25	at 181.5	40.5

COEFFICIENTS OF COMPRESSIBILITY OF VARIOUS LIQUIDS

Liquid	t °C.	Pressure Range, atm.	$\beta t \times 10^6$
Aniline	25	at 281.5	38.3
"	25	at 390	36.1
Benzene	20	1 to 2	95.3
"	15.4	1 to 4	87
"	12.9	1 to 18.5	86.8
"	16	8.12 to 37.2	90
"	20	98.7 to 296	78.7
"	20	296 to 494	67.5
Bromine	20	0 to 98.7	63.5
"	20	98.7 to 197.4	58.4
"	20	197.4 to 296	54.6
"	20	296 to 395	52.1
"	20	395 to 494	49.9
Bromoform	20	0 to 98.7	51.0
"	20	98.7 to 197.4	47.5
"	20	197.4 to 296	44.0
"	20	296 to 395	42.0
"	20	395 to 494	41.0
n-Butyl alcohol	17.4	at 8	90
iso-Butyl alcohol	17.95	at 8	98
Butyl benzoate	10	1 to 5.25	59
Butyl butyrate	10	1 to 5.25	90
Butyl valerate	10	1 to 5.25	92
Calcium chloride, 5.8%	20	2 to 20	39.7
Calcium chloride, 9.9%	20	2 to 20	37.1
" ", 17.8%	20	2 to 20	31.3
" ", 40.9%	20	2 to 20	21.7
Caproic acid	30	20 to 400	68
" "	65	20 to 100	90
" "	100	20 to 200	109
Carbon dioxide	13	at 60	1740
" "	13	at 70	960
" "	13	at 80	660
" "	13	at 90	440
Carbon disulfide	20	1 to 2	80.95
" "	0	1 to 500	66
" "	0	500 to 1000	53
" "	0	1000 to 1500	43
" "	0	1500 to 2000	37
" "	0	2000 to 2500	33
Carbon tetrachloride	10	1 to 5.25	70
" "	20	0 to 98.7	91.6
" "	20	98.7 to 197.4	89.9
" "	20	197.4 to 296	83.5
" "	20	296 to 395	75.5
" "	20	395 to 494	69.9
" "	20	at 542.5	62.5
" "	20	at 664	55.0
Castor oil	14.8	1 to 10	47.2
Chlorine	20	9.9 to 98.7	118
"	20	98.7 to 197.4	110
"	20	197.4 to 296	102
"	20	296 to 395	90.7
"	20	395 to 494	84.5
Chlorobenzene	13.3	1 to 18.5	67.1
"	80	1 to 2	108.4

COEFFICIENTS OF COMPRESSIBILITY OF VARIOUS LIQUIDS

Liquid	t °C.	Pressure Range, atm.	$\beta_t \times 10^6$
Chloroform	20	0 to 98.7	94.9
"	20	98.7 to 197.4	89.8
"	20	197.4 to 296	80.1
"	20	296 to 395	72.9
"	20	395 to 494	67.8
"	0	1 to 2	87.27
"	60	1 to 2	139.13
Cyclohexanol	40	98.7 to 296	56.4
Decane	23	0 to 1	105
Diphenylamine	65	0 to 500	57
"	100	0 to 300	64
"	185	0 to 100	110
Ethyl acetate	13.3	8.12 to 37.45	104
" "	99.6	8.13 to 37.15	250
Ethyl alcohol	20	1 to 50	112
" "	20	50 to 100	102
" "	20	100 to 200	95
" "	20	200 to 300	86
" "	20	300 to 400	80
" "	20	400 to 500	73
" "	20	500 to 600	69
" "	0	1 to 50	96
" "	0	600 to 700	60
" "	0	900 to 1000	52
" "	100	900 to 1000	73
Ethyl bromide	10.1	1 to 500	90
" "	10.1	500 to 1000	63
" "	10.1	1000 to 1500	50
" "	10.1	2000 to 2500	36
" "	13.7	1 to 18.5	113.4
Ethyl chloride	0	1 to 500	103
" "	0	500 to 1000	69
" "	0	1000 to 1500	55
" "	0	2000 to 2500	39
" "	15.2	8.7 to 37.22	153
" "	99	12.77 to 34.47	495
Ethyl ether	8.1	1 to 8	163.8
" "	13.5	8.43 to 25.4	169
" "	185	100 to 200	741
" "	185	100 to 400	478
" "	35	1 to 2000	42.5
" "	0	at 0	159
" "	0	at 100	125.7
" "	0	at 200	112.2
" "	0	at 500	84.5
" "	0	at 1000	63.5
" "	−109.8	at 1000	34.5
Ethyl iodide	10.6	1 to 500	74
" "	10.6	500 to 1000	56
" "	10.6	1000 to 1500	46
" "	10.6	1500 to 2000	38
" "	10.6	2000 to 2500	34
" "	10.6	2500 to 3000	31
Ethylene bromide	10	1 to 5.25	55.8
" "	64	1 to 5.25	76.6
Ethylene chloride	10	1 to 5.25	67.7

COEFFICIENTS OF COMPRESSIBILITY OF VARIOUS LIQUIDS

Liquid	t °C.	Pressure Range, atm.	$\beta_t \times 10^6$
Ethylene chloride	75	1 to 5.25	111.1
Fluorobenzene	13.9	1 to 18.5	87.7
Glycerol	14.8	1 to 10	22.1
Heptane	23	0 to 1	134
Hexane	23	0 to 1	159
Mercury	22.8	1 to 500	3.8
"	22.8	500 to 1000	3.8
"	22.8	1000 to 1500	3.7
"	22.8	1500 to 2000	3.6
"	22.8	2000 to 2500	3.5
"	22.8	2500 to 3000	3.4
"	191.8	1 to 500	4.6
"	191.8	2500 to 3000	4.3
"	0	1 to 50	3.92
"	0	5810 to 6780	3.30
Mesitylene	20	98.7 to 296	68.4
"	20	296 to 494	59.1
Methyl acetate	14.3	8.10 to 37.53	97
Methyl alcohol	0	1 to 500	79
" "	0	500 to 1000	58
" "	0	1000 to 1500	47
" "	0	1500 to 2000	40
" "	0	2500 to 3000	29
" "	14.7	8.50 to 37.12	104
" "	18.1	at 8	120
Methyl butyrate	10	1 to 5.25	89
Methyl valerate	10	1 to 5.25	91
Nitrobenzene	25	at 86.5	46.1
"	25	at 192	43.0
"	25	at 303	40.1
"	25	at 419	38.1
Octane	23	0 to 1	121
Olive oil	20.5	1 to 10	63.3
" "	14.8	1 to 10	56.3
Palmitic acid	65	20 to 100	90
" "	185	20 to 300	134
" "	310	20 to 400	220
Paraffin, M. P. =55°	64	20 to 100	83
"	100	20 to 400	94
"	185	20 to 400	137
"	310	20 to 400	236
Paraffin oil	34	at 1	87
" "	34	at 2000	34
" "	34	at 4500	17
Pentane	0	1 to 29	174
"	20	1 to 29	242
"	0	at 0	175.9
"	0	at 484	94.6
"	0	at 967	68.9
Petroleum	1	1 to 15	67.91
"	16.1	1 to 15	76.77
"	35.1	1 to 15	82.83
"	52.2	1 to 15	92.21
"	72.1	1 to 15	100.16
"	94.0	1 to 15	108.8
Phosphorus trichloride	10.1	1 to 500	72

COEFFICIENTS OF COMPRESSIBILITY OF VARIOUS LIQUIDS

Liquid	t °C.	Pressure Range, atm.	$\beta_t \times 10^6$
Phosphorus trichloride	10.1	500 to 1000	54
" "	10.1	1000 to 1500	45
" "	10.1	1500 to 2000	38
" "	10.1	2000 to 2500	33
Potassium chloride, 2.49%	20	2 to 20	42.6
" " , 4.40%	20	2 to 20	41.2
" " , 8.28%	20	2 to 20	38.9
" " , 16.75%	20	2 to 20	34.1
" " , 24.31%	20	2 to 20	30.1
n-Propyl alcohol	0	1 to 500	69
" "	0	500 to 1000	52
" "	0	1000 to 1500	42
" "	0	2500 to 3000	27
" "	5.6	at 8	89.5
iso-Propyl alcohol	5.65	at 8	95
" "	17.85	at 8	103
n-Propyl benzene	20	98.7 to 296	70.7
" "	20	296 to 494	61.0
iso-Propyl benzene	20	98.7 to 296	71.3
" "	20	296 to 494	61.2
Pseudocumene	20	98.7 to 296	65.2
"	20	296 to 494	56.9
Sodium chloride, 1.32%	15	at 10	45.3
" " , 13.53%	15	at 10	33.9
" " , 22.22%	15	at 10	28.2
" " , 26.21%	15	at 10	25.5
Sugar, cane, 0%	12.4	1 to 146	46.5
" , " , 10%	12.4	1 to 146	42.65
" , " , 20%	12.4	1 to 146	39.65
Sulfurous acid	0	1 to 16	302.5
Thymol	64	20 to 100	69
"	64	20 to 400	66
"	100	20 to 400	80
"	310	20 to 400	268
Toluene	10	1 to 5.25	79
"	66	1 to 5.25	114
"	20	1 to 2	91.47
"	25	at 114.5	80.6
"	25	at 230.5	70.3
"	25	at 355	62.1
p-Toluidine	45	1 to 150	51.2
"	28	20 to 100	56
"	100	20 to 400	77
"	185	20 to 400	112
"	310	20 to 400	243
Water, see special table			
Xylene	10	1 to 5.25	74
"	65	1 to 5.25	106
"	100	1 to 5.25	132

COEFFICIENTS OF CUBICAL EXPANSION FOR VARIOUS LIQUIDS AND AQUEOUS SOLUTIONS

See also the table *Coefficients of Cubical Expansion For Various Solids.*

In the table below are given the values of the coefficients a, b, and c in the equation $V_t = V_o (1 + at + bt^2 + ct^3)$. Where the compound is marked with * the basic volume is not that at 0°C, but at some other temperature, t_o. The equation then reads $V_t = V_{t_o} [(1 + a(t - t_o) + b(t - t_o)^2 + c(t - t_o)^3]$. In the case of aqueous solutions, the concentrations in percent are given after the name.

Liquid	Coef. at 20°C. $\times 10^3$	Range °C.	$a \times 10^3$	$b \times 10^6$	$c \times 10^8$
Acetic acid	1.071	16 to 107	1.063	−0.12636	1.0876
Acetone	1.487	0 to 54	1.324	3.809	−0.87983
Allyl alcohol	1.049	0 to 94	0.97019	1.8725	0.36452
Allyl bromide	1.241	0 to 69	1.2275	−0.44365	2.5843
Allyl chloride	1.475	9 to 44	1.3218	5.078	−4.1915
Allyl ether	1.346	0 to 88	1.2519	2.2401	0.35775
Allyl iodide	1.091	0 to 101	1.0539	0.63572	1.0036
Amyl acetate	1.162	0 to 124	1.1501	−0.09046	1.3015
Amyl alcohol	0.902	−15 to 80	0.89001	0.65729	1.18458
Amyl benzoate	0.848	0 to 198	0.81711	0.7377	0.10593
Amyl bromide	1.102	0 to 80	1.02321	1.90086	0.19756
Amyl chloride	1.208	0 to 100	1.17155	0.50077	1.35368
Amyl iodide	0.986	20 to 142	0.92658	1.4647	0.05962
Aniline	0.858	0 to 141	0.82349	0.8408	0.10741
Arsenous chloride	1.020	−15 to 130	0.97907	0.96695	0.17772
Benzene	1.237	11 to 81	1.17626	1.27755	0.80648
Benzoyl chloride	0.880	12 to 146	0.85893	0.44219	0.27139
Bromine	1.113	−7 to 60	1.03819	1.711138	0.54471
n-Butyl alcohol	0.950	6 to 108	0.83751	2.8634	−0.12415
n-Butyric acid	1.063	0 to 100	1.02573	0.83760	0.34694
iso-Butyric acid	1.068	16 to 118	0.97625	2.3976	−0.32145
Calcium chloride, 40.9%	0.458	17 to 24	0.42383	0.8571	....
Cane sugar, 43.2%	0.343	0 to 35	0.2536	2.247	....
n-Caproic acid	0.975	15 to 155	0.94413	0.68358	0.26586
Carbon disulfide	1.218	−34 to 68	1.1398	1.37065	1.91225
Carbon tetrachloride	1.236	0 to 76	1.18384	0.89881	1.35135
Chloral	0.934	13 to 51	0.9545	−2.2139	5.6392
Chloroform	1.273	0 to 63	1.10715	4.66473	−1.74328
o-Cresol	......	66 to 186	0.71072	1.1464	0.2242
m-Cresol	......	65 to 194	0.77526	0.27102	0.3868
p-Cresol	......	66 to 186	0.86476	0.53912	0.64418
Cymene	0.946	0 to 100	0.895	1.277	....
Diallyl	1.375	0 to 60	1.3423	−0.34339	3.8693
Diethyl ketone	1.233	0 to 95	1.15342	1.88396	0.32021
Dipropyl	1.381	0 to 66	1.2948	1.7471	1.2363
Ethyl acetate	1.389	−36 to 72	1.2585	2.95688	0.14922
Ethyl alcohol	......	0–80	1.04139	0.7836	1.7618
Ethyl alchol 50%	......	0–39	0.7450	1.85	0.730
Ethyl benzoate	0.900	0 to 159	0.86606	0.8229	0.12084
Ethyl benzene	0.961	24 to 131	0.86172	2.5344	−0.18319
Ethyl bromide	1.418	−32 to 54	1.33763	1.50135	1.6900
Ethyl chloride	1.706	−32 to 26	1.57458	2.81366	1.56987
Ethyl ether	1.656	−15 to 38	1.51324	2.35918	4.00512
Ethyl formate	1.417	0 to 63	1.36446	0.13538	3.9248
Ethyl iodide	1.179	10 to 65	1.1520	0.26032	1.4181
Ethyl nitrate	1.299	9 to 72	1.1290	4.7915	−1.8413
Ethyl oxalate	1.136	0 to 141	1.06031	1.0983	2.6657

COEFFICIENTS OF CUBICAL EXPANSION FOR VARIOUS LIQUIDS AND AQUEOUS SOLUTIONS

Liquid	Coef. at 20°C. $\times 10^3$	Range °C.	$a \times 10^3$	$b \times 10^6$	$c \times 10^8$
Ethyl sulfide	1.278	0 to 90	1.19643	1.80653	0.78821
Ethylene chloride	1.161	−28 to 84	1.11893	1.0469	0.10342
Ethylene glycol	0.6375	11 to 136	0.5657	1.7074	0.293
Formic acid	1.025	5 to 104	0.99269	0.62514	0.5965
Glycerol	0.505	....	0.4853	0.4895	....
iso-Hexane	1.445	0 to 55	1.37022	0.97649	2.9819
Hydrochloric acid, 33.2%	0.455	0 to 33	0.4460	0.215	....
4.2%	0.239	0 to 33	0.0652	4.355	....
1.0%	0.211	0 to 32	0.0153	4.899	....
*3.4%, $t_0 = 110°$	......	110 to 140	0.620	4.5	....
Isoprene	1.567	0 to 33	1.4603	0.99793	5.60149
Mercury	......	0 to 100	0.18169041	0.002951266	0.0114562
	......	24 to 299	0.181163	0.01155	0.0021187
Methyl acetate	1.427	0 to 58	1.34982	0.87098	3.5562
Methyl alcohol	1.259	−38 to 70	1.18557	1.56493	0.91113
Methyl benzoate	0.895	0 to 162	0.8633	0.7414	0.15896
Methyl bromide	1.684	−35 to 28	1.41521	3.31528	11.3809
Methyl cyanide	1.301	6 to 66	1.2118	1.7780	1.5322
Methyl ethyl ketone	1.315	0 to 76	1.18654	3.37043	−0.53365
Methyl formate	1.563	0 to 10	1.35824	10.538	−1.8085
Methyl iodide	1.273	5 to 39	1.1440	4.0465	−2.7393
Methyl propionate	1.304	0 to 74	1.3049	−1.3275	4.6943
Methyl sulfide	1.082	0 to 111	1.01705	1.57606	0.19072
Nitrobenzene	......	144 to 164	0.8263	0.52249	0.13779
Olive oil	0.721	....	0.68215	1.14053	−0.539
n-Pentane	1.656	−190 to 30	1.50697	3.435	0.975
iso-Pentane	1.680	0 to 27	1.46834	5.09626	0.6979
Petroleum, sp. gr. 0.8467	0.955	24 to 120	0.8994	1.396	....
Petroleum ether	2.26	−190 to 0	1.46	1.60	....
Phenol	......	36 to 157	0.834	0.10732	0.4446
Phosphorus tribromide	0.868	0 to 100	0.8472	0.43672	0.25276
Phosphorus trichloride	1.154	−36 to 75	1.12862	0.87288	1.79236
Phosphorus oxychloride	1.116	0 to 107	1.06431	1.12666	0.5299
Potassium chloride, 24.3%	0.353	16 to 25	0.2695	2.080	....
Propionic acid	1.102	0 to 133	1.0396	1.5487	0.04301
n-Propyl alcohol	0.956	0 to 94	0.7743	4.9689	−1.4069
iso-Propyl alcohol	1.094	0 to 83	1.04345	0.44303	2.7274
n-Propyl chloride	1.447	0 to 42	1.3306	3.8313	−1.3859
iso-Propyl chloride	1.591	0 to 34	1.3696	5.5287	....
n-Propyl ether	1.354	0 to 88	1.2132	3.9318	−1.3644
iso-Propyl ether	1.452	0 to 67	1.2872	4.2923	−0.58573
Propyl iodide	1.102	10 to 98	1.0276	1.8658	−0.0051
Silicon tetrachloride	1.430	−32 to 59	1.29412	2.18414	4.08642
Sodium acid sulfate, 21%	0.555	0 to 34	0.5364	4.75	....
Sodium chloride, 20.6%	0.414	0 to 29	0.3640	1.237	....
Sodium sulfate, 1.9%	0.235	0 to 40	0.0449	4.749	....
24%	0.410	11 to 40	0.3599	1.258	....
Stannic chloride	1.178	−19 to 113	1.1328	0.91171	0.75798
Sulfur chloride	0.968	12 to 111	0.9591	−0.03819	0.73186
Sulfuric acid, conc.	......	0–30	0.5758	−0.864	....
Sulfuric acid 10.9%	0.387	0 to 30	0.2835	2.580	....
5.4%	0.311	0 to 30	0.1450	4.143	....
1.4%	0.234	0 to 30	0.03335	5.025	....
*2.3%, $t_0 = 100°$	......	110 to 140	0.729	2.8	....

COEFFICIENTS OF CUBICAL EXPANSION FOR VARIOUS LIQUIDS AND SOLUTIONS

Liquid	Coef. at 20°C. ×10³	Range °C.	$a \times 10^3$	$b \times 10^6$	$c \times 10^8$
*4.5%, $t_0 = 110°$	......	110 to 140	0.648	4.2	....
Thymol	......	62 to 157	0.84369	0.26625	0.35997
Titanium tetrachloride	0.998	−22 to 134	0.94257	1.34579	0.0888
Toluene	1.099	0 to 100	1.028	1.779	....
o-Toluidine	0.847	0 to 141	0.82136	0.6046	0.14696
Trimethyl carbinol	1.023	20 to 77	1.31261	−8.8155	3.61209
n-Valeric acid	1.004	8 to 144	0.97557	0.61852	0.30378
Water (see also below)		−13 to 0	−0.09417	1.449	−59.85
o-Xylene	0.973	16 to 131	0.91734	1.3245	0.19586
m-Xylene	1.009	0 to 141	0.96396	1.0251	0.32753
p-Xylene	1.011	19 to 131	0.97013	0.8714	0.5287

WATER

To find the cubical expansion of water, substitute in the following formulas:

0° to 33°: $V_t = V_o(1 - 0.0_4 64268t + 0.0_5 850526t^2 - 0.0_7 678977t^3 + 0.0_9 401209t^4$

0° to 80°: $V_t = V_o(1 - 0.0_4 53255t + 0.0_5 761532t^2 - 0.0_7 437217t^3 + 0.0_9 164322t^4$

CUBICAL EXPANSION OF SOLIDS

The coefficient of cubical expansion is the increase in volume per unit volume per degree C. rise in temperature. For ordinary work the assumption may be made that the coefficient of cubical expansion is about three times the coefficient of linear expansion.

Substance	Temp. °C.	Coef. ×10⁷
Antimony	0 to 100	316.7
Beryl	0 to 100	10.5
Bismuth	0 to 100	394.8
Copper	0 to 100	499.8
Diamond	40	35.4
Emerald	40	16.8
Galena	0 to 100	558
Glass, Corning 790	0 to 350	24
" , Corning 774	0 to 350	96
" , Corning 8800	0 to 350	183
" , Jena 59 III	20 to 100	156
" , soda lime tubing	0 to 300	276
Gold	0 to 100	441.1
Ice	−20 to −1	1125.0
Iceland spar	50 to 60	144.7
Iron	0 to 100	355.0
Lead	0 to 100	839.9

Substance	Temp. °C.	Coef. ×10⁷
Paraffin	20	5880
Platinum	0 to 100	265
Porcelain	0 to 100	108.0
" , Berlin	20	81.4
Potassium chloride	0 to 100	1094
" nitrate	0 to 100	1967
" sulfate	20	1075.4
Quartz	0 to 100	384
Rock salt	50 to 60	1212.0
Rubber	20	4870
Silver	0 to 100	583.1
Sodium	20	2136.4
Stearic acid	33.8 to 45.5	8100
Sulfur, native	13.2 to 50.3	2230
Tin	0 to 100	688.9
Zinc	0 to 100	892.8

COEFFICIENT OF LINEAR EXPANSION

In the table below are given the values of *C* in the formula:—
$l_t = l_o\ (1+Ct)$, where l_o is the length of the material at 0°C., l_t is its length at t°C., and C is the coefficient of linear expansion. See also tables on properties of elements and properties of alloys.

Substance	Temp. °C.	$C \times 10^6$
Alundum	25–900	8.7
Bakelite	20–60	22
Bauxite brick	25–100	4.4
Caoutchouc	16.7–25.3	77.0
Condensite, No. 100	16–79	44.0
" , No. 128	18–56	20.0
Diamond	40	1.18
Ebonite	25.3–35.4	84.2
Emerald, ∥ to axis	0–85	−1.35
" , ⊥ to axis	0–85	1.00
Fire clay brick	25–100	8.1
Fluorspar	0–100	19.50
Formica	20–60	30.0
Gas carbon	40	5.40
Glass, American plate	0–100	*ca.* 9.0
" , American window	0–100	*ca.* 9.0
" , (standard flint) soda lime tubing	0–300	9.2
" , Kimble N-51A	0–300	5.0
" , Jena 16 III	0–100	8.1
" , Jena 59 III	0–100	5.8
" , Jena 59 III	−191 to +16	4.24
" , Corning 790	0–350	0.8
" , Corning 774	0–350	3.2
" , Corning 8800	0–350	6.1
" , Corning 8810	0–350	8.8
" , B & L BSC-2*	25–525	8.3
" , B & L LBC-2*	15–570	9.9
" , B & L DBC-1*	25–600	8.2
" , B & L C-1*	40–501	10.1
" , B & L BF-1*	25–505	9.8
" , B & L DF-2*	25–450	8.0
" , B & L EDF-1*	25–420	9.0
Graphite	40	7.86
Gutta percha	20	198.3
Ice	−20 to −1	51
Iceland spar, ∥ to axis	0–80	26.31
" " , ⊥ to axis	0–80	5.44
Limestone	25–100	9
Magnesium oxide	25–100	9.7–11.4
Marble	15–100	11.7
Paraffin	0–16	106.62
"	16–38	130.30
"	38–49	477.07
Porcelain	20–790	4.13
" , Bayeux	0	2.5
" , Bayeux	1000–1400	5.53

Substance	Temp. °C.	$C \times 10^6$
Porcelain, Berlin	0–100	3.1
Quartz, ∥ to axis	−191 to +16	5.21
" , ∥ " "	0–80	7.97
" , ⊥ " "	0–80	13.37
Quartz glass	−190 to +16	−0.26
" "	16–500	0.57
" "	16–1000	0.58
Rock salt	40	40.4
Rubber, hard	0	69.1
" , "	−160	30.0
Sandstone	20	7–12
Slate	20	6–10
Topaz, ∥ to lesser horizontal axis	0–100	8.32
Topaz, ∥ to greater horizontal axis	0–100	8.36
Topaz, ∥ to vertical axis	0–100	4.72
Tourmaline, ∥ to longitudinal axis	0–100	9.37
Tourmaline, ∥ to horizontal axis	0–100	7.73
Vulcanite	0–18	63.60
Wedgwood ware	0–100	8.90
Wood, ∥ to fiber		
" , " Ash	0–100	9.51
" , " Beech	2–34	2.57
" , " Chestnut	2–34	6.49
" , " Elm	2–34	5.65
" , " Mahogany	2–34	3.61
" , " Maple	2–34	6.38
" , " Oak	2–34	4.92
" , " Pine	2–34	5.41
" , " Walnut	2–34	6.58
Wood, across fiber		
" , " Beech	2–34	61.4
" , " Chestnut	2–34	32.5
" , " Elm	2–34	44.2
" , " Mahogany	2–34	40.4
" , " Maple	2–34	48.4
" , " Oak	2–34	54.4
" , " Pine	2–34	34.1
" , " Walnut	2–34	48.4
Wax, white	10–26	230.0
" , "	26–31	312.0
" , "	31–43	486.0
" , "	43–57	1522.7

*Optical glass.

BAROMETRY AND BAROMETRIC CORRECTIONS

In principle, the mercurial barometer balances a column of pure mercury against the weight of the atmosphere. The height of the column above the level of the mercury in the reservoir can be measured and serves as a direct index of atmospheric pressure. The space above the mercury in a barometer tube should be a Torricellian vacuum, perfect except for the practically negligible vapor pressure of mercury. The perfection of the vacuum is indicated by the sharpness of the click noted when the barometer tube is inclined. A barometer should be in a vertical position, suspended rather than fastened to a wall, and in a good light but not exposed to direct sunlight or too near a source of heat. The standard conditions for barometric measurements are 0°C., and gravity as at 45° latitude and sea level. There are numerous sources of error but corrections for most of these are readily applied. Some of the corrections are very small and their application may be questionable in view of the probably larger errors. The degree of consistency to be expected in careful measurements is about 0.005 inch with a 0.25 inch tube, increasing to 0.0015 inch with a tube 0.5 inch in diameter.

In reading a barometer of the Fortin type (the usual laboratory instrument for precision measurements) the procedure should be as follows: (*1*) Observe and record the temperature as indicated by the thermometer attached to the barometer. The temperature correction is very important and may be affected by heat from the observer's body. (*2*) Set the mercury in the reservoir at zero level, so that the point of the pin above the mercury just touches the surface, making a barely noticeable dimple therein. Tap the tube at the top and verify the zero setting. (*3*) Bring the vernier down until the view at the light background is cut off at the highest point of the meniscus. Record the reading.

The corrections to be made on the reading are as follow: (*1*) Temperature, to correct for the difference in thermal expansion of the mercury and the brass (or glass) to which the scale is attached.—This correction converts the reading into the value at 0°C. The brass scale table is applicable to the Fortin barometer. See tables. (*2a*) Latitude-gravity correction, and (*2b*) altitude-gravity correction, to compensate for differences in gravity, which would affect the height of the mercury column by variation in mass.—If local gravity is unknown, an approximate correction may be made from the tables. Local values of gravity are often subject to irregularities which lead to errors even when the corrections here provided are made. It is, therefore, advisable to determine the local value of gravity, from which the correction can be effected in the following manner:

$$B_t = B_r + \left(\frac{g_1 - g_0}{g_0}\right) \times B_r$$

in which B_t and B_r are the true and the observed heights of the barometer respectively, g_0 is standard gravity (980,665 cm sec^{-2}), and g_1 is the local gravity. It may be noted that for most localities, g_1 is smaller than g_0, which makes the correction negative. These corrections compensate the reading to gravity at 45° latitude and sea level. (*3*) Correction for capillary depression of the level of the meniscus.—This varies with the tube diameter and actual height of the meniscus in a particular case. Some barometers are calibrated to allow for an average value of the latter and approximating the correction. See table. (*4*) Correction for vapor pressure of mercury.—This correction is usually negligible, being only 0.001 mm at 20°C. and 0.006 mm at 40°C. This correction is added. See table of vapor pressure of mercury.

All tables are given in both metric and English units. When a barometer reading is to be converted from one set of units to another, it is important that all corrections be made in the original units before the conversion is made.

The corrections above do not apply to an aneroid barometer. These instruments should be calibrated at regular intervals by checking them against a corrected mercurial barometer.

For records on weather maps, meteorologists customarily correct barometer readings to sea level, and some barometers may be calibrated accordingly. Such instruments are not suitable for laboratory use where true pressure under standard conditions is required. Scale corrections should be specified in the maker's instructions with the instrument, and are also indicated by the lack of correspondence between a gauge mark usually placed exactly 30 inches from the zero point and the 30 inch scale graduation.

BAROMETRIC CONVERSION TABLE

Inches to Centimeters.
1 inch = 2.54001 centimeters

Inches.	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
27.0	68.580	.606	.631	.656	.682	.707	.733	.758	.783	.809
27.1	.834	.860	.885	.910	.936	.961	.987	*.012	*.037	*.063
27.2	69.088	.114	.139	.164	.190	.215	.241	.266	.291	.317
27.3	.342	.368	.393	.418	.444	.469	.495	.520	.545	.571
27.4	.596	.622	.647	.672	.698	.723	.749	.774	.799	.825
27.5	.850	.876	.901	.926	.952	.977	*.003	*.028	*.053	*.079
27.6	70.104	.130	.155	.180	.206	.231	.257	.282	.307	.333
27.7	.358	.384	.409	.434	.460	.485	.511	.536	.561	.587
27.8	.612	.638	.663	.688	.714	.739	.765	.790	.815	.841
27.9	.866	.892	.917	.942	.968	.993	*.019	*.044	*.069	*.095
28.0	71.120	.146	.171	.196	.222	.247	.273	.298	.323	.349
28.1	.374	.400	.425	.450	.476	.501	.527	.552	.577	.603
28.2	.628	.654	.679	.704	.730	.755	.781	.806	.831	.857
28.3	.882	.908	.933	.958	.984	*.009	*.035	*.060	*.085	*.111
28.4	72.136	.162	.187	.212	.238	.263	.289	.314	.339	.365
28.5	.390	.416	.441	.466	.492	.517	.543	.568	.593	.619
28.6	.644	.670	.695	.720	.746	.771	.797	.822	.847	.873
28.7	.898	.924	.949	.974	*.000	*.025	*.051	*.076	*.101	*.127
28.8	73.152	.178	.203	.228	.254	.279	.305	.330	.355	.381
28.9	.406	.432	.457	.482	.508	.533	.559	.584	.609	.635
29.0	.660	.686	.711	.736	.762	.787	.813	.838	.863	.889
29.1	.914	.940	.965	.990	*.016	*.041	*.067	*.092	*.117	*.143
29.2	74.168	.194	.219	.244	.270	.295	.321	.346	.371	.397
29.3	.422	.448	.473	.498	.524	.549	.575	.600	.625	.651
29.4	.676	.702	.727	.752	.778	.803	.829	.854	.879	.905
29.5	.930	.956	.981	*.006	*.032	*.057	*.083	*.108	*.133	*.159
29.6	75.184	.210	.235	.260	.286	.311	.337	.362	.387	.413
29.7	.438	.464	.489	.514	.540	.565	.591	.616	.641	.667
29.8	.692	.718	.743	.768	.794	.819	.845	.870	.895	.921
29.9	.946	.972	.997	*.022	*.048	*.073	*.099	*.124	*.149	*.175
30.0	76.200	.226	.251	.277	.302	.327	.353	.378	.404	.429
30.1	.454	.480	.505	.531	.556	.581	.607	.632	.658	.683
30.2	.708	.734	.759	.785	.810	.835	.861	.886	.912	.937
30.3	.962	.988	*.013	*.039	*.064	*.089	*.115	*.140	*.166	*.191
30.4	77.216	.242	.267	.293	.318	.343	.369	.394	.420	.445
30.5	.470	.496	.521	.547	.572	.597	.623	.648	.674	.699
30.6	.724	.750	.775	.801	.826	.851	.877	.902	.928	.953
30.7	.978	*.004	*.029	*.055	*.080	*.105	*.131	*.156	*.182	*.207
30.8	78.232	.258	.283	.309	.334	.359	.385	.410	.436	.461
30.9	.486	.512	.537	.563	.588	.613	.639	.664	.690	.715

DETERMINATION OF HEIGHTS BY THE BAROMETRIC FORMULA OF BABINET

$$Z = C\frac{B_0 - B}{B_0 + B}$$

$$\text{C (in feet)} = 52494\left(1 + \frac{t_0{}^{\circ}F + t^{\circ}F - 64}{900}\right)$$

$$\text{C (in meters)} = 16000\left(1 + \frac{2(t_0{}^{\circ}C + t^{\circ}C)}{1000}\right)$$

Z = difference in height of two stations.

B_0, B = barometric readings at the lower and upper stations respectively.

t_0, t = temperature of the air at the lower and upper stations respectively.

BAROMETER TEMPERATURE CORRECTION—GLASS SCALE METRIC UNITS

The values in the table below are to be subtracted from the observed readings to correct for the difference in the expansion of the mercury and the glass scale at different temperatures.

Temp. °C.	Observed barometer height in millimeters						
	700	730	740	750	760	770	800
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.12	0.13	0.13	0.13	0.13	0.13	0.14
2	0.24	0.25	0.26	0.26	0.26	0.27	0.27
3	0.36	0.38	0.38	0.39	0.40	0.40	0.42
4	0.49	0.51	0.51	0.52	0.53	0.53	0.55
5	0.61	0.63	0.64	0.65	0.66	0.67	0.69
6	0.73	0.76	0.77	0.78	0.79	0.80	0.83
7	0.85	0.89	0.90	0.91	0.92	0.93	0.97
8	0.97	1.01	1.03	1.04	1.05	1.07	1.11
9	1.09	1.14	1.15	1.17	1.18	1.20	1.25
10	1.21	1.26	1.28	1.30	1.32	1.33	1.39
11	1.33	1.39	1.41	1.43	1.45	1.47	1.52
12	1.45	1.52	1.54	1.56	1.58	1.60	1.66
13	1.58	1.64	1.67	1.69	1.71	1.73	1.80
14	1.70	1.77	1.79	1.82	1.84	1.87	1.94
15	1.82	1.90	1.92	1.95	1.97	2.00	2.08
16	1.94	2.02	2.05	2.08	2.10	2.13	2.21
17	2.06	2.15	2.18	2.21	2.23	2.26	2.35
18	2.18	2.27	2.30	2.33	2.37	2.40	2.49
19	2.30	2.40	2.43	2.46	2.50	2.53	2.63
20	2.42	2.52	2.56	2.59	2.63	2.66	2.77
21	2.54	2.65	2.69	2.72	2.76	2.79	2.90
22	2.66	2.78	2.81	2.85	2.89	2.93	3.04
23	2.78	2.90	2.94	2.98	3.02	3.06	3.18
24	2.90	3.03	3.07	3.11	3.15	3.19	3.32
25	3.02	3.15	3.20	3.24	3.28	3.32	3.45
26	3.14	3.28	3.32	3.37	3.41	3.46	3.59
27	3.26	3.40	3.45	3.50	3.54	3.59	3.73
28	3.38	3.53	3.58	3.63	3.67	3.72	3.87
29	3.50	3.65	3.70	3.75	3.80	3.85	4.00
30	3.62	3.78	3.83	3.88	3.93	3.99	4.14
31	3.74	3.90	3.96	4.01	4.06	4.12	4.28
32	3.86	4.03	4.08	4.14	4.20	4.25	4.42
33	3.98	4.15	4.21	4.27	4.33	4.38	4.55
34	4.10	4.28	4.34	4.40	4.46	4.51	4.69
35	4.22	4.40	4.47	4.53	4.59	4.65	4.83

BAROMETER TEMPERATURE CORREC-

The values in the table below are to be subtracted from the observed readings to correct for the difference in the expansion of the mercury and the brass scale at

Temp. °C.	Observed barometer height in millimeters 640	650	660	670	680	690	700
	mm.	mm.	mm.	mm.	mm.	mm.	mm.
0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1	0.10	0.11	0.11	0.11	0.11	0.11	0.11
2	0.21	0.21	0.22	0.22	0.22	0.23	0.23
3	0.31	0.32	0.32	0.33	0.33	0.34	0.34
4	0.42	0.42	0.43	0.44	0.44	0.45	0.46
5	0.52	0.53	0.54	0.55	0.55	0.56	0.57
6	0.63	0.64	0.65	0.66	0.66	0.67	0.68
7	0.73	0.74	0.75	0.76	0.78	0.79	0.80
8	0.84	0.85	0.86	0.87	0.89	0.90	0.91
9	0.94	0.95	0.97	0.98	1.00	1.01	1.03
10	1.04	1.06	1.07	1.09	1.11	1.12	1.14
11	1.15	1.16	1.18	1.20	1.22	1.24	1.25
12	1.25	1.27	1.29	1.31	1.33	1.35	1.37
13	1.35	1.38	1.40	1.42	1.44	1.46	1.48
14	1.46	1.48	1.50	1.53	1.55	1.57	1.59
15	1.56	1.59	1.61	1.64	1.66	1.68	1.71
16	1.67	1.69	1.72	1.74	1.77	1.80	1.82
17	1.77	1.80	1.82	1.85	1.88	1.91	1.94
18	1.87	1.90	1.93	1.96	1.99	2.02	2.05
19	1.98	2.01	2.04	2.07	2.10	2.13	2.16
20	2.08	2.11	2.15	2.18	2.21	2.24	2.28
21	2.18	2.22	2.25	2.29	2.32	2.35	2.39
22	2.29	2.32	2.36	2.40	2.43	2.47	2.50
23	2.39	2.43	2.47	2.50	2.54	2.58	2.62
24	2.49	2.53	2.57	2.61	2.65	2.69	2.73
25	2.60	2.64	2.68	2.72	2.76	2.80	2.84
26	2.70	2.74	2.79	2.83	2.87	2.91	2.96
27	2.81	2.85	2.89	2.94	2.98	3.02	3.07
28	2.91	2.95	3.00	3.05	3.09	3.14	3.18
29	3.01	3.06	3.11	3.15	3.20	3.25	3.29
30	3.12	3.16	3.21	3.26	3.31	3.36	3.41
31	3.22	3.27	3.32	3.37	3.42	3.47	3.52
32	3.32	3.37	3.43	3.48	3.53	3.58	3.63
33	3.42	3.48	3.53	3.59	3.64	3.69	3.75
34	3.53	3.58	3.64	3.69	3.75	3.80	3.86
35	3.63	3.69	3.74	3.80	3.86	3.91	3.97

CORRECTION OF A BAROM-

(*Smithson-*

Metric Units

Diameter of tube, millimeters	Height of meniscus in millimeters 0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8
			Correction to be added in millimeters					
4	0.83	1.22	1.54	1.98	2.37	....	....	....
5	0.47	0.65	0.86	1.19	1.45	1.80	....	....
6	0.27	0.41	0.56	0.78	0.98	1.21	....	....
7	0.18	0.28	0.40	0.53	0.67	0.82	1.43	....
8	....	0.20	0.29	0.38	0.46	0.56	0.97	1.13
9	....	0.15	0.21	0.28	0.33	0.40	0.65	0.77
10	....	....	0.15	0.20	0.25	0.29	0.46	0.52
11	....	....	0.10	0.14	0.18	0.21	0.33	0.37
12	....	....	0.07	0.10	0.13	0.15	0.24	0.27
13	....	....	0.04	0.07	0.10	0.12	0.18	0.19

TION—BRASS SCALE—METRIC UNITS

different temperatures.

Observed barometer height in millimeters								Temp. °C.
710	720	730	740	750	760	770	780	
mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0
0.12	0.12	0.12	0.12	0.12	0.12	0.13	0.13	1
0.23	0.23	0.24	0.24	0.24	0.25	0.25	0.25	2
0.35	0.35	0.36	0.36	0.37	0.37	0.38	0.38	3
0.46	0.47	0.48	0.48	0.49	0.50	0.50	0.51	4
0.58	0.59	0.59	0.60	0.61	0.62	0.63	0.64	5
0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	6
0.81	0.82	0.83	0.84	0.86	0.87	0.88	0.89	7
0.93	0.94	0.95	0.96	0.98	0.99	1.00	1.02	8
1.04	1.06	1.07	1.08	1.10	1.11	1.13	1.14	9
1.16	1.17	1.19	1.21	1.22	1.24	1.25	1.27	10
1.27	1.29	1.31	1.33	1.34	1.36	1.38	1.40	11
1.39	1.41	1.43	1.45	1.47	1.48	1.50	1.52	12
1.50	1.52	1.54	1.57	1.59	1.61	1.63	1.65	13
1.62	1.64	1.66	1.69	1.71	1.73	1.75	1.78	14
1.73	1.76	1.78	1.81	1.83	1.85	1.88	1.90	15
1.85	1.87	1.90	1.93	1.95	1.98	2.00	2.03	16
1.96	1.99	2.02	2.05	2.07	2.10	2.13	2.16	17
2.08	2.11	2.14	2.17	2.20	2.22	2.25	2.28	18
2.19	2.22	2.25	2.29	2.32	2.35	2.38	2.41	19
2.31	2.34	2.37	2.41	2.44	2.47	2.50	2.54	20
2.42	2.46	2.49	2.53	2.56	2.59	2.63	2.66	21
2.54	2.57	2.61	2.65	2.68	2.72	2.75	2.79	22
2.65	2.69	2.73	2.77	2.80	2.84	2.88	2.91	23
2.77	2.81	2.85	2.88	2.92	2.96	3.00	3.04	24
2.88	2.92	2.96	3.00	3.05	3.09	3.13	3.17	25
3.00	3.04	3.08	3.12	3.17	3.21	3.25	3.29	26
3.11	3.16	3.20	3.24	3.29	3.33	3.38	3.42	27
3.23	3.27	3.32	3.36	3.41	3.45	3.50	3.54	28
3.34	3.39	3.44	3.48	3.53	3.58	3.62	3.67	29
3.46	3.50	3.55	3.60	3.65	3.70	3.75	3.80	30
3.57	3.62	3.67	3.72	3.77	3.82	3.87	3.92	31
3.68	3.74	3.79	3.84	3.89	3.94	4.00	4.05	32
3.80	3.85	3.91	3.96	4.01	4.07	4.12	4.17	33
3.91	3.97	4.02	4.08	4.13	4.19	4.24	4.30	34
4.03	4.09	4.14	4.20	4.26	4.31	4.37	4.43	35

ETER FOR CAPILLARITY

ian Tables.)

English Units

Diameter of tube, inches	Height of meniscus in inches							
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8
	Correction to be added in inches							
0.15	0.024	0.047	0.069	0.092	0.116	.....	.....	.....
0.20	0.011	0.022	0.033	0.045	0.059	0.078	.....	.....
0.25	0.006	0.012	0.019	0.028	0.037	0.047	0.059	.....
0.30	0.004	0.008	0.013	0.018	0.023	0.029	0.035	0.042
0.35	.....	0.005	0.008	0.012	0.015	0.018	0.022	0.026
0.40	.....	0.004	0.006	0.008	0.010	0.012	0.014	0.016
0.45	.....	.....	0.003	0.005	0.007	0.008	0.010	0.012
0.50	.....	.....	0.002	0.004	0.005	0.006	0.006	0.007
0.55	.....	.....	0.001	0.002	0.003	0.004	0.005	0.005

BAROMETRIC TEMPERATURE CORREC-

The table below gives corrections for the expansion of the mercury and of the brass scale in a barometer. The zero correction for the mercury is at 32°F., and for the brass scale at 62°F. The zero correction for the barometer is at 28.5°F. Add or

Temp. °F.	Observed barometer height in inches									
	22.0	22.5	23.0	23.5	24.0	24.5	25.0	25.5	26.0	26.5
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
0	+0.057	+0.059	+0.060	+0.061	+0.063	+0.064	+0.065	+0.066	+0.068	+0.069
2	0.053	0.055	0.056	0.057	0.058	0.059	0.061	0.062	0.063	0.064
4	0.049	0.050	0.052	0.053	0.054	0.055	0.056	0.057	0.058	0.059
6	0.045	0.046	0.047	0.048	0.049	0.050	0.052	0.052	0.054	0.054
8	0.041	0.042	0.043	0.044	0.045	0.046	0.047	0.048	0.049	0.050
10	+0.037	+0.038	+0.039	+0.040	+0.041	+0.041	+0.042	+0.043	+0.044	+0.045
12	0.033	0.034	0.035	0.036	0.036	0.037	0.038	0.038	0.039	0.040
14	0.029	0.030	0.031	0.031	0.032	0.032	0.033	0.034	0.035	0.035
16	0.025	0.026	0.026	0.027	0.028	0.028	0.029	0.029	0.030	0.030
18	0.021	0.022	0.022	0.023	0.023	0.024	0.024	0.025	0.025	0.026
20	+0.017	+0.018	+0.018	+0.018	+0.019	+0.019	+0.020	+0.020	+0.020	+0.021
22	0.013	0.014	0.014	0.014	0.014	0.015	0.015	0.015	0.016	0.016
24	0.009	0.010	0.010	0.010	0.010	0.010	0.011	0.011	0.011	0.011
26	0.005	0.005	0.005	0.006	0.006	0.006	0.006	0.006	0.006	0.006
28	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.001	+0.002
30	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003	−0.003
32	0.007	0.007	0.007	0.007	0.007	0.007	0.008	0.008	0.008	0.008
34	0.011	0.011	0.011	0.011	0.012	0.012	0.012	0.012	0.013	0.013
36	0.015	0.015	0.015	0.016	0.016	0.016	0.017	0.017	0.017	0.018
38	0.019	0.019	0.020	0.020	0.020	0.021	0.021	0.022	0.022	0.022
40	−0.023	−0.023	−0.024	0.024	−0.025	−0.025	−0.026	−0.026	−0.027	−0.027
42	0.027	0.027	0.028	0.029	0.029	0.030	0.030	0.031	0.032	0.032
44	0.031	0.031	0.032	0.033	0.033	0.034	0.035	0.035	0.036	0.037
46	0.035	0.035	0.036	0.037	0.038	0.038	0.039	0.040	0.041	0.042
48	0.039	0.040	0.040	0.041	0.042	0.043	0.044	0.045	0.046	0.046
50	−0.043	−0.044	−0.045	−0.046	−0.046	−0.047	−0.048	−0.049	−0.050	−0.051
52	0.047	0.048	0.049	0.050	0.051	0.052	0.053	0.054	0.055	0.056
54	0.051	0.052	0.053	0.054	0.055	0.056	0.057	0.058	0.060	0.061
56	0.055	0.056	0.057	0.058	0.060	0.060	0.062	0.063	0.064	0.065
58	0.059	0.060	0.061	0.063	0.064	0.065	0.066	0.068	0.069	0.070
60	−0.062	−0.064	−0.065	−0.067	−0.068	−0.069	−0.071	−0.072	−0.074	−0.075
62	0.066	0.068	0.069	0.071	0.073	0.074	0.076	0.077	0.079	0.080
64	0.070	0.072	0.074	0.075	0.077	0.078	0.080	0.081	0.083	0.085
66	0.074	0.076	0.078	0.079	0.081	0.083	0.085	0.086	0.088	0.089
68	0.078	0.080	0.082	0.084	0.085	0.087	0.089	0.090	0.093	0.094
70	−0.082	−0.084	−0.086	−0.088	−0.090	−0.091	−0.094	−0.095	−0.097	−0.099
72	0.086	0.088	0.090	0.092	0.094	0.096	0.098	0.100	0.102	0.104
74	0.090	0.092	0.094	0.096	0.098	0.100	0.103	0.104	0.107	0.108
76	0.094	0.096	0.098	0.101	0.103	0.104	0.107	0.109	0.111	0.113
78	0.098	0.100	0.103	0.105	0.107	0.109	0.112	0.113	0.116	0.118
80	−0.102	−0.104	−0.107	−0.109	−0.111	−0.113	−0.116	−0.118	−0.121	−0.123
82	0.106	0.108	0.111	0.113	0.116	0.118	0.121	0.122	0.125	0.127
84	0.110	0.113	0.115	0.118	0.120	0.122	0.125	0.127	0.130	0.132
86	0.114	0.117	0.119	0.122	0.124	0.126	0.130	0.132	0.135	0.137
88	0.118	0.121	0.123	0.126	0.129	0.131	0.134	0.136	0.139	0.142
90	−0.122	−0.125	−0.127	−0.130	−0.133	−0.135	−0.138	−0.141	−0.144	−0.146
92	0.126	0.129	0.132	0.134	0.137	0.140	0.143	0.145	0.149	0.151
94	0.130	0.133	0.136	0.139	0.142	0.144	0.147	0.150	0.153	0.156
96	0.134	0.137	0.140	0.143	0.146	0.149	0.152	0.155	0.158	0.161
98	0.138	0.141	0.144	0.147	0.150	0.153	0.156	0.159	0.163	0.165
100	−0.142	−0.145	−0.148	−0.151	−0.154	−0.157	−0.161	−0.164	−0.167	−0.170

TION—BRASS SCALE—ENGLISH UNITS

subtract the correction as indicated by its sign. On a metric scale barometer the zero correction is at 0°C. (32°F.); because of this difference, readings taken in inches which are to be converted to readings in centimeters should first be corrected for temperature.

Temp. °F.	27.0	27.5	28.0	28.5	29.0	29.5	30.0	30.5	31.0	31.5
	Observed barometer height in inches									
—	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
0	+0.070	+0.071	+0.073	+0.074	+0.076	+0.077	+0.078	+0.079	+0.081	+0.082
2	0.065	0.066	0.068	0.069	0.070	0.071	0.073	0.074	0.075	0.076
4	0.061	0.061	0.063	0.064	0.065	0.066	0.067	0.068	0.070	0.070
6	0.056	0.056	0.058	0.059	0.060	0.061	0.062	0.063	0.064	0.065
8	0.051	0.051	0.053	0.054	0.054	0.055	0.056	0.057	0.058	0.059
10	+0.046	+0.046	+0.047	+0.048	+0.049	+0.050	+0.051	+0.052	+0.053	+0.053
12	0.041	0.041	0.042	0.043	0.044	0.044	0.045	0.046	0.047	0.048
14	0.036	0.036	0.037	0.038	0.039	0.039	0.040	0.040	0.041	0.042
16	0.031	0.031	0.032	0.033	0.033	0.034	0.034	0.035	0.036	0.036
18	0.026	0.026	0.027	0.028	0.028	0.028	0.029	0.029	0.030	0.030
20	+0.021	+0.021	+0.022	+0.022	+0.023	+0.023	+0.024	+0.024	+0.024	+0.025
22	0.016	0.017	0.017	0.017	0.017	0.018	0.018	0.018	0.019	0.019
24	0.011	0.012	0.012	0.012	0.012	0.012	0.013	0.013	0.013	0.013
26	0.006	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.007	0.008
28	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002	+0.002
30	−0.003	−0.003	−0.003	−0.004	−0.004	−0.004	−0.004	−0.004	−0.004	−0.004
32	0.008	0.008	0.009	0.009	0.009	0.009	0.009	0.009	0.009	0.010
34	0.013	0.013	0.014	0.014	0.014	0.014	0.015	0.015	0.015	0.015
36	0.018	0.018	0.019	0.019	0.019	0.020	0.020	0.020	0.021	0.021
38	0.023	0.023	0.024	0.024	0.025	0.025	0.026	0.026	0.026	0.027
40	−0.028	−0.028	−0.029	−0.029	−0.030	−0.030	−0.031	−0.031	−0.032	−0.032
42	0.033	0.033	0.034	0.034	0.035	0.036	0.036	0.037	0.038	0.038
44	0.038	0.038	0.039	0.040	0.040	0.041	0.042	0.042	0.043	0.044
46	0.043	0.043	0.044	0.045	0.046	0.046	0.047	0.048	0.049	0.049
48	0.047	0.048	0.049	0.050	0.051	0.052	0.053	0.053	0.054	0.055
50	−0.052	−0.053	−0.054	−0.055	−0.056	−0.057	−0.058	−0.059	−0.060	−0.061
52	0.057	0.058	0.059	0.060	0.061	0.062	0.064	0.064	0.066	0.066
54	0.062	0.063	0.064	0.065	0.067	0.068	0.069	0.070	0.071	0.072
56	0.067	0.068	0.069	0.070	0.072	0.073	0.074	0.075	0.077	0.078
58	0.072	0.073	0.074	0.076	0.077	0.078	0.080	0.081	0.082	0.084
60	−0.077	−0.078	−0.080	−0.081	−0.082	−0.084	−0.085	−0.086	−0.088	−0.089
62	0.082	0.083	0.085	0.086	0.038	0.089	0.091	0.092	0.094	0.095
64	0.086	0.088	0.090	0.091	0.093	0.094	0.096	0.097	0.099	0.101
66	0.091	0.093	0.095	0.096	0.098	0.099	0.101	0.103	0.105	0.106
68	0.096	0.098	0.100	0.101	0.103	0.105	0.107	0.108	0.110	0.112
70	−0.101	−0.103	−0.105	−0.106	−0.109	−0.110	−0.112	−0.114	−0.116	−0.117
72	0.106	0.107	0.110	0.111	0.114	0.115	0.118	0.119	0.122	0.123
74	0.111	0.112	0.115	0.117	0.119	0.121	0.123	0.125	0.127	0.129
76	0.116	0.117	0.120	0.122	0.124	0.126	0.128	0.130	0.133	0 134
78	0.120	0.122	0.125	0.127	0.129	0.131	0.134	0.136	0.138	0.140
80	−0.125	−0.127	−0.130	−0.132	−0.135	−0.136	−0.139	−0.141	−0.144	−0.146
82	0.130	0.132	0.135	0.137	0.140	0.142	0.145	0.147	0.149	0 151
84	0.135	0.137	0.140	0.142	0.145	0.147	0.150	0.152	0.155	0.157
86	0.140	0.142	0.145	0.147	0.150	0.152	0.155	0.158	0.161	0.163
88	0.145	0.147	0.150	0.152	0.155	0.158	0.161	0.163	0.166	0.168
90	−0.150	−0.152	−0.155	−0.157	−0.161	−0.163	−0.166	−0.169	−0.172	−0 174
92	0.154	0.157	0.160	0.163	0.166	0.168	0.172	0.174	0.177	0.180
94	0.159	0.162	0.165	0.168	0.171	0.174	0.177	0.179	0.183	0.195
96	0.164	0.167	0.170	0.173	0.176	0.179	0.182	0.185	0.188	0.191
98	0.169	0.172	0.175	0.178	0.181	0.184	0.188	0.190	0.194	0.197
100	−0.174	−0.177	−0.180	−0.183	−0.187	−0.190	--0.193	−0.196	−0.200	0.202

BAROMETRIC LATITUDE-GRAVITY TABLE—METRIC UNITS

(*Smithsonian Tables.*)

The values below are to be subtracted from the barometric reading for latitudes from 0 to 45° inculsive, and are to be added from 46 to 90°.

Deg. Lat.	Barometer readings, millimeters 680	700	720	740	760	780
—	mm.	mm.	mm.	mm.	mm.	mm.
0	1.82	1.87	1.93	1.98	2.04	2.09
5	1.79	1.85	1.90	1.95	2.00	2.06
10	1.71	1.76	1.81	1.86	1.92	1.97
15	1.58	1.63	1.67	1.72	1.77	1.81
20	1.40	1.44	1.49	1.53	1.57	1.61
21	1.36	1.40	1.44	1.48	1.52	1.56
22	1.32	1.36	1.40	1.44	1.48	1.51
23	1.28	1.31	1.35	1.39	1.43	1.46
24	1.23	1.27	1.30	1.34	1.37	1.41
25	1.18	1.22	1.25	1.29	1.32	1.36
26	1.13	1.17	1.20	1.23	1.27	1.30
27	1.08	1.12	1.15	1.18	1.21	1.24
28	1.03	1.06	1.09	1.12	1.15	1.18
29	0.98	1.01	1.04	1.07	1.10	1.12
30	0.93	0.95	0.98	1.01	1.04	1.06
31	0.87	0.90	0.92	0.95	0.98	1.00
32	0.82	0.84	0.86	0.89	0.91	0.94
33	0.76	0.78	0.80	0.83	0.85	0.87
34	0.70	0.72	0.74	0.76	0.79	0.81
35	0.64	0.66	0.68	0.70	0.72	0.74
36	0.58	0.60	0.62	0.64	0.65	0.67
37	0.52	0.54	0.56	0.57	0.59	0.60
38	0.46	0.48	0.49	0.51	0.52	0.53
39	0.40	0.42	0.43	0.44	0.45	0.46
40	0.34	0.35	0.36	0.37	0.38	0.39
41	0.28	0.29	0.30	0.30	0.31	0.32
42	0.22	0.22	0.23	0.24	0.24	0.25
43	0.16	0.16	0.16	0.17	0.17	0.18
44	0.09	0.10	0.10	0.10	0.10	0.11
45	0.03	0.03	0.03	0.03	0.03	0.04
46	0.03	0.03	0.03	0.03	0.04	0.04
47	0.09	0.10	0.10	0.10	0.10	0.11
48	0.16	0.16	0.17	0.17	0.18	0.18
49	0.22	0.23	0.23	0.24	0.25	0.25
50	0.28	0.29	0.30	0.31	0.31	0.32
51	0.34	0.35	0.36	0.37	0.38	0.39
52	0.40	0.42	0.43	0.44	0.45	0.46
53	0.46	0.48	0.49	0.51	0.52	0.53
54	0.52	0.54	0.56	0.57	0.59	0.60
55	0.58	0.60	0.62	0.64	0.65	0.67
56	0.64	0.66	0.68	0.70	0.72	0.74
57	0.70	0.72	0.74	0.76	0.78	0.80
58	0.76	0.78	0.80	0.82	0.85	0.87
59	0.81	0.84	0.86	0.89	0.91	0.93
60	0.87	0.89	0.92	0.94	0.97	1.00
61	0.92	0.95	0.98	1.00	1.03	1.06
62	0.97	1.00	1.02	1.05	1.08	1.11
63	1.03	1.06	1.09	1.12	1.15	1.18
64	1.08	1.11	1.14	1.17	1.20	1.23
65	1.13	1.16	1.19	1.22	1.26	1.29
66	1.17	1.21	1.24	1.28	1.31	1.35
67	1.22	1.25	1.29	1.33	1.36	1.40
68	1.26	1.30	1.34	1.37	1.41	1.45
69	1.31	1.34	1.38	1.42	1.46	1.50
70	1.35	1.39	1.43	1.47	1.51	1.55
72	1.42	1.47	1.51	1.55	1.59	1.63
75	1.53	1.57	1.62	1.66	1.71	1.75
80	1.66	1.71	1.76	1.81	1.86	1.90
85	1.74	1.79	1.84	1.90	1.95	2.00
90	1.77	1.82	1.87	1.93	1.98	2.03

BAROMETRIC LATITUDE-GRAVITY TABLE—ENGLISH UNITS

(*Smithsonian Tables.*)

The values below are to be subtracted from the barometric reading for latitudes from 0 to 45° inclusive, and are to be added from 46 to 90°.

Deg. Lat.	Barometer readings, inches					
	25	26	27	28	29	30
	in.	in.	in.	in.	in.	in.
0	0.067	0.070	0.072	0.075	0.078	0.080
5	0.066	0.069	0.071	0.074	0.077	0.079
10	0.063	0.066	0.068	0.071	0.073	0.076
15	0.058	0.060	0.063	0.065	0.067	0.070
20	0.052	0.054	0.056	0.058	0.060	0.062
21	0.050	0.052	0.054	0.056	0.058	0.060
22	0.049	0.050	0.052	0.054	0.056	0.058
23	0.047	0.049	0.051	0.053	0.054	0.056
24	0.045	0.047	0.049	0.051	0.052	0.054
25	0.043	0.045	0.047	0.049	0.050	0.052
26	0.042	0.043	0.045	0.047	0.048	0.050
27	0.040	0.041	0.043	0.045	0.046	0.048
28	0.038	0.039	0.041	0.043	0.044	0.046
29	0.036	0.037	0.039	0.040	0.042	0.043
30	0.034	0.035	0.037	0.038	0.040	0.041
31	0.032	0.033	0.035	0.036	0.037	0.038
32	0.030	0.031	0.032	0.034	0.035	0.036
33	0.028	0.029	0.030	0.031	0.032	0.034
34	0.026	0.027	0.028	0.029	0.030	0.031
35	0.024	0.025	0.026	0.027	0.027	0.028
36	0.022	0.022	0.023	0.024	0.025	0.026
37	0.019	0.020	0.021	0.022	0.022	0.023
38	0.017	0.018	0.018	0.019	0.020	0.020
39	0.015	0.015	0.016	0.017	0.017	0.018
40	0.013	0.013	0.014	0.014	0.015	0.015
41	0.010	0.011	0.011	0.012	0.012	0.012
42	0.008	0.008	0.009	0.009	0.009	0.010
43	0.006	0.006	0.006	0.006	0.007	0.007
44	0.003	0.004	0.004	0.004	0.004	0.004
45	0.001	0.001	0.001	0.001	0.001	0.001
46	0.001	0.001	0.001	0.001	0.001	0.001
47	0.003	0.004	0.004	0.004	0.004	0.004
48	0.006	0.006	0.006	0.006	0.007	0.007
49	0.008	0.008	0.009	0.009	0.009	0.010
50	0.010	0.011	0.011	0.012	0.012	0.012
51	0.013	0.013	0.014	0.014	0.015	0.015
52	0.015	0.015	0.016	0.016	0.017	0.018
53	0.017	0.018	0.018	0.019	0.020	0.020
54	0.019	0.020	0.021	0.022	0.022	0.023
55	0.021	0.022	0.023	0.024	0.025	0.026
56	0.024	0.024	0.026	0.026	0.027	0.028
57	0.026	0.027	0.028	0.029	0.030	0.031
58	0.028	0.029	0.030	0.031	0.032	0.033
59	0.030	0.031	0.032	0.033	0.035	0.036
60	0.032	0.033	0.034	0.036	0.037	0.038
61	0.034	0.035	0.037	0.038	0.039	0.041
62	0.036	0.037	0.039	0.040	0.042	0.043
63	0.038	0.039	0.041	0.042	0.044	0.045
64	0.040	0.041	0.043	0.044	0.046	0.047
65	0.041	0.043	0.045	0.046	0.048	0.050
66	0.043	0.045	0.047	0.048	0.050	0.052
67	0.045	0.047	0.048	0.050	0.052	0.054
68	0.046	0.048	0.050	0.052	0.054	0.056
69	0.048	0.050	0.052	0.054	0.056	0.058
70	0.050	0.052	0.053	0.055	0.057	0.059
72	0.052	0.054	0.057	0.059	0.061	0.063
75	0.056	0.058	0.061	0.063	0.065	0.067
80	0.061	0.063	0.066	0.068	0.071	0.073
85	0.064	0.067	0.069	0.072	0.074	0.077
90	0.065	0.068	0.070	0.073	0.075	0.078

BAROMETRIC CORRECTION FOR GRAVITY

The values in the table below are to be subtracted from the readings taken on a mercurial barometer to correct for the decrease in gravity with increase in altitude.

Metric Units

Height above sea-level	Observed barometer height in millimeters								
	400	450	500	550	600	650	700	750	800
meters	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.	mm.
100	....	....	....	....	....	....	0.02	0.02	0.02
200	....	....	....	....	....	....	0.04	0.05	0.05
300	....	....	....	....	....	....	0.07	0.07	0.07
400	....	....	....	....	....	....	0.09	0.10	0.10
500	....	....	....	....	....	....	0.11	0.12	0.13
600	....	....	....	....	....	0.12	0.13	0.14	....
700	....	....	....	....	....	0.14	0.15	0.16	....
800	....	....	....	....	....	0.16	0.18	0.19	....
900	....	....	....	....	....	0.18	0.20	0.22	....
1000	....	....	....	0.18	0.19	0.20	0.22	0.24	....
1100	....	....	....	0.19	0.21	0.22	0.24	....	....
1200	....	....	....	0.21	0.23	0.24	0.26	....	....
1300	....	....	....	0.22	0.24	0.26	0.29	....	....
1400	....	....	....	0.24	0.26	0.28	0.31	....	....
1500	....	....	0.24	0.26	0.28	0.30	0.33	....	....
1600	....	....	0.25	0.28	0.30	0.32	....	....	....
1700	....	....	0.27	0.30	0.32	0.34	....	....	....
1800	....	....	0.28	0.31	0.34	0.36	....	....	....
1900	....	....	0.30	0.33	0.36	0.39	....	....	....
2000	....	0.28	0.31	0.34	0.38	0.41	....	....	....
2100	....	0.30	0.33	0.36	0.40	....	....	....	....
2200	....	0.31	0.35	0.38	0.41	....	....	....	....
2300	....	0.32	0.36	0.40	0.43	....	....	....	....
2400	....	0.34	0.38	0.42	0.45	....	....	....	....
2500	0.31	0.35	0.39	0.43	0.47	....	....	....	....
2600	0.33	0.37	0.41	....	....	....	....	....	....
2800	0.35	0.40	0.44	....	....	....	....	....	....
3000	0.38	0.42	0.47	....	....	....	....	....	....
3200	0.40	0.46	....	....	....	....	....	....	....
3400	0.43	0.48	....	....	....	....	....	....	....

English Units

Height above sea-level feet	Observed barometer height in inches								
	14	16	18	20	22	24	26	28	30
	in.	in.	in.	in.	in.	in.	in.	in.	in.
1000	.....	.....	.....	.....	.....	.....	0.003	0.003	0.003
2000	.....	.....	.....	.....	.....	0.004	0.005	0.005	0.006
3000	.....	.....	.....	.....	0.007	0.007	0.008	0.008	.....
4000	.....	.....	.....	.....	0.009	0.009	0.010	.....	.....
5000	.....	.....	.....	0.010	0.011	0.011	0.012	.....	.....
5500	.....	.....	.....	0.011	0.012	0.013	.....	.....	.....
6000	.....	.....	.....	0.011	0.013	0.014	.....	.....	.....
6500	.....	.....	0.011	0.012	0.014	0.015	.....	.....	.....
7000	.....	.....	0.012	0.013	0.015	0.016	.....	.....	.....
7500	.....	.....	0.013	0.014	0.016	0.017	.....	.....	.....
8000	.....	0.012	0.014	0.015	0.017	.....	.....	.....	.....
8500	.....	0.013	0.015	0.016	0.018	.....	.....	.....	.....
9000	0.012	0.014	0.016	0.017	0.019	.....	.....	.....	.....
9500	0.013	0.015	0.016	0.018	0.020	.....	.....	.....	.....
10000	0.013	0.015	0.017	0.019	.....	.....	.....	.....	.....
10500	0.014	0.016	0.018	0.020	.....	.....	.....	.....	.....
11000	0.015	0.017	0.019	0.021	.....	.....	.....	.....	.....
11500	0.015	0.018	0.020	.....	.....	.....	.....	.....	.....
12000	0.016	0.018	0.021	.....	.....	.....	.....	.....	.....
12500	0.017	0.019	0.021	.....	.....	.....	.....	.....	.....
13000	0.017	0.020	.....	.....	.....	.....	.....	.....	.....
13500	0.018	0.021	.....	.....	.....	.....	.....	.....	.....
14000	0.019	0.021	.....	.....	.....	.....	.....	.....	.....
14500	0.019	.....	.....	.....	.....	.....	.....	.....	.....
15000	0.020	.....	.....	.....	.....	.....	.....	.....	.....

VALUES OF GRAVITY AT VARIOUS STATIONS

The following table gives values for the latitude, longitude, altitude and gravity of various places. Gravity is assumed to be the resultant acceleration caused by the attraction of gravity and the rotation of the earth. The values marked * have been corrected for the effect of topography and of isostatic compensation. All values are based on the Potsdam system.

Station	Latitude °	′	Longitude °	′	Altitude, meters	Gravity, cm/sec^2
AFRICA						
Abu Hamed, Egypt	19°	32.0′	33°	19.9′E.	339	978.538
Algiers	36	44.8	3	3 E.	213	979.905
Bizerta, Tunisia	37	16.4	9	52.5 E.	7	979.975
Cape Town	33	56.1 S.	18	28.7 E.	11	979.657
Domjo Ndorobbo	3	8.8 S.	35	13.2 E.	1715	977.549
Freetown, Sierra Leone	8	29.4	13	14.3	65	978.200
Helwan, Egypt	29	51.5	31	20.4 E.	104	979.295
Johannesburg	26	10.9 S.	28	4.5 E.	1805	978.553
Kampo, Cameroons	2	21.2	9	49.6 E.	3	978.040
Khartum, Egypt	15	36.6	32	32.9 E.	383	978.308
Laghwat, Algeria	33	47.7	2	53 E.	755	979.356
Langenburg, S. Africa	9	35.8 S.	34	8.6 E.	477	977.907
Libreville, Gabon	0	22.3	9	27.2 E.	2	977.999
Loanda, Angola	8	48.6 S.	13	14.1 E.	4	978.212
Lourenco Marques	26	2.5 S.	32	19.8 E.	55	979.068
Luxor, Egypt	25	43.1	32	39.3 E.	82	978.982
Minia, Egypt	28	5.8	30	45.5 E.	42	979.155
Monrovia, Liberia	6	19.0	10	48.8	41	978.165
Mozambique	15	2.1 S.	38	25 E.	3	978.451
Ouled Rhamoun, Algeria	36	10.8	6	41 E.	687	979.709
Pangani	5	25.8 S.	38	58.8 E.	7	978.039
Rio del Rey, Nigeria	4	43.5	8	38.3 E.	2	978.087
Tangier, Morocco	35	46.5	5	48.6	63	979.737
Wadi Halfa, Egypt	21	55.8	31	19.9 E.	126	978.728
ALASKA						
Fort Egbert, Eagle City	64	47.4	141	12.4	269	982.141*
Percy Islands	54	55.8	131	35.3	4	981.511*
Point Young	58	11.5	134	33.4	7	981.703*
Quiet Harbor	56	14.1	132	39.6	4	981.590*
St. Michael	63	28.5	162	2.4	1	982.188*
St. Paul Island	57	7.3	170	16.6	10	981.767*
AUSTRALIA						
Brisbane	27	28.0 S.	153	1.6 E.	40	979.148
Hobart, Tasmania	42	53.6 S.	147	22.0 E.	58	980.441
Melbourne	37	49.9 S.	144	58.5 E.	26	979.987
Perth	31	57.1 S.	115	50.5 E.	58	979.378
Sydney	33	51.7 S.	151	12.7 E.	43	979.680
AUSTRIA						
Brenner	47	0.3	11	30.5 E.	1372	980.353
Dalaas	47	8	9	59 E.	838	980.454
Mixnitz	47	19.8	15	22 E.	445	980.657
Stilfserjoch	46	31.8	10	27.4 E.	2760	980.045
Vienna	48	12.7	16	21.5 E.	183	980.860
Waidhofen	47	57.7	14	46.7 E.	352	980.750
Wolfsthal	48	8.3	17	0.5 E.	146	980.904
BELGIUM						
Brussels	50	51.0	4	22 E.	102	981.112
CANADA						
Banff, Alberta	51	10.9	115	34.5	1376	980.741*

VALUES OF GRAVITY AT VARIOUS STATIONS

Station	Latitude		Longitude		Altitude, meters	Gravity, cm/sec^2
	°	′	°	′		
CANADA (Cont.)						
Calgary, Alberta	51°	2.7′	114°	3.8′	1044	980.801*
Charlottetown, P.E.I.	46	13.9	63	7.5	8	980.746*
Halifax, N. S.	44	40.8	63	33.8	9	980.582*
Kenora, Ontario	49	46.0	94	30.0	330	980.992*
Kingston, Ontario	44	14.6	76	28.8	79	980.538*
Liard River, B. C.	59	58.7	123	47.5	160	981.731*
Moose Jaw, Sask.	50	23.4	105	31.8	541	980.946*
Ottawa, Ont.	45	23.6	75	43.0	83	980.618*
Peace River, Alta.	56	14.1	117	17.2	324	981.444*
Port Arthur, Ont.	48	26.0	89	13.0	189	980.806*
St. John, N. B.	45	16.0	66	5.0	33	980.679*
Sault Ste. Marie, Ont.	46	30.4	84	19.2	186	980.675*
Sydney, N. S.	46	8.4	60	11.8	12	980.745*
Vancouver, B. C.	49	16.8	123	6.8	6	980.903*
Winnipeg, Man.	49	54.4	97	8.0	231	980.992*
CENTRAL AMERICA, see SOUTH AMERICA						
CHINA						
Hankow	30	35.5	114	17.5 E.	73(?)	979.369
HongKong	22	18.2	114	10.5 E.	33	978.771
Port Arthur	38	47.9	121	22.3 E.	1	980.128
Shasi	30	18.1	112	14.8 E.	122(?)	979.303
Weihaiwei	37	30.0	122	11.0 E.	1	979.993
Zikawei	31	11.6	121	25.8 E.	4	979.437
CZEKOSLOVAKIA*						
Böhmerwald (Cesky Les)	49	40.1	12	59.3 E.	537	980.921
Cebon (Cebon)	50	0.9	13	0.4 E.	822	980.906
Karlowitz (Karlovice)	49	21.9	18	18.7 E.	510	980.890
Mount Hora (Hora Marenka)	49	10.3	15	42.4 E.	710	980.845
Rosenau (Roznava)	48	39.1	20	32 E.	281	980.871
DENMARK						
Copenhagen	55	41.2	12	34.7 E.	14	981.559
Frederikshavn	57	27.1	10	32.2 E.	15	981.740
Magleby	54	47.3	10	43.0 E.	14	981.502
Trige	56	15.2	10	9.5 E.	91	981.618
ENGLAND, see GREAT BRITAIN						
FINLAND						
Helsingfors	60	9.7	24	57.3 E.	29	981.912
Uleäborg	65	1.2	25	29.1 E.	9	982.262
Viborg	60	42.9	28	43.7 E.	12	981.928
FRANCE						
Arcachon	44	39.6	1	10.4	24	980.586
Bayonne	43	29.7	1	28.0	3	980.475
Bordeaux	44	50.1	0	31.4	72	980.572
Lihons	49	50.0	2	45 E.	106	981.038
Lyon	45	41.0	4	47 E.	286	980.629
Marseille	43	17.9	5	23 E.	61	980.482
Meudon	48	48.3	2	13.9 E.	130(?)	980.919
Mont Blanc	45	50	6	52 E.	4807	979.401
Nice	43	42.8	7	18 E.	367	980.471
Paris	48	50.2	2	20.3 E.	61	980.943
Port-Vendres	42	50.9	3	6 E.	25	980.456
Strasbourg	48	35.0	7	46.1 E.	137	980.904
Valence	44	56	4	53 E.	125	980.562
GERMANY						
Alter Bruch	50	45.7	15	44.6 E.	917	980.990*

*For other stations see end of this table.

VALUES OF GRAVITY AT VARIOUS STATIONS

Station	Latitude		Longitude		Altitude, meters	Gravity, cm/sec²
	°	′	°	′		
GERMANY (Cont.)						
Bremen	53°	5.0′	8°	49.2′ E.	0	981.341
Brocken	51	48.0	10	37 E.	1140	981.103*
Coburg	50	16.0	10	58 E.	290	981.015
Göttingen	51	32.0	9	57 E.	162	981.176
Hamburg	53	32.8	9	58.3 E.	24	981.375
Immenstaad	47	40.0	9	22.1 E.	403	980.709
Jena	50	55.6	11	35.2 E.	154	981.123
Karlsruhe	49	0.7	8	24.7 E.	114	980.967
Kiel	54	20.5	10	9 E.	41	981.464
Kolberg	54	11.3	15	35.8 E.	8	981.453
Königsberg	54	42.8	20	29.8 E.	22	981.477
Leipzig	51	20.1	12	23.5 E.	115	981.180
Munich	48	8.7	11	36.6 E.	525	980.733
Münster	51	57.9	7	37.9 E.	62	981.233
Potsdam	52	22.9	13	4.1 E.	87	981.274
Scharfenstein	51	50.0	10	36.0 E.	623	981.171*
Schneekoppe	50	44.2	15	44.6 E.	1605	980.886*
Stuttgart	48	46.9	9	10.5 E.	247	980.901
Waldsee	47	55	9	45.3 E.	590	980.706
GREAT BRITAIN						
Edinburgh, Scotland	55	57.4	3	9.4	104	981.584
Glasgow, Scotland	55	51.5	4	14.0	61	981.605
Greenwich, England	51	28.6	0	0.0	48	981.184
Kew, England	51	28.1	0	19	5	981.144
Plymouth, England	50	22.2	4	8.4	43	981.148
HOLLAND						
Amsterdam	52	21.9	4	54.7 E.	0	981.288
Breda	51	35.5	4	46.5 E.	1	981.213
De Bilt	52	6.2	5	10.7 E.	2	981.267
Delft	52	0.6	4	22.1 E.	2	981.264
Gronigen	53	13.2	6	34.0 E.	5	981.348
Leeuwarden	53	12.3	5	48.3 E.	1	981.348
Leiden	52	9.4	4	29.1 E.	2	981.273
Maastricht	50	51.2	5	41.6 E.	49	981.140
Terschelling	53	21.6	5	12.9 E.	6	981.376
Utrecht	52	5.2	5	7.8 E.	5	981.263
Winschoten	53	8.7	7	2.4 E.	0	981.346
HUNGARY						
Budapest	47	29.5	19	3.6 E.	108	980.852
Kis-Komarom	46	32.9	17	10.7 E.	115	980.745
INDIA						
Agra	27	10.3	78	1.1 E.	163	979.040*
Allahabad	25	25.9	81	55 E.	88	978.924*
Badnur	21	54.2	77	54.2 E.	641	978.627*
Chatra	24	12.7	88	23.4 E.	20	978.861*
Colaba	18	53.8	72	48.8 E.	10	978.633*
Cuttack	20	29.1	85	52.0 E.	28	978.661*
Dehra Dun	30	19.5	78	3.2 E.	682	978.985*
Dolhpur	26	42.0	77	54.8 E.	176	978.986*
Gesupur	28	33.0	77	42.0 E.	211	979.102*
Jacobabad	28	16.6	68	27.1 E.	56	979.164*
Jalpaiguri	26	31.3	88	44.2 E.	82	978.831*
Jubbulpore	23	8.9	79	59 E.	447	978.719*
Kalianpur	24	7.2	77	39.3 E.	537	978.790*
Madras	13	4.1	80	14.9 E.	6	978.321*

VALUES OF GRAVITY AT VARIOUS STATIONS

Station	Latitude °	Latitude ′	Longitude °	Longitude ′	Altitude, meters	Gravity, cm/sec²
INDIA (Cont.)						
Majhauli	26°	17.8′	83°	58′ E.	67	978.893*
Mian Mir	31	31.6	74	22.5 E.	216	979.352*
Moghal Sarai	25	17.0	83	6 E.	78	978.897*
Montgomery	30	39.8	73	6.3 E.	170	979.304*
Mussoorie	30	27.6	78	4.5 E.	2110	978.827*
Muzaffarpur	26	7.1	85	25 E.	55	978.898*
Quetta	30	12.2	67	0.7 E.	1682	978.877*
Raipur	21	13.9	81	41 E.	304	978.615*
Rajpur	30	24.2	78	5.8 E.	1012	978.938*
Sandakphu Peak	27	6.1	88	0.2 E.	3586	978.333*
Yercaud	11	46.9	78	12.5 E.	1369	978.026*
ISLANDS						
Auckland, New Zealand	36	50.9 S.	174	46.2 E.	3	979.962
Bastia, Corsica	42	41.2	9	27 E.	20	980.519
Batavia, Java	6	11.0 S.	106	49.8 E.	7	978.178
Bridgetown, Barbados	13	4.3	59	36.5	2	978.340
Catania, Sicily	37	30.2	15	4.7 E.	43	980.065
Fornells, Balearic Islands	40	3.4	4	7.9 E.	7	980.283
Honolulu, Hawaii	21	18.1	157	51.8	6	979.108*
Ibiza, Balearic Islands	38	54.3	1	26.1 E.	3	980.146
Jamestown, St. Helena	15	55 S.	5	43.7	10	978.889*
Karajak Glacier, Greenland	70	26.9	50	19.8	20	982.534
Kingston, Jamaica	17	57.7	76	47.3	2	978.591
Kudat, Borneo	6	53.0	116	50.7 E.	2	978.149
Las Palmas, Canary Islands	28	7.0	15	26.0	8	979.385
MaKassar, Celebes	5	7.3 S.	119	24.5 E.	2	978.138
Manila, Philippines	14	34.7	120	38.6 E.	3	978.360
Marau-Sound, Solomon Islands	9	49.1 S.	160	48.5 E.	3	978.349
Mauna Kea, Hawaii	19	49.2	155	28.8	3981	978.538*
Numea, New Caledonia	22	16.6 S.	166	27.8 E.	2	978.877
Palermo, Sicily	38	6.9	13	22.0 E.	20	980.069
Ponta Delgada, Azores	37	43.8	25	40.8	4	980.143
Port Vila, New Hebrides	17	45.0 S.	168	19.0 E.	3	978.637
Reykjavik, Iceland	64	8.5	22	0.3	39	982.273
St. George, Bermuda	32	21	64	40	2	980.024*
Santa Cruz de la Palma, Canary Islands	28	41.0	17	46.0	12	979.459
Singapore, Straits Settlements	1	16.5	103	50.3 E.	21	978.082
Stromboli, Lipari Islands	38	48.2	15	14.1 E.	48	980.212
Whales Point, Spitzbergen	77	30.4	20	58.8 E.	458(?)	982.899
Winter Quarters, Kaiser Wilhelm II Land	66	2.2 S.	89	38.1 E.	1	982.388
Valetta, Malta	35	53.8	14	31.3 E.	62	979.887
ITALY						
Alba	44	42.0	8	2.3 E.	169	980.444
Bologna	44	29.8	11	21.3 E.	51	980.450
Florence	43	46.8	11	15.2 E.	48	980.510
Genoa	44	25.1	8	55.3 E.	93	980.573
Livorno	43	32.0	10	18.5 E.	6	980.516*
Milan	45	28.0	9	11.5 E.	141	980.569
Padua	45	24.0	11	52.3 E.	19	980.658
Pola	44	51.8	13	50.7 E.	28	980.626
Pracchia	44	3.0	10	54.3 E.	627	980.378
Rome	41	53.5	12	29.7 E.	49	980.355*
San Remo	43	49.1	7	46.5 E.	23	980.505

VALUES OF GRAVITY AT VARIOUS STATIONS

Station	Latitude		Longitude		Altitude, meters	Gravity, cm/sec²
	°	′	°	′		
ITALY (Cont.)						
Turin	45°	4.1′	7°	41.8′ E.	233	980.549
JAPAN						
Aomori	40	49	140	45 E.	1	980.325
Fukushima	37	45	140	27 E.	67	980.022
Hachinohe	40	31	141	30 E.	21	980.408*
Hamada	34	54	132	6 E.	3	979.768
Himeji	34	50.1	134	42 E.	16 (?)	979.754
Kofu	35	39	138	35 E.	270	979.719
Kyoto	35	1.6	135	47.1 E.	55	979.727
Matsue	35	30	133	3 E.	23	979.812
Nagasaki	32	44.7	129	52.3 E.	30	979.594
Nagoya	35	10.4	136	53 E.	14	979.756
Okazaki	34	57.4	137	10 E.	25	979.764
Tokyo	35	42.6	139	46.0 E.	18	979.801
Uwajima	33	13	132	34.5 E.	2	979.597
Yamada	34	29.6	136	42.8 E.	4	979.727
JUGOSLAVIA						
Marburg	46	34	15	39 E.	270	980.708
Ragusa	42	38.6	18	6 E.	47	980.394
Serajevo	43	48.2	18	19.7 E.	511	980.382
NORWAY						
Bergen	60	23.9	5	18.3 E.	38	981.922
Dambaas	62	4.6	9	8.3 E.	643	981.892
Mehavn	71	1.3	27	47 E.	10	982.688
Oslo	59	54.7	10	43.5 E.	28	981.927
Rörvik	64	51.9	11	14.3 E.	10	982.313
Sorvaagen	67	53.6	13	2 E.	19	982.622*
Triset	59	25.8	8	10.8 E.	115	981.795
POLAND						
Bedzin	50	19.3	19	8.7 E.	256	981.058
Krakow	50	3.9	19	57.6 E.	205	981.054
Lwow (Lemberg)	49	50.2	24	0.0 E.	314	980.911
Tuchla	48	55.2	23	29 E.	540	980.789
PORTUGAL						
Camposancos	41	53.2	8	49.0	9	980.383
Lisbon	38	42.5	9	11.3	75	980.088
Oporto	41	8.2	8	36.1	94	980.290
Praia da Rocha	37	7.0	8	32.7	17	980.005
ROUMANIA						
Bocsa	46	56.9	22	42 E.	379	980.711
Bucharest	44	24.6	26	6.8 E.	83	980.553
Elesd	47	2.5	22	22 E.	225	980.794
Maros-Ludas	46	28.1	24	6 E.	281	980.715
RUSSIA and SIBERIA						
Alexandropol	40	47.0	43	49.7 E.	1519	979.785
Archangel	64	34	40	31.0 E.	5	982.278
Astrakhan	46	21.0	48	2.7 E.	−21	980.774
Dagarskoje	55	42.2	109	54 E.	465	981.32
Erivan	40	10.7	44	32.8 E.	990	979.880
Irkutsk	52	16.5	104	16.5 E.	470	981.096
Kazan	55	47.4	49	7.3 E.	70	981.572
Leningrad	59	56.5	30	17.7 E.	3	981.929
Listvinichnoe	51	51.0	104	52.5 E.	465	981.051
Moscow	55	45.3	37	34.3 E.	139	981.562
Novgorod	58	31.4	31	17.2 E.	48	981.780
Odessa	46	26.4	30	46.4 E.	43	980.769

VALUES OF GRAVITY AT VARIOUS STATIONS

Station	Latitude		Longitude		Altitude, meters	Gravity, cm/sec^2
	°	′	°	′		
RUSSIA and SIBERIA (Cont.)						
Pulkova	59°	46.3′	30°	19.7′ E.	71	981.899
Simbirsk	54	19.0	48	24.2 E.	181	981.469
Tartu	58	22.8	26	43.2 E.	50	981.793
Tiflis	41	43.1	44	47.8 E.	412	980.176
Volkhovo	59	4.2	31	46.2 E.	21	981.826
SIAM						
Bankok	13	43.9	100	29.4 E.	7	978.278
SIBERIA see Russia						
SOUTH AMERICA						
Bahia Blanca, Argentina	38	47.1 S.	62	15.9	2	980.061
Buenos Aires, Argentina	34	36.5 S.	58	22.2	2	979.669
Bahia, Brazil	12	58.5 S.	38	31.0	4	978.331
Panama, Canal Zone	8	54.9	79	31.9	6	978.243
Valdivia, Chile	39	53.4 S.	73	28.3	10	979.920
Valparaiso, Chile	33	1.8 S.	71	38.5	60	979.609
Callao, Peru	12	4.1 S.	77	15.8	1	978.375
Acajutla, Salvador	13	34.7	89	50.4	12	978.303
Montevideo, Uruguay	34	54.5 S.	56	12.9	4	979.772
SPAIN						
Alcazar de San Juan	39	24.0	3	12.0	648	979.933
Arbas	43	0.9	5	45.0	1329	980.132
Barcelona	41	25.0	2	7.0 E.	407	980.240
Malaga	36	43.0	4	25.2	61	979.918
Salamanca	40	58.0	5	39.0	805	980.057
San Fernando	36	28.0	6	12.3	44	979.843
Seville	37	23.0	5	59.0	11	979.965
Tarita	36	0.0	5	37.0	29	979.748
Toledo	39	51.0	4	1.0	520	980.015
Valencia	39	29.0	0	23.0	6	980.127
Vivero	43	39.0	7	35.0	12	980.553
SWEDEN						
Haparanda	65	49.7	24	9.6 E.	4	982.337
Hernösand	62	37.8	17	57.0 E.	25	982.082
Lund	55	41.9	13	11.3 E.	32	981.564
Stockholm	59	20.6	18	3.5 E.	45	981.843
Upsala	59	51.5	17	37.6 E.	20	981.910
SWITZERLAND						
Basel	47	33.6	7	34.8 E.	277	980.788
Bern	46	56.5	7	26.8 E.	522	980.622
Chanrion	45	56.3	7	22.9 E.	2435	980.220*
Eggishorn	46	25.2	8	6.8 E.	2187	980.255*
Fribourg	46	47.6	7	9.4 E.	633	980.584
Gornergrat	45	59.0	7	46.8 E.	3016	980.157*
Grand St. Bernard	45	52.1	7	10.4 E.	2473	980.203*
Geneva	46	12.0	6	9.2 E.	402	980.592
Gsteig	46	23.2	7	56.2 E.	1185	980.395*
Lausanne	46	31.5	6	38.2 E.	531	980.599
Neuchatel	47	0.1	6	57.3 E.	487	980.627*
St. Maurice	46	13.0	7	0.2 E.	422	980.382*
Simplonhospiz	46	14.9	8	1.9 E.	1998	980.278*
Sion	46	14.1	7	21.5 E.	514	980.398*
Zermatt	46	1.5	7	45.0 E.	1603	980.243*
Zürich	47	22.7	8	33.1 E.	463	980.676
TURKESTAN						
Chardzhui	39	6.2	63	36.1 E.	192	980.014

VALUES OF GRAVITY AT VARIOUS STATIONS

Station	Latitude °	Latitude ′	Longitude °	Longitude ′	Altitude, meters	Gravity, cm/sec²
TURKESTAN (Cont.)						
Derbent, Bokhara	38°	12.0′	67°	3.2′E.	1012	979.672
Kala Khum, Bokhara	38	27.3	70	46.5 E.	1345	979.376*
Samarkand	39	39.1	66	58.7 E.	719	979.883
Sultan-Bend	37	7.5	62	28.0 E.	272	979.798
Tash Kent	41	19.5	69	17.7 E.	478	980.086
UNITED STATES						
Albany, N. Y.	42	39.1	73	46.1	61	980.338*
Apalachicola, Fla.	29	43.5	84	58.8	4	979.337*
Asheville, N. C.	35	35.9	82	33.3	670	979.629*
Atlanta, Ga.	33	45.0	84	23.3	324	979.538*
Austin, Tex.	30	17.2	97	44.2	189	979.282*
Baltimore, Md.	39	17.8	76	37.3	30	980.103*
Bismarck, N. D.	46	48.5	100	47.0	516	980.620*
Boise, Idaho	43	37.2	116	12.3	821	980.170*
Calais, Maine	45	11.2	67	16.9	38	980.641*
Cambridge, Mass.	42	22.8	71	7.8	14	980.408*
Charleston, W. Va.	38	20.9	81	37.7	184	979.926*
Charleston, S. C.	32	47.2	79	56.0	6	979.562*
Charlottesville, Va.	38	2.0	78	30.3	166	979.940*
Chicago, Ill.	41	47.4	87	36.1	182	980.285*
Cincinnati, Ohio	39	8.3	84	25.3	245	980.006*
Cleveland, Ohio	41	30.4	81	36.6	210	980.241*
Colorado Springs, Colo.	38	50.7	104	49.0	1841	979.483*
Denver, Colo.	39	40.6	104	56.9	1638	979.594*
Dover, Del.	39	9.7	75	32.0	12	980.112*
El Paso, Tex.	31	46.3	106	29.0	1146	979.125*
Galveston, Tex.	29	18.2	94	47.5	3	979.279*
Georgetown, Tex.	30	38.0	97	40.1	231	979.300*
Goldfield, Nev.	37	42.2	117	14.5	1716	979.483*
Hartford, Conn.	41	44.8	72	41.8	37	980.344*
Hinsdale, Mont.	48	23.8	107	5.3	661	980.722*
Hoboken, N. J.	40	44	74	2	11	980.277*
Indianapolis, Ind.	39	45.9	86	8.8	217	980.093*
Ithaca, N. Y.	42	27.1	76	29.0	247	980.305*
Kansas City, Mo.	39	5.8	94	35.4	278	979.989*
Key West, Fla.	24	33.6	81	48.4	1	979.005*
Lancaster, N. H.	44	29.5	71	34.3	261	980.493*
Las Vegas, N. M.	35	35.8	105	12.1	1960	979.221*
Little Rock, Ark.	34	45.0	92	16.4	89	979.722*
Madison, Wis.	43	4.6	89	24.0	270	980.368*
Minneapolis, Minn.	44	58.7	93	13.9	256	980.592*
Mount Hamilton, Cal.	37	20.4	121	38.6	1282	979.780*
New Orleans, La.	29	57.0	90	4.2	2	979.337*
New York, N. Y.	40	48.5	73	57.7	38	980.278*
Norris Geyser Basin, Wyo.	44	44.2	110	42.0	2276	979.981*
Pembina, N. D.	48	58.1	97	14.9	243	980.908*
Philadelphia, Pa.	39	57.1	75	11.7	16	980.205*
Pierre, S. D.	44	21.9	100	20.8	454	980.414*
Pittsburgh, Pa.	40	27.4	80	0.6	235	980.118*
Point Isabel, Tex.	26	4.7	97	12.4	8	979.091*
Portland, Ore.	45	31.4	122	40.7	8	980.630*
Potsdam, N. Y.	44	40.1	74	58.8	130	980.567*
Princeton, N. J.	40	21.0	74	39.5	64	980.191*
Richmond, Va.	37	32.2	77	26.1	30	979.970*
St. Louis, Mo.	38	38.0	90	12.2	154	980.002*

VALUES OF GRAVITY AT VARIOUS STATIONS

Station	Latitude °	′	Longitude °	′	Altitude, meters	Gravity, cm/sec^2
UNITED STATES (Cont.)						
Salt Lake City, Utah	40°	46.1′	111°	53.8′	1322	979.762*
San Francisco, Cal.	37	47.5	122	25.7	114	980.010*
Sandpoint, Idaho	48	16.4	116	33.3	637	980.636*
Seattle, Wash.	47	39.6	122	18.3	58	980.713*
Springfield, Ill.	39	47.7	89	39.5	183	980.094*
State College, Pa.	40	47.9	77	51.8	358	980.134*
Terre Haute, Ind.	39	28.7	87	23.8	151	980.073*
Washington, D. C.	38	53.2	77	0.5	14	980.116*
Washington, D. C.	38	56.3	77	4.0	103	980.107*
Wilmington, N. C.	34	14.2	77	56.6	9	979.686*
Worcester, Mass.	42	16.5	71	48.5	170	980.342*
Yavapai, Ariz.	36	3.9	112	7.1	2179	979.226*
CZEKOSLOVAKIA (Cont.)						
Brno	49	12.4	16	36.0	247	980.961
Budejovice	48	52.0	14	17.0	1084	980.716
Dobsina	48	49.0	20	23.0	443	980.875
Mukacevo	48	26.0	22	43.0	123	980.940
Praha	50	8.0	14	28.2	356	981.016

REDUCTION OF THE BAROMETER TO SEA LEVEL

A barometer located at an elevation above sea level will show a reading lower than a barometer at sea level by an amount approximately 2.5 millimeters (0.1 inch) for each 30.5 meters (100 feet) of elevation. A closer approximation can be made by reference to the following tables which take into account, (1) the effect of altitude of the station at which the barometer is read, (2) the mean temperature of the air column extending from the station down to sea level, (3) the latitude of the station at which the barometer is read and, (4) the reading of the barometer corrected for its temperature, a correction which is applied only to mercurial barometers since the aneroid barometers are compensated for temperature effects.

Example.—A barometer which has been corrected for its temperature read 650 mm. at a station whose altitude is 1350 meters above sea level and at a latitude of 30°. The mean temperature (outdoor temperature) at the station is 20°C.

Table A (metric units) gives for these conditions a temperature-altitude factor of.. 135.2
The Latitude Factor Table gives for 135.2 at 30° lat. a correction of.......... +0.17
Therefore, the corrected value of the temperature-altitude factor is...... 135.37

Entering Table B (metric units), with a temperature-altitude factor of 135.37 and a barometric reading of 650 mm. (corrected for temperature), the correction is found to be... 109.6
Accordingly the barometric reading reduced to sea level is 650 + 109.6 = 759.6 mm.

LATITUDE FACTOR—ENGLISH OR METRIC UNITS

For latitudes 0°-45° add the latitude factor, for 45°-90° subtract the latitude factor, from the values obtained in Table A.

Temp.—Alt. Factor From Table A	Latitude				
	0°	10°	20°	30°	45°
50	0.1	0.1	0.1	0.1	0.0
100	0.3	0.3	0.2	0.1	0.0
150	0.4	0.4	0.3	0.2	0.0
200	0.5	0.5	0.4	0.3	0.0
250	0.7	0.6	0.5	0.3	0.0
300	0.8	0.8	0.6	0.4	0.0
350	0.9	0.9	0.7	0.5	0.0
	90°	80°	70°	60°	45°

REDUCTION OF THE BAROMETER TO SEA LEVEL—METRIC UNITS

TABLE A. VALUES OF THE TEMPERATURE-ALTITUDE FACTOR FOR USE IN TABLE B.

(From *Smithsonian Meteorological Tables*, 3d Ed., 1907.)

Altitude in Meters	Mean Temperature of Air Column in Centigrade Degrees										
	−16°	−8°	−4°	0°	6°	10°	14°	18°	20°	22°	26°
10	1.2	1.1	1.1	1.1	1.1	1.0	1.0	1.0	1.0	1.0	1.0
50	5.8	5.6	5.5	5.4	5.3	5.2	5.1	5.0	5.0	5.0	4.9
100	11.5	11.2	11.0	10.8	10.6	10.4	10.3	10.1	10.0	9.9	9.8
150	17.3	16.7	16.5	16.2	15.9	15.6	15.4	15.1	15.0	14.9	14.7
200	23.0	22.3	22.0	21.6	21.1	20.8	20.5	20.2	20.0	19.9	19.6
250	28.8	27.9	27.5	27.0	26.4	26.0	25.6	25.2	25.0	24.9	24.5
300	34.5	33.5	33.0	32.5	31.7	31.2	30.7	30.3	30.1	29.8	29.4
350	40.3	39.0	38.5	37.9	37.0	36.4	35.9	35.3	35.1	34.8	34.3
400	46.0	44.6	43.9	43.3	42.3	41.6	41.0	40.4	40.1	39.8	39.2
450	51.8	51.3	49.4	48.7	47.6	46.8	46.1	45.4	45.1	44.8	44.1
500	57.5	55.8	54.9	54.1	52.9	52.0	51.2	50.5	50.1	49.7	49.0
550	63.3	61.4	60.4	59.5	58.1	57.2	56.4	55.5	55.1	54.7	53.9
600	69.0	66.9	65.9	64.9	63.4	62.4	61.5	60.6	60.1	59.7	58.8
650	74.8	72.5	71.4	70.3	68.7	67.6	66.6	65.6	65.1	64.6	63.7
700	80.6	78.1	76.9	75.7	74.0	72.9	71.7	70.7	70.1	69.6	68.6
750	86.3	83.7	82.4	81.1	79.3	78.1	76.9	75.7	75.1	74.6	73.5
800	92.1	89.2	87.9	86.5	84.6	83.3	82.0	80.8	80.1	79.6	78.4
850	97.8	94.8	93.4	92.0	89.8	88.5	87.1	85.8	85.2	84.5	83.3
900	103.6	100.4	98.9	97.4	95.1	93.7	92.2	90.8	90.2	89.5	88.2
950	109.3	106.0	104.4	102.8	100.4	98.9	97.4	95.9	95.2	94.5	93.1
1000	115.1	111.5	109.8	108.2	105.7	104.1	102.5	100.9	100.2	99.4	98.0
1050	120.8	117.1	115.3	113.6	111.0	109.3	107.6	106.0	105.2	104.4	102.9
1100	126.6	122.7	120.8	119.0	116.3	114.5	112.7	111.0	110.2	109.4	107.8
1150	132.3	128.3	126.3	124.4	121.6	119.7	117.9	116.1	115.2	114.4	112.7
1200	138.1	133.8	131.8	129.8	126.8	124.9	123.0	121.1	120.2	119.3	117.6
1250	143.8	139.4	137.3	135.2	132.1	130.1	128.1	126.2	125.2	124.3	122.5
1300	149.6	145.0	142.8	140.6	137.4	135.3	133.2	131.2	130.2	129.3	127.4
1350	155.3	150.6	148.3	146.0	142.7	140.5	138.4	136.3	135.2	134.2	132.3
1400	161.1	156.2	153.8	151.4	148.0	145.7	143.5	141.3	140.2	139.2	137.2
1450	166.8	161.7	159.3	156.8	153.3	150.9	148.6	146.4	145.3	144.2	142.1
1500	172.6	167.3	164.8	162.3	158.5	156.1	153.7	151.4	150.3	149.1	147.0
1550	178.3	172.9	170.2	167.7	163.8	161.3	158.8	156.4	155.3	154.1	151.8
1600	184.1	178.5	175.7	173.1	169.1	166.5	164.0	161.5	160.3	159.1	156.7
1650	189.8	184.0	181.2	178.5	174.4	171.7	169.1	166.5	165.3	164.1	161.6
1700	195.6	189.6	186.7	183.9	179.7	176.9	174.2	171.6	170.3	169.0	166.5
1750	201.4	195.2	192.2	189.3	185.0	182.1	179.3	176.6	175.3	174.0	171.4
1800	207.1	200.8	197.7	194.7	190.2	187.3	184.5	181.7	180.3	179.0	176.3
1850	212.9	206.3	203.2	200.1	195.5	192.5	189.6	186.7	185.3	183.9	181.2
1900	218.6	211.9	208.7	205.5	200.8	197.7	194.7	191.8	190.3	188.9	186.1
1950	224.4	217.5	214.2	210.9	206.1	202.9	199.8	196.8	195.3	193.9	191.0
2000	230.1	223.0	219.7	216.3	211.4	208.1	204.9	201.9	200.3	198.8	195.9
2050	235.9	228.6	225.1	221.7	216.7	213.3	210.1	206.9	205.3	203.8	200.8
2100	241.6	234.2	230.6	227.1	221.9	218.5	215.2	211.9	210.4	208.8	205.7
2150	247.4	239.8	236.1	232.5	227.2	223.7	220.3	217.0	215.4	213.8	210.6
2200	253.1	245.4	241.6	237.9	232.5	228.9	225.4	222.0	220.4	218.7	215.5
2250	258.9	250.9	247.1	243.4	237.8	234.1	230.6	227.1	225.4	223.7	220.4
2300	264.6	256.5	252.6	248.8	243.1	239.3	235.7	232.1	230.4	228.7	225.3
2350	270.4	262.1	258.1	254.2	248.3	244.5	240.8	237.2	235.4	233.6	230.2
2400	276.1	267.7	263.6	259.6	253.6	249.7	245.9	242.2	240.4	238.6	235.1
2450	281.9	273.2	269.1	265.0	258.9	254.9	251.0	247.3	245.4	243.6	240.0
2500	287.6	278.8	274.5	270.4	264.2	260.1	256.2	252.3	250.4	248.5	244.9
2550	293.4	284.4	280.0	275.8	269.5	265.3	261.3	257.3	255.4	253.5	249.8
2600	299.1	290.0	285.5	281.2	274.8	270.5	266.4	262.4	260.4	258.5	254.7
2650	304.9	295.5	291.0	286.6	280.0	275.7	271.5	267.4	265.4	263.4	259.6
2700	310.6	301.1	296.5	292.0	285.3	280.9	276.6	272.5	270.4	268.4	264.5
2750	316.4	306.7	302.0	297.4	290.6	286.1	281.8	277.5	275.4	273.4	269.4
2800	322.1	312.3	307.5	302.8	295.9	291.3	286.9	282.6	280.4	278.3	274.3
2850	327.9	317.8	313.0	308.2	301.2	296.5	292.0	287.6	285.4	283.3	279.2
2900	333.6	323.4	318.4	313.6	306.4	301.7	297.1	292.6	290.4	288.3	284.1
2950	339.4	329.0	323.9	319.0	311.7	306.9	302.2	297.7	295.5	293.3	289.0
3000	345.1	334.5	329.4	324.4	317.0	312.1	307.4	302.7	300.5	298.2	293.8

REDUCTION OF THE BAROMETER TO SEA LEVEL—METRIC UNITS

TABLE B. VALUES IN MILLIMETERS TO BE ADDED

(From *Smithsonian Meteorological Tables*, 3d Ed., 1907.)

Temp. —Alt. Factor	Barometer Reading in Millimeters						
	790	770	750	730	710	690	670
1	0.9	0.9	0.9	0.8	0.8	0.8	
5	4.6	4.4	4.3	4.2	4.1	4.0	
10	9.1	8.9	8.7	8.5	8.2	8.0	
15	13.8	13.4	13.1	12.7	12.4	12.0	
20	18.4	17.9	17.5	17.0	16.5	16.1	
25		22.5	21.9	21.3	20.7	20.1	
30		27.1	26.4	25.7	25.0	24.2	
35		31.7	30.8	30.0	29.2	28.4	
40		36.3	35.3	34.4	33.5	32.5	31.6
45			39.9	38.8	37.8	36.7	35.6
	750	730	710	690	670	650	630
50	44.4	43.3	42.1	40.9	39.7		
55	49.0	47.7	46.4	45.1	43.8		
60	53.6	52.2	50.8	49.3	47.9		
65	58.3	56.7	55.2	53.6	52.1		
70		61.3	59.6	57.9	56.2		
75		65.8	64.0	62.2	60.4		
80		70.4	68.5	66.6	64.6	62.7	60.8
85		75.0	73.0	70.9	68.9	66.8	64.8
90			77.5	75.3	73.1	71.0	68.8
95			82.1	79.7	77.4	75.1	72.8
	710	690	670	650	630	610	
100	86.6	84.2	81.8	79.3	76.9		
105	91.2	88.7	86.1	83.5	81.0		
110	95.9	93.2	90.5	87.8	85.1		
115	100.5	97.7	94.8	92.0	89.2		
120		102.2	99.3	96.3	93.3		
125		106.8	103.7	100.6	97.5	94.4	
130		111.4	108.2	104.9	101.7	98.5	
135		116.0	112.7	109.3	105.9	102.6	
140		120.7	117.2	113.7	110.2	106.7	
145			121.7	118.1	114.5	110.8	
	670	650	630	610	590	570	
150	126.3	122.5	118.8	115.0			
155	130.9	127.0	123.1	119.2			
160	135.5	131.5	127.4	123.4			
165	140.2	136.0	131.8	127.6			
170		140.5	136.2	131.9	127.5	123.2	
175		145.1	140.6	136.2	131.7	127.2	
180		149.7	145.1	140.5	135.9	131.3	
185		154.3	149.5	144.8	140.0	135.3	
190		158.9	154.0	149.2	144.3	139.4	
195			158.6	153.5	148.5	143.5	

Temp. —Alt. Factor	Barometer Reading in Millimeters					
	630	610	590	570	550	530
200	163.1	157.9	152.8	147.6		
205	167.7	162.4	157.1	151.7		
210	172.3	166.8	161.4	155.9		
215	176.9	171.3	165.7	160.1	154.5	148.9
220		175.8	170.1	164.3	158.5	152.8
225		180.4	174.5	168.5	162.6	156.7
230		184.9	178.9	172.8	166.7	160.7
235		189.5	183.3	177.1	170.9	164.7
240		194.1	187.8	181.4	175.0	168.7
245		198.8	192.3	185.7	179.2	172.7
	590	570	550	530	510	
250	196.8	190.1	183.4	176.8		
255	201.3	194.5	187.7	180.8		
260	205.9	198.9	191.9	185.0	178.0	
265	210.5	203.3	196.2	189.1	181.9	
270	215.1	207.8	200.5	193.2	185.9	
275	219.8	212.3	204.9	197.4	190.0	
280		216.8	209.2	201.6	194.0	
285		221.4	213.6	205.8	198.1	
290		225.9	218.0	210.1	202.1	
295		230.5	222.4	214.3	206.3	
	570	550	530	510	490	
300	235.1	226.9	218.6	210.4		
305	239.8	231.4	223.0	214.6	206.1	
310		235.9	227.3	218.7	210.1	
315		240.4	231.7	222.9	214.2	
320		245.0	236.1	227.2	218.3	
325		249.6	240.5	231.4	222.4	
330		254.2	244.9	235.7	226.5	
335		258.8	249.4	240.0	230.6	
340		263.5	253.9	244.4	234.8	
345			258.4	248.7	238.9	

REDUCTION OF THE BAROMETER TO SEA LEVEL—ENGLISH UNITS

TABLE A. VALUES OF THE TEMPERATURE-ALTITUDE FACTOR FOR USE IN TABLE B.

(From *Smithsonian Meteorological Tables*, 3d Ed., 1907.)

Altitude in Feet	Mean Temperature of Air Column in Fahrenheit Degrees										
	−20°	−8°	0°	10°	20°	30°	40°	50°	60°	70°	80°
100	3.7	3.6	3.5	3.5	3.4	3.3	3.2	3.2	3.1	3.0	3.0
200	7.4	7.2	7.1	6.9	6.8	6.6	6.5	6.3	6.2	6.1	6.0
400	14.8	14.4	14.1	13.8	13.5	13.2	13.0	12.7	12.4	12.2	11.9
600	22.2	21.6	21.2	20.7	20.3	19.9	19.5	19.0	18.6	18.2	17.9
800	29.6	28.8	28.3	27.7	27.1	26.5	25.9	25.4	24.8	24.3	23.8
1000	37.0	36.0	35.3	34.6	33.8	33.1	32.4	31.7	31.1	30.4	29.8
1200	44.3	43.2	42.4	41.5	40.6	39.7	38.9	38.1	37.3	36.5	35.8
1400	51.7	50.3	49.5	48.4	47.4	46.4	45.4	44.4	43.5	42.6	41.7
1600	59.1	57.5	56.5	55.3	54.1	53.0	51.9	50.8	49.7	48.7	47.7
1800	66.5	64.7	63.6	62.2	60.9	59.6	58.4	57.1	55.9	54.7	53.6
2000	73.9	71.9	70.6	69.1	67.7	66.2	64.8	63.4	62.1	60.8	59.6
2200	81.3	79.1	77.7	77.7	74.4	72.9	71.3	69.8	68.3	66.9	65.5
2400	88.7	86.3	84.8	84.8	81.2	79.5	77.8	76.1	74.5	73.0	71.5
2600	96.1	93.5	91.8	91.8	87.9	86.1	84.3	82.5	80.7	79.1	77.5
2800	103.5	100.7	98.9	98.9	94.7	92.7	90.8	88.8	87.0	85.1	83.4
3000	110.9	107.9	106.0	106.0	101.5	99.3	97.2	95.2	93.2	91.2	89.4
3200	118.2	115.1	113.0	113.0	108.2	106.0	103.7	101.5	99.4	97.3	95.3
3400	125.6	122.3	120.1	120.1	115.0	112.6	110.2	107.9	105.6	103.4	101.3
3600	133.0	129.4	127.2	127.2	121.8	119.2	116.7	114.2	111.8	109.5	107.2
3800	140.4	136.6	134.2	134.2	128.5	125.8	123.2	120.5	118.0	115.5	113.2
4000	147.8	143.8	141.3	141.3	135.3	132.4	129.6	126.9	124.2	121.6	119.2
4200	155.2	151.0	148.3	145.1	142.1	139.1	136.1	133.2	130.4	127.7	125.1
4400	162.6	158.2	155.4	152.0	143.8	145.7	142.6	139.6	136.6	133.8	131.1
4600	170.0	165.4	162.5	159.0	155.6	152.3	149.1	145.9	142.8	139.9	137.0
4800	177.3	172.6	169.5	165.9	162.3	158.9	155.6	152.2	149.0	145.9	143.0
5000	184.7	179.8	176.6	172.8	169.1	165.6	162.0	158.6	155.2	152.0	148.9
5200	192.1	187.0	183.7	179.7	175.9	172.2	168.5	164.9	161.5	158.1	154.9
5400	199.5	194.1	190.7	186.6	182.6	178.8	175.0	171.3	167.7	164.2	160.8
5600	206.9	201.3	197.8	193.5	189.4	185.4	181.5	177.6	173.9	170.3	166.8
5800	214.3	208.5	204.8	200.4	196.2	192.0	188.0	184.0	180.1	176.3	172.8
6000	221.7	215.7	211.9	207.3	202.9	198.7	194.4	190.3	186.3	182.4	178.7
6200	229.1	222.9	219.0	214.2	209.7	205.3	200.9	196.6	192.5	188.5	184.7
6400	236.4	230.1	226.0	221.1	216.4	211.9	207.4	203.0	198.7	194.6	190.6
6600	243.8	237.3	233.1	228.0	223.2	218.5	213.9	209.3	204.9	200.7	196.6
6800	251.2	244.5	240.1	235.0	230.0	225.1	220.4	215.7	211.1	206.7	202.5
7000	258.6	251.6	247.2	241.9	236.7	231.8	226.8	222.0	217.3	212.8	208.5
7200	266.0	258.8	254.3	248.8	243.5	238.4	233.3	228.4	223.5	218.9	214.4
7400	273.4	266.0	261.3	255.7	250.2	245.0	239.8	234.7	229.7	225.0	220.4
7600	280.8	273.2	268.4	262.6	257.0	251.6	246.3	241.0	235.9	231.1	226.4
7800	288.1	280.4	275.4	269.5	263.8	258.2	252.8	247.4	242.2	237.1	232.3
8000	295.5	287.6	282.5	276.4	270.5	264.8	259.2	253.7	248.4	243.2	238.3
8200	302.9	294.8	289.6	283.3	277.3	271.5	265.7	260.1	254.6	249.3	244.2
8400	310.3	302.0	296.6	290.2	284.0	278.1	272.2	266.4	260.8	255.4	250.2
8600	317.7	309.1	303.7	297.1	290.8	284.7	278.7	272.7	267.0	261.4	256.1
8800	325.1	316.3	310.7	304.0	297.6	291.3	285.2	279.1	273.2	267.5	262.1
9000	332.5	323.5	317.8	310.9	304.3	297.9	291.6	285.4	279.4	273.6	268.0

REDUCTION OF THE BAROMETER TO SEA LEVEL—ENGLISH UNITS

TABLE B. VALUES IN INCHES TO BE ADDED

(From *Smithsonian Meteorological Tables*, 3d Ed., 1907.)

Temp.—Alt. Factor	Barometer Reading in Inches					Temp.—Alt. Factor	Barometer Reading in Inches				
	31	30	29	28	27		25	24	23	22	21
1	0.04	0.03	0.03	....	....	175	5.58	5.36	....	....	....
5	0.18	0.17	0.17	....	....	180	5.76	5.53	5.30	....	....
10	0.36	0.35	0.34	0.32	....	185	5.93	5.70	5.46	....	....
15	0.54	0.52	0.51	0.49	....	190	6.11	5.87	5.62	....	....
20	0.72	0.70	0.68	0.65	....	195	6.29	6.04	5.79	....	....
25	....	0.88	0.85	0.82	....	200	6.47	6.21	5.96	....	....
30	....	1.05	1.02	0.98	....	205	....	6.39	6.12	....	....
35	....	1.23	1.19	1.15	....	210	....	6.56	6.29	....	....
40	....	1.41	1.37	1.32	1.27	215	....	6.74	6.46	....	....
45	....	1.60	1.54	1.49	1.44	220	....	6.92	6.63	6.34	....
50	....	....	1.72	1.66	1.60	225	....	7.10	6.80	6.51	....
55	....	....	1.90	1.83	1.76	230	....	7.28	6.97	6.67	....
60	....	....	2.07	2.00	1.93	235	....	7.46	7.15	6.84	....
65	....	....	2.25	2.18	2.10	240	....	....	7.32	7.00	....
70	....	....	2.43	2.35	2.27	245	....	....	7.49	7.17	....
75	....	....	....	2.53	2.43	250	....	....	....	7.34	....
80	....	....	....	2.70	2.60	255	....	....	....	7.51	....
85	....	....	....	2.88	2.78	260	....	....	....	7.68	7.33
90	....	....	....	3.06	2.95	265	....	....	....	7.85	7.49
95	....	....	....	3.24	3.12	270	....	....	....	8.02	7.66
	28	27	26	25	24		22	21	20		
75	2.53	2.43	2.34	....	....	275	8.19	7.82	....		
80	2.70	2.60	2.51	....	....	280	8.37	7.99	....		
85	2.88	2.78	2.67	....	....	285	8.54	8.16	....		
90	3.06	2.95	2.84	....	....	290	8.72	8.32	....		
95	3.24	3.12	3.01	....	....	295	8.90	8.49	8.09		
100	3.42	3.29	3.17	....	....	300	9.08	8.66	8.25		
105	3.60	3.47	3.34	3.21	....	305	9.26	8.83	8.41		
110	....	3.65	3.51	3.38	....	310	9.44	9.01	8.58		
115	....	3.82	3.68	3.54	....	315	9.62	9.18	8.74		
120	....	4.00	3.85	3.70	....	320	9.80	9.35	8.91		
125	....	4.18	4.02	3.87	....	325	....	9.53	9.08		
130	....	4.36	4.20	4.04	....	330	....	9.71	9.24		
135	....	4.54	4.37	4.20	....						
140	....	....	4.55	4.37	4.20						
145	....	....	4.72	4.54	4.36						
150	....	....	4.90	4.71	4.52						
155	....	....	5.08	4.88	4.69						
160	....	....	5.26	5.06	4.85						
165	....	....	5.44	5.23	5.02						
170	....	....	5.62	5.40	5.19						

STANDARD LETTER SYMBOLS AND ABBREVIATIONS

At present the following publications in this field are available:

1. "American Standard Abbreviations for Scientific and Engineering Terms," ASA Z 10.1 (1941). To be revised in 1948 or 1949. The American Association of Physics Teachers also has a Committee on Nomenclature and Abbreviations under the chairmanship of Duane Roller, Harvard University.
2. "American Standard Letter Symbols for Hydraulics," ASA Z 10.2 (1942).
3. "American Standard Letter Symbols for Mechanics of Solid Bodies," ASA Z 10.3 (1942).
4. "American Standard Letter Symbols for Heat and Thermodynamics, Including Heat Flow," ASA Z 10.4 (1943); see also *Am. J. Physics* **11**, *344* (*1943*).
5. "American Standard Letter Symbols for Physics," ASA Z 10.6 (1948).
6. "American Standard Letter Symbols for Chemical Engineering," ASA Z 10.12 (1946).
7. "Illuminating Engineering Nomenclature and Photometric Standards," ASA Z 7.1 (1942).
8. "American Standard Letter Symbols for Gear Engineering," ASA B 6.5 (1943).
9. "Report of a Joint Committee of The Chemical Society, The Faraday Society and The Physical Society on Symbols for Thermodynamical and Physico-Chemical Quantities and Conventions Relating to Their Use."
10. "International Electrotechnical Letter Symbols," U. S. National Committee of the International Electrotechnical Commission, USNC 67 (1946).

Publication No. 9 above may be obtained from The Chemical Society, Burlington House, Piccadilly, London, W. 1, England; all the other publications are distributed by the American Standards Association, 70 East 45 Street, New York 17, N. Y.

The following list for physics embodies the final recommendations of the following Joint Committee on Letter Symbols for Physics of the American Standards Association and The American Association of Physics Teachers: Harold K. Hughes, *Chairman, Socony-Vacuum Laboratories, Brooklyn 22, New York;* E. L. Chaffee, *Harvard University;* A. W. Foster, *University of Western Ontario;* A. T. Jones, *Smith College;* Victor F. Lenzen, *University of California;* Duane Roller, *Harvard University;* M. W. Zemansky, *College of the City of New York*, as published in the *Am. J. Physics* **16**, *164* (*1948*) and reprinted here by permission. In this list, symbols separated by commas are alternates of equal rank; reserve symbols, the use of which is discouraged, are given in parentheses.

(1)	absorption coefficient for a room, mean (*acous.*)	a
(2)	absorption index [$= (\lambda/4\pi x)\ln P_0/P$]	κ
(3)	acceleration, angular	α
(4)	acceleration, gravitational	g
(5)	local value	g_L
(6)	standard value [= 980.665 cm/sec²]	g_0
(7)	acceleration, linear	$\mathbf{a}$
(8)	acceleration of free fall	$-g$
(9)	accommodation coefficient	a
(10)	action	S
(11)	action variable	J
(12)	activity at time t (*radioactivity*)	I
(13)	activity (*chem.*)	a
(14)	activity, initial (*radioactivity*)	I_0
(15)	adiabatic exponent [$pV\gamma$ = const.]	γ
(16)	admittance (reciprocal impedance)	Y
(17)	admittance with plate load, grid or imput [$= g_g - jb_g$]	y_g
(18)	admittance, output (plate) [$= g_p - jb_p$]	y_p
(19)	affinity, electron [$= w/e$, volts]	ϕ
(20)	affinity, gross electron [$= w_g/e$, volts]	ϕ_g
(21)	altitude	h, y
(22)	amplification factor [$= -(\partial e_p/\partial e_g)_{i_p}$]	μ
(23)	amplification factor, gas (*photoelectric tube*)	μ
(24)	amplification of amplifier, power	A, A_p
(25)	amplification of amplifier, voltage	A, A_v
(26)	amplitude	A
(27)	amplitude of simple harmonic pressure (*acous.*)	P
(28)	angle of incidence, or angle between ray and normal in first medium	ϕ, i
(29)	angle of refraction, or angle between ray and normal in second medium	ϕ', r
(30)	angle, critical	ϕ_c
(31)	angle, epoch	ϵ, (ϕ)
(32)	angle, glancing	θ
(33)	angle of contact	θ
(34)	angle of deviation	δ
(35)	angle of diffraction	θ
(36)	angle of incidence, principal	ϕ
(37)	angle of minimum deviation	D, δ_m
(38)	angle of optical rotation	θ
(39)	angle of reflection	r
(40)	angle of slope in image space	u'
(41)	in object space	u
(42)	angle, plane	θ, (α, β)
(43)	angle, polarizing, or principal angle of incidence in dielectrics	$\bar{\phi}$
(44)	angle, refracting, of prism	A
(45)	angle, solid	ω
(46)	angular frequency of free vibration with damping	ω', (n')
(47)	angular frequency of impressed force	ω, (p)
(48)	angular frequency without damping	ω, (n)

STANDARD LETTER SYMBOLS AND ABBREVIATIONS

(49)	angular frequency, or periodicity, or angular velocity [$= 2\pi f$, radians/time]	ω
(50)	aperature (*optics*)	a
(51)	area	A, S, σ
(52)	area of cross section, walls (*acous.*)	S
(53)	atomic number	Z
(54)	atomic volume	V
(55)	atomic weight	A, M
(56)	attenuation, optical	D
(57)	attenuation constant	α
(58)	azimuth angle (optics)	ψ
(59)	azimuth angle, principal	$\bar{\psi}$
(60)	base of natural logarithms [$= 2.718\ldots$]	ϵ, e
(61)	Bohr (or orbital) magneton [$= eh/4\pi mc$]	μ_0
(62)	Bohr radius [$= h^2/4\pi^2 me^2$]	a_1
(63)	Boltzmann constant	k
(64)	Boltzmann function [$= \Sigma n_i \ln n_i$]	H
(65)	Bragg planes in a crystal, spacing of	d
(66)	Bragg reflection indices	$h_1[= nh]$ $h_2[= nk]$ $h_3[= nl]$
(67)	breadth, or width	b
(68)	brightness, or luminance [$= dI/dA \cos\theta$]	B
(69)	candlepower, or luminous intensity [$dF/d\omega$]	I
(70)	capacitance, or permittance	C
(71)	capacitance, partial (with suitable subscripts)	c
(72)	capacitance, reciprocal, or elastance	S
(73)	capacitivity, or dielectric coefficient (dielectric constant	
	In cgs units	ϵ
	In mks units (*see* permittivity)	ϵ_r
(74)	Cauchy constants [$n = A + B/\lambda^2 + C/\lambda^4$]	A, B, C
(75)	charge density, linear	λ
(76)	charge density, surface	σ
(77)	charge density, volume	ρ
(78)	charge, electronic	$-e$
79)	charge, electric	q, Q
80)	chemical potential (*see* Gibbs function)	μ
81)	circle of least confusion, radius of	Z
82)	coefficient of starting, or static (use f when μ designates the Poisson ratio)	μ_s
83)	collision frequency, molecular (no./time)	Z
84)	compliance	C
85)	compressibility factor (coefficient of compressibility; reciprocal of volume modulus of elasticity)	k
86)	concentration (*solutions*), or use bracket [ ] notation	c
87)	concentration, molecular, or molecular density [$= N/V$]	n
88)	at 0°C and 1 atm (Loschmidt number)	n_o
89)	condensation (*acous.*)	s
90)	conductance, electric	G, g
91)	conductance, grid or input	g_g
92)	conductance, grid, at zero frequency and constant plate potential [$= (\partial i_g/\partial v_g)_{vp}$]	k_g
93)	conductance, plate or output	g_p
94)	conductance, plate, at zero frequency and constant grid potential [$= (\partial i_p/\partial v_p)_{vp}$]	k_p
95)	conductivity, electric	$\sigma, (\gamma)$
96)	conductivity, equivalent (mho/equivalent)	Λ
97)	conductivity, molecular (mho/mole)	μ
98)	conductivity of an opening, acoustic	$\delta, (c)$
99)	conductivity, thermal	k
(100)	contrast of photographic emulsion	γ
(101)	control ratio, grid (*thyratrons*)	μ
(102)	co-ordinate, generalized	$\underline{b}$
(103)	current, average	$I_{av}, \bar{I}$
(104)	current, conduction	I
(105)	current, convection	$I, \rho v$
(106)	current density, electric	$\mathbf{J}$
(107)	current displacement	$\dot{\mathbf{D}}, \dot{\mathbf{D}}/4\pi$
(108)	current, effective (rms)	I
(109)	current, instantaneous	$i, (I)$
(110)	current, maximum	$I_m, (I_{max})$
(111)	current, maximum peak	$\hat{I}_m, I_{mp}$
(112)	current peak	$I_p, \hat{I}, (I_{pk})$
(113)	current, quiescent	$\bar{I}$
(114)	current, saturation	I_s
(115)	current, steady, direct	I
(116)	curvature	K
(117)	decay constant [$N = N_0 \exp(-\lambda t)$	λ
(118)	decay modulus [$s = A \cos(\omega t + \phi) \exp(-t/\tau)$]	τ
(119)	deflection beam, galvanometer, etc.	δ
(120)	degeneracy (statistical weight)	g
(121)	degrees of freedom (*kinetic theory, Gibbs phase rule*)	f
(122)	density [$= m/V$]	$\rho, (D)$
(123)	density, linear (mass/length)	$\lambda, (\rho)$
(124)	density, molecular, or molecular concentration [$= N/V$]	n
(125)	at 0°C and 1 atm (Loschmidt number)	n_0
(126)	density of electric charge, volume	ρ
(127)	density of electric flux [$= d\psi/dA$]	$\mathbf{D}$
(128)	density of magnetic flux	$\mathbf{B}$
(129)	density, optical [$= \log_{10} P_0/P$] absorbance	D
(130)	density, surface [$= m/A$]	$\sigma, (\rho)$
(131)	density, vapor	ρ
(132)	depth and height	h, y
(133)	deviation	δ
(134)	diameter	D
(135)	diameter of molecule, collision	σ
(136)	dielectric coefficient, or capacitivity (*see* permittivity)	ϵ
(137)	dielectric flux density [$\Psi = \int \mathbf{D} \cdot d\mathbf{A}$].	$\mathbf{D}$
(138)	dielectric flux, total [$= \int D \cdot dA$]	Ψ
(139)	difference in phase (e.g. cm)	δ
(140)	diffusion, coefficient of (*fluid*)	$D, (\mu)$
(141)	dioptric power [$= n/f$]	D
(142)	Dirac h[$= h/2\pi$]	$\hbar$
(143)	direction cosines	l, m, n
(144)	disintegration constant [$N = N_0 \epsilon^{-\lambda t}$]	λ
(145)	dispersion [$= dn/d\lambda$]	σ
(146)	dispersion, angular [$= d\theta/d\lambda$]	D
(147)	dispersive power [$= (n_F - n_C)/(n_D - 1)$]	ω
(148)	dispersive power, reciprocal of	ν
(149)	displacement, angular	θ
(150)	displacement components (of sound-bearing particle)	ξ, η, ζ
(151)	displacement constant, Wien[$= \lambda_m T$]	b
(152)	displacement, electric	$\mathbf{D}$
(153)	displacement flux density	$\mathbf{D}$
(154)	displacement flux, total electric [$= \int \mathbf{D} \cdot d\mathbf{A}$]	Ψ
(155)	displacement in general	s
(156)	displacement, linear	$\mathbf{s}$
(157)	displacement, longitudinal (*acous.*)	ξ
(158)	displacement of sound-bearing particle	ξ, η, ζ
(159)	displacement, transverse (*acous.*)	$\eta, (\xi, y, w)$
(160)	displacement, volume (*acous.*)	X
(161)	dissociation, degree of (electrolytes)	α
(162)	distance, angular	θ

STANDARD LETTER SYMBOLS AND ABBREVIATIONS

(163)	distance between adjacent principal foci of two lens units	Δ
(164)	distance between a principal plane of a lens system and the appropriate principal plane of a unit	p
(165)	distance between image and principal focus of image space	x'
(166)	distance between image and corresponding principal plane (image distance)	s'
(167)	distance between lens units in an optical system	d
(168)	distance from neutral axis to extreme fiber (*beams*)	c
(169)	distance between object and principal focus of object space	x
(170)	distance between object and corresponding principal plane (object distance)	s
(171)	distance, image (*optics*)	s'
(172)	distance, interplanar (*Bragg law*)	d
(173)	distance, linear	s
(174)	distance, object (*optics*)	s
(175)	distance of approach, closest possible (in Rutherford scattering formula)	b
(176)	distance, radial	r
(177)	distribution function	f, F
(178)	double layer, strength of surface	P_s
(179)	efficiency	η
(180)	efficiency, voltage [$= V_{\text{theor}}/V_{\text{actual}}$] (*electrolysis*)	η_V
(181)	elastance, or reciprocal capacitance	S
(182)	elasticity, modulus of shear	G, n
(183)	elasticity, volume modulus of (reciprocal of compressibility factor)	B
(184)	electric flux density [$\Psi = \int \mathbf{D} \cdot d\mathbf{A}$]	$\mathbf{D}$
(185)	electric flux, total [$= \int \mathbf{D} \cdot d\mathbf{A}$]	Ψ
(186)	electromotive force, or emf	$\mathcal{E}$, (E)
(187)	elongation, total (deflection)	δ
(188)	emission, total electron (saturation)	I_s
(189)	emissivity	ϵ'
(190)	monochromatic (color, spectral)	ϵ_λ'
(191)	total value	ϵ', ϵ_t'
(192)	emittance	ϵ
(193)	end correction for a tube (*acous.*)	α
	energy	
(194)	density of radiant [$= dU/dV$]	u
	internal or intrinsic (*thermodyn.*)	
(195)	per atom or molecule	u, u_m
(196)	per mole	u, U, U_M
(197)	per unit mass	u
(198)	total value	U
(199)	kinetic	E_k, (T)
(200)	average molecular [$= \frac{1}{2}m\bar{v}^2$]	ϵ
(201)	luminous [$= \int F dt$]	Q
(202)	nuclear dissociation	Λ
(203)	of vibration	E_v
(204)	potential	E_p, U, (V)
(205)	radiant	U
(206)	self [$= mc^2$]	ϵ
(207)	spectral radiant [$= dU/d\lambda$]	U_λ
(208)	storage factor	Q
(209)	total	E, U
(210)	work	W, (w)
	enthalpy (heat content)	
(211)	per atom or molecule	h, h_m
(212)	per mole	h, H, H_M
(213)	per unit mass	h
(214)	total value	H
	entropy	
(215)	per atom or molecule	s, s_m
(216)	per mole	s, S, S_M
(217)	per unit mass	s
(218)	total value	S
(219)	equilibrium constant (products/reactants)	K
(220)	equivalent weight, electrochemical	M/Z
(221)	equivalent, Joule	J
(222)	expansion, total thermal	δ
(223)	expansivity, linear, or coefficient of linear expansion	α
(224)	expansivity, volume, or coefficient of volume expansion	β
(225)	exposure [$= Et$]	Σ
(226)	extinction coefficient [$= (1/cl) \log_{10} P_0/P$]	ϵ
(227)	Faraday constant or equivalent	F
(228)	field strength, electric	$\mathbf{E}$
(229)	field strength, or field intensity, magnetic	$\mathbf{H}$
(230)	figure of merit of inductance [$= X/R$]	Q
(231)	filament (subscript designation)	f
(232)	fine-structure or Sommerfeld constant [$= 2\pi e^2/ch$]	α
(233)	fluidity (reciprocal of viscosity)	ϕ
	flux	
(234)	electric [$= \int \mathbf{D} \cdot d\mathbf{A}$]	Ψ
(235)	luminous	F
(236)	magnetic [$= \int \mathbf{B} \cdot d\mathbf{A}$]	Φ
(237)	radiant, or radiant power [$= dU/dt$]	Φ, P
(238)	flux density, magnetic	$\mathbf{B}$
(239)	flux density, propagation	Ξ
(240)	flux density, radiant, or irradiance [$= d\Phi/dA$ or dP/dA]	W
	(When referring to a source is called radiancy, symbol $\mathcal{R}$)	
(241)	focal length of image space	f'
(242)	focal length of object space	f
(243)	force	F
(244)	force constant [$= -F/s$]	k
(245)	force, gravitational	F, F_g
(246)	force in a string or membrane	F, (T)
(247)	force, shearing (in beam section)	V
(248)	force, stretching ("tension"), in string or membrane	F
(249)	formality	F
(250)	free path	l, λ
(251)	free path, mean	$\bar{l}$, λ
(252)	free path, Tait	l_T, λ_T
(253)	frequency (*elec. circuits, mech., acous.*)	f
(254)	frequency (*optics, quantum theory*)	ν
(255)	frequency, angular, of free vibration with damping	ω', (n')
(256)	frequency, angular, of impressed force	ω, (p)
(257)	frequency, angular, without damping	ω, (n)
(258)	frequency, angular, or periodicity, or angular velocity [$= 2\pi f$, radian/time]	ω
(259)	frequency deviation [$= \Delta f/f_r$]	δ
(260)	frequency of molecular collision (no./time)	Z
(261)	frequency, photoelectric threshold	ν_0, (f_0)
(262)	frequency, resonant, or natural	f_r
(263)	frequency, rotational [rev/time]	n
(264)	friction, coefficient of	μ
(265)	rolling	μ_r
(266)	sliding, or kinetic	μ, (μ_k)
(267)	starting, or static	μ_s
	(use f when μ designates the Poisson ratio)	
(268)	fugacity	f
(269)	gain of amplifier, voltage	A, A_v
(270)	gas constant, molecular, or Boltzmann constant	k
	gas constant	
(271)	universal [$pV = nRT = mRT/M$; $pv_M = RT$]	R
(272)	specific [$pv = rT$, where $v = V/m$ and $r = R/M$]	r
(273)	Gibbs function equation, integration constant of	I
	Gibbs function	

(274)	partial molal, or chemical, potential [$= \partial G/\partial n$]	μ
(275)	per atom or molecule	g, g_m
(276)	per mole [$= G/n$]	g, G, G_M
(277)	per unit mass	g
(278)	total value [$= H - TS$]	G
(279)	grating space (distance between corresponding points)	d
(280)	gravitational constant, Newtonian	G
(281)	grid control ratio (*thyratrons*)	μ
(282)	grid or imput admittance with plate load [$= g_g - \mathrm{j}b_g$]	y_g
(283)	grid, control. Use subscript $_g$, or $_{g1}$, etc., numbered from cathode	
(284)	grid, injector. Use subscript $_{g4}$, etc., numbered from cathode	
(285)	grid-plate transadmittance [$= g_{gp} - \mathrm{j}b_{gp}$]	y_{gp}
(286)	grid-plate transadmittance, real part of, or grid-plate transconductance	g_{gp}, (g_m)
(287)	gyromagnetic ratio	g
(288)	half angle subtended at point object by objective of microscope	α
(289)	half-life (*radioactivity*)	T
(290)	Hamiltonian function or operator	H
(291)	Hamiltonian function or operator, perturbing	$\mathcal{H}$
(292)	Hamilton-Jacobi equation variable, time dependent	W, (V)
(293)	head (*hydrodyn.*)	h
	heat capacity	
(294)	per atom or molecule	c, c_m
(295)	per mole	c, C, C_M
(296)	per unit mass (specific heat capacity)	c
(297)	total value (Use subscript $_p$ or $_v$ to indicate constancy of pressure or volume)	C
(298)	heat content, relative	L
(299)	heat, electric or mechanical equivalent of (Joule equivalent)	J
(300)	heat entering system	q
(301)	heat flow path, length of	L, l
	heat of reaction or phase change (evaporation, fusion, sublimation, etc.)	
(302)	per atom or molecule	Δh, Δh_m
(303)	per mole	Δh, ΔH, ΔH_M
(304)	per unit mass	Δh
(305)	total value	ΔH
(306)	heat, quantity of	Q
(307)	heater, reference to (attach subscript to symbol)	$_h$
(308)	height, depth and thickness	h, y
(309)	height of image	y'
(310)	height of object	y
	Helmholtz function, or maximum isothermal work function	
(311)	per atom or molecule	a, a_m
(312)	per mole	a, A, A_M
(313)	per unit mass	a
(314)	total value [$= U - TS$]	A
(315)	Henry law constant	H
(316)	Hertzian vector	Π
(317)	humidity, absolute	ρ
(318)	humidity, relative	r, f
(319)	hydrolysis constant	K_h
(320)	hydrolysis, degree of (*electrolysis*)	h
(321)	ice point	T_0, t_0
(322)	illuminance, or amount of illumination [$= \mathrm{d}F/\mathrm{d}A$]	E
(323)	imaginary unit ($= \sqrt{-1}$, same as right-angle turning operator; use j in electric circuits)	j, i
(324)	impact parameter (*Rutherford scattering formula*)	p
(325)	impedance; acoustic impedance	Z
(326)	impedance, specific acoustic [$= ZA$]	z
(327)	increment, finite	δ, Δ
(328)	inductance	L
(329)	inductance, mutual	M, L_{12}, etc.
(330)	inductance, reciprocal	Γ
(331)	induction coefficient, or partial capacitance coefficient	c
(332)	induction density, electric	$\mathbf{D}$
(333)	induction density, magnetic	$\mathbf{B}$
(334)	induction, electric flux of [$= \int \mathbf{D} \cdot \mathrm{d}\mathbf{A}$]	Ψ
(335)	induction, magnetic flux of [$= \int \mathbf{B} \cdot \mathrm{d}\mathbf{A}$]	Φ
(336)	inductivity, or absolute permeability	μ
(337)	inertia of photographic plate	i
(338)	integration constant of Gibbs function equation	I
(339)	intensity, acoustic (e.g., erg $\mathrm{cm}^{-2}\mathrm{sec}^{-1}$)	I
(340)	intensity, luminous [$= \mathrm{d}F/\mathrm{d}\omega$]	I
(341)	intensity of magnetization, or magnetization [$= \mathbf{m}/V$]	$\mathbf{M}$
(342)	intensity, radiant [$= \mathrm{d}\Phi/\mathrm{d}\omega = \mathrm{d}P/\mathrm{d}\omega$]	J
(343)	ionization, degree of (*solutions, electrolytes*)	α
(344)	irradiance, or radiant flux density [$= \mathrm{d}\Phi/\mathrm{d}A$ or $\mathrm{d}P/\mathrm{d}A$]	$\mathcal{E}$, H
(345)	Joule equivalent (electric or mechanical equivalent of heat)	J
(346)	Joule-Thomson (Kelvin) coefficient [$= (\partial T/\partial p)_H$]	μ
(347)	Kerr constant	K
(348)	$1/kT$	β
(349)	Lagrange function, or Lagrangian [$= E_k - E_p$]	L
(350)	Lande factor	g
(351)	leakage coefficient, magnetic	σ
(352)	length	l
(353)	length of arc or path	s
(354)	length of image	y'
(355)	length of object (*optics*)	y
(356)	length of prism base	t
(357)	length of vibrating string, rod or tube	l
(358)	length, optical	Δ
(359)	length, rest	l_0
(360)	light, quantity of	Q
(361)	light speed in vacuum	c
(362)	load per unit displacement	k
(363)	Lorentz unit [$= Be/4\pi mc^2$]	L
(364)	Loschmidt number (number of molecules per unit volume at 0°C and 1 atm)	n_0
(365)	luminance, or brightness [$= \mathrm{d}I/\mathrm{d}A \cos\theta$]	B
(366)	luminosity (luminous efficiency, monochromatic or visibility factor) [$= F_\lambda/P_\lambda = F_\lambda/\Phi_\lambda$]	K_λ
(367)	luminous efficiency [$= F/P$, $\lambda = 5550A$]	K
(368)	luminous energy [$= \int F \mathrm{d}t$]	Q
(369)	magnetic field strength, or magnetic field intensity	$\mathbf{H}$
(370)	magnetic flux [$= \int \mathbf{B} \cdot \mathrm{d}\mathbf{A}$]	Φ
(371)	magnetization [$= \mathbf{m}/V$]	$\mathbf{M}$
(372)	magnetization, specific [$= M/\rho$]	σ
(373)	magnetomotive force, or magnetic scalar potential	$\mathfrak{F}$
(374)	magneton, nuclear [$= \mu_0/1838$]	μ_I
(375)	magnification, linear	m
(376)	magnification, angular [$= \tan u'/\tan u$]	γ
(377)	mass (general use)	m
(378)	mass of atom or molecule	m, m_m
(379)	mass of electron (use m_e when m is magnetic quantum number)	m
(380)	mass per unit area	σ, (ρ)
(381)	mass per unit length	λ, (ρ)
(382)	mass per unit volume (density)	ρ, (D)

STANDARD LETTER SYMBOLS AND ABBREVIATIONS

(383)	**mass, reduced** $\frac{1}{\mu} = \frac{1}{m_1} + \frac{1}{m_2}$	μ
(384)	mass, rest	m_0
(385)	mean-life (*radioactivity*)	τ
(386)	Miller indices	h, k, l
(387)	mixing ratio, or water-vapor content	w
(388)	modulation factor	m
(389)	modulus of decay [$s = A \cos(\omega t + \phi) \exp(-t/\tau)$]	τ
(390)	modulus of elasticity, shear	G, n
(391)	modulus of elasticity, volume (reciprocal of compressibility factor)	B
(392)	modulus of elasticity, Young	E, Y
(393)	modulus of section [$= I/c$, where c is distance of neutral axis from extreme fiber]	Z
(394)	molecular cross section, effective	σ, S
(395)	molecular mass	m, m_m
(396)	molecules, number of	N
(397)	mole factor, or van't Hoff coefficient	i
(398)	moment, electric	$\mathbf{p}$
(399)	moment, quadrupole (electric)	Q
(400)	moment, magnetic	$\mathbf{m}$
(401)	moment of area [$= \int y\,dA$]	Q
(402)	moment of atom, molecule or dipole, electric	μ, μ_e
(403)	magnetic	μ_m, μ
(404)	moment of inertia	I, I_{zz}, etc., (J)
(405)	moment of inertia, areal	I
(406)	polar [$= \int r^2 dA$]	J
	rectangular [$= \int y^2 dA$]	
(407)	momentum, generalized	p
(408)	Napierian base	ϵ, e
(409)	normality	C
(410)	normalization factor (*probability*)	N
(411)	number	n
(412)	number of atoms or nuclei (if more than one type is considered)	$N_{1,2}\ldots$
(413)	number of atoms or nuclei at time t (*radioactivity*)	N
(414)	number of atoms or nuclei, initial (*radioactivity*)	N_0
(415)	number of atoms or nuclei, initial (if more than one type is considered)	$N^\circ_{1,2}\ldots$
(416)	number of components (Gibbs phase rule)	n
(417)	number of lines of a grating, total	N
(418)	number of molecular collisions per unit time, or collision frequency	Z
(419)	number of molecules (total)	N
(420)	number of molecules per mole at 0°C and 1 atm (Avogadro number)	N_0
(421)	number of molecules per unit volume (molecular concentration)	n
(422)	at 0°C and 1 atm (Loschmidt number)	n_0
(423)	number of moles	n
(424)	number of phases (*elec. circuits*)	m
(425)	number of revolutions or rotations per unit time	n
(426)	number of turns or of conductors	N
(427)	orbital (or Bohr) magneton	μ_0
(428)	order of spectrum	$m, (n)$
(429)	oscillation period	T
(430)	path difference, optical	Δ
(431)	Peltier coefficient	Π
(432)	Peltier potential	V_π
(433)	periodicity [$= 2\pi f$]	ω
(434)	periodicity, resonant	ω_r
(435)	period of a periodic motion	T
(436)	permeability or inductivity, magnetic	μ
(437)	permeability, reciprocal, or reluctivity [$= 1/\mu$]	ν
(438)	of free space	ν_0
(439)	permeability, relative magnetic [$= \mu/\mu_0$ mks units]	μ_r
(440)	permeance [$= L/N^2$]	Γ
(441)	permittance, or capacitance	C
(442)	permittivity (mks units; *see* capacitivity)	ϵ
(443)	of free space	ϵ_0
(444)	relative [$= \epsilon/\epsilon_0$]	ϵ_r
(445)	phase angle	ϕ
(446)	phase constant [$\gamma = \alpha + j\beta$]	β
(447)	piezoelectric strain constant or modulus	δ
(448)	piezoelectric stress constant	e
(449)	Planck constant	h
(450)	Planck function [$= -A/T$]	Ψ
(451)	Planck radiation law constants $\left[\frac{J_\lambda}{A\cos\theta} = N_\lambda = c_1/\lambda^5 \left(\exp\frac{c_2}{\lambda T} - 1\right)\right]$	c_1, c_2
(452)	plate power	P_p
(453)	plate resistance	r_p
(454)	Poisson ratio	μ, ν
(455)	polar coordinates	r, θ
(456)	polarization, electric	$\mathbf{P}$
(457)	polarization, surface, or strength of double layer (*elec.*)	$\mathbf{P}_s$
(458)	polarization, magnetic, or magnetization	$\mathbf{M}$
(459)	position vector	$\mathbf{r}$
	potential, chemical (see Gibbs function)	
(460)	potential coefficient, partial	p
(461)	potential difference, average	$V_{av}, \bar{V}$
(462)	potential difference, contact or Volta	V_v
(463)	potential difference, electric	V
(464)	potential difference, excitation	V_e
(465)	potential difference, instantaneous	v
(466)	potential difference, maximum	$V_m, (V_{max})$
(467)	potential difference, maximum peak	$\hat{V}_m, V_{mp}$
(468)	potential difference, peak	$\hat{V}, V_p, (V_{pk})$
(469)	potential difference, Peltier	V_π
(470)	potential difference, quiescent	$\bar{V}$
(471)	potential difference, rms or effective	V
(472)	potential difference, Seebeck	V_s
(473)	potential difference, Thomson	V_t
(474)	potential difference, steady d-c	V
(475)	potential, electric	V
(476)	potential, electromagnetic scalar	ϕ
(477)	potential energy	$E_p, U, (V)$
(478)	potential, inner (*metals*)	V, V_i
(479)	potential, ionization	V_i
(480)	potential, kinetic, or Lagrange function ($= E_k - E_p$)	L
(481)	potential, magnetic scalar (magnetomotive force)	$\mathfrak{F}$
(482)	potential, magnetic vector	$\mathbf{A}$
(483)	potential, velocity (*hydrodyn.*)	ϕ
(484)	power	P
	(Use same system of subscripts as for current except that P, unmodified, signifies average power)	
(485)	power, active (*elec.*)	P
(486)	power, emissive, monochromatic	J_λ, J_ν
(487)	power, emissive, total	J
(488)	power, input	P_i
(489)	power of lens system, or refracting power [$= n/f$, diopters]	D
(490)	power, output	P_o
(491)	power, plate	P_p
(492)	power, radiant, or radiant flux	P, Φ
(493)	power, thermoelectric	Q
(494)	Poynting vector	Π
(495)	pressure [$= F/A$] (Use P for total pressure when p represents vapor pressure)	p
(496)	amplitude of simple harmonic	$\hat{P}$

STANDARD LETTER SYMBOLS AND ABBREVIATIONS

(497)	static	P_0
(498)	varying	p
(499)	pressure, critical	p_c
(500)	pressure, osmotic	p, Π, (π)
(501)	pressure, partial	p
(502)	pressure, vapor	p
(503)	probability	P
(504)	product of inertia	I_{xy}, etc.
(505)	propagation constant [$= \alpha + j\beta$]	γ
(506)	pulsatance, or periodicity [$= 2\pi f$]	ω
(507)	Q-factor, or quality factor of reactor [$= X/R$]	Q
(508)	quantity of light, or luminous energy [$= \int F\,dt$]	Q
	quantum number	
(509)	azimuthal or orbital	l
(510)	azimuthal or orbital, total	L
(511)	hyperfine [$= I + J$]	F
(512)	inner	j
(513)	inner, total	J
(514)	magnetic	m
(515)	magnetic, total	M
(516)	principal	n
(517)	rotational	R
(518)	spin	s
(519)	spin, total	S
(520)	spin, nuclear	I
(521)	vibrational	v
	(Strictly, spin is not a quantum number)	
(522)	radiancy, or radiance, or radiant flux density [$d\Phi/dA = dP/dA$]	$\mathcal{R}$, W
(523)	radiant energy	U
(524)	radiant energy density [$= dU/dV$]	u
(525)	radiant energy, spectral (monochromatic) [$= dU/d\lambda$]	U_λ
(526)	radiant flux density [$= d\Phi/dA$ or dP/dA]	W
	(When referring to a source is called radiancy, symbol $\mathcal{R}$)	
(527)	radiant intensity, spectral [$= dJ/d\lambda$]	J_λ
(528)	radiant power, or radiant flux [$= dU/dt$]	Φ, P
(529)	radiation law constants (*see* Planck radiation law constants)	c_1, c_2
(530)	Stefan-Boltzmann	σ
(531)	Wien	b
(532)	radius	r
(533)	radius of circle of least confusion	Z
(534)	radius of curvature	ρ
(535)	radius of gyration	k
(536)	radius of image of a point	Z
(537)	radius of lens zone	h
(538)	radius of nucleus	r
(539)	radius of tube, disk or membrane (*acous.*)	a, (R)
(540)	radius vector	$\mathbf{r}$
(541)	range (*radioactivity*)	R
(542)	ratio of speed to speed of light [$= v/c$]	β
(543)	reactance, acoustic reactance	X
(544)	capacitive	X_C
(545)	inductive	X_L
(546)	reactance, specific acoustic [XA]	x
(547)	reaction rate, specific, or reaction velocity constant	k
(548)	reaction velocity [$= -dc/dt$]	u
(549)	reciprocal impedance, or admittance	Y
(550)	reciprocal permeability, or reluctivity	ν
(551)	recombination, coefficient of	α
(552)	rectangular coordinates	x, y, z
(553)	reflectance, or reflection factor [$= P/P_0$]	ρ
(554)	reflectivity	ρ'
(555)	refractive index	n, (μ)
(556)	refractive index, group	n_g, (μ_g)
(557)	relative dielectric coefficient, or specific inductive capacity	ϵ, ϵ_r
(558)	relative magnetic permeability	μ, μ_r
(559)	relativity ratio [$= v/c$]	β
(560)	reluctance	$\mathcal{R}$
(561)	reluctivity [$= 1/\mu$]	ν
(562)	resilience, coefficient of, or coefficient of restitution	e
(563)	resistance, acoustic	R
(564)	resistance, electric	R, (r)
(565)	resistance, plate	r_p
(566)	resistance, radiation	R
(567)	resistance, specific, or resistivity	ρ
(568)	resistance, specific acoustic [$= RA$]	r
(569)	resistance, thermal	R
(570)	resistance, thermal coefficient of	α
(571)	resistivity, or specific resistance	ρ
(572)	resistivity, thermal	$1/k$
(573)	resolving power of telescope, angular	α
(574)	resonance periodicity	ω_r
(575)	restitution, coefficient of, or resilience	e
(576)	restoring force per unit displacement	k
(577)	revolutions or rotations per unit time	n
(578)	Richardson equation factors [$I_s = AT^2e^{-b/T}$]	A, b
(579)	right-angle turning operator ($= \sqrt{-1}$; use j in elec. circuits)	j, i
(580)	rigidity, or shear modulus of elasticity	n
(581)	rms (effective) potential difference	V
(582)	rotation, specific [$= \theta/lc$]	α
(583)	rotation, specific magnetic, or Verdet constant	V, ω
(584)	Rydberg constant	R
(585)	Rydberg constant for infinite mass	R_∞
(586)	safety factor	N
(587)	sag or deflection of beam	δ
(588)	scattering coefficient (turbidity)	s
	sensitivity of phototube	
(589)	static	S
(590)	dynamic	s
(591)	shear modulus of elasticity	G, n
(592)	shell, strength of magnetic	I
(593)	slip (*elec. machinery*)	σ, s
(594)	Sommerfeld, or fine-structure, constant [$= 2\pi e^2/ch$]	α
(595)	spacing of Bragg planes in a crystal	d
(596)	specific heats, ratio of [$= c_p/c_v$]	γ
(597)	speed	u, v
(598)	speed at time t	u, u_t, v, v_t
(599)	speed, angular	ω
(600)	speed, average	$\bar{u}$, $\bar{v}$, u_{av}, v_{av}
(601)	speed, initial	u_0, v_0
(602)	speed, linear or particle	u, v
(603)	speed, most probable	$\hat{u}$, $\hat{v}$, (c_0), α
(604)	speed of light in vacuum; speed of sound	c
(605)	speed, rms	$\tilde{u}$, $\tilde{v}$, (C)
(606)	spin	s
(607)	nuclear	I
(608)	total	S
(609)	spring constant [$= -F/s$]	k
(610)	square-root of minus one [$= \sqrt{-1}$]	j, i
	(This is the special case, where $\phi = \pi/2$, of the operator exp $j\phi$ which turns a vector through the angle ϕ; use j in elec.)	
(611)	Stefan-Boltzmann constant [$= \mathcal{R}/T^4$]	σ
(612)	steradiancy [$= dJ/dA \cos\theta$]	$\mathcal{B}$, N
(613)	strength of magnetic pole	p, (m)
(614)	strength of magnetic shell	I
(615)	strength of simple acoustic source	A
(616)	summation operator	Σ
(617)	super-compressibility factor	y
(618)	surface tension	γ, σ
(619)	susceptance	B, b
(620)	susceptibility, electric [$\mathbf{P} = \eta\mathbf{E}$]	η
(621)	susceptibility, volume magnetic [$\mathbf{M} = k\mathbf{H}$]	k
(622)	susceptibility, specific magnetic [$= k/\rho$]	χ

STANDARD LETTER SYMBOLS AND ABBREVIATIONS

(623)	Tait free path	l_T, λ_T
(624)	temperature, absolute	T, (Θ)
(625)	temperature coefficient of resistance	α
(626)	temperature, critical	t_c, T_c
(627)	temperature, Debye characteristic	Θ
(628)	temperature, Kelvin	T, (Θ)
	temperature of ice point	
(629)	absolute	T_0
(630)	ordinary	t_0
(631)	temperature, ordinary	t, (θ)
(632)	tension (force) in spring or membrane	F
	thermal expansion, coefficient of, or expansivity	
(633)	linear	α
(634)	volume $[= \alpha_1 + \alpha_2 + \alpha_3]$	β
(635)	thickness and height	h, y
(636)	Thomson coefficient	σ
(637)	time (Use τ when t is used for temperature)	t, (τ)
(638)	time constant	τ
(639)	time-dependent variable in Hamilton-Jacobi equation	W, (V)
(640)	time, reverberation	T
(641)	torque per unit twist, or torsion constant	k
(642)	transconductance, grid-plate (real part of grid-plate transadmittance)	g_{pg}, (g_m)
(643)	transconductance at zero frequency and constant plate potential $[= (\partial i_p/\partial v_g)_{cp}$	s_g
(644)	transmittance $[= P/P_0]$	τ
(645)	turning operator, 90° ($= \sqrt{-1}$; use j in elec. circuits)	j, i
(646)	u/c	β
(647)	valence	z
(648)	Van de Waals constants $\left[\left(p + \frac{n^2a}{V^2}\right)(V - nb) = nRT\right]$	a, b
(649)	Van't Hoff coefficient	i
(650)	vapor pressure constant	i
(651)	variable	x, y, z
(652)	variable in Hamilton-Jacobi equation, time-dependent	W, (V)
(653)	vector in X-direction, unit	$\mathbf{i}$
(654)	in Y-direction	$\mathbf{j}$
(655)	in Z-direction	$\mathbf{k}$
(656)	tangent to path, unit	$\boldsymbol{\tau}$
(657)	vector, position	$\mathbf{r}$
(658)	vector turning operator $[= \sqrt{-1}]$ (This is the special case, where $\phi = \pi/2$, of the operator $\exp j\phi$ which turns a vector through the angle ϕ; use j in elec. circuits)	j, i
(659)	velocity	$\mathbf{u}$, $\mathbf{v}$
(660)	velocity, angular	ω
(661)	velocity, average	$\bar{\mathbf{u}}$, $\bar{\mathbf{v}}$, $\mathbf{u}_{av}$, $\mathbf{v}_{av}$
(662)	velocity at time t	$\mathbf{u}$, $\mathbf{v}$, $\mathbf{u}_t$, $\mathbf{v}_t$
(663)	velocity, components of linear or particle	$\mathbf{u}_x$, $\mathbf{u}_y$, $\mathbf{u}_z$ $(\mathbf{u}, \mathbf{v}, \mathbf{w})$
(664)	velocity constant, reaction	k
(665)	velocity, group	$\mathbf{u}$, $\mathbf{v}$, $\mathbf{u}_g$, $\mathbf{v}_g$
(666)	velocity, initial	$\mathbf{u}_0$, $\mathbf{v}_0$
(667)	velocity, ionic (with suitable subscript)	u
(668)	velocity, linear or particle	$\mathbf{u}$, $\mathbf{v}$
(669)	velocity, most probable	$\mathbf{u}$, $\mathbf{v}$, (c_0, α)
(670)	velocity of light in vacuum	c
(671)	velocity of sound or other waves	c, v
(672)	velocity, phase or wave	u_w, u_ϕ, (w)
(673)	velocity potential	ϕ
(674)	velocity, reaction $[= -dc/dt]$	u
(675)	velocity, rectangular components	$\mathbf{u}_x$, $\mathbf{u}_y$, $\mathbf{u}_z$, $\mathbf{v}_x$, $\mathbf{v}_y$, $\mathbf{v}_z$
(676)	velocity, rms	$\bar{\bar{u}}$, $\bar{\bar{v}}$, (C)
(677)	velocity, specific reaction, or reaction velocity constant	k
(678)	Verdet constant	V, ω
(679)	viscosity, coefficient of kinematic $[= \eta/\rho]$	ν
(680)	viscosity, coefficient of	η
(681)	visibility factor, or luminosity, or monochromatic luminous efficiency $F_\lambda/P_\lambda = F/\Phi_\lambda$	K_λ
(682)	voltage (*see* potential difference)	V
(683)	Volta potential, or contact potential.	V_V
	volume	
(684)	critical	V_c
(685)	molecular	V
(686)	of a cavity or room	V
(687)	of configuration-space	V
(688)	of phase space	Ω
(689)	per atom or molecule	v, v_m
(690)	per mole	v, V, V_M
(691)	per unit mass (specific volume)	v
(692)	specific $[= V/m]$	v
(693)	total	V, (τ)
(694)	volume electric charge density	ρ
(695)	volume expansivity, or coefficient of volume expansion	β
(696)	volume modulus of elasticity (reciprocal of compressibility factor)	B
(697)	volume susceptibility, magnetic $[\mathbf{M} = k\mathbf{H}]$	k
(698)	water-vapor content, or mixing ratio	w
(699)	wave-function, time dependent	ψ
(700)	wave-function, time independent	u
(701)	wavelength	λ
(702)	wavelength constant $[= 2\pi/\lambda]$	k
(703)	wavelength, effective	λ_e
(704)	wave number	σ
(705)	weight $[= mg]$	w, F, (W)
(706)	weight, equivalent (*chem.*)	M/z
(707)	weight, molecular	M
(708)	weight, specific $[w/V]$	γ
(709)	weight, statistical, or degeneracy	g
(710)	weightivity, or specific weight $[w/V]$	γ
(711)	width or breadth	b
(712)	width of slit (transparent portion)	a
(713)	Wien displacement constant $[= \lambda_m T]$	b
(714)	work	W, (w)
(715)	work function, gross	w_g
(716)	work function per unit charge, gross, or gross electron affinity $[d\phi_g = dw_g/de$, volts$]$	ϕ_g
(717)	work function, net	w
(718)	work function per unit charge, net, or electron affinity $[d\phi = dw/de$ volts$]$	ϕ
(719)	Young modulus of elasticity	E, Y

SUBSCRIPTS

adiabatic: attach subscript $_s$ to symbol
adsorbed: attach subscript $_a$ to symbol
average value: use subscript $_{av}$, or bar over symbol (e.g., I_{av}, $\bar{I}$)
black body, reference to: attach subscript $_b$ to symbol
cathode: attach subscript $_c$ to symbol
control grid: subscript $_g$
(For several grids, use subscript $_{g1}$, $_{g2}$, . . . , beginning at cathode)
critical properties: subscript $_c$
gas or vapor, reference to: attach subscript $_G$ to symbol
grid, screen: use subscript $_s$ or $_{g2}$, etc., numbered from cathode
grid, suppressor: use subscript $_{su}$ or $_{g3}$, etc., numbered from cathode
liquid, reference to: attach subscript $_L$ to symbol
maximum: attach subscript $_m$ or $_{max}$ to symbol
minimum: attach subscript $_{min}$ to symbol
monochromatic: attach subscript λ to symbol
normal (perpendicular), reference to: attach subscript $_n$ to symbol
plate, reference to: attach subscript $_p$ to symbol
reduced properties (fluids): attach subscript $_r$ to symbol
solid, reference to: attach subscript $_X$ to symbol (*x*tal)
source, reference to: attach subscript $_s$ to symbol
spectral or monochromatic: attach subscript λ to symbol
transition between polymorphic forms, reference to: attach subscript $_t$ to symbol
vapor or gas, reference to: attach subscript $_G$ to symbol

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FINDING INDEX TO STANDARD LETTER SYMBOLS AND ABBREVIATIONS

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GAS CONSTANT

Values of R in $PV = RT$ for one mole of ideal gas, selected from *A. P. I. Research Project* 44.

1 Bar = 10^6 dyne/sq cm = 0.987 atm. 1 Kg/sq cm = 0.968 atm.

1 Atm = 760 mm of Hg = 29.921 inches of Hg = 14.696 lb/sq in. abs = 1.01325 bar = 1.03328 kg/sq cm.

Gram molar volume of ideal gas at 1 atm and 0°C = 22,414.6 cc = 22.4140 liters.

Pound molar volume of ideal gas at 1 atm and 32°F = 359.05 cu ft.

Ice point = 0°C = 273.16°K = 32°F = 491.69°R.

1 Calorie (thermochemical) = 4.1833 intern. joules.

1.8 Btu/lb = 1.0 Chu/lb = 1.0 IT cal/g = 1.000657 cal/g.

1 Horsepower = 550 ft-lb/sec = 745.575 intern. watts.

1 Liter = 1000.27 cc.

*Per gram mole. †Per pound mole.

Units			*R*
Pressure	Volume	Energy	
Temperature in degrees Kelvin, °K:			
		calories	1.9872*
		abs joules	8.3144*
		int joules	8.3130*
		Chu	1.986†
atm	cc		82.057*
atm	liters		0.082054*
atm	cu ft		1.314†
bar	liters		0.08314*
kg/sq m	liters		847.8*
kg/sq cm	liters		0.08478*
mm of Hg	liters		62.361*
mm of Hg	cu ft		998.9†
Temperature in degrees Rankine, °R:			
		Btu (1T)	1.986†
		HP-hrs	0.0007805†
		Kw-hrs	0.0005819†
atm	cu ft		0.7302†
mm of Hg	cu ft		555.0†
in. of Hg	cu ft		21.85†
lb/sq in. abs	cu ft		10.73†
lb/sq ft abs	cu ft	ft-lbs	1545.0†

COMMON PHYSICAL CHEMISTRY EQUATIONS

By Frank Hovorka, Ph. D.

Gases

1. Molecular weight, volume, and temperature.

Perfect Gas Law: $PV = \frac{W}{M}RT$

Van der Waals' Equation: $\left[P + \frac{a}{V^2}\left(\frac{W}{M}\right)^2\right]\left[V - b\frac{W}{M}\right] = \frac{W}{M}RT$

Berthelot's Equation: $PV = \frac{W}{M}RT\left[1 + \frac{9}{128}\frac{P}{Pc}\frac{Tc}{T}\left(1 - 6\frac{Tc^2}{T^2}\right)\right]$

R is a constant independent of the nature of the gas and must be expressed in the same units as the pressure and the volume. It has the following values:

$R = 0.08205$ liter-atmospheres per degree per mole
82.05 cc-atmospheres per degree per mole
8.314 joules per degree per mole
1.987 calories per degree per mole
8.314×10^7 ergs per degree per mole

P, V, T, M, and W are the pressure, volume, absolute temperature, molecular weight, and the mass of the gas respectively. Pc and Tc are the critical pressure and the critical absolute temperature; a and b are individual constants that must be determined empirically for each substance. (See critical temperature and volume.) When V is in cubic centimeters then b must be expressed in cubic centimeters per molecular weight. When P is in atmospheres a must be in cc^2-atmospheres per molecular weight.

2. Critical temperature, pressure, and volume.

$$Pc = \frac{a}{3Vc^2} \qquad Tc = \frac{8PcVc}{3R}$$

$$Vc^3 = \frac{ab}{Pc} \qquad a = 3PcVc^2 \qquad b = \frac{Vc}{3}$$

Vc is the critical volume. For explanation of the other terms see part (1).

3. Effusion of Gases. $c = \sqrt{\frac{3PV}{mn}} = \sqrt{\frac{3RT}{M}} = \sqrt{\frac{3P}{d}}$

c is the root mean square velocity; m is the mass of each molecule; n is the number of molecules in a volume V at the pressure P or at the temperature T. When c is in centimeters per second, m is expressed in grams, V in cubic centimeters, P in dynes per square centimeter and R in ergs; d is the density; M is the molecular weight.

raham's Law:

$$\frac{c_1}{c_2}=\sqrt{\frac{d_2}{d_1}}=\sqrt{\frac{M_2}{M_1}}$$

c_1 and c_2, d_1 and d_2, M_1 and M_2 are the root mean square velocities, ensities, and molecular weights of the two gases under consideration.

$$\frac{t_1}{t_2}=\frac{c_2}{c_1}=\sqrt{\frac{M_1}{M_2}}$$

t_1 and t_2 are the times of passage of each gas under a given pressure hrough an orifice. For an explanation of the other terms in the quation see the preceding equation.

$$\bar{n}=n\sqrt{\frac{RT}{2\pi M}}$$

$\bar{n}$ is the number of molecules striking a surface per square centineter per second; n is the total number of molecules per cubic centineter; M is the molecular weight; T is the absolute temperature; R is expressed in ergs per degree and is equal to 8.315×10^7 ergs.

. **Dissociation.**

$$x=\frac{d_1-d_2}{d_2(n-1)}=\frac{M_1-M_2}{M_2(n-1)}=\frac{V_2-V_1}{V_1(n-1)}$$

d_1, M_1, and V_1 are respectively the density, the molecular weight, nd the volume of the undissociated gas; d_2, M_2, and V_2 are respecively the density, the apparent molecular weight, and the volume of he dissociated gas at the same temperature; α is the degree of disociation, and n is the number of particles into which a molecule lissociates.

. **Adsorption.**

reundlich's Isotherm:

$$\log\frac{x}{m}=k+\frac{1}{n}\log P$$

x is the mass of the gas absorbed; m is the mass of the absorbent; and n are experimentally determined constants; P is the pressure of the as.

angmuir's Equation:

$$\frac{P}{x}=a+bP$$

x is the number of gram molecules adsorbed per square centimeter t a pressure P; a and b are experimentally determined constants.

Liquids

. **Viscosity.**

$$\frac{n_1}{n_2}=\frac{d_1t_1}{d_2t_2}$$

n_1 and n_2, d_1 and d_2, t_1 and t_2 are respectively the absolute visosities, densities, and times of flow in seconds of the two liquids hrough the same capillary at the same temperature and pressure;

$\frac{n_1}{n_2}$ is the relative viscosity where n_2 usually refers to water.

2. Surface tension. $\gamma = \frac{1}{2} hdgr$

γ is the surface tension in dynes per centimeter, h is the height in centimeters to which a liquid of the density d rises in a capillary of the radius r (in centimeters); g is the gravitational constant expressed in centimeters per sec.^{2}

Molecular Surface Energy: $\gamma\left(\frac{M}{d}\right)^{2/3} = k(t_c - t - 6)$

M, d, and t_c are respectively the molecular weight, density, and the critical temperature of the liquid; t is the experimental temperature; k is the constant (Eötvos constant) equal to 2.12 for unassociated liquids.

Molecular Weight: $M = \left[\frac{k(t_2 - t_1)}{\gamma_1 d_1^{-2/3} - \gamma_2 d_2^{-2/3}}\right]^{3/2}$

γ_1 and γ_2, d_1 and d_2 are respectively the surface tensions and densities of a liquid at the temperature t_1 and t_2 respectively.

Eötvos Constant: $k = \frac{\gamma_1\left(\frac{M}{d_1}\right)^{2/3} - \gamma_2\left(\frac{M}{d_2}\right)^{2/3}}{t_2 - t_1}$

For explanation of the terms in this equation see equations on molecular surface energy and molecular weight.

Association: $x = \left(\frac{2.12}{k}\right)^{3/2}$

x is the degree of association.

Gibbs Adsorption Equation: $\mu = -\frac{C}{RT} \times \frac{d\gamma}{dC}$

μ is the excess of solute per unit surface or interface; C is the concentration of the solute, and $\frac{d\gamma}{dC}$ is the rate at which surface tension changes with concentration.

Sugden's Parachor: $P = \frac{m}{D - d} \times \gamma^{1/4}$

P is the parachor of the liquid under consideration, m is its molecular weight, D its density, γ its surface tension, and d the density of its saturated vapor (d may be neglected at low pressures).

3. Boiling Point and the Heat of Vaporization.

The Law of Ramsay and Young: $\frac{T_A}{T_B} = \frac{T_{A1}}{T_{B1}} + C(T_{A1} - T_A)$

T_A and T_B are the absolute boiling points of the substances A and B under the same pressure. T_{A1} and T_{B1} are the corresponding boiling points under another pressure. C is a constant. This relation holds very closely for related substances for which C is practically zero.

Heat of Vaporization. *Trouton's Rule:* $\frac{\Delta H}{T} = 21$

Nernst-Bingham Rule: $\frac{\Delta H}{T} = 17 + 0.011T$

ΔH is the heat of vaporization per molecular weight and T its absolute boiling point under one atmosphere of pressure.

Both rules hold quite well for non-associated liquids.

4. Index of Refraction.

Lorenz and Lorentz Equation: $\frac{n^2 - 1}{n^2 + 2} \times \frac{1}{d} = r$

n is the index of refraction, d the density, and r the specific refraction.

Solutions

1. Vapor Pressure. Raoult's Law: $P = P_0 X_0$

P is the vapor pressure of the solvent or volatile solute over its solution; X_0 is the mole fraction and P_0 is the vapor pressure of the pure solvent or the volatile solute at the same temperature as the solution.

2. Molecular Weight of Solutes.

Rise of Boiling Point: $M = 1000\text{K}_b \frac{g}{G\Delta T_b}$

Lowering of the Freezing Point: $M = 1000\,K_f \frac{g}{G\Delta T_f}$

Lowering of the Vapor Pressure: $M = \frac{gm}{G} \times \frac{P}{P_0 - P}$

M is the molecular weight of the solute, g is the mass of the solute and G is the weight of the solvent. K_b and K_f are the molal boiling point and molal freezing point constants. T_b and T_f are the experimental boiling point raising and freezing point lowering respectively. m is the molecular weight of the solvent, P_o is the vapor pressure of pure solvent and P is the vapor pressure of the solvent from its solution at the same temperature.

3. Conductivity.

Resistance: $R = \frac{E}{I}$

R is the resistance in ohms, E the voltage and I the amperage.

Conductance: $L = \frac{1}{R}$

L is the conductivity in reciprocal ohms; R is the resistance in ohms.

COMMON PHYSICAL CHEMISTRY EQUATIONS

Specific Conductivity: $\overline{L} = \frac{l}{A} \times L$

$\overline{L}$ is the specific conductivity, l is the distance between the electrodes, A the area of the electrodes, and L is the conductivity in reciprocal ohms.

Cell Constant: $K = \frac{A}{l}$

K is the cell constant; l is the distance between the electrodes and A the area of the electrodes.

Equivalent Conductivity: $\Lambda = \frac{1000\overline{L}}{C}$

Λ is the equivalent conductivity, $\overline{L}$ is the specific conductivity, and C is the normality of the solute.

Thermodynamics

1. **First Law of Thermodynamics:** $\Delta E = q - W$

ΔE is the change of internal energy of a system, q is the heat absorbed by the system, and W is the work done by the system against the surroundings.

Work Done by an Ideal Gas During Expansion:

(1) Against constant external pressure: $W = P(V_2 - V_1)$

(2) Against variable external pressure:

$$W = RT \ln \frac{V_2}{V_1} = RT \ln \frac{P_1}{P_2}$$

W is the work done, and P is the external pressure. P_1, V_1, P_2, V_2 are the initial and final pressures and volumes. If P is expressed in atmospheres and V is expressed in cubic centimeters, then W is in cc-atmospheres. One calorie is equal to 41.3 cc-atmospheres. When R is in calories then the term W (in 2) is in calories regardless of the units of V or P.

2. **Effect of Temperature on Equilibrium.**

In all of the following equations ΔH is positive when heat is absorbed.

Clapeyron Equation: $\frac{dP}{dT} = \frac{\Delta H}{T(V_2 - V_1)}$

$\frac{dP}{dT}$ is the rate of change of vapor pressure of a pure substance with temperature. V_1 and V_2 are the initial and final volumes. ΔH is the amount of heat absorbed by the substance undergoing a change of phase. T is the absolute equilibrium temperature of the two phases. When P is in atmospheres and V in cubic centimeters, ΔH must be in cc-atmospheres. (One calorie = 41.3 cc-atmospheres.) Likewise when V_1 refers to one gram of a substance, V_2 and ΔH also must refer to one gram.

COMMON PHYSICAL CHEMISTRY EQUATIONS

Clausius-Clapeyron Equation: The following equation is applicable to vaporization and sublimation only: $ln\frac{P_1}{P_2} = \frac{\Delta H}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$

P_1 and P_2 are the vapor pressures at absolute temperatures T_1 and T_2 respectively. ΔH is the molecular heat of vaporization or sublimation. If R is in calories, ΔH will be in calories regardless of the units of pressure.

$$ln\frac{C_1}{C_2} = \frac{\Delta H}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

C_1 and C_2 are the solubilities of a substance (in any units) at the absolute temperature T_1 and T_2. ΔH is the molecular heat of solution. When R is expressed in calories, then ΔH must be expressed in calories.

Van't Hoff's Isochore:
$$ln\frac{K_{c1}}{K_{c2}} = \frac{\Delta H}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$
$$ln\frac{K_{p1}}{K_{p2}} = \frac{\Delta H}{\mathrm{R}}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

All K_c and K_p values are obtained by placing the products in the numerator and the reactants in the denominator. K_{c1} and K_{p1} are the equilibrium constants at absolute temperature T_1; K_{c2} and K_{p2} are the equilibrium constants at absolute temperature T_2. ΔH is the heat of reaction for that reaction on which K_c and K_p are based. When R is in calories ΔH must also be in calories.

Free Energy and Equilibrium Constant: $\Delta F^0 = -RT\, ln\, K_p$

ΔF^0 is equal to the change in free energy for a reaction in which the reactants are in their standard states (1 atmosphere) and are converted into products at 1 atmosphere.

Nernst Heat Theorem: $\log K_p = -\frac{\Delta H}{4.58T} + \Sigma n(1.75 \log T) + \Sigma(nc)$

ΔH is the heat of reaction at the absolute temperature T. Σn is equal to the number of moles of gaseous products minus the number of moles of gaseous reactants. $\Sigma(nc)$ is the sum of the Nernst constants; it is equal to the sum of individual constants (each constant must be multiplied by the number of moles of that substance) for gaseous products minus the sum of constants for gaseous reactants. For the values of Nernst constants see Taylor, *Treatise on Physical Chemistry*, p 586 (1931). In cases where the constant has not been determined for a particular substance, 3 to 3.2 may be used as a fair approximation.

Rates of Reaction

1. **Unimolecular Reaction:** $k = \frac{1}{t} ln\left(\frac{a}{a-x}\right)$

$$t_{1/2} = \frac{0.693}{k}$$

k is the velocity constant, a is the initial concentration, $(a-x)$ is the concentration remaining after the time t, x is the amount reacting in the time t, and $t_{1/2}$ is the period of half life of a unimolecular reaction.

2. Bimolecular Reaction.

(1) When equimolecular quantities (a and b) of the initial substance are used:

$$k = \frac{1}{t} \times \frac{x}{a(a-x)}$$

(2) When other than equimolecular quantities of the initial substances are used:

$$k = \frac{1}{t(a-b)} \ln \frac{b(a-x)}{a(b-x)}$$

3. Influence of Temperature on the Rate of Reaction.

Arrhenius Equations:

$$\frac{d \ln k}{dt} = \frac{E}{RT^2}$$

$$\ln \frac{k_1}{k_2} = \frac{E}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right)$$

E represents the energy of activation per gram mole of a substance; k_1 and k_2 are the specific reaction rates at absolute temperatures T_1 and T_2 respectively; R is the gas constant.

Electromotive Force

1. Variation with Temperature: $E = T\left(\frac{dE}{dT}\right) - \frac{\Delta H}{nF}$

E is the electromotive force of a system; n is the change in valence of the ion causing the potential difference; F is equal to the charge carried by gram ion or is equal to 23,060 calories; $\frac{dE}{dT}$ is the rate of change of electromotive force with temperature; T is the experimental absolute temperature; ΔH is the heat of reaction.

2. Concentration Cell.

(1) *Without transference*: $E = \frac{RT}{nF} \ln \frac{C_1}{C_2}$

(2) *With transference*: $E = \left(\frac{2\mu}{\mu + v}\right)\frac{RT}{nF} \ln \frac{C_1}{C_2}$

μ and v are the velocities of the positive and negative ions respectively; C_1 and C_2 are the concentrations (in any units); the velocity of the faster ion is inserted in the numerator. See part 1 for the explanation of the other terms.

DEFINITIONS OF CHEMICAL, PHYSICAL, AND PHARMACEUTICAL TERMS

Most crude drugs are not suitable for administration in their natural state being either too bulky or too nauseous. Preparations suitable for administration are therefore prepared from them by the pharmacist. Brief definitions for the more common pharmaceutical preparations are given.

Therapeutic terms are employed to designate the effect of drugs when applied as remedial agents in the treatment of disease. In the cases of drugs which are cited as illustrations, it should be especially noted that most drugs have several distinct therapeutic effects, the effect cited being but one of the several characteristic of the drug. In selecting the examples an attempt has been made to cite one or two drugs which exhibit the therapeutic effect described. In certain cases of diseases many drugs are contraindicated because of certain other therapeutic activities and for this reason the following brief descriptions should not be considered as aids to self medication.

Absolute Zero—The beginning or zero point in the absolute (thermodynamic) temperature scale. According to the kinetic theory of heat, it represents the temperature at which all thermal motion ceases. It is equal to −273.18°C. or −459.72°F.

Absorption, Heat of—The heat evolved when a given amount of a substance is absorbed.

Aceta (**Vinegars**)—Liquid preparations made by extracting the drug with diluted acetic acid and filtering.

Acetyl Number (**value**)—A number or value which indicates the extent to which a substance may be acetylated. In the analysis of fats, oils, etc., it is taken as the measure of the amount of hydroxy acids and higher alcohols which are present since other substances ordinarily present are not affected by the acetylating agent. It is expressed in milligrams of potassium hydroxide required to neutralize the acetic acid liberated from one gram of acetylated fat or oil.

Acetylene—Any open chain hydrocarbon containing one or more triple bonds; specifically the hydrocarbon $CH \vdots CH$, in distinction from diacetylene, triacetylene, etc., with two, or three, etc., respectively, triple bonds.

Acid—Any chemical compound containing hydrogen capable of being replaced by positive elements or radicals to form salts. In terms of the dissociation theory, it is a compound which on dissociation in solution yields excess hydrogen ions.

Acid Number (**value**)—A number or value which indicates the amount of free acids present in a substance. In the analysis of fats, oils, etc., it is expressed by the number of milligrams of potassium hydroxide which are required to neutralize the free fatty acids in a gram of substance.

Active Mass—A term used in connection with the law of mass action. Guldberg and Waage defined the term as the molarity of the reacting substance, or its partial pressure. Expressed in this form, the law of mass action is only approximately correct. To make the law exact, "activities" must be substituted for molarities and "fugacities" for partial pressures.

Activity—A thermodynamic term denoted by a. Activities are *effective* concentrations and have the dimensions of concentrations. When activities are employed in a mass law expression the equilibrium constant has a fixed value.

Activity Coefficient—A factor which, when multiplied by the molecular concentration, yields the active mass. The activity coefficient is evaluated by thermodynamic calculations, usually from data on the emf of certain cells, or the lowering of the freezing point of certain solutions. It is a correction factor which makes the thermodynamic calculations correct.

Additive Property—A property, the numerical value of which is equal to the sum of the values for the component parts and which depends only on the number and kinds of molecules or atoms present without any regards to their arrangements; e.g., the molecular weight, which is the sum of the weights of the component atoms.

Adiabatic Process—A process carried out in such a way that no heat is absorbed or evolved by a system.

Adsorption—A surface phenomenon exhibited by solids which consists in the adhesion, in an extremely thin layer, of the molecules of gases, of liquids, or of dissolved substances with which they are in contact.

Alcohol—Any one of a class of compounds which are analogous to ethyl alcohol in constitution in that they are hydroxides of organic radicals; specifically, the term is applied to ethyl alcohol.

Aldehyde—Any one of a class of organic compounds intermediate in oxidation between a primary alcohol and a carboxylic acid, having two hydrogen atoms less than the alcohol, and characterized by the radical $-CH{:}O$; specifically, the term aldehyde is applied to acetaldehyde, CH_3CHO.

Alicyclic—See *cyclic*.

Aliments (Foods)—Substances which maintain some vital process or renew some structural material. They may be vegetable, animal, or mineral in origin and are either *oxidizable* (sugar, starch), *nitrogenous* (albumin), or *unoxidizable* (water, inorganic salts). See *restoratives*.

Alkali—Any compound having marked basic properties; see *base*.

Alkalinity—The combining power of a base measured by the maximum number of equivalents of an acid with which it can react to form a salt. In water analysis, it represents the carbonates, bicarbonates, hydroxides, and occasionally the borates, silicates, and phosphates in the water and is determined by titration with standard acid to certain standard datum points and expressed as milligrams of calcium carbonate per liter (nearly the same as "parts per million").

Alkaloid—An alkaline, nitrogenous organic substance (i.e., an organic base) with marked physiological action. The term is usually restricted to substances which occur naturally in plants and animals; e.g., nicotine, quinine, etc.

Alloy—The product formed by the blending of a metal with other metals or non-metals usually by fusion and solution in each other when molten.

Alpha Radiation—The radiation of doubly positively charged particles, called *alpha particles*, emitted during certain radioactive transformations. These particles have a mass of 4.00 and are identical with the nuclei of helium atoms.

Alteratives—Drugs which alter or change morbid conditions by furthering metabolism or modifying nutritive processes (sarsaparilla). As most alteratives promote absorption of inflammatory deposits they are also called *resolvents* or *discutients*.

Ampere—The practical unit of intensity of electric current being defined by U. S. statute as the unvarying current which, when passed through a standard solution of silver nitrate in water, deposits silver at the rate of 0.001118 grams per second. It is equal to the current produced by an electromotive force of one volt flowing through a circuit of one ohm resistance.

Ampullae (Ampuls)—Hermetically sealed containers filled with a sterilized medicinal liquid intended for hypodermic or intravenous injection. They are usually made of glass which should be of high quality especially in regard to its resistance to water.

Analgesics (Anodynes)—Drugs which relieve pain by either (*a*) depressing sensory nerve centers, or (*b*) impairing nerve-fiber conductility (opium, belladonna, antipyrine). See *cerebral depressants*.

Anaphrodisiacs—Substances which lessen sexual functions and appetite, by diminishing excitability of the nerves of the genital organs or by depressing the genital centers in the brain and spinal cord, or by decreasing local circulation (bromides, camphor).

Androgenic—Favoring masculine characteristics.

Anesthetics—Drugs which abolish sensation either by depression of the central nervous system (*general anesthetics*, ether, chloroform) or by decreasing the ability of peripheral nerve structures to receive or conduct nerve impulses (*local anesthetics*, novocain). See also *cerebral depressants*, and *sedatives*.

Angstrom—A unit of length, used especially in expressing the length of light waves, equal to one ten-thousandth of a micron, or one hundred-millionth of a centimeter (1×10^{-8}cm.)

Anhydrotics—Drugs which check perspiration by reducing the action of the sweat glands, the excitability of the sweat centers, or the circulation in the skin (pilocarpine, belladonna).

Anhydrous—A term meaning without water. It is usually applied in referring to the absence of water of crystallization.

Animal Oil—An oily material obtained, in any manner of various ways, from animal substances. It usually refers to a mixture of the glyceryl esters of various organic acids although it is also applied to substances other than glycerides; e.g., bone oil, which is a mixture containing pyrrole, pyridine, quinoline, amines, and other nitrogenous compounds, as well as hydrocarbons, etc., which are obtained on the destructive distillation of bones.

Anion—The charged particle in a solution of an electrolyte which, under the influence of an electrical potential, moves toward the anode. It is the negatively charged ion.

Anode—The electrode at which an oxidation process occurs. It is the negative pole of a battery, or the positive pole of a solution of an electrolyte through which current is being forced. In a vacuum tube, the anode is the electrode towards which the electrons flow within the tube.

Anodynes—See *analgesics*.

Anthelmintics—Drugs which destroy (*vermicides*) or expel (*vermifuges*) intestinal worms (vermifuges: castor oil, jalap; vermicides for: (*a*) thread worms —alum, tannin, quassia, and (*b*) round worms—santonin, chenopodium, and (*c*) tape worms (*taenifuges*)—aspidium).

Antiemetics—Drugs which lessen nausea and vomiting. If the action is a sedative one on the end organs of the gastric nerves it is said to be *local* (bismuth sub-nitrate); if the irritability of the vomiting center in the medulla is reduced the action is *general* (chloral).

Antihydrotics—See *anhydrotics*.

Antilithics—Drugs which are supposed to prevent the formation of urinary and biliary concretions in the excretory passages (alkaline salts).

Antimonial—A medicine containing the element antimony.

Antiperiodic—Drugs which prevent recurrence of certain periodic febrile diseases usually by arresting further development of successive crops of pathogenic organisms in the blood (cinchona).

Antiphlogistics—Drugs which reduce inflammation of serous membranes (mercury, opium).

Antipyretics (**Febrifuges**)—Drugs which reduce abnormally high body temperature. This may be accomplished either by decreasing heat production (by lessening tissue change or reducing circulation) or by increasing heat loss (by dilating skin vessels or causing perspiration) (quinine; acetanilide).

Antiscorbutic—A remedy for the treatment or prevention of scurvy (lemon juice, vitamin C).

Antiseptic—A substance which prevents or retards septic decomposition by killing bacteria or arresting their development (mercuric chloride, phenol). See *antizymotics*.

Antispasmotics—Drugs which relax spasm (belladonna, lobelia). See *cerebral excitants*.

Antitoxin—A serum employed hypodermically for the treatment or prevention of those diseases caused by bacterial toxins (diphtheria antitoxin).

Antivenin—A serum used hypodermically to counteract or neutralize snake venom.

Antizymotics—Drugs which arrest fermentation dependent upon organic ferments (enzymes) or organized ferments (yeasts, bacteria). Antizymotics are usually classified into (*a*) antiseptics, (*b*) disinfectants, and (*c*) deodorants.

Aperients—See *laxatives*.

Aphrodisiacs—Drugs which stimulate sexual appetite by acting directly or reflexly upon the cerebral or spinal genital center (strychnine, cannabis, alcohol).

Aquae (**Aquae Aromaticae; Aromatic Waters**)—Preparations made by impregnating distilled water with volatile substances. Aromatic waters when prepared from volatile oils are intended to be, as nearly as possible, saturated solutions. They must be clear and free from solid particles. They are prepared either by distillation or solution.

Aqueous Tension—The vapor pressure of pure water, or the partial pressure of water vapor over any aqueous solution or solid hydrate, at any given temperature.

Aromatics—See *carminatives*.

Arsenicals—Medicines containing the element arsenic.

Astringents—Drugs which contract muscular fiber by direct irritation and sometimes condense tissues by precipitating albumin and gelatin (alum, tannin).

Athermanous—Not transmitting radiant heat; not *diathermanous* (q.v.).

Atom—According to the atomic theory, the smallest quantity of an element which is capable of entering into chemical combination or that can exist alone.

Atomic Number—A number, characteristic of an element, which designates the position of the element in the periodic table. It represents the net positive charge on the nucleus of each atom, or the number of electrons outside of the nucleus.

Atomic Radius—The radius of the volume occupied by an atom. This volume may approximate a sphere or, in many cases, a highly distorted sphere. In a given crystal, the atomic radii when added together equal the inter-atomic distances within the crystal. The ionic radius of the same species of atom will be somewhat less, or greater, than that of the atomic radius because the outermost shell of electrons has been stripped off, or increased, in the formation of the ion.

Atomic Theory—A theory postulating that all elements are composed of small discrete unit particles called atoms. The atoms of any one element are supposed to be of the same size and essentially of the same weight, but differ in both from element to element. Chemical combination is the union of atoms of various elements into the smallest discrete entities of the compound; viz., the molecules.

Atomic Weight—The relative weight of the atom of an element, referred to some element taken as a standard. An atomic weight of 16 for oxygen is the one usually adopted as a basis for reference.

Average Life—In radioactivity, the reciprocal of the radioactive constant (q.v.).

Avogadro's Hypothesis—The hypothesis that equal volumes of all gases, under the same conditions of temperature and pressure, contain equal numbers of molecules.

Avogadro's Number—The number representing the number of molecules in one gram-molecular weight of any substance, as for oxygen, the number in 32 grams. It is equal to 6.0228×10^{23}.

Base—A compound of a metal, or a metal-like group, with hydrogen and oxygen in the proportion to form an OH radical, which ionizes in aqueous solution to yield hydroxyl ions. A base is formed when a metallic oxide reacts with water.

Beta Radiation—See *radioactivity*.

Bicyclic—Containing two rings in the molecule, usually fused rings as in naphthalene.

Boiling Point—The temperature at which the vapor pressure of a liquid becomes equal to the external pressure. This temperature differs for the same liquid under different pressures. The *normal boiling point* is the temperature at which the vapor pressure reaches 760 mm of mercury.

Boiling Point, Molal Elevation of—See *molecular elevation*.

Bougies (Pencils)—Small solid cylinders impregnated with various drugs for insertion into the urethra, uterus, or nose. They are made of gelatin, glycerogelatin, or oil of theobroma.

Boyle's Law—The law that the volume of any gas varies inversely as the pressure upon it, providing the temperature is kept constant. It is also known as *Mariotte's law*.

Brinell Hardness—A value of the hardness of a material obtained by pressing a hardened ball, having a diameter of 10 mm, into the surface of the specimen to be tested. The weight applied to steels is 3000 kg for 30 seconds; to brasses and bronzes 500 kg for 60 seconds. The diameter of the impression forms the basis for calculating hardness.

British Thermal Unit (btu)—The quantity of heat required to raise the temperature of one pound of water one degree Fahrenheit at, or near, its point of maximum density (39.1°F.) The btu is equivalent to 0.252 kilogram-calorie.

Buffer—Any substance, or combination of substances, which when dissolved in water produces a solution which resists a change in its hydrogen ion concentration upon the addition of acid or alkali.

Cachets (Wafers; Konseals)—Various sized, concave wafers made of unleavened bread or starch paper; the cavity, formed by moistening the concave edges of two and pressing them together, containing the drug.

DEFINITIONS OF TERMS

Calorie—The small calorie (*c*) is an energy unit used to measure the quantity of heat. It is equal to the amount of heat required, at a pressure of one atmosphere, to raise the temperature of one gram of water one degree Centigrade. Since the specific heat of water varies with the temperature, the rise of one degree is sometimes specified to be between certain temperature intervals (as from 0° to 1°C.; at or near the temperature of greatest density, which is 4°C.; or, at from 15° to 16°C., in which case the unit is almost exactly that of the *mean calorie*). The amount of heat required to raise one gram of water from 0° to 100°C. is the *rational calorie*, one hundredth of the rational calorie being called the *mean calorie*.

Capsulae (Capsules)—Various sized transparent casings (short tubes, usually with one open end fitting over that of another) of gelatin. They are either hard, or soft and elastic, and are used for the administration of nauseous or disagreeable solids or liquids.

Carbocyclic—See *cyclic*.

Carbohydrate—Any one of a group of compounds composed of carbon, hydrogen, and oxygen with the ratio of hydrogen to oxygen usually as in water; viz., 2H:1O. They are neutral compounds comprising the sugars, starches, celluloses, pentosans, galactans, etc.

Cardiac Depressants (Cardiac Sedatives)—Drugs which lessen the force and frequency of the heart's action and control its over-action and palpitation (aconite, veratrum viride).

Cardiac Stimulants (Cardiac or Heart Tonics)—Drugs which stimulate the cardiac muscle, slow and strengthen its contractions (digitalis).

Carminatives (Aromatics)—Drugs which expel gases from the stomach and intestines by increasing peristalsis, by stimulating the circulation, and by relaxing the pyloric and cardiac orifices (peppermint, cardamon seed).

Catalyst or Catalytic Agent—Any substance which, by virtue of its presence affects the rate of a chemical reaction and which may be recovered practically unchanged at the end of the reaction. The term *contact agent* is often applied to a solid catalyst in contact with gaseous reactants.

Cataplasmata (Poultices)—Soft pasty masses for external application of moist heat, with or without the addition of active medicaments. Substances commonly employed in the preparation of poultices are bran, flaxseed meal, kaolin, glycerol, and oatmeal. Glycerol or fixed oil is added to prevent caking.

Cathartics—See *purgatives*.

Cathode—The electrode at which reduction occurs. It is the negative electrode in a cell through which current is being forced, but it is the positive pole of a battery. In a vacuum tube, the cathode is the electrode from which electrons are liberated; see also the term *anode*.

Cation—The charged particle in the solution of an electrolyte which, under the influence of an electrical potential, moves toward the cathode. It is the positively charged ion.

Causticity—A measure of the hydrogen ion concentration in a sample of water; see *hardness*.

Caustics—See *escharotics*.

Cell (galvanic or electromotive)—A combination made up of a cup, or other vessel, containing a solution of a suitable electrolyte and two suitable electrodes which dip into it. It may be used either for generating electricity by chemical action, or for use in electrolysis (in the latter case it is called an *electrolytic cell*).

Cellulose—An anhydroglucose polysaccharide which constitutes the major portion of plant materials and which can be hydrolyzed by acid into glucose. *Alpha cellulose* is the cellulosic fraction which is insoluble in aqueous 17.5% sodium hydroxide solution. *Beta cellulose* is the cellulosic fraction which is soluble in aqueous 17.5% sodium hydroxide solution and from which it can be precipitated by acidifying the solution. *Gamma cellulose* is the cellulosic fraction which is soluble in aqueous 17.5% sodium hydroxide solution in which it remains dissolved, even after the solution is acidified.

Ceramic—Pertaining to the manufacture, or the products therefrom, of material made from earth by the agency of fire, such as pottery, enamel, cement, glass, etc. For definitions of ceramic terms see special *glossary of ceramic terms*.

Cerata (Cerates)—Adhesive preparations for external use containing wax which are capable of being spread at ordinary temperatures and do not melt at body temperature.

Cerebral Depressants—Drugs which lower or suspend the higher brain functions usually after a preliminary stage of excitement. Cerebral depressants or cerebral sedatives are usually classified as follows: (*a*) narcotics; (*b*) hypnotics; (*c*) analgesics; and (*d*) anesthetics; see these latter terms.

Cerebral Stimulants (Cerebral Excitants; Antispasmotics)—Drugs which increase the functional activity of the brain without causing subsequent depression of the cerebral functions (caffeine, valerian).

Cetane Number—This is a number which is a measure of the "ignition quality" of a Diesel fuel. It represents the percentage by volume of normal cetane (hexadecane) in a mixture with alpha-methylnaphthalene which gives the same ignition lag as the fuel to be rated when tested under standard conditions. Thus, by definition, alpha-methylnaphthalene has a cetane-number rating of zero, and normal cetane of 100. The cetane number is reported to the nearest whole number. Cf. ASTM Standards of Petroleum Products and Lubricants No. D-613-43T (CRC F-5-543) Method of Test for Ignition Quality Diesel Fuels.

Charles' Law—The law that at constant pressure the volume of a gas varies directly as the absolute temperature. The variation in volume amounts to 1/273 of its volume at 0°C. for each degree Centigrade.

Chemical Equivalent—See *equivalent weight*.

Chemiluminescence—See *luminescence*.

Cholagogue—See *purgatives*.

Ciliary Excitants—Drugs, which when dissolved in the saliva, increase bronchial mucous expectoration, usually through reflex action on the bronchial and tracheal cilia (ammonium chloride, acacia).

Clysters—*See enemata*.

Colligative Property—A property depending only upon the number of atoms or molecules present in a system and not upon the nature of the atoms or molecules; e.g., gaseous pressure is a colligative property.

Collodia (Collodions)—Preparations for external use, either simple collodion (a solution of nitrocellulose in ether or alcohol), or simple collodion containing active medicinal substances. They form a protective film over the skin due to the rapid evaporation of the solvent.

Colloid—A state of subdivision of matter characterized by a particle size intermediate between molecular dispersion (true solution), and a size just about visible with an ordinary microscope; i.e., from 10^{-5} to 10^{-7} cm in diameter. A colloidal substance, when apparently dissolved in a liquid, diffuses not at all or very slowly through a membrane and shows no pronounced effect on the freezing point or vapor pressure of the solvent.

Combining Weight—See *equivalent weight.*

Combustion, Heat of—The total amount of heat evolved when a definite quantity of a substance is completely burned (oxidized). It is expressed variously, as in calories per gram or per gram molecule, or (especially for fuels) in British thermal units (btu) per pound.

Compressibility, Coefficient of—The decrease in volume per unit volume produced by a unit change in pressure.

Concentrated Solution—A solution containing a relatively large amount of dissolved substance per unit volume of solvent.

Condensation, Heat of—A value numerically the same as the *heat of vaporization* (q.v.).

Conductance—The property of an electrical circuit which determines, for a given applied potential across its terminals, the rate at which electrical energy is converted into heat. It is the reciprocal of the electrical resistance and its unit, the *mho*, is the reciprocal of the ohm.

Constant Proportions, Law of—The law of chemical combination which states that a chemical compound always contains the same elements combined in the same proportions by weight.

Constitutive Property—A property dependent on the arrangement of the molecules or atoms in a substance (constitution) rather than on their kind or number; e.g., a physical property, such as the rotation of the plane of polarized light, which depends on the arrangement of atoms within the molecule, is called a constitutive property.

Cortical—Relating to the adrenal cortex.

Coulomb—The practical unit quantity of electricity. It is the quantity of electricity which must pass through a circuit to deposit 0.0011180 grams of silver from a solution of silver nitrate. An ampere is one coulomb per second. A coulomb is also the quantity of electricity on the positive plate of a condenser of one-farad capacity when the electromotive force is one volt.

Counter-irritants—These are irritants which when applied to the skin are used to produce reflex action on remote parts. See *irritants.*

Critical Point—The transition point at which the liquid and gaseous states of a substance merge into each other. It is the temperature above which a substance cannot exist in two phases, no matter how great the pressure. See also *critical temperature* and *critical pressure.*

Critical Pressure—The pressure which is just sufficient to cause the appearance of two phases at the critical temperature. It is the vapor pressure of a liquid at the critical temperature.

Critical Temperature—The temperature above which a gas cannot be liquefied by pressure alone. At this temperature there is no distinction between liquid and vapor, both having the same density and constituting one homogeneous system.

Critical Volume—The volume occupied by unit mass of a substance at the critical temperature *and* critical pressure.

Crystal—A homogeneous particle of solid formed by the solidification, under favorable conditions, of a chemical element, a compound, or an isomorphous mixture, whose boundary surfaces are planes symmetrically arranged at definite angles to one another in a definite geometrical form. Many chemical substances solidify into various such forms, each being quite characteristic for every substance. See also *liquid crystal.*

DEFINITIONS OF TERMS

Crystalline Form—A combination of faces included under a general crystallographic symbol. Faces of two or more crystal forms are often exhibited by a single crystal and these supplement one another or truncate on another's edges or corners.

Crystalline System—The six (or seven) groups into which crystals are classified according to forms which are dependent upon the relative lengths and inclinations of the axes to which they are referred. The systems are the *isometric*, *tetragonal*, *triclinic*, *hexagonal* (including the *rhombohedral*), *orthorhombic*, and *monoclinic*. See definitions for each of these systems.

Crystalloluminescence—See *luminescence*.

Cubic Form—See *isometric*.

Cycle or Cyclical Process—A process conducted in such a manner that at the end of a complete course of operations of some kind the system is back at its starting point with restoration of the original state.

Cyclic—Pertaining to, or characterized by, a ring or closed-chain formation. Compounds in which the ring is composed solely of carbon atoms are called *carbocyclic*; of atoms of the same kind, whether of carbon or not, *isocyclic* or *homocyclic*; of atoms of different kinds, *heterocyclic*; carbon ring compounds not derived from benzene are called *alicyclic*.

Dalton's Law of Partial Pressures—In any mixture of gases the total pressure is equal to the sum of the pressures which each gas would exert were it alone present in the volume occupied by the mixture; i.e., the total pressure P is equal to the sum of the partial pressures of the individual gases.

Decocta (**Decoctions**)—Aqueous solutions of vegetable drugs prepared by boiling for 15 minutes in a closed vessel, allowing to cool, and expressing and straining. They are usually prepared in 5% concentrations.

Decomposition, Heat of—The heat evolved or absorbed by the decomposition of a compound into its elements or into two or more simpler products, the nature of which must be specified in connection with the numerical value of the heat of decomposition. It is usually expressed in calories per gram molecule.

Decomposition Potential or Voltage—The minimum voltage required to keep a steady current passing through a solution or, in other words, to cause a steady electrolysis in the solution.

Decrepitation—The property, possessed by some crystalline material, of making a crackling noise when heated and which is due to decomposition with evolution of gases, water vapor, etc.

Deflagration—The act of burning suddenly with the appearance of flame and sparks.

Deliquescence—The liquefaction of a solid substance due to the solution of the solid by absorption of moisture from the air.

Demulcents—Substances intended to soothe the parts to which they are applied, usually mucous membranes (acacia).

Density—The ratio of the amount of anything per unit volume; e.g., mass of any substance per unit volume at any definite temperature (see also *specific gravity*); the quantity of an electric charge distributed in space per unit volume; or the quantity of energy per unit volume.

Dental Anodynes—Drugs used locally in toothache due to caries (oil of cloves, phenol).

Dentifricia (**Dentifrices; Tooth Powders**)—Finely powdered drugs, usually antiseptic, antacid, non-irritating, non-gritty, saponaceous, sweetened and flavored.

Deodorants—Substances which destroy foul odors. They may be volatile and act chemically on the obnoxious gases (chlorine) or non-volatile and act by condensing or decomposing the odoriferous substance (charcoal, potassium permanganate). See *antizymotics*.

Depression (molecular), Coefficient of—The depression of the freezing point produced by the solution of one gram molecule of a substance in 1000 grams of the solvent.

Depresso-motors—See *motor depressants*.

Dew Point—The temperature at which the liquefaction of a vapor begins; the term is usually applied to condensation of moisture from the water vapor in the atmosphere.

Dextro (rotatory)—A clockwise or right-handed turning motion usually applied to the turning of the plane of polarized light.

Diamagnetic—Possessing, or pertaining to, the magnetic properties of bodies whose permeability is less than unity (i.e., less than that of a vacuum). Diamagnetic substances are repelled by a magnet if the surrounding medium is air.

Diaphoretics (Sudorifics)—Drugs which cause secretion of sweat. They may be (*a*) simple; i.e., enter the circulation and stimulate the suderiferous glands by which they are eliminated (pilocarpus); (*b*) nauseating; i.e., relax and dilate the superficial capillaries (ipecac, tartar emetic); or (*c*) refrigerant; i.e., reduce circulation by acting on the sweat centers in the medulla (potassium citrate).

Diathermanous—Possessing, or pertaining to, the property of affording a free passage of heat rays.

Dielectric—A material which does not conduct the electric current because the lines of force of an electrostatic field will pass through it, thus making it the seat of the strain.

Dielectric Constant—A constant factor (ϵ) which is part of the formula for the force between two charges separated by a dielectric; viz., $\epsilon f \gamma^2 = Q_1 Q_2$, where f is the force between two charges Q_1 and Q_2 separated by a distance of γ.

Diffusion, Coefficient of—The quantity of gas traveling one centimeter per second through a surface of one square centimeter.

Digestive Acids—Drugs which check all glandular acid secretion thus increasing alkaline secretion (dilute mineral acids). See *restoratives*.

Digestive Ferments—Enzymes aiding digestion (pepsin, diastase). See *restoratives*.

Dilute Solution—A solution containing a relatively small amount of dissolved substance per unit volume of solvent.

Dilution, Heat of—The heat evolved per mole of solute when a solution is diluted.

Diolefin—Any open chain hydrocarbon containing two double bonds; e.g., $CH_2{:}CH \cdot CH{:}CH_2$. See *olefin*.

Dipole (Moment)—A dipole consists of two electrical charges very close together and opposite in sign. Its magnitude is measured by its moment which is the product of either charge by the distance between the two charges. Dipole moments are usually expressed in Debye units, one Debye being equal to 10^{-18} electrostatic units. This value is obtained by multiplying the electronic charge in 10^{-10} electrostatic units by the intermolecular distance in 10^{-8} centimeters.

Discutients—See *alteratives*.

Disinfectants—Substances which destroy specific germs, etc. They may react by (*a*) acting as oxidizing agents; (*b*) combining with albumin; (*c*) chemically combining to form substitution compounds; (*d*) arresting molecular changes; and (*e*) altering the reaction of the media (potassium permanganate, mercuric chloride, chlorine, sulfur dioxide, chlorinated lime). See *antizymotics*.

Dissociation—The splitting up of a compound or element into two or more simpler molecules, atoms, or ions. The term is applied usually to the effect of the action of heat or other forms of energy on gases, and of solvents upon dissolved substances. Dissociation is a reversible reaction and not as permanent as decomposition; i.e., when the dissociated gas is cooled, the split parts recombine; when the solvent is removed, the ions recombine.

Dissociation, Degree of—The ratio of the amount of substance which has dissociated to the total amount originally present.

Dissociation, Heat of—The heat evolved or absorbed during the dissociation of a compound. It is usually expressed in calories per gram molecule.

Distillation—The process of heating a liquid to its boiling point, removing the vapors through a cooling and condensing apparatus, and finally collecting the condensed liquid in a separate receiver. It is commonly used for the separation of two or more liquids in a mixture, or for the separation of the solvent from dissolved substances.

Distribution Coefficient—See *distribution law.*

Distribution Law (Nernst)—The law that the ratio in which a dissolved substance distributes itself between two immiscible solvents (the *coefficient of distribution* or *partition*) is a constant at constant temperature.

Diuretics—Drugs which increase the output of urine. They act by (*a*) increasing circulation through the kidney (digitalis); (*b*) decreasing tubular resorption of water (potassium acetate); or (*c*) increasing water content of the circulating blood (water).

Drying Oil—An oil which, when exposed in a thin film to the air, readily forms a hard, tough, elastic substance. The chemical constitution of such oils is characterized by unsaturated linkages between carbon atoms.

Dulong and Petit's Law—The principle that the specific heat of a solid element multiplied by the atomic weight is a constant equal approximately to 6.2 to 6.4.

Ecbolics (Oxytocics)—Drugs which stimulate the muscular fibers of the gravid uterus to contraction, thus causing premature birth or abortion (ergot, cottonroot-bark).

Efflorescence—The act or process by which crystalline material changes on the surface, or throughout, to a whitish, mealy, or crystalline powder from the loss of water on exposure to the air. The term is also applied to the process of becoming covered with such a crust; e.g., bricks may effloresce because of soluble salts in them.

Electric Moment—See *dipole moment.*

Electrochemical Equivalent—The weight in grams of a substance caused to react (in some cases to deposit) when one coulomb of electricity is passed through a solution of the substance. It is the 1/96,500*th* part of the gram equivalent.

Electrode—The pole or plate of an electrolytic cell by which the current enters or leaves the cell.

Electrode Potential—The difference in potential established between an electrode and a solution when the electrode is immersed in the solution.

Since it is impossible to measure such a single electrode potential experimentally, the values listed in tables are relative values, the standard being a rigidly defined hydrogen electrode, which is arbitrarily given a potential of zero volts. See *Table of Standard Electrode Potentials.*

Electroluminescence—See *luminescence.*

Electrolysis—Electrolysis is the process of the passage of an electric current through a solution with simultaneous chemical changes either in the electrodes or in the solutions in contact with the electrodes, or both.

Electrolyte—Any substance which, when in solution or fused, forms a liquid which will conduct the electric current. Acids, bases, and salts are common electrolytes.

Electrolytic Dissociation Theory—The theory, first proposed by Arrhenius, which postulates that whenever an electrolyte is placed in a dissociating medium, such as water, part or all of the molecules dissociate into ions. Some of these ions are positively, the rest negatively, charged; but in any case the oppositely charged ions are present in exactly equivalent quantities.

Electromotive Force—The driving tendency behind an electric current. It is often abbreviated *emf* and it is measured in volts. The emf of a battery is the potential difference between its terminals when no current flows through the battery. See *potential difference.*

Electron—The most elementary negatively charged particle which is the constituent of all matter. It is the electrical opposite of the proton and is the quantity of electricity equal to 4.77×10^{-10} cgs electrostatic units. Its mass is approximately 1/1845 of that of the proton. Electrons constitute cathode rays and beta rays, and are emitted by hot bodies.

Electron Theory of Matter—The atom is pictured as a nucleus around which are arranged electrons, or negative charges, equal in number to the net charge on the nucleus. The nuclear charge and the number of external electrons vary from element to element, increasing by one for every increase in the atomic number of the elements. The total number of external electrons is thus identical with the atomic number of the element.

Elixira (Elixers)—Sweet, aromatic, hydro-alcoholic, medicated liquids. The alcoholic strength varies between 20 and 25%.

Elongation—The total stretch (deformation) in the direction of load, or per unit length, caused by a tensile force. It is the amount of permanent stretch before rupture and is usually expressed as a percentage of the original length.

Emetics—Drugs which cause vomiting. The action may be local; i.e., by the irritation of the end organs of the gastric, pharyngeal or esophageal nerves by reflex action (zinc sulfate); or systematic; i.e., by stimulating the vomiting centers directly through the circulation (apomorphine, ipecac).

Emmenagogues—Drugs which restore the menstrual function, either by stimulating directly the uterine muscular fiber (ergot), or indirectly by enriching the blood and thus toning up the nervous system (quinine, iron).

Emollients—Substances which soften and relax the tissues when applied locally. They diminish tension and pressure on the nerves, dilate the vessels and protect inflamed surfaces. They are usually applied to the skin (fixed oils).

Emplastra (Plasters)—Substances, solid at ordinary temperatures but pliable and adhesive at body temperature. They are intended for external application. They may or may not be spread.

DEFINITIONS OF TERMS

Emulsa (Emulsions)—Aqueous milk-like mixtures of oils, fats or resins in a minutely divided state, suspended by mucilaginous materials.

Emulsion—The product of the dispersion of one liquid in another liquid, the dispersed phase particles being larger than colloidal size. The liquid in which the particles or globules are suspended is called the *continuous phase*, the particles or globules the *dispersed phase*. In photography, the term is applied to the light-sensitive coating of gelatine in which silver halide salts are suspended in an extremely fine state of separation and which is applied to glass plates, film, and paper.

End Point—The point indicating the end of some operation or at which a certain definite change is observed. In titration this change is frequently a change in color of an indicator which has been added to the solution, or to the disappearance or excess of one of the reactants which is colored. In the analysis of liquids, such as gasoline, the end point is the temperature at which liquid ceases to distill over.

Endometrial—Pertaining to the mucous membrane lining the uterus.

Enemata (Enemas)—Liquids intended for injection into the rectum.

Entropy—A thermodynamic quantity. In any *reversible* process, the increase in entropy of any system, or part of a system, is equal to the heat which it absorbs, divided by the absolute temperature at which the heat is absorbed.

Enzyme—Any one of a class of naturally occurring, complex, organic substances which catalyze specific reactions. Enzymes are elaborated by cells of plants and animals but their action is independent of life processes.

Epispastics—See *vesicants*.

Equilibrium (chemical)—The state in a reversible chemical reaction at which the rate of the direct action is equal to the rate of the opposing reaction.

Equilibrium Constant—According to the law of mass action, for any reaction such as: $aA + bB \ldots\ldots \rightleftarrows dD + eE \ldots\ldots,$

$$\frac{C_D^d \times C_E^e}{C_A^a \times C_B^b} = K_c$$

at any definite temperature. Here C is the equilibrium concentration of the constituents in moles per liter, while K_c is a constant known as the equilibrium constant.

Equivalent Weight—One of the comparative weights of different compounds, elements, or radicals, which possess the same chemical value for reaction when compared by reference to the same standard (usually oxygen = 8). The following are examples of this relationship:
(1) An equivalent weight of an acid, or a base, is the quantity that would furnish one gram-ionic weight of hydrogen ion (1.008 grams), or hydroxyl ion (17.008 grams), respectively, if the substance were completely ionized. Thus, an equivalent of H_2SO_4 is one-half the molecular weight; an equivalent of $Fe(OH)_3$ is one-third the molecular weight. (2) An equivalent weight of a salt is the gram-molecular weight divided by the total positive, or total negative, valence. Thus, an equivalent of $Al_2(SO_4)_3$ is one-sixth of the molecular weight. (3) An equivalent weight of an oxidizing, or reducing, agent is the gram-molecular weight divided by the total change in valence of all atoms in the molecule which change valence (usually only one element). Thus, when $KMnO_4$ in acid solution is reduced to Mn^{++}, the valence of Mn decreases from +7 to +2; a change of five units. In this case, an equivalent weight of $KMnO_4$ is one-fifth the gram-molecular weight.

Errhines—See *sternutatories*.

Escharotics (Caustics)—Substances which destroy tissue either by abstraction of water, combining with the albumin of the skin, or by corrosive deoxidation of the tissues, thus causing slough (mineral acids, sodium hydroxide, phenol). See *irritants*.

Essential Oil—Any one of a class of odoriferous, volatile liquids, insoluble in water, which are obtained from plants to which they impart odors and other characteristic properties. They are of various organic types, such as ethers, aldehydes, esters, etc., or mixtures of the same. Some contain dissolved resin and are known as *oleoresins*. They are sometimes called *volatile oils* in distinction from *fixed oils*.

Ester—A compound which may be regarded as formed by the replacement of the acid hydrogen of an acid, organic or inorganic, by a hydrocarbon radical. When the radical is not specified in the name, *ethyl* is often understood; e.g., acetic ester is ethyl acetate.

Ester Number (**value**)—The numerical difference between the saponification number and the acid number. It is a measure of the neutral fats (esters of the fatty acids) present.

Estrogenic—Favoring female characteristics, especially the development of estrus (heat); the estrogenic state is a component of the normal female endocrinological cycle.

Excito-motors—See *motor excitants*.

Exfoliation—The property possessed by substances which are capable of casting or throwing off from their surfaces scales, laminae, or splinters.

Expansion, Coefficient of—The ratio of the increase in length (linear coefficient), area (superficial), or volume (cubical) of a body for a given rise in temperature (usually from 0° to 1°C.) to the original length, area, or volume, respectively. These three coefficients are approximately in the ratio of 1:2:3. When not expressly specified, the cubical coefficient is usually intended.

Expectorants—Drugs which change the broncho-pulmonary mucous membrane secretion promoting its expulsion (ammonium chloride, senega, squill).

Explosive—A substance which acts by explosive chemical reaction to liberate, at high speed, gas and heat thus causing tremendous pressure.

Extracta (**Extracts**)—Pasty or semi-solid masses, or dry, solid or powdered products prepared by exhausting organic drugs with appropriate solvents and then carefully evaporating the solutions. Pasty or semi-solid extracts are usually referred to as *pilular extracts*.

Factor—A quantity by which a measure must be multiplied in order to express it in other terms. The number which is used to multiply a given weight of some compound in order to obtain the equivalent weight of some other compound is called a *gravimetric factor*; similarly, volumes may be interconverted by *volumetric factors*.

Faraday's Laws of Electrolysis—The law that: (1) For any electrolyte the amount of electrolysis is proportional to the quantity of electrical current which is passed through a solution; (2) for the same quantity of current passed through solutions of various electrolytes, the amounts liberated at the electrodes are directly proportional to chemical equivalents of the electrolytes. The quantity of current required to deposit one chemical equivalent weight is one *faraday* which is equal to 96,500 coulombs.

Fat—Any one of a class of compounds, composed of carbon, hydrogen, and oxygen, which are glyceryl esters of certain acids, such as stearic, palmitic, etc. The fats are neutral in reaction and on saponification all yield glycerol. The various varieties of natural fats are mixtures of different glycerides. A fat which is liquid at room temperatures is called a *fatty oil*. See *oil*.

Febrifuges—See *antipyretics*.

DEFINITIONS OF TERMS

Ferments—See *digestive ferments.*

Fixed Carbon—The percentage of combustible material in a sample (of coal usually) which is not volatile at 950°C.

Fixed Oil—An oil which is not readily volatile as distinguished from *volatile* or *essential oil* (q.v.). The term is especially applied to the liquid fats (glycerides) found in the fatty tissue of plants and animals, and in the seeds of plants. See *oil.*

Fluid—A substance which yields readily to any force which tends to alter its shape. Fluids possess no definite shape. The term includes both liquids and gases.

Fluidextracta (Fluidextracts)—Concentrated liquid preparations made from organic drugs by extracting with suitable solvents. The activity of one cubic centimeter of the fluid extract is adjusted to equal that of one gram of the drug. Various menstrua are employed, generally mixtures of alcohol and water, or mixtures of alcohol and water with glycerol or acids.

Fluorescence—The property of emitting radiation as the result of absorption of radiation from some other source. The emitted radiation persists only as long as the exposure is subjected to radiation which may be either electrified particles or waves. The fluorescent radiation generally has a longer wave length than that of the absorbed radiation. If the fluorescent radiation includes waves of the same length as that of the absorbed radiation it is termed resonance radiation. For laws, see *photochemistry*. See also *Raman effect.*

Foods—See *aliments*; *restoratives.*

Formation, Heat of—The heat evolved or absorbed when a compound is formed by direct union of its elements at some stated temperature. It is usually expressed in calories per gram-molecule of the compound.

Formula Weight—The sum of the atomic weights of all the atoms appearing in a chemical formula.

Free Energy—A thermodynamic term. Absolute values for free energy are unknown but when a system changes from one state to another at constant temperature and pressure, the decrease in free energy is numerically equal to the maximum useful work which can be done. This does not include work done on or by the atmosphere.

Freezing Point—The temperature at which a liquid solidifies. It is the temperature at which the liquid and solid states of a substance are in equilibrium at a given pressure (usually atmospheric). For pure substances it is identical with the melting point of the solid form.

Fusion, Latent Heat of—The amount of heat which must be supplied at the melting point to a unit quantity of a solid in order to transform it into a liquid at the same temperature (usually at standard pressure). The term is also called *heat of fusion*. It is usually expressed in calories per gram, or btu per pound.

Galactagogues—Drugs which increase lacteal secretion (pilocarpine, alcohol).

Gamma Radiation—A form of radiation emitted by certain radioactive substances. This radiation is similar to, but of shorter wave length than, X rays (about 10^{-8} to 10^{-9}cm). Like X rays, it is used in cancer therapy.

Gargarismata (Gargles)—Fluid preparations intended for gargling.

Gas—An aeriform fluid, having neither independent shape nor volume, but tending to expand indefinitely. Without qualification, the word is often popularly used to denote anesthetics, combustibles (gasoline), poisonous war materials, etc., whether liquids or solids at ordinary temperatures.

Gas Constant—A general term for all gases, being the term R in the ideal gas law equation: $PV = nRT$. It is an energy term equal to 0.08205 liter-atmospheres per degree per mole; or, 1.987 calories per degree per mole; or, 8.314×10^7 ergs per degree per mole.

Gay-Lussac's Law of Volumes—The law that in gaseous reactions the volume of the combining gases, if at the same pressure, bear to each other, as well as to the product of the reaction, a simple whole numbered relationship. That is, the volume of the product is either equal to the sum of the volumes of the reactants or is less than, and bears a simple ratio to, this sum.

Germicides—See *parasiticides*.

Gibbs' Phase Rule—An equation advanced by Gibbs which defines the general conditions under which a system of several phases may be in heterogeneous equilibrium. It is: $F = C - P + 2$. Here F is the number of degrees of freedom of a system (i.e., the number of independent variables which must be fixed to completely define the system); C is the smallest number of components in terms of which the chemical composition of each phase may be described by means of a chemical equation; and P is the number of phases present at any stage.

Glucoside—Any one of a class of compounds, either natural or synthetic, which on hydrolysis yields a sugar, usually glucose, and one or more substances. Widely distributed in plants, they are generally white or colorless, crystalline compounds, often bitter, poisonous, and optically active. They are hydrolyzed by enzymes which are often present in the same plant from which they are obtained, by alkalies and by acids. Similar compounds derived from other aldose sugars or ketose sugars are called *aldosides* or *ketosides*, respectively.

Glycerita (Glycerites)—Solutions of a drug in glycerol; usually intended for external use.

Graham's Law of Effusion—The mean (root-mean-square) velocities of the molecules of two gases are inversely proportional to the square roots of their densities or of their molecular weights. If two gases are forced through the same small aperture, under the same pressure difference, then the rates of effusion (the time required for the same weight of each gas to pass through the aperture) are inversely proportional to the mean velocities of the molecules, and therefore directly proportional to the square roots of the molecular weights or of the densities.

Gram-atomic Weight—The mass, in grams, of an element equal numerically to its atomic weight.

Gram-molecular Weight—The mass, in grams, of an element or a compound equal numerically to its molecular weight.

Gravimetric Factor—See *factor*.

Grotthus, Law of—The law that only those rays of light which are absorbed produce chemical change.

Guldberg and Waage's Law—See *mass action law*.

Gum—Any one of a class of colloidal substances exuded by, or extracted from, plants. Gums are either soluble in water, or swell up and become glutinous when moist but harden on drying. The term is often applied to a variety of other plant exudations such as resins, gum resins, etc.

Half Period or Half Life—A term used in chemical kinetics to denote the time (in years, days, seconds, etc.) for half of a given initial quantity of material to decompose.

Hardness (of water)—The hardness or soap destroying power of water is due principally to the calcium and magnesium ions present in the water and is independent of the accompanying acid ions. The *total hardness* is measured in terms of "parts per million" of calcium carbonate (more accurately milligrams of calcium carbonate per liter). It may be divided into two parts, the "temporary" and the "permanent" hardness. The *temporary hardness* is that part of the total hardness which is removed by boiling and corresponds roughly, but not quantitatively, to the calcium and magnesium bicarbonates in the water. The *permanent hardness* is that remaining after boiling and is due principally to the sulfates, chlorides, and nitrates of calcium and magnesium, and to the small amount of carbonates still held in solution. The total hardness also may be divided into the "alkalinity" or "carbonate" hardness and the "non-carbonate" hardness. The *alkalinity* of a natural water represents its content of carbonates, bicarbonates, hydroxides, and occasionally borates, silicates, and phosphates. It is determined by titration with dilute (usually 0.02 N) sulfuric acid to a methyl orange end point. Alkalinity is roughly equivalent to the temporary hardness. The difference between the total hardness and the alkalinity is the *non-carbonate hardness*, which is roughly equivalent to the permanent hardness. When the hardness of a water is greater than its alkalinity, the amount of hardness due to the alkalinity is called *carbonate hardness* and the amount of hardness in excess of this is called *non-carbonate hardness* or *incrustants*; when the hardness of a water is less than its alkalinity then the alkalinity, or part of the alkalinity, will be the *carbonate hardness* and the excess of the alkalinity over the hardness is called *negative non-carbonate hardness*. The *causticity* of a water is that part of its alkalinity due to hydroxides.

Heat Capacity—The *average* or *mean heat capacity* of a system, between any two given temperatures, is the quantity of heat required to raise the temperature of the system from the lower to the higher temperature divided by the difference between the two temperatures. The *true heat capacity*, *c*, at any given temperature is defined by the differential equation:

$c = \left(\frac{q}{dT}\right)$, where q is the infinitesimal amount of heat required to change the temperature by an amount dT, at the given temperature. The heat capacity is usually determined either at constant pressure, or at constant volume. The heat capacity per gram is the *specific heat*. The heat capacity per mole is called the *molar heat capacity* (at constant pressure or volume).

Hehner Number (value)—A number expressing the percentage (i.e., grams per 100 grams) of water-insoluble fatty acids in an oil or fat.

Hematinics—Drugs which increase the amount of combined iron in the blood (iron salts, chalybeate waters).

Hemostatics—Substances which arrest hemorrhage (bleeding). Some authorities consider the word synonymous with styptics, others consider the word hemostatic as limited to those substances which are for internal application (ergot, ceanothus), whereas styptic signifies external use (alum, ferric chloride).

Henry's Law—The law that the solubility of a gas in a liquid is directly proportional to the pressure of the gas above the liquid at a definite temperature.

Hess' Law of Heat Summation—The law that the quantity of heat liberated or absorbed in any chemical transformation is independent of the manner in which the reaction takes place, provided the initial and final states are the same in every case. That is, the total heat of the reaction is the sum of the heats of the various intermediate steps. This is true only if all steps of the process are carried out either at constant volume or at constant pressure.

Heterocyclic—See *cyclic*.

Hexagonal System—One of the groups of crystalline form (including the *rhombohedral* division) in which three equal lateral angles intersect at angles of 60° and with a vertical axis of variable length at right angles, as in the hexagonal prism.

Homocyclic—See *cyclic.*

Honeys—See *mellita.*

Hormone—A chemical secretion from a gland which by passage through the blood stream stimulates the activity of another organ.

Humidity—In hygrometry the *absolute humidity* is the amount of vapor actually present in the air and is expressed either in its expansive force, or in its weight per given volume. *Relative humidity* is the ratio of the quantity of vapor actually present to the greatest amount possible at the given temperature. Complete saturation of the air by a vapor is designated as humidity 100.

Hydragogue—See *diuretic, purgatives.*

Hydration, Heat of—The heat evolved or absorbed when hydration occurs. It is the difference between the heats of solution of the anhydrous and the hydrated forms. It is usually expressed in calories per gram molecule.

Hydrocarbon—A chemical compound containing only hydrogen and carbon.

Hydrogen Ion Concentration—The concentration of hydrogen ions in a solution in gram-ionic weights per liter. See *pH.*

Hydrometer—A floating instrument for determining specific gravities, especially of liquids and solutions. It is usually a hollow glass or metal instrument, weighted at one end so as to float upright. The stem of the instrument is graduated so as to indicate the gravity of the liquid. Many instruments, for use with specific solutions, have arbitrary scales and are usually known by the names of the inventors. See special section on *Hydrometers.*

Hygroscopic—Readily absorbing, becoming coated with, and retaining moisture but not enough to make a liquid. See *deliquescence.*

Hypnotics (Somnifacients; Soporifics)—Drugs which produce sleep leaving undisturbed the normal relationship of the mental faculties to the external world. In a broad sense these may be considered to include narcotics and anesthetics (chloral hydrate, sulfonal). See *cerebral depressants.*

Hypodermic—A subcutaneous (beneath the skin) injection.

Hypoglycemic—Indicating a low or reduced level of blood sugar.

Indicator—A substance, which by some visible change, such as a change of color, indicates the condition of a solution as to the presence of free acid, alkali, or other substance. Indicators are employed in volumetric (titrimetric) analysis to indicate the end points of reactions.

Infusa (Infusions)—Aqueous solutions of vegetable drugs prepared by adding boiling water to the drug in a closely-covered container and allowing to stand for half an hour, then straining and expressing. They are usually prepared in a 5% concentration.

Inorganic—Designating, or pertaining to, the branch of chemistry which deals with substances of earthy or mineral matter. It includes the treatment of all substances with the exception of those classed as *organic* (q.v.)

Intumescence—A swelling or bubbling caused by heat.

Iodine Number (value)—A number expressing the percentage (i.e., grams per 100 grams) of iodine absorbed by a substance. It is a measure of the proportion of unsaturated linkages present and is usually determined in the analysis of oils and fats.

DEFINITIONS OF TERMS

Ion—In electrolytic phenomenon, a particle bearing an electric charge which is formed when a neutral atom, or group of atoms, loses or gains one or more electrons. Loss of electrons results in positive charges producing a *cation*; gain of electrons results in the formation of an *anion* with negative charges. The valence of an ion is equal to the number of charges borne by it. In some crystals, such as NaCl, ions are supposed to form the units of the space lattice. Solution of such a crystal in an ionizing solvent such as water merely separates the ions. In other cases, ionization probably does not occur until the substance is dissolved in the solvent. Gaseous ions may be formed by the exposure of a gas to X rays, fast moving electrons, alpha or beta particles, etc.

Ionic Radius—See *atomic radius*.

Ionization Constant—The equilibrium constant for the reversible dissociation of a weak electrolyte. For example, if the weak acid HA dissociates into H^+ and A^-, then

$$K_i = \frac{(C_{H^+})\,(C_{A^-})}{(C_{HA})}$$

where K_i is the ionization constant if the concentrations of ions is expressed in gram-ionic weights per liter and the concentration of the unionized molecules, HA, is expressed in gram-moles per liter. See *equilibrium constant*.

Ionization, Heat of—The amount of heat evolved or absorbed when a definite amount of a solute ionizes. It is usually expressed in calories per gram molecule.

Ionization Theory—See *electrolytic dissociation theory*.

Irritants (Counter-irritants)—Substances which when applied to the skin cause vascular excitement. They are called *counter-irritants* if they are used to promote reflex action on remote parts. Irritants are usually classified as (*a*) rubifacients, (*b*) vesicants, (*c*) pustulants, and (*d*) escharotics. See these latter terms.

Isobar(e)—One of two atoms having practically identical atomic weights but different atomic numbers and, therefore, different chemical properties; e.g., calcium-40 (with 20 protons and 20 neutrons) and argon-40 (with 18 protons and 22 neutrons).

Isocyclic—See *cyclic*.

Isometric System—One of the groups of crystalline form in which the three axes of a crystal are at right angles, as in the cube, regular octahedron, etc.

Isotopes—Forms of an element that differ from one another in the mass of their atoms and in the properties dependent on that mass. Having the same atomic number and the same number of valence electrons, isotopes occupy the same position in the periodic table and have identical chemical properties. They are distinguishable only by the small differences in atomic weight or by radioactive transformations.

Izod—The units of impact strength as obtained on an Izod impact testing machine.

Juices—See *succi*.

K-electron—An electron from the innermost shell of a complicated electron.

Ketone—Any one of a class of compounds having two hydrogen atoms less than a secondary alcohol, and characterized by the carbonyl group (:CO) united to two hydrocarbon radicals.

Kinetic Energy—Energy, or the capacity for performing work, which a body or system possesses by virtue of its motion.

Kinetic Theory of Gases—The theory that all gases are made up of discrete spherical entities, molecules, which are in constant motion. It is assumed that the molecules move in straight lines with high average velocity, continually encountering one another, and hence changing their individual velocities and directions by perfectly elastic collisions. The distances between the molecules are large compared with their size. Temperature is due to the average kinetic energy of these molecules, while pressure is caused by the bombardment of the walls of the container by the molecules.

Konseals—See *cachets*.

Latent Heat of Vaporization (**or of fusion**)—See *heat of vaporization* (*or of fusion*).

Lattice (**or space-lattice**)—The geometrical arrangement of the atoms in a crystal as disclosed by X ray analysis. It is the sum total of the points of intersection of any three sets of equidistant parallel planes.

Laxatives (**Aperients**)—Purgatives which excite moderate peristalsis giving soft movements without irritation (magnesia). See *purgatives*.

Le Chatelier-Braun Principle (**or law**)—When a system, which is in equilibrium, is subjected to a stress, the system tends to adjust itself in such a way as to partly relieve the stress. The stress may be an increase or decrease in temperature, in pressure, in the concentration of one of the reactants or one of the products, etc. For example, in the equilibrium: $2NH_3 \leftrightarrows N_2 + 3H_2$, if the pressure is increased the equilibrium will be shifted toward the left because two ammonia molecules occupy less space than three molecules of hydrogen plus one molecule of nitrogen; the shifting of the equilibrium in this direction will tend to counteract the pressure stress in this case.

Levo (**rotatory**)—A counterclockwise or left-handed turning motion usually applied to the turning of the plane of polarized light.

Lignin—A plant material which, in conjunction with cellulose, forms the cell walls and the cementing material between them in woods and many plants. It can be isolated by means of aqueous 72% sulfuric acid under properly controlled conditions of temperature and time.

Linimenta (**Liniments**)—Solutions or mixtures for external application usually by rubbing. They usually contain fixed or volatile oils.

Liquefaction—The act or process of transforming any substance into a liquid, especially the conversion of a solid into a liquid by heat, or of a gas into a liquid by cooling or pressure.

Liquefaction, Heat of—This is also called heat of fusion or of condensation. See *fusion, heat of*.

Liquid—A form of fluid which is characterized by free movement of the constituent molecules among themselves but (differing in this respect from gases) without the tendency to separate from one another. Liquids differ from solids in yielding easily to pressure and the ease with which their particles move upon one another, thus causing them to adopt themselves to the shape of the containing vessel. See also *fluid*.

Liquid Crystal—A liquid having certain physical properties characteristic of crystals, such as double refraction and interference colors. It is an anisotropic liquid.

Liquores (**Liquors**)—Aqueous solutions of non-volatile substances, usually inorganic compounds.

Lithotriptics—Drugs supposedly dissolving or causing the excretion of urinary and biliary concretions (urates: alkaline salts; calcium oxalate: acids, carbonated waters; phosphatic deposits: ammonium benzoate).

Loss of Head (**or friction loss**)—The pressure lost in a pipe line due to the velocity of the liquid in the pipe line, the condition of the pipe wall, and the alignment of the pipe. It is usually expressed as loss of head in feet per thousand feet of pipe.

Lozenges—See *trochisci.*

Luminescence—Any emission of light occurring at low temperatures and not caused by incandescence. It may be produced in various ways, such as, by chemical action (chemiluminescence); by electric action (electroluminescence); by crystallization (crystalloluminescence); by friction (triboluminescence); by moderate and sudden heating of substances previously exposed to light or cathode rays (thermoluminescence); by exposure to light (photoluminescence; called *fluorescence* if observed during excitation, and *phosphorescence* if observed after excitation); by autoluminescence of radioactive substances (without exposure to light or external excitation).

Magmae—Suspensions of finely divided insoluble substances in water usually produced by chemical reaction. The suspensions are fairly stable and are often known as *milks.*

Magnetic—See *diamagnetic* and *paramagnetic.*

Malleable—Possessing the property of being shaped or extended by beating with a hammer or by pressure of rollers.

Mariotte's Law—See *Boyle's law.*

Mass Action, Law of—The law, established by Guldberg and Waage, that the rate of a chemical reaction is proportional at any instant to the active masses of the reacting substances. By "active mass" is meant the molecular concentration of the substance available for chemical reactions; i.e., the number of moles per unit volume. For dissolved substances the active mass may sometimes be expressed in terms of osmotic pressure, and with gases in terms of the partial pressures of the reactants.

Mass Number—The mass of the individual atoms of an isotope compared with the value of 16.0000 as the mass of the atom of the most abundant isotope of oxygen. It is the whole number nearest the isotopic weight.

Massae (Masses)—Pill masses preserved in bulk, to be used when required.

Maumene Number (value)—The maximum rise in temperature, expressed in degrees Centigrade, obtained by slowly introducing 10 cc of concentrated sulfuric acid into 50 g of oil.

Mechanical Equivalent of Heat—The amount of work which is equivalent to one calorie of heat. It is equal to 4.1855 ±0.0004 absolute joules per gram-calorie (15°).

Medicated Pencils—See *stili medicamentorum.*

Mellita (Honeys)—Mixtures of medicinal substances with clarified honey.

Melting Point—The normal melting point of a solid is the temperature at which the solid and the liquid phases of the material are in equilibrium, under a pressure of one atmosphere.

Metal—In a broad sense (including alloys, q.v.), a metal is any one of a class of substances which typically show metallic luster, are good conductors of heat and electricity, are opaque, are malleable and ductile, and may be fused. In a narrow sense, the term refers to metallic elements.

Metal Shrinkage (or pattern maker's allowance)—The allowance which must be taken into account in constructing a pattern because of the diminution in volume (shrinkage) which occurs when metal passes from the liquid to the solid form.

Metalloid—See *metal* and *nonmetal.*

Methoxyl Number (value)—The amount of methoxyl, a chemical radical CH_3O, which occurs as a substituent group in some substances and which can be determined as methyl iodide by treating the substances with hydriodic acid.

Mho—See *conductance.*

Mineral—Any element or compound occurring naturally in the mineral kingdom as distinguished from occurrence in either the vegetable or animal kingdoms.

Mineral Oil—Any oil of mineral origin as distinguished from plant and animal oils. The mineral oils include such materials as petroleum, shale oil, or oils obtained from them by distillation. They are essentially mixtures of hydrocarbons.

Misturae (Mixtures)—Liquid preparations of insoluble, suspended, active substances, or solutions containing more than one liquid of medicinal activity.

Modulus (coefficient) of Elasticity—The modulus of elasticity is the ratio of the internal stress to the strain giving rise to it. For any special type of deformation it is a number characteristic of each substance. Special coefficients are used for deformations involving changes both in volume and in shape. Young's modulus is most often used and applies to the stretching of a wire or rod, or to the compression of a pillar; it is the ratio of F/A to l/L, where F is the increase in the force acting over the cross section whose area is A, corresponding to a change in length l of a wire or rod whose original length was L.

Molality—The strength of a solution expressed in gram moles of solute per 1000 grams of solvent; e.g., a solution containing 2 gram-moles of sodium chloride per 1000 grams of water is 2 molal.

Molarity—The strength of a solution expressed in gram moles of solute per liter of solution.

Mole (or mol)—The weight of a substance equal numerically to its molecular weight. A gram-mole is the weight in grams equal to the molecular weight; a pound-mole is the weight in pounds equal to the molecular weight.

Mole (or mol) Fraction—The quotient obtained by dividing the number of moles of any one substance in a system by the total number of moles of all substances in the system.

Molecular Depression (or lowering)—See *depression (molecular), coefficient of.*

Molecular Elevation—The increase of the boiling point in degrees Centigrade produced by the solution of one gram molecular weight of a substance in 1000 grams of a specified solvent.

Molecular Volume—The quotient obtained by dividing the molecular weight of a substance by its density in grams per cubic centimeter at the desired temperature is the molecular volume in cubic centimeters per gram-mole.

Molecular Weight—The sum of the atomic weights of all the constituent atoms in the molecule of an element or a compound.

Molecule—When atoms combine they form a molecule. In the case of an element or a compound, a molecule is the smallest unit which chemically still retains the properties of the substance in mass.

Monoclinic System—One of the groups of crystalline form in which there are three unequal axes, with one oblique intersection, as in the oblique rhombic prism.

DEFINITIONS OF TERMS

Motor Depressants (Depresso-motors)—Drugs which lower the functional activity of the motor apparatus and spinal cord (amyl nitrite, gelsemium).

Motor Excitants (Excito-motors; Spinants)—Drugs which increase the functional activity of the motor apparatus and spinal cord (nux-vomica, picrotoxin).

Mucilagines (Mucilages)—Saturated aqueous liquids, either adhesive or jelly-like, prepared from gums or starch.

Mydriatics—Drugs which dilate the pupil of the eye (atropine).

Myotics—Drugs which contract the pupil of the eye (pilocarpine).

Narcotics—Drugs which first excite and stimulate all body functions, then cause profound sleep, stupor, coma, insensibility and which may cause death by paralyzing the medulla centers governing respiration and other vital functions (opium, cannabis). See *cerebral depressants.*

Nebulae (Sprays)—Aqueous or oily (light liquid petrolatum) solutions to be used in an atomizer for nares and throat.

Neutralization, Heat of—The heat evolved in dilute solution by neutralization of a gram equivalent of an acid with a base at some specified temperature. For strong acids and bases, the heats of neutralization are nearly constant, the average being 13,800 gram calories per gram-mole at 20°C.

Neutron—An uncharged particle of about the same mass as a hydrogen atom (which is 1 on the chemist's scale) and about 1800 times heavier than the electron. Neutrons and protons make up the nucleus of the atom.

Non-carbonate Hardness—See *hardness.*

Nonmetal—An element which does not possess the properties of a metal (q.v.). Unlike the metals, the nonmetals form stable compounds with hydrogen and do not form basic oxides or hydroxides. Certain elements, such as arsenic and antimony, are classed as *metalloids* because they share certain properties of both the metals and the nonmetals.

Normal Solution—A solution of such a concentration that it contains one gram-equivalent of a substance per liter of solution.

Octane Number—This is a number which is a measure of the antiknock value, or better of the detonation characteristic, of a motor fuel. It represents the percentage by volume of "iso-octane" (2,2,4-trimethylpentane) in a mixture of iso-octane and normal heptane which gives the same amount of detonation as the fuel to be rated *when tested under the same conditions.* Cf. ASTM Standards of Petroleum Products and Lubricants, No. D-357-34T.

Ohm—The international ohm is the resistance offered at 0°C. by a column of mercury 106.300 centimeters in length, of constant cross-sectional area, and weighing 14.4521 grams. Such a column has a cross-sectional area of approximately one square millimeter.

Oil—Any one of a large class of substances which are liquid at room temperature, soluble in ether and in alcohol, insoluble in water, and usually lighter than water. They are classified in various ways; from their origin, as *mineral*, *vegetable*, and *animal*; according to their behavior when heated as *fatty* or *fixed*, and *essential* or *volatile.* The fixed oils are further subclassified as *drying*, *semi-drying*, and *non-drying*, according to the degree with which they absorb oxygen thus becoming hard and resinous when exposed in a thin film to the air. See also *fat*, and *wax.*

Ointments—See *unguenta.*

DEFINITIONS OF TERMS

Olea (Oils)—Fixed or volatile oils, the former obtained by expression and the latter by distillation.

Oleata (Oleates)—Solutions of medicinals in oleic acid, usually intended for external application.

Olefin—Any open-chain hydrocarbon containing one double bond. Olefins are members of the ethylene series and have the general formula C_nH_{2n}. Somewhat similar hydrocarbons, but having two, three, or more, double bonds, are called diolefins or dienes (C_nH_{2n-2}), triolefins or trienes (C_nH_{2n-4}), etc.

Oleoresin—See *essential oil*.

Oleoresinae (Oleoresins)—Natural solutions of resins in volatile oils, occurring as such in plants.

Optical Activity—Possessing the property of rotating the plane of polarized light. See *polarization*.

Organic—Designating, or pertaining to, the branch of chemistry which treats of the hydrocarbons and their derivatives (or, which is almost the same, the chemistry of the carbon compounds), whether of natural or of synthetic origin.

Orthobaric Density—The density of a liquid substance and the density of the vapor of the substance in equilibrium with the liquid at a given temperature and pressure. As the temperature rises, the density of the liquid decreases, while the density of the vapor increases, until they become equal at the critical temperature and critical pressure.

Orthobaric Volume—The reciprocal of the orthobaric density. See *orthobaric density*.

Orthorhombic System—One of the groups of crystalline form in which there are three unequal axes at right angles, as in the right rhombic prism.

Osmotic Pressure—The unbalanced pressure which gives rise to the phenomena of diffusion and of osmosis; as when a solution is separated from a pure solvent or from another solution of different concentration by a semipermeable membrane, molecules of the solvent will diffuse through the membrane from the more dilute to the more concentrated solution. The hydrostatic pressure required to stop this diffusion is the osmotic pressure. Closely related to gas pressure, it is proportional to the absolute temperature and also to the molecular concentration, and apparently it is equal to what the pressure of the dissolved substance would be if it were a gas at the same temperature and had a volume equal to that of the pure solvent.

Oxidation—In a broad sense oxidation is the increase in positive valence or decrease in negative valence of any element in a substance. On the basis of the electron theory, oxidation is a process in which an element loses electrons. In a narrow sense, oxidation means the chemical addition of oxygen to a substance.

Oxidation, Heat of—The heat evolved when a substance is oxidized. It is usually expressed in calories per gram-molecule.

Oxidizing Agent—A chemical reagent which causes oxidation of other substances and is thereby reduced. See *oxidation* and *reduction*.

Oxytocics—See *ecbolics*.

P (proton) Number—A term used, instead of isotopic weight, to designate the whole-numbered atomic weight or the number of hydrogen nuclei.

Packing Fraction—The packing fraction of any atomic species is equal to $(A - W)/W$, where A is the exact atomic weight of the species and W is the integer nearest to A. Values 10,000 times larger than the values given in the preceding definition are also called the packing fraction and commonly employed.

DEFINITIONS OF TERMS

Parachor—A constant dependent on the constitution of a compound and related to its molecular volume. Being an additive property, it finds application in organic chemistry for checking structure of compounds. The parachor (P) is equal to $(M \times \gamma^{\frac{1}{4}})/(D - d)$, where M is the molecular weight, γ the surface tension, D the density of the liquid, and d the density of the vapor at the same temperature.

Paramagnetic—Possessing, or pertaining to, the magnetic properties of bodies whose permeability is greater than unity (i.e., greater than that of a vacuum). Paramagnetic substances are attracted by a magnet if the surrounding medium is air. See *diamagnetic*.

Parasiticides (Germicides)—Substances which kill animal and vegetable parasites (mercuric chloride, phenol).

Partial Pressure, Law of—See *Dalton's law*.

Partition Coefficient—See *distribution law*.

Pastilles—See *trochisci*.

Pearl—A term used in pharmacy for a glass capsule containing some volatile liquid for inhalation, as amyl nitrite. For use, the capsule is crushed in a handkerchief and the vapors inhaled therefrom.

Pencils—See *bougies*.

Pentosan—Any one of a group of anhydropentose residues which generally occur as polysaccharides in plant materials and which can be hydrolyzed by acid to pentose sugars.

Perfect Gas—A perfect or ideal gas is one which fulfills two conditions: (1) the equation $PV = nRT$ is obeyed exactly when the temperature T, the pressure P, and the volume V are varied (n is the number of moles of gas, and R is the gas constant, q.v.); and, (2) its internal energy E is a function of the temperature alone, and does not change with a change in volume of the gas at a constant temperature.

Periodic Law—The law that the chemical and physical properties of the elements are periodic functions of their atomic numbers. By periodic function is meant that the properties repeat at certain intervals. See *periodic table*.

Periodic Table—A table in which the elements are arranged in order of increasing atomic number. Elements of similar properties are placed one under the other, yielding families or groups of elements of which there are eight. Within each group there is a gradation of chemical and physical properties, but in general a similarity of chemical behavior. From group to group, however, there is a progressive shift of chemical behavior from one end of the table to the other.

pH—The exact significance of pH is still in dispute (cf. *J. Am. Chem. Soc.* 60, *1094* (*1938*)). It is commonly considered to be the negative logarithm (to the base 10) of the hydrogen ion concentration of a solution. Others interpret it as the negative logarithm of the "activity" of the hydrogen ions in a solution. Exactly, neither is correct but the experimental determination of pH continues to offer valuable information as to the immediate acidity, as contrasted to the total acidity, (which may be titrated), of a solution. The experimental meaning of pH is given by the following equation: pH = (emf of H_2-calomel cell − emf of calomel half-cell at temp. T)/$0.000198322T$.

Phenol—Any one of a series of aromatic hydroxyl derivatives which has the OH group directly attached to the ring and of which phenol (carbolic acid) is the type. Specifically the term phenol is applied to carbolic acid, C_6H_5OH.

Phenol Coefficient—The ratio of the dilution of a disinfectant required to kill the Hopkins strain of typhoid bacillus under carefully controlled conditions in a specified time compared with the dilution of phenol required for the same organism under the same conditions. Usually 2.5 and 15 minute time limits are used and the coefficient is calculated from the average of these two. For example, if 1:80 and 1:110 dilutions of phenol kill in 2.5 and 15 minutes, respectively, and the corresponding dilutions of a disinfectant under test are 1:375 and 1:650, then the phenol coefficient of the disinfectant is $\frac{1}{2}[(375/80) + (650/110)]$ or 5.30.

Photochemistry—The branch of chemistry concerned with the effect of radiant energy, especially light, in causing chemical changes. *First law* (*Grotthuss-Draper law*)—Only that light which is absorbed can act chemically. *Bunsen-Roscoe law*—The amount of material transformed in a photochemical change is proportional to the product of the light intensity and the time of illumination. *Second law* (*Einstein photochemical equivalence law*)—Each absorbed quantum should cause one light-absorbing molecule to react. *First law of fluorescence* (*Stoke's emission law*)—The energy emitted as light during fluorescence is less than the energy absorbed as light for excitation; i.e., the absorbed wave lengths are shorter than the emitted wave lengths. *Second law of fluorescence* (*luminescence equivalence law*)—The absorption of radiation by a luminescent system is a quantum process involving one quantum per absorbing particle (e.g., atom or "center"), the yield being unity in the ideal case.

Photoluminescence—See *luminescence.*

Photon—An amount of radiant energy equal to the quantum, having a momentum equal to the energy divided by the velocity of light, occupying a small volume, and moving as a whole in one direction with the velocity of light.

Pilulae (Pills)—Solid bodies, usually spherical or oval, containing medicinal substances, and intended to be swallowed whole. They may be uncoated or coated with various substances (gelatin, sucrose, cacao, tolu, etc.) to mask unpleasant taste. If it is desired that the pill pass unchanged through the stomach and be dissolved in the intestine, it is coated with keratin or salol. Such a coating is known as an *enteric* coating.

Pitot Tube—A device used to measure the velocity of fluid flow. It consists of a tube with a short right-angled bend, placed vertically in the moving body of fluid with the bent part lowermost and its opening normal to the direction of flow.

Planck's Constant—The term h in the fundamental equation of the quantum theory: $\Delta E = h\nu$, where ΔE is the difference in energy of an electron in two different orbits of an atom, ν the frequency of the radiation emitted by the atom when the electron jumps from one orbit to the other in which its energy is less, and h a universal constant with dimensions the same as those of action. It is equal to $(6.624 \pm 0.002) \times 10^{-27}$ erg-seconds.

Plasters—See *emplastra.*

Plastic—A substance capable of, or the property of, being deformed continuously and permanently in any direction without rupture, under a stress greater than the yield value.

Polar—Designating, or characterized by, a union of atoms in which the bonds are electrostatic attractions between oppositely charged particles (ions). Thus, in potassium chloride (KCl), the potassium atom has lost an electron to the chlorine thereby becoming positively charged (K^+), while the chlorine has thereby become negatively charged (Cl^-). The term polar is used also to designate molecules which possess a permanent *electric moment,* or *dipole moment,* μ.

Polarization (of light)—The act or process of affecting light in such a manner that the vibrations assume a definite form. In nonpolarized light the vibrations are in all directions perpendicular to the ray, whereas in polarized light the paths of the vibrations (all in a plane perpendicular to the ray) may be straight lines, *plane polarized*; or circles, *circularly polarized*; or ellipses, *elliptically polarized*.

Potential Difference (between two points)—This is the quotient obtained when the work done in transporting any quantity of electricity from one of the points to the other is divided by that quantity of electricity. It is commonly measured in volts and often abbreviated *p. d.*

Potential Energy—Energy which a system possesses by virtue of its position or configuration.

Potentiometer—An apparatus for the dividing of a given potential into any fractional part. An instrument for measuring or comparing electromotive forces, in which the impressed potential is opposed by a known potential until there is no current flow.

Poultices—See *cataplasmata*.

Primary Standard—A term in analytical chemistry designating a substance of constant composition and of sufficient purity to be used for standardizing volumetric (titrimetric) solutions, or which may be used for the preparation of volumetric (titrimetric) solutions, and when made up to an exact volume the solution requires no further standardization.

Progestational—Favoring female characteristics, especially the receptivity to pregnancy; the progestational state is a component of the normal female endocrinological cycle.

Proliferation—Growth on the cell level.

Proof Spirit—In the United States proof spirit is an alcoholic liquor of specific gravity $0.93426\frac{60°}{60°}$ F. Such a solution contains one-half its volume of an alcohol with the specific gravity $0.7939^{60°}$ F. which represents 42.49% of absolute alcohol by weight, or 50 parts of alcohol to 53.71 parts of water by volume, the apparent excess of water being due to a contraction in volume on mixing the alcohol with the water. Liquors containing less alcohol than proof spirit are termed *under proof*; thus, 10% or 10° under proof is a spirit which at 60°F. contains 90 volumes of proof spirit and 10 of water. Similarly a 25° *overproof* (or *above proof*) indicates a spirit of such a concentration that 100 volumes at 60°F. must be diluted with water to 125 volumes to obtain proof spirit. Although the laws in the United States are worded in terms of proof spirit, it is more customary to express the concentration of alcohol in % by volume.

Prophylactics—Substances administered to prevent disease (diphtheria antitoxin).

Protectives—Substances used as mechanical coverings to protect various injured parts from air, water, and friction (collodion).

Protein—Any one of a class of naturally occurring compounds containing carbon, hydrogen, oxygen, nitrogen, often sulfur, phosphorus, occasionally iron and a few other elements. They are essentially very complex combinations of amino acids and are constituents of all living cells both animal and vegetable. They combine with both acids and bases, and are usually amorphous and colloidal. Since most proteins contain about 16% nitrogen, it is customary in analytical chemistry to multiply the total nitrogen by the factor 6.25 in computing the per cent of protein in a sample. Proteins are an essential constituent of the diet of the animal organism.

Proton—A positively charged particle of about the same mass as a hydrogen atom (which is 1 on the chemist's scale) and about 1800 times heavier than the electron. The electrical charge of the proton is equal and opposite to the charge of the electron. Protons and neutrons (q.v.) make up the nucleus of the atom.

Proton Number—See *P number*.

Pulmonary Sedatives—Drugs which lessen the irritability of the respiratory nerves or center, thereby diminishing cough and dyspnea. They may depress the center, remove irritating substances from the passages, lessen local congestion, or lower excitability of the vagus end-organs and afferent filaments of the respiratory tract (morphine, codeine, hydrogen cyanide).

Pulveres (Powders)—Finely powdered drugs or mixtures of the same, frequently consisting in part of some suitable diluent.

Purgatives (Cathartics)—Drugs which increase or hasten intestinal evacuations. They are usually classified as follows: (*a*) *laxatives*; (*b*) *simple purgatives*, which cause active peristalsis and stimulate secretion of the intestinal glands, giving one or more copious, semifluid movements accompanied by some irritation and griping (aloe, castor oil); (*c*) *saline purgatives*, which stimulate intestinal glands, increase peristalsis and osmosis, causing watery stools (magnesium sulfate); (*d*) *drastic purgatives*, which cause violent peristalsis, watery stools, griping and irritation (jalap, colocynth); (*e*) *hydragogue cathartics*, which remove much water from the vessels causing watery stools (croton oil, elaterinum); (*f*) *cholagogue purgatives*, which stimulate the flow of bile causing free purgation of green colored (bilious), liquid stools (aloe, mercurials).

Pustulants—Drugs which cause blisters. See *irritants*.

Quantum—The "bundle" of radiant energy which, according to the quantum theory, is emitted as a unit by a "resonator" vibrating with a frequency ν. The energy of such a bundle (i.e., of a quantum) is equal to $h\nu$, where h is Planck's constant (q.v.).

Radical—A group of atoms remaining unchanged during a series of reactions and which may be regarded as playing the part of a single atom. See special *table of radicals*.

Radioactive Constant—The constant λ in the equation for the rate of change of radioactive material: $E = E_0 e^{-\lambda t}$, in which E_0 is the initial quantity of radioactive material undergoing change, E the quantity remaining unchanged after the lapse of any interval of time t, e the base of the Naperian logarithmic system, and λ the radioactive (decay) constant, by which is meant the fraction of the total which changes in unit of time.

Radioactivity—The property possessed by certain elements and their compounds of spontaneously emitting radiation by the disintegration of the nuclei of the atoms. The radiation consists of alpha, beta, or gamma rays, neutrons, protons, deuterons, and nuclei of hydrogen-3. Alpha rays are emitted when an atom loses a helium nucleus and thereby changes to an atom with an atomic number two units lower. Beta rays are the result of the loss of an electron from the nucleus whereby an atom is formed with an atomic number one unit higher. These changes are sometimes accompanied by the emission of gamma rays which are vibrations of high frequency. A series of such changes (disintegration series) continues until a stable product is formed.

Raman Effect—The changing of the wave length of some of the scattered rays when a beam of light is passed through a pure liquid or vapor. It is useful in the determination of constitution.

Raoult's Law—The lowering of the vapor pressure of a solvent due to the presence of dissolved solute, divided by the vapor pressure of the pure solvent, is equal to the mole fraction of the solute. The law may be used for the calculation of the vapor pressure of solutions containing non-volatile solutes, or the partial pressure of the solvent if the solute is volatile. This law plays the same role with solutions as do the perfect gas laws in the case of gases; i.e., it expresses the conditions which exist in an ideal solution. It does not hold for electrolytes because of dissociation.

Rare Earth—Any one of a series of very similar oxides of metals with consecutive atomic numbers from 57 through 71 (with the exception of cerium, No. 58, which is sometimes considered not to be a member of the series) and a characteristic valence of three. They occur in widely distributed but relatively scarce minerals.

Rayon—A generic name of filaments made from various solutions of modified cellulose by pressing or drawing the cellulose through an orifice and solidifying it in the form of a filament or filaments by means of some precipitating medium; also a fabric woven from such filaments.

Reacting Weight—See *equivalent weight*.

Reaction, Heat of—The heat evolved or absorbed during a chemical reaction in which the final state of the system is brought to the same temperature as that of the initial state. The numerical values for heats of reaction usually accompany a chemical equation expressing the reaction and are for the number of gram-moles (usually) involved in the equation as written.

Reaction (or van't Hoff) Isochore—The equation which represents the variation of the equilibrium constant with temperature: $d \ln K_c / dT = Q/RT^2$, where $\ln K_c$ is the logarithm to the base e of the equilibrium constant obtained when the "active masses" of the products and reactants are measured in moles per liter at the absolute temperature T; R is the gas constant expressed in calories per degree per mole (1.987); and Q is the heat of the reaction at constant volume expressed in calories.

Reducing Agent—A chemical reagent which brings about the reduction of some other substance and is itself simultaneously oxidized. See *reduction* and *oxidation*.

Reduction—In a narrow sense reduction means the decrease in the oxygen content, or the increase in the hydrogen content, of a substance. In a broad sense, reduction is the decrease in positive valence or the increase in negative valence of an element. See also *oxidation*.

Reflection, Law of—The law that light, falling upon a plane surface, is so reflected that the angle of incidence is equal to the angle of reflection, and that the incident ray, the reflected ray, and the normal all lie in the same plane.

Refraction—The deflection from a straight path suffered by a ray of light in passing obliquely from one medium into another in which its velocity is changed. See also *refraction, index of*.

Refraction, Index of—A constant, characteristic of each substance, which represents the ratio of the velocity of light in a vacuum to that in the substance. It is the ratio of the sine of the angle of incidence to the sine of the angle of refraction when light passes obliquely into a medium. It varies with the temperature, pressure, wave length of light, and with the media. *Absolute index* is the ratio of the velocity of light in a vacuum to that in a given medium. Since the index of refraction of air is so near unity, it is commonly used as a more convenient standard than a vacuum. *Relative Index* is the ratio of the velocity of light in two different media. See also special section *index of refraction*.

Refractive Index—See *refraction, index of*.

Refrigerants—Drugs which allay thirst, giving the sensation of coolness (diluted vegetable and mineral acids).

Reichert-Meissl Number—The number of milliliters of decinormal alkali required for neutralization of the volatile water-soluble fatty acids obtained from 5.5 grams of a fat or oil by a certain method of saponification and distillation. The number is a measure of the amount of low molecular weight fatty acids present in the sample.

Resin—A solid or semi-solid, amorphous (noncrystalline) organic substance which often softens and melts but not at any definite temperature. The natural resins are chiefly of plant origin, usually yellowish to brown in color, soluble in alcohol, ether, etc., but not in water. They are chiefly excretion products and exude from plants alone or as mixtures with essential oils, with gums, etc. Some are found as fossils after decay of the plant. The term is also applied to synthetic products of various types of chemical combinations which possess many of the same properties as the natural resins. They are all nonconductors or electricity and many are transparent or translucent.

Resistivity—The electrical resistance offered to the passage of a steady current. The specific resistance of a material is numerically equal to the resistance of a cylinder one centimeter in length and one square centimeter in cross-section.

Resolvents—See *alteratives*.

Respiratory Sedatives (Depressants)—Drugs which lower the activity of the respiratory center resulting in shallow and slow respirations (aconite, physostigma).

Respiratory Stimulants — Drugs which stimulate the respiratory center resulting in deeper and quicker breathing (strychnine, digitalis).

Restoratives—Substances which give strength and vitality. Restoratives are classified into (*a*) foods; (*b*) digestive ferments, (*c*) digestive acids, (*d*) fats, (*e*) hematinics, and (*f*) tonics. See these latter terms.

Rhombohedral System—A division of the hexagonal system (q.v.) in which the form is referred to three equal oblique axes parallel to the faces of the fundamental rhombohedron.

Roentgen Ray—See *X ray*.

Rubefacients—Substances which produce temporary redness and skin congestion. If left too long the action may become vesicant or even escharotic (mustard).

Salt—Any one of a class of similar compounds formed when the acid hydrogen of an acid is partly or wholly replaced by a metal or a metallic radical. They are formed by the action of acids on metals (with the elimination of hydrogen), and on oxides and hydroxides (with the elimination of water), by the direct action of an acid with ammonia or an ammonia derivative, and in other ways. Specifically, the term salt is applied to sodium chloride, NaCl.

Saponification—Process, act, or result of hydrolysis of an ester by an inorganic base, the product being a salt and an alcohol. When the ester being saponified is an animal or vegetable fat, the products are soap and glycerol. By extension, the hydrolysis of compounds other than esters.

Saponification Number—In the analysis of fats, oils, etc., the number of milligrams of potassium hydroxide required for the complete saponification of one gram of substance.

Saturated Solution—A solution which contains at any constant temperature as much dissolved substance as it can possibly hold in presence of solid solute.

Sectile—A mineralogical term applied to minerals which are capable of being severed by the knife with a smooth cut, but yet pulverizable, as distinguished from brittle or malleable.

Sedatives—In general, drugs which allay nervous irritation and irritability. Synonymous with cerebral depressants. See *pulmonary sedatives.*

Semi-alteratives (Alkalies)—Drugs which stimulate acid secretions and check alkaline secretions (carbonates).

Shrinkage—See *metal shrinkage.*

Sialagogues—Substances which promote the secretion and flow of saliva and buccal mucous (capsicum, physostigma).

Single Electrode Potential—See *electrode potential.*

Soap—The sodium or potassium salt of a higher molecular weight fatty acid; by extension, any salt of the fatty acids and commonly called a *metallic soap* when containing some metal other than sodium or potassium.

Solid—A part of space bounded on all sides and which does not perceptibly flow. Between typical solids and liquids are many gradations designated by terms such as *viscous solid*, *semi-solid*, *viscous liquid*, etc.

Solidification Point—The temperature at which a liquid changes into a solid. It may be identical with, or lower than, the melting point.

Solubility—The quantity of solute present in a given amount of the saturated solution, at a certain temperature, is called the solubility of the solute. It is expressed in any of the units used to express concentration of solution, such as grams of solute per 100 milliliters of solvent, grams solute per 100 grams of solution, moles of solute per liter of solution or per 1000 grams of solvent, etc.

Solubility Product—The maximum product of the ionic concentrations of a difficultly soluble salt which can exist in equilibrium with the solid phase at a definite temperature, each concentration being raised to its proper power. In general, if $A \rightleftarrows bB \times cC$ represents the equilibrium between the molecule A and its ions B and C in a saturated solution, then the solubility product K_{sp} is given by the equation: $K_{sp} = [B]^b \times [C]^c$, where $[B]$ and $[C]$ are expressed in gram-ionic weights per liter.

Solute—When a solid is dissolved in a liquid, the solid is termed the *solute*, the liquid the *solvent*. When one liquid is dissolved in a second liquid, the liquid present in the smaller amount is usually called the solute. In this case, the designation is arbitrary, particularly when the liquids are completely miscible.

Solution—A homogeneous mixture formed by the process in which a substance, whether solid, liquid, or gaseous, is mixed with a liquid (or by extension, with a solid, or gas) called the solvent. The term is usually associated with liquids but may include solids, as in alloys, or gaseous mixtures.

Solution, Heat of—The heat evolved or absorbed when a substance (solute) dissolves in a solvent. The *integral heat of solution* is the heat absorbed when one mole of solute is dissolved in a sufficient quantity of solvent to produce the specified concentration. Most values of heats of solutions are integral heats of solution of the solute in a large amount or specified amount of solution. The *differential heat of solution* is the amount of heat absorbed when one mole of solute is dissolved in such a large volume of solution of definite concentration that the concentration of the solution is not apparently altered. The differential heat of solution is the rate of change of the integral heat of solution per mole of solute at any specified concentration.

Solvent—See *solute.*

Somnificants—See *hypnotics.*

Soporifics—See *hypnotics.*

DEFINITIONS OF TERMS

Species (Teas)—Mixtures of cut or bruised vegetable drugs from which teas can be made.

Specific Gravity—The ratio of the weight of any volume to the weight of an equal volume of some other substance taken as the standard at stated temperatures. For solids or liquids the standard is usually water, and for gases the standard is air or hydrogen.

Specific Heat—The amount of heat required to raise a unit weight of substance one degree of temperature at either constant pressure or constant volume. It is usually expressed in calories per gram per degree Centigrade. See *heat capacity* for distinction between mean and true specific heats.

Spectrum—A series of radiant energies arranged in order of wave length; as for example, when a beam of light is subjected to dispersion and then brought to a focus to form a series of images arranged in order of their wave lengths.

Spinants—See *motor excitants*.

Spiriti (Spirits)—Solutions of volatile substances in alcohol or diluted alcohol.

Sprays—See *nebulae*.

Standard Solution—A solution, of accurately known or standard concentration, used as a reagent.

Sternutatories—Drugs which cause sneezing. When used to increase nasal secretion by applying to the mucous membrane of the nose they are usually referred to as *errhines* (ipecac, cubeb).

Stili Medicamentorum (Medicated Pencils)—Medicinal agents made into a plastic mass and rolled into cylinders for external application.

Styptics—See *hemostatics*.

Sublimation—The process of passing from the solid to the gaseous state directly. There is a definite vapor or sublimation pressure for a solid at each temperature. At this pressure and temperature the gaseous and solid phases are in equilibrium. If the temperature is kept constant and the outside pressure on the system is lowered, the solid will sublime. Substances like camphor, which sublime at atmospheric pressure, have a sublimation pressure at that temperature which is greater than the atmospheric pressure.

Sublimation, Heat of—The heat evolved or absorbed in subliming a unit mass at a specified temperature.

Succi (Juices)—Expressed vegetable juices usually preserved by the addition of alcohol.

Sudorifics—See *diaphoretics*.

Supersaturated Solution—A solution which contains more dissolved substance than it can normally hold at the same temperature in the presence of undissolved solute.

Suppositoria (Suppositories)—Solids of various shapes: cone-shaped, pencil-shaped, globular, or oviform, which contain medicines and which melt when inserted into the rectum, nares, urethra, or vagina. They are usually made from oil of theobroma, glycerinated gelatin, or sodium stearate.

Surface Tension—The property, due to molecular forces, existing in the surface film of all liquids which tends to contract the volume into a form with the least surface area. The particles in the surface film are inwardly attracted thus resulting in tension.

Symbol—An arbitrary or conventional sign, such as a character, a letter, abbreviation, etc., used instead of a word or words, as in chemistry, mathematics, etc., to represent elements, operations, etc.

DEFINITIONS OF TERMS

Syrupi (Syrups)—Concentrated aqueous solutions of sucrose containing either medicinal agents or flavoring agents.

Tabellae (Tablets)—Solid disk-like lenticular bodies made by compression. *Tablet triturates* are prepared by triturating drugs and then molding; lactose is usually employed as the diluent. See also *trochisci* and *toxitabellae*.

Taenifuges—See *anthelmintics*.

Teas—See *species*.

Tensile Strength—The greatest longitudinal stress a substance can withstand without rupture. It is usually expressed with reference to a unit cross-sectional area, as kilograms per square centimeter, or pounds per square inch, necessary to produce rupture.

Tetragonal System—One of the groups of crystalline form in which three axes are at right angles, but only two, the lateral axes, equal, as in the right square prism.

Thermal Conductivity—The quantity of heat passing in unit time through a plate of unit area and unit thickness, with a temperature differential of one degree between the faces of the plate. See special section on *heat conductivity*.

Thermal Expansion—See *expansion, coefficient of*.

Thermochemical Equation — An equation which, besides the stoichiometric chemical relationships, indicates also the energy change involved in a reaction.

Thermochemistry—That branch of chemical science concerned with the relations existing between chemical action and heat (thermal changes) which accompany chemical reactions.

Thermo (electric) Couple—Two bars or wires of dissimilar metals joined at one extremity and which develop a current (thermoelectric current) when heated.

Thermodynamics, Laws of—The laws of thermodynamics expressing certain energy relationships which were found to be true empirically. *First law*—This law, known also as the law of the conservation of energy, states that energy can be neither created nor destroyed; when one form of energy disappears another form always appears in equivalent quantity. *Second law*—This law states that heat cannot pass spontaneously from a colder to a warmer body; when free interchange of heat takes place, it is always the hotter of two bodies which loses energy and the colder that gains energy. *Third law*—This law states that every substance has a finite positive entropy, but at absolute zero the entropy may become zero, and is zero in the case of perfect crystalline substances.

Thermoluminescence—See *luminescence*.

Thermoneutrality, Law of—The law that no thermal effect is produced when dilute solutions of neutral salts are mixed and no precipitation occurs.

Tincturae (Tinctures)—Alcoholic solutions of drugs, prepared either by maceration, percolation, or solution. The alcoholic strength is variable and the drugs generally used are non volatile. The drug strength, where the drug is potent, is usually 10%. Where the drug is not very potent the strength is usually 20%.

Titer—The titer, as applied to solutions, is the concentration of a dissolved substance as determined by titration. The term is also applied to the minimum amount or volume required to bring about a given result in titration. The titer, as applied to fats, is the solidification point of the fatty acids liberated from a fat by hydrolysis.

Titration—A method, or the process, of using a standard solution for the determination of the amount of some substance in another solution. The known solution is usually added in a definite quantity to the unknown until equivalent quantities have been added. If the reaction in question is in itself invisible, an indicator, having a visible reaction, correlated with the invisible, is used. From the quantity of known substance added and the reaction involved the quantity of unknown substance may be calculated.

Titrimetric—A word synonymous with volumetric when used with reference to chemical titration.

Tonics—Drugs which improve the tone of specific tissues by stimulating vital functions (mineral: phosphates; vegetable: gentian). See *restoratives.*

Toxitabellae (Poison Tablets)—These are tablets of angular shape (not discoid) each having the word "poison" and the skull and cross bones distinctly stamped upon it. The purpose of the distinctive shape and marking is to diminish poisoning by their accidental ingestion. The common one is corrosive sublimate.

Transference Number—In electrolysis, a number denoting the fraction of the total current passed through a solution of an electrolyte which any one ion carries. If *n* is the transference number of the anion, then *1* − *n* is that of the cation.

Transition Point (or temperature)—The temperature at which two crystalline forms of a substance are in equilibrium with each other. The transition temperature changes with the pressure on the system.

Triboluminescence—See *luminescence.*

Triclinic System—One of the groups of crystalline form in which there are three unequal axes and intersections oblique, as in the oblique rhomboidal prism.

Trochisci (Troches)—Solid, round oval, or flat masses composed of medicinal agents combined with sugar o extract of licorice, massed with mucilage of tragacanth, flavored, and dried They are also called *lozenges*. In England they are called *tablets* and are of a definite weight and have a chocolate base; *pastilles* (in England) have a glyco-gelatin base.

Ultimate Strength—The maximum force or load per square inch for a substance under tension.

Unguenta (Ointments)—These are soft or solid fatty preparations for external use, liquifying when applied to the skin and containing medicaments in a base of benzoinated lard, petrolatum, wool fat, prepared suet, expressed oil of almond, wax, spermaceti, paraffin, etc. They are also called *salves.*

Unsaponifiable—That portion of a fat or oil which does not react with alkali in the hydrolysis to form glycerol and fatty acid soaps.

Valence—The degree of combining power of an element or a radical. It is usually expressed by a number based upon hydrogen equal to unity. Thus when $H = 1$, then $Na = 1$, $Mg = 2$, $PO_4 = 3$.

Van't Hoff Isochore—See *reaction isochore.*

Van't Hoff's Law—The law that, when a system is in equilibrium, of the two opposed interactions the endothermic is promoted by raising the temperature, the exothermic by lowering it. It is a particular case of Le Chatelier's law (q.v.).

Vapor Density—The weight of a vapor per unit volume at any stated temperature and pressure.

Vapor Pressure—The pressure exerted by a vapor when a state of equilibrium has been reached between a liquid, solid, or solution, respectively, and its vapor, is called the vapor pressure of a liquid, solid, or solution. When the vapor pressure of a liquid exceeds that of the confining atmosphere the liquid commonly is said to be boiling. See *boiling point.*

Vaporization, Heat of—The quantity of heat required to convert a unit quantity of liquid at a definite temperature to vapor at the same temperature. It is usually expressed in calories per gram, or calories per gram-mole.

Vegetable Oil—Any oil from plant origin as distinguished from animal (origin) oil. Usually the volatile (essential) oils are not included in this classification which is primarily intended to designate the fixed oils (i.e., glyceryl esters of various fatty acids). See *oil* and *animal oil.*

Vermicides—See *anthelmintics.*

Vermifuges—See *anthelmintics.*

Vesicants (Epispastics)—Substances which produce much inflammation of the skin with the effusion of serum between the epidermis and the derma (cantharides, volatile oil of mustard). See *irritants.*

Vina (Wines)—Liquids differing from tinctures in that the drug is extracted with white wine. The alcoholic content varies between 7 and 12%.

Vinegars—See *aceta.*

Viscosity—The resistance offered by a fluid (liquid or gas) to flow. The viscosity is a characteristic property and is a measure of the combined effects of adhesion and cohesion.

Vitamin—Any one of a group of constituents of most foods in their natural state and of which very small amounts are essential for normal nutrition. See special section on *vitamins.*

Volatile Acid—In analytical chemistry, any one of those acids which can be distilled from an aqueous solution at atmospheric pressure, such as acetic, butyric, etc., in contradistinction to the fixed acids, such as tartaric, phosphoric, etc.

Volatile Matter (**in coal**)—The percentage of the sample which consists of combustible material which is volatile, in the absence of air, at 950° ± 20°C.

Volatile Oil—An oil which is appreciably volatile. See *essential oil.*

Volt—The unit of electromotive force. It is the difference in potential required to make a current of one ampere flow through a resistance of one ohm.

Volumetric—A measurement of, or by, volumes as with standard solutions in titrimetric analysis or with the eudiometer in gas analysis.

Volumetric Factor—See *factor.*

Wafers—See *cachets.*

Watt—A unit of power. The power, P, in watts developed by an electric current of I amperes flowing under a potential drop of E volts is: $P = EI$.

Wax—Any one of a class of substances of plant or animal origin, insoluble in water, partly soluble in alcohol, ether, etc., and miscible in all proportions with oils and fats. They consist of esters and often, in addition, free fatty acids, free alcohols, and higher hydrocarbons. Usually, *true waxes* are distinguished chemically from fats (which are esters of glycerol) as consisting chiefly of esters of higher monohydroxy alcohols. Sometimes the distinction between waxes and fats is based only on physical properties, the waxes being less greasy, more brittle and harder than fats. The *mineral waxes* are substances of similar properties but of mineral origin and consist mostly of higher hydrocarbons.

DEFINITIONS OF TERMS

Weir—A device for determining fluid flow by measurements of the depth of fluid over the crest of sill and known dimensions of the device.

Wines—See *vina*.

X ray—Any of the radiations, similar to light radiation but of much shorter wave length, which are emitted by suddenly changing the velocity of a moving electric charge by impact of a cathode ray on a target in a vacuum tube and by the changes in the atoms of the target caused by the impact. These rays possess the peculiar properties of ionizing a gas through which they pass, of penetrating various solids, of affecting photographic plates, and of causing certain substances to fluoresce. They are also known as *roentgen rays*.

Yield Strength—The stress at which a material exhibits a specified limiting permanent set.

MEDICAL PRESCRIPTION NOTATION

1 drachm	ʒ i, or ʒ j.
1½ "	ʒ iss.
2 "	ʒ ii, or ʒ ij.
3 "	ʒ iii, or ʒ iij.
3½ "	ʒ iiiss.
1 gallon	Ci or Cj.
½ grain	gr. ss.
1 "	gr. i, or gr. j.
1½ "	gr. iss.
2 "	gr. ii, or gr. ij.
2½ "	gr. iiss.
4 grain	gr. iv.
8 "	gr. viii. or gr. viij.
½ ounce	℥ ss.
1 "	℥ i, or ℥ j.
1½ "	℥ iss.
½ pint	Oss.
1 "	Oi or Oj.
½ scruple	℈ ss.
1 "	℈ i. or ℈ j.
1½ "	℈ iss.
2 "	℈ ii, or ℈ ij.

℞ (L. *recipe*, take)—A symbol placed at the beginning of a prescription. It is supposed to have been originally ♃, the symbol of Jupiter, serving as an invocation to this king of the gods that the compound might act beneficially.

PHYSIOLOGICAL RESPONSE TO VARIOUS CONCENTRATIONS OF SOME COMMON GASES AND VAPORS

Reproduced from "Dow Calcium Chloride for Refrigeration," copyright 1929 by The Dow Chemical Co., by permission.

Vapor or gas	Kills most animals in a very short time		Dangerous in 30 to 60 minutes		Max. amt. for 60 min. without serious disturbances		Slight symptons after several hours or max. amt. for prolonged exposure	
	% by volume	Relative order	% by volume	Relative order	% by volume	Relative order	% by volume	Relative order
Phosgene	0.02–0.05	1	0.0025	1	No data	0	0.0001	1
Chlorine	0.10	2	0.004$^{a.b.}$–0.006$^{a.c.}$	2	0.0004	2	0.0001	1
Bromine	0.1	3	0.004–0.006	3	0.0004	3	0.0001	1
Hydrogen sulfide	0.06–0.10^{c} 0.10 0.20^{a}	4	0.05–0.07$^{a.c.}$	6	0.02–0.03	7	0.01–0.015^{a} 0.02^{c}	7
Hydrocyanic acid	0.48^{c} 0.30^{a}	5	0.012–0.015$^{a.b.}$ 0.024^{c}	4	0.005–0.006	4	0.002–0.004	3
Hydrogen chloride	0.1 0.2$^{a.b.}$ 0.5^{c}	6	0.15–0.2	7	0.005–0.01	5	0.005	4
Sulfur dioxide	0.20^{c}	7	0.04–0.05	5	0.005–0.02^{a}	6	0.01^{c} 0.001^{b}	2
Carbon monoxide	0.5–1.0^{c} 0.3–1.5^{a}	8	0.2–0.3 0.2	8	0.05–0.10^{c} 0.05^{a}	9	0.05^{a} 0.04^{c}	9
Ammonia	0.5–1.0	9	0.25–0.45	10	0.03–0.05	8	0.01^{a}	6
Benzene	1.9	10	No data		0.31–0.47	11	0.15–0.31^{b}	13
Gasoline	2.4	11	1.1–2.2	11	0.43–0.71	14	No data	
Methyl bromide	2.0– 4.0^{d}	12	0.2–0.4^{d}	9	0.1^{d}	10	0.005–0.017^{d}	5
Chloroform	6.8– 8.2^{a}	13	1.4	12	0.5–0.6	13	0.02	8
Carbon tetrachloride	2.5^{d} 4.8– 6.3	14	2.4–3.2	14	0.4–0.6	12	0.16	11
Ethyl bromide	10.0–20.0^{d}	15	1.0–2.0^{d}	13	0.6^{d}	15	0.17–0.3^{d}	12
Methyl chloride	15.0–30.0^{d}	16	2.0–4.0^{d}	15	0.7^{d}	16	0.05–0.10^{d}	10
Ethyl chloride	15.0–30.0^{d}	17	6.0 10.0^{d}	16	4.0^{d}	17	2.0^{d}	14

From Physiological Response attending exposure to Vapors of Methyl Bromide, Methyl Chloride, Ethyl Bromide and Ethyl Chloride. By—Bayers, Yant, Thomas and Berger, Bureau of Mines, Report No. 746-B; 156.

(a) Bureau of Mines Technical Paper No. 248, 1921.
(b) Henderson, Yandell, and Haggard, H. H., "Noxious Gases" A. C. S. Monograph No. 35, 1927.
(c) International Critical Tables, Vol. II, 1927.
(d) Data from Figures 3, 4, 5, and 6, and Tables 6, 7, 8, and 9 of this report.

PHENOL COEFFICIENTS

Phenol coefficient determinations as usually performed do not always give a true indication of the value of a germicide in actual use. Organisms dried on various surfaces should also be exposed to the action of the germicide in order to test practical effectiveness and Shippen[7] subcultures should be made. Many antiseptics inhibit growth rather than kill. This is well known in the case of mercurials.[6]

Compound	Method	Temperature* Deg. C.	Values obtained with Following test organisms	
			Staph. aureus	*B. typhosus*
Chlorine Group				
Chloramine	Rideal-Walker (1)	37	133	100
Dakin's Solution	A.P.H.A. (2)	20	......	0.78
ICl_3 (0.5% aq. soln.)	A.P.H.A.	20	......	2.40
Phenolic Group				
Lysol	F.D.A. (Reddish)	20	......	5.0
Lysol	F.D.A. (Reddish)	20	3.2	......
Lysol	F.D.A. (Reddish)	37	4.6	......
Creolin	Rideal-Walker	37	......	9–10
Kreso-Dip	F.D.A. (Reddish)	20	......	6
Tricresol	(3)	....	......	2.6
Ethyl phenol	Rideal-Walker (4)	25	6.0	7.4
n-Propyl phenol	Rideal-Walker (4)	25	16.5	21.6
n-Butyl phenol	Rideal-Walker (4)	25	50	68
n-Amyl phenol	Rideal-Walker (4)	25	139	197
n-Hexyl phenol	Rideal-Walker (4)	25	375	500
Naphthol	Hygienic Laboratory	20	......	11.4
Hexyl resorcinol	Reddish (Modification)	20	150	72
Mercury Compounds				
Mercuric chloride	Reddish	20	143	100
Mercurochrome (220 soluble)	Reddish (Modification)	20	1.7	......
Merthiolate ($C_2H_5HgSC_6H_4CO_2Na$)	Reddish	20	40–50	40–50
Metaphen ($C_{11}H_{11}O_7NHg_2$)	Reddish (Modification)	20	1500	......
Phenylmercuric nitrate (6) $C_6H_5HgNO_3 \cdot C_6H_5HgOH$	Reddish (Modification)	25	300	625
Miscellaneous				
Formalin	Rideal-Walker	37	0.3	0.7
Hydrogen peroxide	Rideal-Walker	20	......	0.01
Tinct. of iodine USP	Reddish (Modification)	20	38	......
Tinct. of iodine USP 3% Alcoholic I_2, USP tinct. dil. C_2H_5OH	Reddish	20	6.3	5.8
Lugol's iodine	A.P.H.A.	20	5.1	5.0
Menthol	Hygienic Laboratory	20	......	5.1
Menthol isomers:				
l-Menthol	Rideal-Walker	12–16	5–8	......
d-Menthol	Rideal-Walker	12–16	7–12	......
dl-Menthol (racemic)	Rideal-Walker	12–16	7–12	......
dl-iso-Menthol	Rideal-Walker	12–16	7–12	......
Methyl salicylate	Hygienic Laboratory	20	......	1.76
Picric acid (2-3% in C_2H_5OH)	Rideal-Walker	37	......	6.0

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*The time of exposure of the organisms to the disinfectants was 7.5 minutes.

(1) Approved Technique of the Rideal-Walker Test. London: H. K. Lewis and Co. (1921). (2) American Public Health Association. *Amer. J. Pub. Health* 7, 506 (1918). (3) Public Health Report, 36, 1559 (1921). (4) Schaffer and Tilley, *Jour. Bacteriology* 14, 259 (1927). (5) Klarman et al., *Jour. Bacteriology* 17, (1929). (6) Ecker, Hovorka, and Smith, *Mod. Hospital* 49, 80 (1937). (7) Shippen, *Am. J. Pub. Health* 18, 1231 (1928).

PHOTOGRAPHIC FORMULAS

The purest water, preferably distilled, should be used for making all photographic solutions. Dissolve all chemicals in the order given. Do not add the next chemical until the last is completely dissolved. Use judgment in the warming of solutions during the dissolving of chemicals. Slightly warm water will produce prompt dissolving, but too much heat may cause reactions to occur which will destroy the value of the solution.

Throughout this table all references to sodium sulfite and sodium carbonate indicate the desiccated or anhydrous salt. If monohydrated or crystalline salt is used, increase the amount by 17 per cent for the monohydrated salt or double the amount for the crystalline form. In some formulas a proprietary alkali known as "Kodalk" is used. These formulas are designated by the letters "DK" before the formula number.

In most cases the manufacturer now encloses with each package of film, plates or paper a group of formulas which have been tested and found to give the best results for that particular product. Whenever such information is available, the user should not hesitate to take advantage of it, as it is to the manufacturer's advantage to have his customers obtain the best possible results with his product.

Many manufacturers of sensitized materials make available the most useful of their formulas in prepared form for large and smaller users. All the photographer needs to do is to dissolve the powders in the proper volume of water as directed in the instructions printed on the package, in order to have the best possible formula for his particular job. This method is especially recommended for people doing only occasional photographic processing since each batch is fresh when used and, because of the small volumes available, it is not necessary to save solutions in the interest of economy. This method also eliminates the necessity of maintaining large stocks of the individual chemicals necessary.

DEVELOPERS

Fine Grain (Kodak DK-20)

	Avoirdupois	Metric
Water, about 125°F. (50°C.)	96 ounces	750.0 c.c.
Elon	290 grains	5.0 grams
Sodium Sulfite, desiccated	13¼ ounces	100.0 grams
Kodalk	116 grains	2.0 grams
Sodium Thiocyanate (Sulfocyanate)	58 grains	1.0 gram
Potassium Bromide	29 grains	0.5 gram
Cold water to make	1 gallon	1.0 liter

Dissolve chemicals in the order given.

Time of development, 15 to 25 minutes in a tank at 65°F. (18°C.) according to the contrast desired. Decrease the time about 20% for tray use. Develop underexposures fully for best results.

High Contrast (Kodak D-19)

STOCK SOLUTION

	Avoirdupois	Metric
Water (about 125°F.) (50°C.)	64 ounces	2.0 liters
Elon	128 grains	8.8 grams
Sodium Sulfite, desiccated	12 ozs. 360 grains	384.0 grams
Hydroquinone	1 oz. 75 grains	35.2 grams
Sodium Carbonate, desiccated	6 ozs. 180 grains	192.0 grams
Potassium Bromide	290 grains	20.0 grams
Cold water to make	1 gallon	4.0 liters

Dissolve chemicals in the order given.

Use without dilution. Develop 3 to 6 minutes in a tray at 65°F. (18°C.) according to the contrast desired. Increase the time about 25% for tank development.

For infrared landscape photography, dilute as follows: stock solution 1 part, water 4 parts. Develop about 5 minutes at 65°F. (18°C.).

This developer may also be used for x-ray films and in most cases where high contrast is desired.

Low Contrast (Kodak D-76)

	Avoirdupois	Metric
Water (about 125°F.) (50°C.)	96 ounces	3.0 liters
Elon	116 grains	8.0 grams
Sodium Sulfite, desiccated	13¼ ounces	400.0 grams
Hydroquinone	290 grains	20.0 grams
Borax, granular	116 grains	8.0 grams
Water to make	1 gallon	4.0 liters

Dissolve chemicals in the order given.

Develop amateur roll films and aero films about 20 minutes in a tank or 16 minutes in a tray of fresh developer at 65°F. (18°C.).

Develop professional films and plates 10 to 25 minutes in a tank at 68°F. (18°C.) according to the contrast desired. For tray use, decrease the time about 20%. This developer gives greatest shadow detail on fine grain panchromatic films.

A faster working developer can be obtained by increasing the quantity of borax. A still more active developer can be obtained by replacing the borax by Kodalk.

The developer may become slightly muddy due to the formation of a suspension of colloidal silver but this is harmless and can be ignored.

For duplicate negative film, average time of development is 6 to 9 minutes at 65°F. (18°C.).

Extreme Contrast (Kodak D-8)
STOCK SOLUTION

	Avoirdupois	Metric
Water	96 ounces	3.0 liters
Sodium Sulfite, desiccated	12 ounces	360.0 grams
Hydroquinone	6 ounces	180.0 grams
Sodium Hydroxide (Caustic Soda)	5 ounces	150.0 grams
Potassium Bromide	4 ounces	120.0 grams
Water to make	1 gallon	4.0 liters

Dissolve chemicals in the order given. Stir the solution thoroughly before use.

For use, take 2 parts of stock solution and 1 part of water. Develop about 2 minutes in a tray at 65°F. (18°C.). This formula is especially recommended for making line and half-tone screen negatives for printing directly on metal.

A formula which is slightly less alkaline and gives almost as much density can be obtained by using 3¾ ounces of sodium hydroxide per gallon of stock solution (112 grams per 4 liters) instead of the quantity given in the formula.

General Elon-Hydroquinone (Kodak D-61a)
STOCK SOLUTION

	Avoirdupois	Metric
Water (about 125°F.) (50°C.)	16 ounces	500.0 c.c.
Elon	45 grains	3.1 grams
Sodium Sulfite, desiccated	3 ounces	90.0 grams
Sodium Bisulfite	30 grains	2.1 grams
Hydroquinone	85 grains	5.9 grams
Sodium Carbonate, desiccated	165 grains	11.5 grams
Potassium Bromide	24 grains	1.7 grams
Cold water to make	32 ounces	1.0 liter

Dissolve chemicals in the order given.

For *tray* use take 1 part of stock solution to 1 part of water. Develop for about 7 minutes at 65°F. (18°C.)

For *tank* use take 1 part of stock solution and 3 parts of water. At a temperature of 65°F. (18°C.), the development time is about 14 minutes. It is advisable to make up a greater quantity than is needed to fill the tank. If the developer in the tank is of normal strength, but the volume of solution has been reduced, add a sufficient quantity of the surplus solution diluted 1:3 to fill the tank.

Photomicrographic Low and Medium Contrast (D-76c)

	Avoirdupois	Metric
Water (about 125°F.) (50°C.)	96 ounces	3.0 liters
Elon	116 grains	8.0 grams
Sodium Sulfite, desiccated	13¼ ounces	400.0 grams
Hydroquinone	290 grains	20.0 grams
Borax, granular	116 grains	8.0 grams
Potassium Iodide, 1% solution	1 dram	4.0 c.c.
Potassium Bromide, 2.5% solution	10 drams	40.0 c.c.
Cold water to make	1 gallon	4.0 liters

Dissolve chemicals in the order given.

Use without dilution.

For low contrast, develop about 5 minutes, and for normal contrast, about 6½ minutes, at 65°F. (18°C.) in a tray of fresh developer. Increase the time about 25% for tank development.

Photomicrographic High Contrast (D-19) See formula D-19 given previously.

Tropical Non-blistering (Kodak DK-15)

	Avoirdupois	Metric
Water (about 125°F.) (50°C.)	24 ounces	750.0 c.c.
Elon	82 grains	5.7 grams
Sodium Sulfite, desiccated	3 ounces	90.0 grams
Kodalk (Potassium Metaborate)	¾ ounce	22.5 grams
Potassium Bromide	27 grains	1.9 grams
* Sodium Sulfate, desiccated	1½ ounces	45.0 grams
Cold water to make	32 ounces	1.0 liter

Dissolve chemicals in the order given.

Average time for tank development is 9 to 12 minutes at 65°F. (18°C.) and 2 to 3 minutes at 90°F. (32°C.), in the fresh developer according to the contrast desired. When working *below* 75°F. (24°C.) the sulfate may be omitted if a more rapid formula is required. Development time *without* the sulfate is 5 to 7 minutes at 65°F. (18°C.). Develop about 20 per cent less for tray use.

When development is completed rinse the film or plate in water for 1 or 2 seconds only and immerse in the Tropical Hardener (Formula SB-4) for 3 minutes (omit water rinse if film tends to soften); then fix for at least 10 minutes in an acid hardening fixing bath, such as Formula F-5, and wash for 10 to 15 minutes in water (not over 95°F.) (35°C.).

Further details on tropical development will be found in the booklet "Tropical Development" obtainable on request from the Eastman Kodak Co., Rochester, N. Y.

Infrared Medium Contrast (D-76) See formula D-76 given previously.

Infrared High Contrast (D-19) See formula D-19 given previously.

Lantern Slide (Kodak D-32)

STOCK SOLUTION A

	Avoirdupois	Metric
Water (about 125°F.) (50°C.)	16 ounces	500.0 c.c.
Sodium Sulfite, desiccated	90 grains	6.3 grams
Hydroquinone	100 grains	7.0 grams
Potassium Bromide	50 grains	3.5 grams
Citric Acid	10 grains	0.7 gram
Cold water to make	32 ounces	1.0 liter

STOCK SOLUTION B

	Avoirdupois	Metric
Cold water	32 ounces	1.0 liter
Sodium Carbonate, desiccated	1 ounce	30.0 grams
Sodium Hydroxide (Caustic Soda)	60 grains	4.2 grams

* If it is desired to use crystalline sodium sulfate instead of the desiccated sulfate then 3½ ounces per 32 ounces (105 grams per liter) should be used.

Dissolve chemicals in the order given.

For use, take 1 part of A and 1 part of B. For warmer tones, 1 part of A and 2 parts of B.

Develop about 5 minutes at 70°F. (21°C.).

Oscillograph, Cardiograph, and other line record materials.

See high contrast developer formula D-19 given previously.

Universal Paper (Kodak D-72)

STOCK SOLUTION

	Avoirdupois		Metric
Water (about 125°F.) (50°C.)	16	ounces	500.0 c.c.
Elon	45	grains	3.1 grams
Sodium Sulfite, desiccated	1½	ounces	45.0 grams
Hydroquinone	175	grains	12.0 grams
Sodium Carbonate, desiccated	2¼	ounces	67.5 grams
Potassium Bromide	27	grains	1.9 grams
Water to make	32	ounces	1.0 liter

Dissolve chemicals in the order given.

For chloride papers take stock solution 1 part, water 2 parts. Develop 45 seconds at 70°F. (21°C.).

For bromide papers take stock solution 1 part, water 4 parts. Develop not less than 1½ minutes at 70°F. (21°C.).

For lantern slides take stock solution 1 part, water 2 parts. Develop 1 to 2 minutes at 70°F. (21°C.). For greater contrast dilute 1:1 and for less contrast dilute 1:4.

Warm Tone Paper (Kodak D-52)

STOCK SOLUTION

	Avoirdupois		Metric
Water (about 125°F.) (50°C.)	16	ounces	500.0 c.c.
Elon	22	grains	1.5 grams
Sodium Sulfite, desiccated	¾	ounce	22.5 grams
Hydroquinone	90	grains	6.3 grams
Sodium Carbonate, desiccated	½	ounce	15.0 grams
Potassium Bromide	22	grains	1.5 grams
Cold water to make	32	ounces	1.0 liter

Dissolve chemicals in the order given.

For professional contact papers, use stock solution 1 part, water 1 part.

For professional enlarging papers and bromide papers, use full strength solution.

Develop all papers not less than 1½ minutes at 70°F. (21°C.).

FIXING BATHS

Acid Hardening (Kodak F-5)

	Avoirdupois		Metric
Water (about 125°F.) (50°C.)	20	ounces	600.0 c.c.
Sodium Thiosulfate (Hypo)	8	ounces	240.0 grams
Sodium Sulfite, desiccated	½	ounce	15.0 grams
*Acetic Acid (28% pure)	1½	fluid ozs.	48.0 c.c.
**Boric Acid, crystals	¼	ounce	7.5 grams
Potassium Alum	½	ounce	15.0 grams
Cold water to make	32	ounces	1.0 liter

Dissolve the hypo in the specified volume of water (about 125°F.) (52°C.) and then add the remaining chemicals in the order given, taking care that each chemical is dissolved before adding the next. Then dilute with water to the required volume.

The F-5 fixing bath has the advantage over the older type of fixing baths, which do not contain boric acid, in that it gives much better hardening and has a lesser tendency to precipitate a sludge of aluminum sulfite throughout its useful life.

* To make 28% acetic acid from glacial acetic acid, dilute three parts of glacial acetic acid with eight parts of water.

** Crystalline boric acid should be used as specified. Powdered boric acid dissolves only with great difficulty, and its use should be avoided.

Non-hardening (Kodak F-24)

	Avoirdupois	Metric
Water (about 125°F.) (50°C.)	16 ounces	500.0 c.c.
Sodium Thiosulfate (Hypo)	8 ounces	240.0 grams
Sodium Sulfite, desiccated	145 grains	10.0 grams
Sodium Bisulfite	365 grains	25.0 grams
Cold water to make	32 ounces	1.0 liter

Dissolve chemicals in the order given.

This bath is recommended for films, plates or paper when no hardening is desired. It may be used satisfactorily only in case the temperature of the developer, rinse bath, and wash water is not higher than 65°F. (18°C.), and provided ample drying time is allowed so that relatively cool drying air can be used.

MISCELLANEOUS

Acid Rinse Bath (Kodak SB-1); Short Stop

	Avoirdupois	Metric
Water	32 ounces	1.0 liter
*Acetic Acid (28% pure)	1½ fluid ozs.	48.0 c.c.

Rinse prints for at least 5 seconds.

With a 1 to 2 second drain, the equivalent of approximately twenty-five 8 by 10 prints may be processed by 1 quart (1 liter) of this bath before it becomes alkaline and should be discarded.

Hardener-Rinse Bath (Kodak SB-3)

	Avoirdupois	Metric
Water	32 ounces	1.0 liter
Potassium Chrome Alum	1 ounce	30.0 grams

This bath is intended for use in hot weather after development and before fixation in conjunction with formula F-5.

Agitate the negatives for several seconds when first immersed in the hardener and allow to remain in the solution for 3 to 5 minutes to secure maximum hardening.

IMPORTANT: The bath should be renewed frequently and if there is any tendency for scum to form on the films, it should be removed by swabbing with cotton. The bath should be skimmed each day before use.

Intensifier (Kodak IN-4)

STOCK SOLUTION

	Avoirdupois	Metric
Potassium Bichromate	3 ounces	90.0 grams
Hydrochloric Acid, C. P.	2 fluid ozs.	64.0 c.c.
Water to make	32 ounces	1.0 liter

For use, take 1 part of stock solution to 10 parts of water.

Harden the negative with an alkaline solution of formalin (Formula SH-1) before treatment with the chromium intensifier, or the gelatin may reticulate and ruin the negative.

Bleach thoroughly at 65°F. (18°C.), then wash five minutes and redevelop fully (about 5 minutes) in artificial light or daylight (not sunlight) in any quick-acting, non-staining developer containing the normal proportion of bromide, such as Formula D-72, diluted 1:3. If the negative is not redeveloped fully then fix for five minutes, and wash thoroughly. Fixing is unnecessary if redevelopment is thorough. The degree of intensification may be controlled by varying the time of redevelopment. Greater intensification can be secured by repetition.

Warning: Developers containing a high concentration of sulfite, such as Formula D-76, are not suitable for redevelopment, since the sulfite tends to dissolve the bleached image before the developing agents have time to act on it.

Negatives intensified with chromium are more permanent than those intensified with mercury.

* To make 28% acetic acid from glacial acetic acid dilute three parts of glacial acetic acid with eight parts of water.

The Eastman Chromium Intensifier Powders are equally as satisfactory as Formula In-4, and are supplied in prepared form ready to use simply by dissolving in water.

Reducer (Kodak R-4a)

STOCK SOLUTION A

	Avoirdupois	Metric
Potassium Ferricyanide	1¼ ounces	37.5 grams
Water to make	16 ounces	500.0 c.c.

STOCK SOLUTION B

	Avoirdupois	Metric
Sodium Thiosulfate (Hypo)	16 ounces	480.0 grams
Water to make	64 ounces	2.0 liters

For use take: Stock Solution A, 1 ounce (30 c.c.), stock solution B, 4 ounces (120 c.c.), and water to make 32 ounces (1 liter). Add A to B, then add the water.

Pour the mixed solution at once over the negative to be reduced. Watch closely. The action is best seen when the solution is poured over the negative in a white tray. When the negative has been reduced sufficiently, wash thoroughly before drying.

Solutions A and B should not be combined until they are to be used. They will not keep long in combination.

Hand Stain Remover (Kodak S-5)

SOLUTION NO. 1

	Avoirdupois	Metric
Potassium Permanganate	¼ ounce	7.5 grams
Water	32 ounces	1.0 liter

SOLUTION NO. 2

	Avoirdupois	Metric
Sodium Bisulfite	16 ounces	480.0 grams
Water	32 ounces	1.0 liter

Rub the hands with a small amount of the No. 1 solution, rinse in water; then rinse with the No. 2 solution which will remove the stains.

Tray Cleaner (Kodak TC-1)

	Avoirdupois	Metric
Water	32 ounces	1.0 liter
Potassium Bichromate	3 ounces	90.0 grams
Sulfuric Acid, C.P.	3 fluid ozs.	96.0 c.c.

Add the sulfuric acid slowly while stirring the solution rapidly.

For use, pour a small volume of the tray cleaner solution in the vessel to be cleaned. Rinse around so that the solution has access to all parts of the tray; then pour the solution out and wash the tray six or eight times with water until all traces of the cleaning solution disappear.

Desensitizer

In the development of panchromatic emulsions it is necessary to work in absolute darkness, or with the very dense panchromatic safelight. When visual control of development is necessary, Pinacryptol Green is used as a desensitizer. Two methods are available for using this material, namely in a preliminary bath, or mixed with the developing solution. As it is sometimes necessary to change the method used, it has been found best to make up a stock solution of the following proportions:

Pinacryptol Green	1 part
Water	500 parts

To use this solution as a separate preliminary bath, the stock solution is diluted 10 times, making a solution of 1 in 5000 in the tray. If the desensitizer is to be used in the developer, the stock solution is added in the ratio of 1 ounce of solution to every 10 ounces of developer. After the film has been immersed in the solution a minute, the red light may be turned on, but to be absolutely safe it is best to use a strong green light.

Special Formalin Hardener (Kodak SH-1)

Formalin (37% formaldehyde solution)	2½ drams	10.0 c.c.
Sodium Carbonate	73 grains	5.0 grams
Water to make	32 ounces	1.0 liter

PHOTOGRAPHIC FORMULAS

This formula is recommended for the treatment of negatives which would normally e softened considerably by a chemical treatment in the removal of several types of tains, or by intensification or reduction.

After treatment for 3 minutes in the hardening solution, films or plates should ways be rinsed and immersed for 5 minutes in a fresh acid fixing bath and well ashed before giving any further chemical treatment.

ropical Hardener (Kodak SB-4)

This solution is recommended for use in conjunction with the Tropical Developer ormula DK-15), when working above 75°F. (24°C.).

	Avoirdupois	Metric
Water	32 ounces	1.0 liter
Potassium Chrome Alum	1 ounce	30.0 grams
*Sodium Sulfate, desiccated	2 ounces	60.0 grams

Agitate the negatives for 30 to 45 seconds when first immersing in the hardener, r streakiness will result. Leave them in the bath for at least 3 minutes between evelopment and fixation. If the temperature of the developer is below 85°F. (29°C.) nse for 1 to 2 seconds in water before immersing in the chrome alum hardener bath. he hardening bath is a violet blue color by tungsten light when freshly mixed, but ultimately turns a yellow-green with use; it then ceases to harden and should be placed with a fresh bath. The hardening bath should never be overworked. An nused bath will keep indefinitely, but the hardening properties of a partially used ath fall off rapidly on standing for a few days.

hrome Alum-Bisulfite Hardener

	Avoirdupois	Metric
Water	1 pint	500 c.c.
Potassium Chrome Alum	150 grains	10 grams
Sodium Bisulfite	150 grains	10 grams

Negatives are allowed to remain in this bath for 4-6 minutes. A freshly prepared ath is to be used and discarded after one day's use. Where stock solutions must be pt on hand, the chrome alum and the bisulfite are made up into separate solutions of grams each per liter of water (300 grains per quart). Equal portions of these solu- ons are mixed when needed.

ypo Eliminator (Kodak HE-1)

	Avoirdupois	Metric
Water	16 ounces	500.0 c.c.
Hydrogen Peroxide, (3% sol'n.)	4 ounces	125.0 c.c.
Ammonia, (3% sol'n.)	3¼ ounces	100.0 c.c.
Water to make	32 ounces	1.0 liter

Wash the prints for about 30 minutes at 65° to 70°F. in running water which flows pidly enough to replace the water in the vessel (tray or tank) completely once every minutes. Then immerse each print about 6 minutes at 70°F. in hypo eliminator lution (HE-1) and finally wash about 10 minutes before drying. Further details the use of this formula will be found by referring to the paper "Elimination of ypo from Photographic Images" by Crabtree, Eaton, and Muehler, *Jour. Phot. c. Amer. 6, page 6, (1940).*

ypo Test

Process with the batch of prints an unexposed white sheet of photographic paper of e same weight and size as the majority of prints in the batch. After the final wash, ut off a strip of this sheet and immerse it in a 1 per cent solution of silver nitrate lution for about 3 minutes; then rinse in water and compare, while wet, in subdued aylight or artificial light with the wet, untreated portion. If the hypo has been mpletely removed no color difference should be observed. A yellow-brown stain dicates the presence of hypo.

* If it is desired to use crystalline sodium sulfate instead of the desiccated sulfate, then use 4 ozs. 0 grains per 32 ounces (140 grams per liter) when mixing the formula.

TONERS FOR SLIDES AND FILMS

Uranium Toner (Kodak T-9) For Brown to Red Tones

	Avoirdupois	Metric
Uranium (Uranyl) Nitrate	35 grains	2.5 grams
Potassium Oxalate	35 grains	2.5 grams
Potassium Ferricyanide	15 grains	1.0 gram
Ammonium Alum	85 grains	6.0 grams
Hydrochloric Acid, 10% sol.	1¼ drams	5.0 c.c.
Water to make	32 ounces	1.0 liter

Dissolve chemicals in the order given.

The solution should be perfectly clear and pale yellow in color. *It is light sensitive, however, and should be stored in the dark.* The maximum effect is produced in about 10 minutes, the tone passing from brown to red during this time.

It is convenient to keep 10% stock solutions of the constituent chemicals of the above toning bath for quick compounding of a new bath.

For motion picture work, 120 gallons of the above bath will tone about 12,000 feet of film without any appreciable change in the tone. A volume of acid may then be added equal to that originally used, when a further 12,000 feet may be toned. After toning the second quantity of film, the bath should be discarded.

After toning, wash for about 10 minutes, though the washing should not be prolonged, especially if the water is slightly alkaline, since the toned image is soluble in alkali.

Sulfide Toner (Kodak T-10) For Sepia Tones

	Avoirdupois	Metric
SOLUTION A		
Potassium Ferricyanide	1 ounce	30.0 grams
Potassium Bromide	½ ounce	15.0 grams
Water to make	32 ounces	1.0 liter
SOLUTION B		
*Sodium Sulfide, fused (not sulfite)	13 grains	0.9 gram
Water to make	32 ounces	1.0 liter

The well washed slide is thoroughly bleached in A, washed for 5 minutes, and immersed in Solution B for about 2 minutes until thoroughly toned. The slide should then be washed thoroughly for 10 to 15 minutes before drying. The transparency of the tone is much improved by the addition of a little hypo to the B solution, say, 66 grains per 32 ounces or 4.5 grams per liter.

Iron Toner (Kodak T-11) For Blue Tones

	Avoirdupois	Metric
Ammonium Persulfate	7 grains	0.5 gram
Iron and Ammonium Sulfate (Ferric Alum)	20 grains	1.4 grams
Oxalic Acid	45 grains	3.0 grams
Potassium Ferricyanide	15 grains	1.0 gram
Ammonium Alum	75 grains	5.0 grams
Hydrochloric Acid 10%	¼ dram	1.0 c.c.
Water to make	32 ounces	1.0 liter

Dissolve chemicals in the order given.

The method of compounding this bath is very important. Each of the solid chemicals should be dissolved separately in a small volume of water, the solutions then mixed strictly in the order given, and the whole diluted to the required volume. If these instructions are followed, the bath will be pale yellow in color and perfectly clear.

Immerse the slides or films from 2 to 10 minutes at 70°F. (21°C.) until the desired tone is obtained. Wash for 10 to 15 minutes until the highlights are clear. A very slight permanent yellow coloration of the clear gelatin will usually occur, but should be too slight to be detectable on projection. If the highlights are stained blue, then either the slide (film) was fogged during development, or the toning bath was stale or not mixed correctly.

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* Use three times the quantity of crystalline sodium sulfide.

Since the toned image is soluble in alkali, washing should not be carried out for too long a period, especially if the water is slightly alkaline.

Dye Toners (Kodak T-20)

	Avoirdupois	Metric
*Dye	x grains	x grams
Acetone or Wood Alcohol	3¼ fluid ozs.	100.0 c.c.
Potassium Ferricyanide	15 grains	1.0 gram
Acetic Acid (glacial)	1¼ drams	5.0 c.c.
Water to make	32 ounces	1.0 liter

The nature of the tone varies with time of toning and eventually a point is reached beyond which it is unsafe to continue as the gradation of the toned image becomes affected. Average toning time at 65°F. (18°C.) is from 3 to 9 minutes. Further details on the use of this formula may be obtained by referring to the paper by Crabtree and Ives.†

ORGANIC COMPOUNDS USED AS PHOTOGRAPHIC DEVELOPERS

Acrol—See amidol.

Activol—See rhodinal.

Adurol—See chlorohydroquinone and bromohydroquinone.

Amidol (**Acrol; Diamol; Nerol**)—2, 4-Diaminophenol dihydrochloride, $C_6H_3(OH)(NH_2)_2 \cdot 2HCl$.

Athenon—See glycin.

Azol—See rhodinal.

Brom(o)hydroquinone (**Adurol-Schering**) — 2-Bromo-1, 4-dihydroxybenzene, $BrC_6H_3(OH)_2$.

Catechol—See pyrocatechin.

Certinal—See rhodinal.

Chloranol—A combination of chlorohydroquinone and metol base, $ClC_6H_3(OH)_2 \cdot (CH_3NH)C_6H_4OH$.

Chlornol—See chlorohydroquinone. Not to be confused with chloranol (*q.v.*)

Chlor(o)hydroquinone (**Adurol-Hauff; C.H.Q.; Chlornol; Quinotol**)—2-Chloro-1, 4-dihydroxybenzene, $ClC_6H_3(OH)_2$.

C.H.Q.—See chlorohydroquinone.

Citol—See rhodinal.

Diamine-H—See para-phenylenediamine hydrochloride.

Diamine-P—See para-phenylenediamine.

Diaminophenol—See amidol.

Diamol—A trade name for either amidol (*q.v.*) or para-phenylenediamine base (*q.v.*) The term used in French literature usually refers to amidol. In the U.S.A. the term is a trade name of one company for its *p*-phenylenediamine.

Diogen—Sodium α-aminonaphthol-disulfonate, $NH_2C_{10}H_4(SO_3Na)_2OH$, (1:3:6:8)?

Diolene—See ortho-phenylenediamine.

Duratol—*p*-Benzylaminophenol, $C_6H_5CH_2 \cdot NHC_6H_4OH$.

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* The quantity of dye varies according to the dye used as follows:

Safranine (Extra Bluish)	3 grains	0.2 gram
Chrysoidine 3R	3 grains	0.2 gram
Auramine	6 grains	0.4 gram
Victoria Green	6 grains	0.4 gram
Rhodamine B	6 grains	0.4 gram

All dyes listed can be supplied by the National Aniline and Chemical Co., 40 Rector St., New York, N. Y.

† "Dye Toning With Single Solutions" by J. I. Crabtree and C. E. Ives. *Trans. Soc. Mot. Pict. Eng.* *12*: *967* (*1928*).

PHOTOGRAPHIC FORMULAS

Edinol—*m*-Hydroxymethyl-*p*-hydroxyaniline hydrochloride, $(CH_2OH)(OH)C_6H_3NH_2 \cdot HCl$.
Eikonogen—Sodium aminonaphtholsulfonate, $(NH_2)(HO)(SO_3Na)C_{10}H_5 \cdot 2\frac{1}{2}H_2O$ (1:2:6)
Elon—See metol.
Finegrainol—Undisclosed formula; probably a mixture or a double salt of two of the more common developing agents together with small amounts of some other substance.
Genol—See metol.
Glycin (Athenon; Monazol)—*N*-(*p*-Hydroxyphenyl)-glycine; (*p*-hydroxyphenylamino)-acetic acid, $HOC_6H_4 \cdot NHCH_2CO_2H$.
Gradol—Undisclosed formula; probably a derivative of *p*-aminophenol.
Hydramine—A combination of hydroquinone and *p*-phenylenediamine, $C_6H_4(OH)_2 \cdot C_6H_4(NH_2)_2$.
Imogen—AGFA compound not made public.
Hydroquinone—*p*-Dihydroxybenzene, $C_6H_4(OH)_2$.
Kachin—See pyrocatechin.
Kodelon—See par(a)aminophenol.
Meritol—A combination of pyrocatechin and *p*-phenylenediamine, $C_6H_4(OH)_2 \cdot C_6H_4(NH_2)_2$.
Metol (Elon; Genol; Monotol; Photol; Pictol; Rhodol; Satrapol; Veritol)—*p*-Methylaminophenol sulfate, $HOC_6H_4(NHCH_3) \cdot \frac{1}{2}H_2SO_4$.
Metoquinone—A combination of hydroquinone and metol base, $C_6H_4(OH)_2 \cdot 2C_6H_4(OH)(NHCH_3)$.
Monazol—See glycin.
Monomet—*p*-Amino-*o*-cresol hydrochloride, $C_6H_3(CH_3)(OH)(NH_2) \cdot HCl$ (1:2:5).
Monotol—See metol.
Neol—Aminosalicylic acid, $C_6H_3(NH_2)(OH)(CO_2H)$(5:2:1).
Nerol—See amidol.
Orthamine—See ortho-phenylenediamine.
Ortho-phenylenediamine (Diolene; Orthamine) — 1, 2-Diaminobenzene, $C_6H_4(NH_2)_2$.
Ortol—A mixture of hydroquinone and *o*-methylaminophenol sulfate, $C_6H_4(OH)_2 + C_6H_4(OH)(NHCH_3) \cdot \frac{1}{2}H_2SO_4$.
Paraminol—A condensation product of hydroquinone and *p*-aminophenol.
Par(a)aminophenol (Kodelon)—*p*-Aminophenol, usually sold as the oxalate or the hydrochloride salt. Free base: $C_6H_4(OH)(NH_2)$; Kodelon: $C_6H_4(OH)(NH_2) \cdot HCl$.
Paranol—See rhodinal.
Para-phenylenediamine (Diamine-P; Diamol) — 1, 4-Diaminobenzene, $C_6H_4(NH_2)_2$.
Para-phenylenediamine Hydrochloride (Diamine-H; P.D.H.)—1, 4-Diaminobenzene dihydrochloride, $C_6H_4(NH_2)_2 \cdot 2HCl$.
P.D.H.—See para-phenylenediamine hydrochloride.
Phenylenediamine—See para-phenylenediamine and ortho-phenylenediamine.
Photol—See metol.
Pictol—See metol.
Pyrocatechin (Catechol; Kachin)—*o*-Dihydroxybenzene, $C_6H_4(OH)_2$.
Pyro—See pyrogallol.
Pyrogallic Acid—See pyrogallol.
Pyrogallol (Pyro; Pyrogallic Acid)—1, 2, 3-Trihydroxybenzene, $C_6H_3(OH)_3$.
Quinotol—See chlorohydroquinone.
Reducin—1, 3, 5-Triamino-2-hydroxybenzene trihydrochloride, $C_6H_2(OH)(NH_2)_3 \cdot 3HCl$.
Rhodinal (Activol; Azol; Certinal; Citol; Paranol)—Sodium *p*-aminophenolate $C_6H_4(NH_2)(ONa)$. Usually sold in the form of a solution.
Rhodol—See metol.
Rubinol—Undisclosed formula; probably a derivative of pyrogallol.
Satrapol—See metol.
Veritol—See metol.

PHOTOGRAPHIC FORMULAS

TRADE NAMES AND CHEMICAL SYNONYMS OF DYES FOR SENSITIZING PHOTOGRAPHIC PLATES

Trade Name	Chemical Name	Sensitizer for
Ethyl red	1, 1′-diethylisocyanine iodide	Green and yellow
Pinachrome	1, 1′-diethyl-6, 6′-diethoxyisocyanine bromide	Green and orange
Pinaverdol	1, 1′, 6-trimethylisocyanine iodide	Green and yellow
Sensitol green cf. pinaverdol.		
Pinacyanol	1, 1′-diethyl-2, 2′-carbocyanine iodide	Orange and red
Sensitol red cf. pinacyanole		Orange and red
Erythrosin	Sodium salt of tetra-iodo fluorescein	Yellow-green
Orthochrome T	6, 6′-dimethyl-1, 1′-diethylisocyanine iodide	Green
Kryptocyanine	1, 1′-diethyl-4, 4′-carbocyanine iodide	Infra red
Dicyanine A	4′, 2-dimethyl-1, 1′-diethyl-6, 6′-diethoxy-2, 4′-carbocyanine iodide	Extreme red
Neocyanine	1, 1′-diethyl-8-(4-quinolyl ethiodide) methyl 4, 4′-carbocyanine iodide	Infra red

COMPARATIVE PHOTOGRAPHIC EMULSION SPEED RATINGS

The data in this table have been taken from *Popular Photography* 20, *90* (*1947*), copyright by Ziff-Davis Publishing Co., Chicago, 1947, and printed here by permission.

This table must be used with caution because the various speed ratings, being based upon entirely different principles, cannot be compared directly with each other. It must be borne in mind that an effective speed of a given emulsion depends upon the type and character of developer used in processing.

Relative Value	ASA Index	General Electric	Weston Numbers	Scheiner		H & D		DIN Degrees
				American	European	American	European	
106.66	0.6	0.6	0.5	6	12			
64.00	1.0	1.0	0.7	8	14			1/10
40.00	1.6	2.0	1.2	10	16			3/10
32.00	2.0	. . .	1.5	11	17			4/10
21.33	3	4	2.5	13	19	117		6/10
12.80	5	6	4	15	21	190		8/10
8.00	8	10	6	17	23	308	1300	10/10
6.40	10	12	8	18	24	390	1700	11/10
5.33	12	16	10	19	25	500	2100	12/10
4.00	16	20	12	20	26	636	2700	13/10
3.20	20	24	16	21	27	800	3500	14/10
2.56	25	32	20	22	28	1050	4400	15/10
2.00	32	40	24	23	29	1300	5600	16/10
1.60	40	48	32	24	30	1700	7200	17/10
1.28	50	64	40	25	31	2100	9100	18/10
1.00	64	80	50	26	32	2700	11600	19/10
0.80	80	100	64	27	33	3500		20/10
0.64	100	125	80	28	34	4400		21/10
0.50	125	150	100	29	35	5600		22/10
0.40	160	200	125	30	36	7200		23/10
0.32	200	250	160	31	37			24/10
0.25	250	300	200	32	38			25/10
0.20	320	400	250	33	39			26/10
0.16	400	500	320	34	40			27/10
0.13	500	600	400	35	41			28/10
0.10	650	800	500	36	42			29/10
0.08	800	900	650	37	43			30/10
0.06	1000	1000	800	38	44			31/10

PHOTOGRAPHIC FILM EMULSIONS

Most of the information in the following table was obtained from *Popular Photography* 23, *138* (*1948*), copyright by Ziff-Davis Publishing Co., Chicago, 1948, and printed here by permission.

The following table gives an *approximate* comparison of the properties of various photographic emulsions. It should not be considered as a comparison of products from different manufacturers. The speed ratings are subject to a number of variables such as the spectral quality of light used for exposure, the type of developer, the method of development, age of the emulsion, etc. Therefore, this table is to be used merely as a guide to selecting various films and to depend upon the values supplied by the manufacturer of the exposure meter being used and the method of development recommended by the manufacturer of the film.

The filter factors are those established for the well-known Wratten filters. It should be noted that properties given in the column headed *Characteristics and Special Properties* will vary with different methods and procedures of development.

The manufacturers are indicated by abbreviations as follows: A, Anken; An, Ansco; D, Dassonville; DF, Dufay; DP, Du Pont; E, Eastman; G, Gevaert; KL, Kin-O-Lux; W, Weimet.

Notations: † Exact factors for cut film vary with different batches and are supplied by the manufacturer in each package. * Read meter from reflection of white surface placed over copy. ** With Wratten 85B filter. ‡ With Wratten A (No. 25) filter. § With filter recommended by the manufacturer. # Can be processed by the user. ## Processed by the manufacturer.

Type and Name of Film	Manufacturer	Speed						Filter Factors												Characteristics and Special Properties
		ASA		Weston		General Electric		Yellow				Orange		Red		Green				
								Light K-1		Medium K-2		G		A		Light X-1		Dark X-2		
		Day	Tungsten	Day	Tungsten	Day	Tungsten	Day	Tung.	Day	Tung.	Day	Tung.	Day	Tung.	Day	Tung.	Day	Tung.	
Orthochromatic																				
Anken	A	...	...	50	32	...	...	2	...	2	...	...	...	...	...	...	...	...	...	General amateur use; normal gradation and contrast
Plenachrome	An	50	25	50	32	64	32	2	1.5	3	2	6	3	...	...	4	3	6	4	
Verichrome	E	50	25	50	32	64	32	2	1.5	2.5	2	5	3	...	...	...	...	...	...	
Superchrome	G	50	25	24	12	64	32	3	2	3.5	2.5	...	...	...	...	...	...	...	...	
Triple S Ortho	An	125	64	100	64	150	80	2	1.5	3	2	6	3	...	...	4	3	6	4	Portrait; soft gradation; medium contrast
Supersensitive Plenachrome	An	50	25	50	24	64	32	2	1.5	3	2	6	3	...	...	4	3	6	4	
Defender Pentagon	DP	32	12	24	16	40	16	3	2.5	7	4	24	9	...	...	8	5	...	...	
Super Speed Ortho Portrait	E	50	25	50	16	64	32	2	1.5	2.5	2	5	3	...	...	...	...	...	...	
Ortho Portrait	G	50	25	...	...	64	32	3	2	3.5	2.5	...	...	...	...	...	...	...	...	
Defender Ortho-7	DP	64	32	100	64	80	40	1.7	1.5	4	2	5	3	...	...	4.5	3	...	...	Press; high speed; normal contrast
Defender X-F Ortho	DP	50	5	50	16	64	6	1.7	1.5	4	2	5	3	...	...	4.5	3	...	...	
Super Ortho Press	E	100	50	100	32	125	64	2	1.5	2.5	2	5	3	...	...	...	...	...	...	
Ortho-X	E	125	64	100	64	150	80	2	1.5	2.5	2	5	3	...	...	...	...	...	...	

PHOTOGRAPHIC FILM EMULSIONS

Type and Name of Film	Manufacturer	Speed						Filter Factors												Characteristics and Special Properties
		ASA		Weston		General Electric		Yellow				Orange		Red		Green				
								Light K-1		Medium K-2		G		A		Light X-1		Dark X-2		
		Day	Tungsten	Day	Tungsten	Day	Tungsten	Day	Tung.	Day	Tung.	Day	Tung.	Day	Tung.	Day	Tung.	Day	Tung.	
Commercial Ortho	An	25	12	24	12	32	16	2	1	3	2	6	3	....	....	4	3	6	4	Copy; fine grain; high contrast
Commercial Ortho	E	32	10	24	8	40	12	2	1.5	2.5	2	5	3	....	....	....	....	....	....	
Contrast Process Ortho	E	20	12	....	8	24	16	....	1.5	....	2	....	4	....	....	....	....	....	....	
Panchromatic																				
Supreme	An	50	32	50	32	64	40	1.5	1.5	2	1.5	3	2	11	6	4	3	6	4	General use; fine grain; good contrast
Isopan	An	50	32	50	32	64	40	1.5	1.5	2	1.5	3	2	11	6	4	3	6	4	
Defender X-F Pan	DP	50	32	50	32	64	40	1.5†	1.3†	2†	1.5†	3†	1.8†	9†	4.5†	4†	3†	....	....	
Defender Fine Grain Pan	DP	32	20	24	16	40	24	1.3†	1.2†	1.8†	1.5†	2.6†	2.2†	9.5†	4.5†	4.5†	3†	....	....	
Kodak Plus-X	E	50	32	50	32	64	40	1.5	1.5	1.5	1.5	3	2	8	4	4	3	....	....	
Kodak Panatomic-X	E	32	20	24	16	40	24	1.5	1.5	2	1.5	3	2	8	4	3	2	....	....	
Green Seal Panchromatic	W	64	40	50	32	75	48	1.5	....	2	....	3	....	8	....	3	....	5	....	
Ultra-Speed Panchromatic	An	100	64	100	64	125	80	1.5	1.5	2	1.5	3	2	11	6	4	3	6	4	
Superpan Press	An	125	80	100	64	150	100	1.5	1.5	2	1.5	3	2	11	6	4	3	6	4	High speed; general use; good contrast
Defender Arrow Pan	DP	100	64	100	64	125	80	1.2†	1.1†	1.5†	1.3†	1.8†	1.2†	4.3†	3†	4†	3†	....	....	
Kodak Super-XX	E	100	64	100	64	125	80	1.5	1.5	1.5	1.5	3	2	8	4	4	3	....	....	
Super Panchro-Press, Type B	E	125	100	100	64	150	125	1.5	1.5	2	1.5	3	2	8	4	....	....	....	....	
Panchromosa	G	80	64	64	40	100	80	1.5	1.5	1.5	1.5	....	....	6	4	....	....	....	....	
Panchromosa A.H.	G	100	80	....	....	125	100	1.5	1.5	1.5	1.5	....	....	6	4	....	....	....	....	
Superior No. 2	KL	100	64	50	32	125	80	1.6	....	2	....	2.5	....	5	....	....	....	....	....	
Superior No. 3	KL	50	32	....	....	64	40	1.6	....	2	....	2.5	....	3.2	....	....	....	....	....	
Triple S Pan	An	200	160	200	125	250	200	1.5	1.5	2	1.5	3	2	11	6	4	3	6	4	
Super Panchro-Press, Sports Type	E	250	200	200	160	300	250	1.5	1.5	2	1.5	3	2	8	4	....	....	....	....	Extreme speed; long gradation; low contrast
Tri-X Panchromatic, Type C	E	200	160	200	125	250	200	1.5	1.5	2	1.5	2.5	2	6	3	4	3	6	4	
Superpan Portrait	An	50	32	50	32	64	40	1.5	1.5	2	1.5	3	2	11	6	4	3	6	4	
Dassonville Panchromatic	D	....	....	50	32	....	....	2	....	2	....	....	....	....	....	....	....	....	....	Portrait; soft gradation; moderate contrast
Kodak Portrait Pan, Type B	E	50	32	50	32	64	40	1.5	1.5	2	1.5	3	2	8	4	....	....	....	....	
Pan Portrait	G	64	40	....	....	80	48	1.5	1.5	1.5	1.5	....	....	6	4	....	....	....	....	
Direct Positive Pan	E	64	50	50	32	80	64	1.5	1.5	1.5	2	3	2	8	4	4	3	....	....	Low graininess; for reversal
Pan Micro 35mm	G	24	12	....	....	32	16	1.5	1.5	1.5	1.5	....	12	6	....	....	....	....	....	Fine grain; extreme enlargements
Micro-File Safety	E	....	3*	....	2.5*	....	4*	....	1.5	....	....	....	2	....	6	....	....	....	....	Copy work
Contrast Process Pan	E	20	16	....	10	24	20	....	....	....	1.5	....	2.5	....	5	....	....	....	....	High contrast; copying col'd. originals

PHOTOGRAPHIC FILM EMULSIONS

Type and Name of Film	Manufacturer	Speed						Filter Factors												Characteristics and Special Properties
		ASA		Weston		General Electric		Yellow				Orange		Red		Green				
								Light K-1		Medium K-2		G		A		Light X-1		Dark X-2		
		Day	Tungsten	Day	Tungsten	Day	Tungsten	Day	Tung.	Day	Tung.	Day	Tung.	Day	Tung.	Day	Tung.	Day	Tung.	
Blue Sensitive																				
Memo Positive	An	....	8*	....	....	....	10*	....	....	....	....	....	....	....	....	....	....	....	....	Positive transparencies; copy
Commercial	An	25	6	24	6	32	8	....	....	....	....	....	....	....	....	....	....	....	....	Fine grain; copy; comm'l.
Process	An	....	6	12	4	....	8	....	....	....	....	....	....	....	....	....	....	....	....	High contrast; line copy
Kodak Commercial	E	25	6	24	6	32	8	4	3	12	10	....	....	....	....	....	....	....	....	Fine grain; copy; comm'l.
Kodak Commercial Matte	E	25	6	24	4	32	8	4	3	12	10	....	....	....	....	....	....	....	....	Matte emulsion and back
Infra-Red																				
Kodak Infrared	E	....	8‡	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	Haze penetration; unusual effects
Color																				
Ansco Color Daylight	An	12	3§	10	2§	16	4§	....	....	....	....	....	....	....	....	....	....	....	....	#Screenless; practically grainless; positive color transparency
Ansco Color Tungsten	An	12§	12	10§	10	16§	16	....	....	....	....	....	....	....	....	....	....	....	....	
Dufay Color	DF	12	10§	10	8§	15	12§	....	....	....	....	....	....	....	....	....	....	....	....	#Additive screen type, transparency
Kodachrome Regular	E	10	4§	8	3§	12	5§	....	....	....	....	....	....	....	....	....	....	....	....	##Subtractive; screenless; practically grainless; for projection
Kodachrome, Type A	E	10§	16	8§	12	12§	20	....	....	....	....	....	....	....	....	....	....	....	....	
Kodacolor	E	25	....	20	....	32	....	....	....	....	....	....	....	....	....	....	....	....	....	Color snapshots and prints
Ektachrome Daylight	E	8	....	8	....	12	....	....	....	....	....	....	....	....	....	....	....	....	....	#Positive color transparency
Ektachrome, Type B	E	6**	10	5**	8	8**	12	....	....	....	....	....	....	....	....	....	....	....	....	
Kodachrome Professional Daylight	E	8	....	10	....	10	....	....	....	....	....	....	....	....	....	....	....	....	....	##Positive color transparency; screenless
Kodachrome Professional, Type B	E	6**	10	4**	6	8**	12	....	....	....	....	....	....	....	....	....	....	....	....	
Weimet Color	W	40	....	32	....	48	....	....	....	....	....	....	....	....	....	....	....	....	....	##Correction filter suppl.

MOTION PICTURE 16 mm FILM EMULSIONS

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The following table gives an approximate comparison of the properties of various photographic emulsions. It should not be considered as a comparison of products from different manufacturers. The speed ratings are subject to a number of variables such as the spectral quality of light used for exposure, age of the emulsion, etc. Therefore, this table is to be used merely as a guide to selecting various films and to depend upon the values supplied by the manufacturer of the exposure meter being used. The filter factors are those for the well-known Wratten filters.

The manufacturers are indicated by abbreviations as follows: An, Ansco; D, Dassonville; DF, Dufay; DP, Du Pont; E, Eastman; G, Gevaert; KL, Kin-O-Lux; S, Solar; SU, Superior (bulk film).

Abbreviations and other notations: dbl., double; Ex, extra; Fr, free; Rev., reversible; sgl., single; Tung., tungsten. † Also available single-perforated for sound. ‡ Also in double 8 mm, 25 ft daylight loading rolls. § With filter recommended by manufacturer. * Free processing on daylight loading rolls and magazines only. ** Also in double 8 mm, 25 ft daylight loading rolls and 25 ft magazines. # Also in double 8 mm, 30 ft daylight loading rolls. ## Also in single 8 mm.

Type and Name of 16 mm Film	Manufacturer	Processing	Speed						Filter Factors			Packing in Feet Dy = Daylight loading Mg = Magazine Bk = Bulk	Characteristics and Special Properties
			ASA		Weston		General Electric		Daylight Only				
			Day	Tung.	Day	Tung.	Day	Tung.	K-2	G	A		
Orthochromatic													
Solar Type 12 (Rev.) #	S	Fr	16	...	12	...	16	...	...	...	...	Dy 50, 100	Slow speed; fine grain; high contrast; outdoor use; also positives for projection
Superior Regular (Rev.) †‡**##	SU	Fr*	10	...	8	...	...	...	...	...	...	Dy 50, 100; Bk 100, 400	
Superior Plus (Rev.) †‡##	SU	Fr*	16	...	12	3	16	...	...	...	...	Dy 50, 100; Mg 50; Bk 100, 400	
Panchromatic													
Cine-Kodak-8 (Rev.) Dbl. 8 only	E	Fr	10	8	8	6	12	10	2	2	4	Dy 25	Slow speed; fine grain; high contrast; outdoor use; also positives for projection
Super Pan (Rev.) ‡	G	Fr	25	16	24	16	32	20	2	2.5	3	Dy 100	
Micro Pan (Rev.) ‡	G	Fr	10	6	10	6	12	8	2	2.5	3	Dy 100	
Hypan (Rev.) †‡	An	Fr	40	32	32	24	48	40	1.5	2	4	Dy 50, 100, 200, 400	
Supreme Negative†	An	Ex	50	32	32	24	64	40	2	3	11	Dy 100, 200	
Dassonville Type 40 (Rev.) ‡	D	Fr	50	.	40	...	...	...	1.5	2	3	Dy 25, 100	
Pan Negative-301	DP	Ex	50	32	50	32	80	50	...	...	...	Dy 100; Bk 400, 800, 1000, 1200	
Pan Negative-314 (or Rev.)	DP	Ex	32	20	32	20	50	32	...	...	...		
Pan-324 (Rev.)	DP	Ex	40	25	32	20	50	32	...	...	...		
Super-X (Rev.) **	E	Fr	40	32	32	24	48	40	2	2	8	Dy 50, 100, 200; Mg 50; 50 ft packottes for Simplex Pockette and Filmo 121	Medium speed; normal gradation and contrast; general use

MOTION PICTURE 16 mm FILM EMULSIONS

Type and Name of 16 mm Film	Manufacturer	Processing	Speed						Filter Factors			Packing in Feet Dy = Daylight loading Mg = Magazine Bk = Bulk	Characteristics and Special Properties
			ASA		Weston		General Electric		Daylight Only				
			Day	Tung.	Day	Tung.	Day	Tung.	K-2	G	A		
Reversal-No. 3‡	KL	....	64	50	50	40	75	64	2	2.5	5	Dy 50, 100	
Solar Type 24 (Rev.)	S	Fr	32	20	24	16	32	24	....	....	...	Dy 50, 100; Dy 30 in dbl. 8	
Superpanex No. 24 (Rev.) †‡**##	SU	Fr*	32	...	24	16	....	....	2	3	3	Dy 50, 100; Mg 50; Bk 100, 400; Dy 50 in sgl. and dbl. 8 mm	
Green Seal (Rev.) ‡	W	....	40	32	32	24	48	36	2	3	8	Dy 100	
Gold Seal (Rev.) ‡	KL	....	....	25	....	100	....	150	....	....	...	Dy 50, 100	For tungsten only
Triple S Pan (Rev.) †‡	An	Fr	100	80	100	64	125	100	1.5	2	4	Dy 50, 100, 200, 400	
Dassonville Type 80 (Rev.) ‡	D	Fr	100	...	80	....	....	....	1.5	2	3	Dy 25, 100	
Super-XX (Rev.)	E	Fr	100	80	100	80	125	100	2	2	8	Dy 50, 100, 200; Mg 50; 50 ft packettes for Simplex Pockette and Filmo 121	
Ultra Pan (Rev.)	G	Fr	80	64	80	64	100	80	1.5	2	2	Dy 100	High speed for fast negative work; long gradation, wide latitude, medium contrast
Solar Type 100 (Rev.)	S	Fr	125	80	100	64	150	100	....	....	...	Dy 50, 100; Dy 30 in dbl. 8 mm	
Superpanex No. 64 (Rev.) †‡**##	SU	Fr*	80	...	64	40	....	....	2	3	3	Dy 50, 100; Mg 50; Bk 100, 400; Dy 50 in sgl. and dbl. 8 mm	
Blue Sensitive													
Reversal No. 1‡	KL	....	16	...	12	....	18	....	....	....	...	Dy 50, 100	Outdoor use only
Color													
Ansco Daylight Type†	An	Fr	10	...	8	....	12	....	....	....	...	Dy 50, 100, 200	Full natural color; screenless
Ansco Tungsten Type†	An	Fr	....	12	....	12	....	16	....	....	...	Dy 50, 100, 200	
Dufay Color	DF	....	12	10	10	8	15	12	....	....	...	Dy 50, 100	Can be processed by user
Kodachrome Daylight Type	E	Fr	10	4§	8	3§	12	50§	....	....	...	Dy 50, 100, 200; Mg 50; 50 ft packettes for Simplex Pockette and Filmo 121	Full natural color; screenless; practically grainless; Type A balanced for photoflood illumination
Kodachrome Photoflood Type A	E	Fr	10§	16	8§	12	12§	20	....	....	...		

LABORATORY ARTS AND RECIPES

PLATINUM (Courtesy J. Bishop and Co. Platinum Works, Malvern, Pa.)

1. Purposes for which Platinum can be used

A—Fusions

1. Fusions with sodium carbonate or fusion mixture.
2. Fusions with sodium carbonate and sodium nitrate or nitrite.
3. Fusions with sodium borate or sodium metaphosphate.
4. Fusions with alkali bifluorides.
5. Fusions with alkali or alkaline earth chlorides.
6. Fusions with alkali bisulfates.

Loss of weight of the platinum amounts to only a fraction of a milligram in case 1 and is practically nil in case 4. Nitrates or nitrites in the fusion mixture (case 2) cause heavier losses of platinum, but under the usual laboratory conditions these are not likely to exceed 1-2 mg. Borax is inert to platinum and sodium metaphosphate attacks the metal only at very high temperatures or under reducing conditions. Alkali chlorides and alkaline earth chlorides attack the metal above 1000° C. in the presence of air which liberates chlorine from the fused salt; in a neutral atmosphere they are inert. Alkali bisulfates attack platinum slightly above 700° C.; the attack is diminished by addition of ammonium sulfate.

In all cases except case 4, traces of platinum should be looked for in the solutions when making accurate analyses; the platinum is precipitated with the hydrogen sulfide group.

B—Evaporations

1. Evaporations with sulfuric acid with or without hydrofluoric acid.
2. Evaporations with hydrofluoric acid.
3. Evaporations with hydrofluoric and nitric acids in the absence of halides, especially chlorides.
4. Evaporations with hydrochloric acid in the absence of oxidizing agents which yield nascent chlorine.
5. Evaporations with alkali hydroxides or carbonates to avoid contamination of the solution with silica, etc.
6. Evaporations with sodium peroxide solutions (cf. II. C. 6).

C—Ignitions

1. Ignition of barium sulfate.
2. Ignition of alkaline earth carbonates, oxalates, etc.
3. Ignition of sulfates of metals which are not readily reducible.
4. Ignition of oxides which are not readily reducible, e. g., Al_2O_3, MgO, BaO, CaO, SrO, TiO_2, ZrO_2, ThO_2, MoO_3, WO_3, Ta_2O_5, Cr_2O_3, Mn_3O_4, and in the absence of carbonaceous matter ZnO, Co_3O_4, NiO, CdO.
5. Determination of ash in organic materials, e. g., coke, coal, plants.

   The carbonaceous matter should be burnt off at as low a temperature as possible with free access of air to avoid danger of contamination of the platinum with sulfur, phosphorus, iron, etc., derived from reduction of sulfates, phosphates, iron compounds, etc., present in the material.
6. Determination of volatile matter in fuels. Here the maintenance of a non-oxidizing atmosphere is essential to prevent loss of fixed carbon hence there is a greater danger of contamination of the platinum, especially when the fuel is rich in sulfur or phosphorus compounds.

D—Electrolytic Operations

1. As an anode in most electrolytes except strongly acid chloride solution.
2. As cathode for the deposition of metals from acid, alkaline or ammoniacal solutions. For the deposition of zinc, gallium and bismuth, the platinum should first be copper-plated to prevent superficial alloying with the deposited metal.

Atmospheres in Which Platinum Can Be Heated:

1. Air, nitrogen and oxygen up to the melting point of platinum.
2. Oxides of nitrogen.
3. Bromine and iodine vapor.
4. Hydrogen, carbon dioxide.

2. *Conditions Under which Platinum is Attacked*

A—By Heating in Atmospheres Containing the Following Gases:

1. Ammonia: the surface becomes darker, less lustrous and soon develops pores and a crystalline appearance.
2. Sulfur dioxide: sulfur trioxide is formed and the platinum surface becomes coated with platinous sulfide.
3. Chlorine: the metal becomes converted into a mass of crystals due to the alternate formation and decomposition of platinous chloride.
4. Volatile chlorides especially those which readily decompose.
5. Highly carburetted gases and vapors; the metal disintegrates, possibly with the formation of PtC_2, and becomes very brittle. Hence platinum ware should never be heated in the reducing zone of a gas flame.

B—By Heating in the Following Liquids:

1. Aqua Regia.
2. Hydrochloric acid and oxidizing agents.
3. Concentrated sulfuric acid. The action is extremely slow and, for all laboratory purposes, negligible.
4. Concentrated phosphoric acid. Here again the action is noticeable only after very prolonged heating.

C—By Heating in the Following Solids, Their Fusions or Vapors:

1. Sulfur, selenium and tellurium. The action of sulfur vapor is very slow, and prolonged heating is required to produce any serious effect; selenium and tellurium readily combine with platinum.
2. Phosphorus, arsenic and antimony. Combination with platinum occurs readily at a red heat.
3. Magnesium pyrophosphate above 900° C.
4. Silica and borax at high temperatures.
5. Molten lead, zinc, tin, bismuth, silver, gold, or copper or mixtures which form these metals by reduction.
6. Fused alkali oxides and peroxides, and, to a smaller extent in the presence of air, alkali hydroxides.
7. Fused nitrates. The action is intensified by the presence of alkali hydroxides or carbonates but in no case is it very severe (see I. A. 2 *et seq.*).
8. Phosphorus pentoxide or phosphoric acid. The action is relatively small.
9. Fused cyanides. Platinocyanides are formed.
10. Iron oxide above 1200° C. Oxygen is liberated and the iron combines with the platinum.
11. Silica, silicates, alumina and magnesia above 1600° C. At lower temperatures no action occurs.
12. Fused alkali and alkali chlorides in the presence of air at 1000° C. or above (see I. A. 5).
13. Lead and bismuth oxides above 1250° C.

CLEANING PLATINUM

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Every careful analyst of necessity uses clean utensils. The habit of cleaning and polishing platinum ware immediately after using is easily formed, and repays the user with increased confidence in his work as well as with the prolonged life of the article.

The loosening effect of the Bunsen flame upon the surface of platinum exposed to its action produces the familiar gray appearance which cannot be removed except by burnishing. Rubbing the surface of platinum with moist sea sand (round grains only), applied with the finger, serves to remove most impurities and to polish the metal, without material loss in weight.

Fusing bisulphate of potash or borax in the vessel and then boiling in water and polishing as above with sand is recommended by Gmelin. When it is desired to clean the outer surface of vessels in this manner, they must be placed in dishes of sufficient size to allow the fused flux to envelope completely the article to be cleaned.

Sodium amalgam possesses the property of wetting platinum without amalgamating with it, even when other metals are purposely added to the amalgam. This substance is, therefore, useful for effecting a quick and thorough cleansing of platinum. The amalgam is gently rubbed upon the metal with a cloth and then moistened with water, which oxidizes the sodium and leaves the mercury free to alloy with foreign metals. The mercury is then wiped off and the article cleaned and polished with sand, as above described.

If the existence of a base metal alloyed with the platinum is suspected, immerse the article in question first in boiling HCl for a few minutes; then, after thoroughly rinsing with clean water, in boiling HNO_3 free from chlorine. If the article is unaffected in weight or appearance, and the acid baths fail to give reaction for base metals, the absence of such is assured.

PERMANENT MARKING OF GLASS AND PORCELAIN VESSELS.

(Reprinted from *The Chemist-Analyst*, J. T. Baker Chemical Co., Phillipsburg, N. J., publishers, by permission.)

According to H. G. Isbell (*Vol.* 20, *No.* 3, *p.* 20, 1931) a good ceramic ink can be made from the following: 1 part K_2CO_3, 1 part $Na_2B_4O_7$, 2 parts PbO, 2 parts $Co(NO_3)_2$ or other salt of cobalt. Grind this mixture in a mortar to a fine powder (dry if necessary). Mix intimately with a mixture of 4 parts copaiba balsam, 1 part clove oil, and 1 part lavender oil; if these oils are not available raw linseed oil may be used in place of the oil mixture. The amount of oil used should be such that the mixture will run slowly from a pen. The desired markings are made on a clean surface which is then warmed gently over a flame to dry the oil and prevent cracking in the final heating. The place where the marking has been made is then heated slowly by holding against the side of a flame at a tangent and the article rotated slightly. The marking first turns black due to the carbonization of the oil after which it will begin to glow red. At this point the article is removed from the flame and allowed to cool slightly after which it is reheated until the markings, not the glass, begin to glow. The marking thus obtained presents a smooth and shiny surface, blue in color, which cannot be removed by mechanical or the usual chemical means.

Robbins (*The Chemist-Analyst, Vol.* 18, *No.* 1, *p.* 18, 1929) gives the following directions for the marking of glassware by lead etching.—(1) Take a quantity of PbO or Pb_3O_4, break up all lumps to a fine powder, place in a dish, and warm slightly over a flame to remove traces of moisture. (2) The glass to be etched must be free from finger prints, moisture, or grease. (3) An ordinary rubber stamp having the desired lettering and an ordinary stamp pad are used. Stamp the wording on the part to be etched, shake a small quantity of the lead oxide over the wording, and brush off the excess lead oxide with a camel's hair brush. The ink from the stamp pad acts only as a binder for the oxide. (4) Run the piece of glassware through the flame until the oxide has a glassy appearance. In some cases the wording may become black due to the formation of a higher oxide of lead by the use of the oxidizing part of the flame. This higher oxide may be removed by holding in the extreme upper part of the flame, and burning the oxide off, leaving a clear etching. (5) Care must be taken to avoid too hot a flame as this has a tendency to spread the lead.

Matthews (*The Chemist-Analyst, Vol.* 18, *No.* 1, *p.* 22, 1929) prepares a marking ink for chemical porcelain as follows: —18.8 grams of commercial, black cobalt oxide, 1.2 grams of bismuth subnitrate, 15 cc of turpentine, 15 drops of Dresden thick oil. This mixture is ground together and applied to the porcelain with a pen. The porcelain is then heated slowly to evaporate the liquids and finally ignited.

Gifford (*The Chemist-Analyst, Vol.* 18, *No.* 1, *p.* 16, 1929) recommends that apparatus, flasks, test tubes, beakers, etc., which are used daily in making routine analyses be marked with a good grade of automobile enamel of any desired color. The marking is placed on the etched circle with either a marking brush or a tooth pick. When it is desired to remove the marking it is first scraped with a knife and finally washed with carbon tetrachloride or other suitable solvent.

LABORATORY ARTS AND RECIPES

Hirsch (*The Chemist-Analyst, Vol.* 19, *No.* 1, *p.* 18, 1930) finds that permanent identification marks, superior to those often written with blue wax pencils, may be made on laboratory ware, such as crucibles, evaporating dishes, etc., with ordinary blue black ink, using a pen as a marker. The surface to be marked is wiped dry and the desired characters made conveniently with a fountain pen, using sufficient ink to give a continuous opaque film. After allowing the ink to dry, the surface is gradually ignited over a Meeker burner, finally bringing the flame to bear directly upon the configurations until fused into the surface or glaze. A successful marking is reddish brown, smooth, homogeneous, and without any appearance of external roughness. This method was applied to marking tare weights on pyrex beakers used as drying dishes, thereby obviating continual reweighing. During the ignition to fuse in the numerals, the beakers lost about ½ milligram in weight; allowance, therefore, was made in marking. The marked weights themselves serve as identifications. A similar procedure is employed by Liebschultz (*ibid. No.* 9, *p.* 11, 1914) and by Baker (*ibid. No.* 7) for the marking of crucibles except that they recommend the addition of a trace of platinum chloride to the ink used in marking.

Schollenberger (*The Chemist-Analyst, Vol.* 18, *No.* 1, *p.* 17, 1929) recommends that porcelain and silica ware be marked with platinum. According to his procedure, about one decigram of scrap platinum is dissolved in aqua regia in a small porcelain crucible and the solution evaporated to dryness. About 1 cc of lavender oil is added and the mixture stirred until permanently mixed. The ware to be marked is warmed slightly and the mixture applied with a rubber stamp or thinly painted on with a fine brush, sharpened match, or something of the kind. The ware is then gently heated to burn off the oil and strongly ignited to fuse the metal into the surface, producing a distinct black mark. If applied too thickly the characters may be blurred, or may be a metallic mirror less distinct than the black deposit. If the marking ink becomes gummy after long keeping, it may be thinned with a little more of the oil.

Temporary marks may be made on glass or porcelain by writing with a graphite pencil on a ground or sandblasted portion. Glassware is often furnished with a small sandblasted label for such markings, but often the sandblasting is so poorly done that a legible result is difficult to produce. By the use of a discarded piece of alundum ware, a good ground surface is easily made on glass or porcelain; the edge of the alundum is wetted with water and rubbed with short firm strokes at the place desired. Surfaces so ground take pencil more readily than a sandblasted label and the mark is more readily erased with a rubber eraser when desired. Even porcelain crucibles thus marked may be ignited and the mark survive several ignitions but ink is better for this purpose. Ground surfaces thus produced have not been found to increase liability to breakage on heating.

CLEANING MIXTURES FOR CHEMICAL GLASSWARE AND PORCELAIN

The commonly employed chromic acid cleaning mixture which may be used repeatedly until the crystals have disappeared and the solution assumes a greenish tinge, is prepared by mixing with the usual precautions 800 cc of crude, concentrated sulfuric acid with 500 cc of a saturated solution of potassium dichromate in water.

Potassium dichromate, the active material in the ordinary dichromate-sulfuric acid cleaning mixture, leaves the by-products potassium sulfate and chromic sulfate which gradually accumulate leaving the mixture worthless. If heat has been applied to hasten the action or to evaporate any water which has been absorbed, the chromic sulfate sometimes adheres so firmly to the apparatus which is being cleaned that it can only be removed with difficulty. Various solutions have been devised to replace it. Trisodium phosphate as a possible laboratory detergent has been investigated and has much to recommend it. A 15% solution, heated to about 70°C. may be used for cleaning burettes and other volumetric glassware with satisfactory results.

Mathers (*The Chemist-Analyst, No.*

13, *p.* 10, 1915) recommends placing the glass or porcelain apparatus in a large evaporating dish containing hot sulfuric acid and a little nitric acid. If the apparatus is not completely immersed in the hot acids, it is turned after a few minutes so that the cleaning solution comes in contact with every part. The acids should be kept very warm but not hot enough to evolve sulfur trioxide or to distil out the nitric acid. The solution is permanent except that sufficient nitric acid must be added from time to time to keep it white or at least yellow in color rather than black. This mixture has been found especially useful in cleaning dyes, gums and waxes from glassware. A thin film like a dye will be removed almost instantly, but the removal of masses of organic material requires longer treatment.

Gibbs (*The Chemist-Analyst, Vol.* 20, *No.* 4, *p.* 17, 1931) describes a material which effectively cleans glassware in a minimum of time and which works effectively in cold water. It is prepared as follows. Take a 10 oz. cake of a good grade of cleaning and polishing grit cake soap, such as "Bon Ami" and pulverize it to a powder with a mortar and pestle. Cut a 12 oz. cake of a good grade of rosin laundry soap, such as "Octagon," into thin slices and add just enough water to cover the mass. Slowly heat on a hot plate until the soap has dissolved in the water and a clear solution results. Add this liquid soap mixture to the powdered grit cake in a beaker or earthen jar, stirring the mixture well. Allow to stand over night or until the resulting mixture has solidified into a soft mass. This mixture can then be applied to the wet glassware in the usual manner with a brush or the hands, scrubbing thoroughly and finally rinsing in running water. It is only necessary to add small quantities of water from time to time to keep the mixture at the proper consistency.

REMOVAL OF MARKINGS FROM LABORATORY PORCELAIN

It is often desirable to change the old markings on porcelain beakers or evaporating dishes. Cox (*The Chemist-Analyst, Vol.* 19, *No.* 4, *p.* 22, 1930) describes a method for removing such markings leaving a clean, easily remarked surface. It consists merely of washing the old marks with hydrofluoric acid solution and washing the excess acid off as soon as the mark is removed. The hydrofluoric acid is easily applied with a rubber policeman on the end of a glass stirring rod. The acid attacks the markings before it does the porcelain, but if the acid is left on longer than necessary to remove the marks, the porcelain may become etched. The same process may be used to make a surface on new porcelain so that it will take ink easily and not allow the ink to run in burning.

INK REMOVERS

Mathews (*The Chemist-Analyst, Vol.* 18, *No.* 1, *p.* 22, 1929) suggests the following procedure for the removal of ink from paper or cloth. An alkali hypochlorite is first applied to the ink to be removed, followed by an application of dilute acid. To remove red ink stains, cover the spot with concentrated potassium permanganate solution for five minutes. Then place the material in an oxalic acid solution until the permanganate spot disappears. A rather concentrated solution of sodium bicarbonate may be used to neutralize the oxalic acid. Wash the material thoroughly with water. Repeat the process if the stain is not completely removed. Black ink stains may be removed in a similar manner. Always wash well with fresh water after using these solutions.

PURIFICATION OF MERCURY

The purest mercury is obtained by special methods of distillation, a description of which is beyond the scope of this book. The reader is referred to the description of a method by Booth and Jones (*Jour. Ind. Eng. Chem.*, 19, 104, 1927). But for many laboratory uses one of the following methods will yield a material of sufficient purity. If the mercury is very dirty an initial purification can be made by filtering through a dry filter paper having several pin-holes at the apex; or it may be squeezed through the pores in a piece of clean chamois skin.

(*a*) Mercury is shaken in a separatory funnel with a paste of concentrated sulfuric acid and mercurous nitrate, after which it is separated, washed with water, separated from the water, poured into a porcelain evaporating dish, the last visible traces of water removed with a clean blotter or piece of filter paper, and then dried in an oven at 100-10°C.

(*b*) Mercury is placed in a glass or porcelain beaker, then covered with a layer of nitric acid (10 cc concentrated acid diluted with 90 cc of water) and air bubbled through the mercury layer for about 24 hours, after which it is separated, washed, and dried as described in part *a*.

(*c*) Mercury is allowed to spray from a funnel, with a capillary point, into an aqueous 10% sodium hydroxide solution contained in a glass tube one inch in diameter and about three feet in length, which is held in a vertical position and which has fused to its lower end a smaller diameter tube bent so as to form a U-tube and of a length somewhat more than 1/13.6 the length of the aqueous column in the large tube. A small amount of mercury is poured into the U-tube and this supports the column of aqueous solution above it in the large diameter tube. The open end of the small tube is bent over at the top (but for only a very short distance to prevent its acting as a syphon) to form a convenient delivery for the mercury. As the mercury enters the large diameter tube it falls to the bottom of the U-tube and over-flows through the small tube. After several successive passages through the column of sodium hydroxide solution, the mercury is passed in the same manner through dilute nitric acid (10 cc concentrated nitric acid and 90 cc of water), and finally several times through distilled water, after which it is dried as described in method *a*.

DESICCATOR LID LUBRICANT

Case (*The Chemist-Analyst, Vol.* 21, *No.* 2, *p.* 23, 1932) recommends the following preparation as an economical and efficient lubricant for desiccator lids. Two grams of dry soap powder are added to 100 cc of medium grade lubricating oil. The mixture is heated to 150-200°C. (300-400°F.) with stirring for a few minutes until the solution is complete. Twenty grams of paraffin wax are then added with stirring, thus forming a stiff jelly which is not subject to the usual room temperatures. The addition of the paraffin produces a smoother grease which permits a desiccator lid to slide easily even under considerable vacuum.

STOPCOCK LUBRICANT

Meloche and Frederick (*Jour. Amer. Chem. Soc.* 54, 3264, 1932) describe the preparation of a stopcock grease which is not affected by many organic solvents and in which most other greases are soluble. It is prepared as follows. A thick paste is prepared by mixing 25 grams of anhydrous glycerol, 7 grams of dextrin, and 3.5 grams C. P. *d*-mannitol, then heating until the mixture just begins to boil and cooling to room temperature with stirring. The viscosity of the mixture can be increased by the addition of more dextrin and the fluidity can be increased by the addition of more glycerol. The grease is suitable for use with the following solvents: acetic anhydride, acetophenone, benzaldehyde, benzene, bromobenzene, carbon disulfide, carbon tetrachloride, chlorobenzene, tetrachloroethane, cyclohexane, ethyl acetate, ethyl acetoacetate, ethyl bromide, ethyl carbonate, ethylene bromide, ethylene chloride, methyl acetate, methylaniline, nitrobenzene, nitromethane, petroleum ether, diphenyl ether, toluene, *o*-toluidine, turpentine, and *o*-xylene. It is not suitable for use with aniline, acetic acid, *tert*-amyl alcohol, benzyl alcohol, *n*-butyl alcohol, *tert*-butyl alcohol, ethyl alcohol, methyl alcohol, diethylamine, ethylene chlorohydrin, ethylene glycol, formic acid, propionic acid, pyridine, quinoline, water, and solvents containing water.

Shepherd and Ledig (*Jour. Ind. and Eng. Chem.* 9, 1059, 1927) have developed several different stopcock greases of the following compositions. (*a*) For high vacuum work requiring a viscous lubricant, 31 parts pale crepe rubber, 24 parts white vaseline, 5 parts paraffin (melting point 36°C.). (*b*) For general laboratory uses, 6 parts pale crepe rubber, 7 parts vaseline, 1 part paraffin. (*c*) A light grease for volumetric burette cocks where easy manipulation is desired, 10 parts smoked sheet or pale crepe rubber, 18 parts white or yellow vaseline, 1 part paraffin (melting point 30°C.) The mixture of the respective ingredients is heated to 155°C. for 190 hours with continuous stirring, then poured into 2-ounce ointment cans, a small portion to each can and chilled on ice immediately. After aging for 10 days the grease is ready for use.

LABORATORY CEMENTS

Litharge-glycerol cement is prepared by adding sufficient litharge to a mixture of six parts commercial 95% glycerol (glycerine) with one to three parts of water to form a paste of the desired consistency. Inert materials such as iron oxide, sand, or Fuller's earth are often added to retard the setting time and to prevent cracking. This cement is fairly acid resistant.

Jackson (*The Chemist-Analyst, Vol.* 20, *No.* 2, *p.* 23, 1931) prepares a general laboratory cement from the following materials: 1 part or 25 grams of asphalt, 6 parts or 150 grams of rosin, 3 parts or 75 grams of rubber, and 1 part or 25 cc of turpentine. Mix the rosin and asphalt, heat with a small flame and then add the rubber (an old inner tube is satisfactory). The mixture is heated at as low a temperature as possible to keep it fluid and until nearly all the rubber is melted, which requires about two or three hours. The turpentine is then added and the heating continued two or three hours or until the mass becomes homogeneous. It is best to heat in a large beaker as there is a tendency to frothing and it should be stirred at intervals of fifteen minutes. The cement may then be cast into sticks for convenient use. The cement is applied (to dry surfaces only) by holding in a small flame until it liquifies or catches fire; it is then applied directly. This cement is satisfactory for an adhesive to make gas tight joints as well as other uses where it is desired to stick two objects together. It is not affected by chemical reagents in moderate concentrations. The formula above gives a pliant cement that is somewhat sticky when cold; it does not adhere to the fingers when touched. A harder and less pliant cement may be made by increasing the amount of rosin.

Matthews (*The Chemist-Analyst, Vol.* 18, *No.* 1, *p.* 22, 1929) suggests a cement for porcelain, metals or stoneware. Casein is soaked in an equal weight of water for two hours during which time the casein swells but does not dissolve. At the end of this time, sodium silicate and lime are stirred in and the cement is ready for use.

LACQUER

Taylor (*The Chemist-Analyst, Vol.* 20, *No.* 4, *p.* 10, 1931) finds that an excellent label lacquer and general utility cement may be prepared from the pyroxylin handles of discarded tooth brushes. The bristled end is broken off and the handle dissolved in enough of a solvent such as butyl acetate, acetone, or ether-alcohol to give a glycerine-like consistency. About 300 cc of solution usually results. The color of the original handle is unimportant since even the darkest ones give an almost colorless film. The lacquer so prepared is not only useful for protecting labels but has been used successfully for sealing leaks in apparatus, notably vacuum distillation, and sealing bottles against moisture. It is a good library paste since it does not wrinkle paper, and it may also be used to cement pieces of glass together.

TEMPERATURE SENSITIVE PAINTS

Paper impregnated with temperature sensitive paint will change color when heated by a flame, electric spark, etc. Such paper is suitable for use in recording systems, for application to bearings, on condensers to indicate if sufficient water is being used for cooling, and other readily suggested uses. Any one of the following four mixtures is suitable for this purpose. (1) One part by weight of cuprous iodide and 1 part of mercuric chloride are ground to a fine powder and mixed with a thin, light colored, non-acid oil or spirit varnish. It is applied to a surface with a brush (do not apply to aluminum). The color is bright red below 130°F. at which temperature it begins to darken, becoming noticeably darker at 135°F. and at 145°F. the color is maroon; at 155°F the color changes to a light chocolate, to a dark chocolate at 160°F, and at 212°F it is black. Decomposition begins at 300°F.

(2) Aniline hydrochloride 9.8 grams, potassium nitrate 8.0 grams, and water 100 cc.

(3) Nickel nitrate 5.0 grams, sodium thiosulfate 3.9 grams, sodium nitrate 1.0 grams, 1% gelatin solution 5 cc, and water 100 cc.

(4) Gelatin 10 grams, sodium chloride 5 grams, phenolphthalein 0.5 grams, and water 100 cc.

BLACK ACID PROOF STAIN FOR WOOD

Kiskadden (*The Chemist-Analyst, Vol.* 20, *No.* 3, *p.* 17, 1931) gives the following formula for an acid proof stain for wood. Solution No. 1: Iron sulfate 4 parts, copper sulfate 4 parts, potassium permanganate 9 parts, and water 83 parts. Solution No. 2: Aniline 12 parts, hydrochloric acid 18 parts, and water 70 parts. Apply two coats of No. 1; the second coat being applied as soon as the first has dried. Rub off the excess of the last coat when dry and apply two coats of No. 2. Dry thoroughly and apply a coat of linseed oil using a cloth. The color develops into an ebony black in a few hours. The surface may be washed with soap and water. One hundred cc of No. 1 will cover approximately 20 sq. ft. of surface; 50 cc of No. 2 will cover approximately 20 sq. ft. of surface.

According to the U. S. Bureau of Chemistry the same results are obtained by an application of the following two solutions. No. 1: Copper sulfate 125 grams and potassium chlorate 125 grams are dissolved in 1000 cc of water. No. 2: Aniline hydrochloride 60 grams and hydrochloric acid (sp. gr. 1.20) 90 cc are dissolved in 500 cc of water. Application: Paint the wood first with solution No. 1 and as soon as it dries sufficiently, apply a coat of solution No. 2; allow to dry for several hours. Wash with hot water and repeat the operations until the color is a dark green. Finish by rubbing with raw linseed oil until a jet black surface is obtained.

DRESSING WAX FOR ALBERENE DESK TOPS

Melt 450 grams of paraffin on a water bath, cool to 60°C., add 340 cc of kerosine with constant stirring, and then add 340 cc of gasoline.

HEAT FILTERS

Either of the following two solutions may be employed to prevent heat rays from passing, and permit light rays to pass through. They are used in glass cells being placed between the source of artificial light and other parts of the optical apparatus. Solution No. 1: copper sulfate 0.5 grams, water 100 cc, and sulfuric acid 1 drop. Solution No. 2: ferrous ammonium sulfate 20 grams, water 100 cc, and sulfuric acid sufficient to clear the solution or about 5 drops. These solutions are stable for about two weeks.

ELECTRICAL POLARITY INDICATORS

Dipping the ends of the two wires into a dilute solution of sulfuric acid or of salt will produce about the negative terminal a larger number of bubbles of gas than appear at the positive terminal.

Another method is to cut strips of filter paper and then immerse them in a solution of sodium chloride containing a few drops of phenolphthalein indicator; the strips thus prepared are then dried. When ready for use, they are moistened with water and the terminal wires are touched to the paper strips. A pink coloration appears at the point of contact with the negative terminal.

PRESERVATIVE FOR ALGAE, etc.

King's fluid for the preservation of algae consists of the following mixture: 50 grams of distilled water, 0.5 grams of glacial acetic acid, 0.2 grams of copper nitrate crystals, 0.2 grams of copper chloride crystals, and 50 grams of camphor water prepared by allowing a lump of camphor to stand in distilled water for a few days.

FORMULAS AND PROPERTIES OF DENATURED ALCOHOLS

The data given in the tables on denatured alcohols have been compiled: from (1) *REGULATIONS No. 3*, and the *APPENDIX TO REGULATIONS No. 3*, Bureau of Internal Revenue, U. S. Treasury Department, both of which may be obtained from the Superintendent of Documents, Washington, D. C., at a cost of 40¢ and 10¢ respectively; and from information furnished by O. F. Roller, Jr. of Publicker Industries, Inc., Philadelphia, Penna. Additional information as to the procedure to be followed and assistance in filing applications for permits to procure specially denatured alcohol can be obtained from Publicker Industries, Inc. who will also assist alcohol users in the selection of a formula most suitable to their needs.

Because of its use in beverages, nearly every country has considered alcohol a proper article for taxation and government control. The tax on alcohol is usually high so that the cost of pure alcohol is far above the cost of actual manufacture. In the United States of America, alcohol which has not been denatured is subject to the Internal Revenue Tax except to certain classes of users. See definition of tax-free alcohol which follows.

Alcohol which is intended for industrial purposes is not subject to the high tax but, to make possible the removal from taxation, it is necessary to render the alcohol unfit for beverage purposes. See definitions of completely and specially denatured alcohols which follow. In the following tables, the formulas, their numbers, and authorized uses, are set by the United States Government. They are the only ones that can be used by manufacturers in the United States. These are changed from time to time but at no set interval. The Government can make changes at will either for the benefit of the manufacturers of new products or for the protection of the revenue.

The values in the tables, giving specific gravity and weight per gallon of the denatured alcohols prepared from 190 proof alcohol, are those determined by the U. S. Bureau of Standards. The specific gravity is "true specific gravity"; *i.e.*, all weighings are corrected for the buoyancy of the air. It was necessary, therefore, to change these values to "apparent specific gravity" before they could be multiplied by the weight of a gallon of water at 15.6°C to give the weight of a gallon of alcohol at the same temperature. The magnitude of this correction to specific gravity is as follows:

True specific gravity at 15.6°/15.6°C	Correction	Apparent specific gravity at 15.6°/15.6°C
0.70	−0.00035	0.69965
0.80	−0.00023	0.79977
0.90	−0.00012	0.89988

DEFINITIONS

Absolute alcohol is an alcoholic liquor containing 99.75% to 100% by volume of ethyl alcohol and is 200 proof.

Anhydrous denatured alcohol refers to denatured alcohol made with absolute alcohol. Therefore, it is anhydrous or practically free from water.

Tax-free alcohol is ethyl alcohol which may be withdrawn under permit from a bonded warehouse by: (1) the several States and Territories, or municipal subdivisions thereof, or the District of Columbia and must be used solely for mechanical and scientific purposes or for hospitals and clinics; (2) hospitals, sanitariums, or clinics operated for charity and not for profit and must be used only for medicinal, mechanical and scientific purposes, and in the treatment of patients; (3) scientific universities and colleges of learning, and must be used only for scientific, mechanical, and medicinal purposes; (4) laboratories for use exclusively in scientific research.

Tax-paid alcohol is subject to a Federal tax (in the year 1946, $9.00 a proof gallon which is at the rate of $17.10 per wine gallon of 190 proof alcohol, or $18.00 per wine gallon of 200 proof alcohol). Tax-paid alcohol may be purchased by manufacturers and others for non-beverage purposes without a Federal bond or permit. Most States have special regulations governing its purchase and use.

Completely denatured alcohol is ethyl alcohol to which have been added such denaturing materials (see following tables) as render the alcohol unfit for use as an

FORMULAS FOR SPECIALLY DENATURED ALCOHOL

intoxicating beverage and of such a nature that after denaturation it may be sold and used within certain limitations, covered by Government regulations, without permit or bond. Dealers in and manufacturers using it (but not recovering for re-use) are not required to obtain a permit under Government regulations. Manufacturers using completely denatured alcohol and recovering the same for re-use must file bond and procure a permit. Dealers and manufacturers receiving, storing, selling or using as much as 11 drums or barrels (550 wine gallons) in a calendar month must keep prescribed records of the receipt, storage and disposition of such completely denatured alcohol.

Specially denatured alcohol is ethyl alcohol that has been so denatured that it can be used in specified arts and industries (see following tables) where it is not practical to use completely denatured alcohol. Specially denatured alcohol may be procured and used, free of tax, for manufacturing purposes under permits. Application for permit is required to be filed with the District Supervisor, Alcohol Tax Unit, of the district in which applicant is resident. Blank forms and instructions relative to the proper execution thereof may be obtained by applying to the District Supervisor's office. Records of the receipt, storage and disposition of specially denatured alcohol must be kept. Samples of specially denatured alcohol may be procured by manufacturers holding permits to use specially denatured alcohol and by applicants or prospective applicants for such permits. Application for withdrawal of samples of specially denatured alcohol in excess of 8 fluid ounces must be made to the District Supervisor of the applicant's district. Samples of 8 fluid ounces or less may be procured by permittees and applicants or prospective applicants for permits without the necessity of filing application and procuring permit therefor.

Alcohol proof is a term expressing the alcoholic content, and is twice the percentage by volume of alcohol; *e.g.*, 190 proof is 95% by volume.

Apparent proof of a denatured alcohol is the same as the proof of pure alcohol having the same gravity as the denatured one.

Proof gallon is one gallon (231 cubic inches at 60°F; 3785.4 milliliters at 15.56°C) of alcohol-water solution containing 50% by volume of alcohol.

Proof spirits (100 Proof) is an alcoholic liquor which contains one-half its volume of alcohol of a specific gravity of 0.7939 at 60°F (15.56°C) referred to water at 60°F as unity.

Wine gallon is 231 cubic inches (3785.4 milliliters) of alcohol of any proof. A wine gallon of 190 proof alcohol is equal to 1.90 proof gallons.

Tax gallon of alcohol is one gallon of 100 proof alcohol. A gallon of spirits is taxed according to the quantity of alcohol it contains, or according to proof. One wine gallon of 190 proof alcohol is taxed as 1.90 proof gallons.

(*Continued on following page.*)

FORMULAS FOR SPECIALLY DENATURED ALCOHOL

Formula Number	Composition	Properties of Finished Formula				
	Giving amounts of denaturant to be added to 100 gallons of 190° proof ethyl alcohol	At 15.6°C		Sp. gr. in vac. 15.6°/15.6°C	% Ethyl Alcohol	
		Wt. in lbs./gal.	Apparent Proof		by vol.	by wt.
1	5 gal. approved wood alcohol (*a*)	6.785	190.6	0.8149	90.48	86.31
2A	2 gal. approved wood alcohol (*a*) and 2 gal. benzene	6.805	189.3	0.8173	91.35	87.45
2B	0.5 gal. benzene (*b*)	6.795	190.0	0.8161	94.53	91.75
3A	5 gal. commercially pure methyl alcohol (*a*)	6.781	191.8	0.8144	90.48	86.31
3B	1 gal. pine tar (pix liquida, U. S. P.)	6.810	189.0	0.8179	94.06	91.11
4	1 gal. of the following solution: 5 gal. of an aqueous solution containing 40% nicotine; 3.6 oz. methylene blue; water to make 100 gal.	6.823	188.2	0.8195	94.06	91.11
6A	15 gal. condensed fumes recovered in the process of manufacture of fulminate of mercury containing not less than 4 grams/100 cc of mixed aldehydes calculated as acetaldehyde	.....	.....	......	.....	.....
6B	0.5 gal. pyridine bases	6.801	189.5	0.8169	94.53	91.75
12A	5 gal. benzene	6.820	188.3	0.8192	90.48	86.31
13A	10 gal. ethyl ether	6.740	193.3	0.8095	86.36	81.10
17	0.05 gal. (6.4 fluid oz.) animal oil (Dippel's oil)	6.795	190.0	0.8161	94.95	92.35
18	100 gal. vinegar containing not less than 9% acetic acid	7.802	97.2	0.9369	47.50	41.25
19	100 gal. ethyl ether	6.468	200.0	0.7769	47.50	48.80
20	5 gal. crude chloroform	7.062	170.9	0.8481	90.48	86.31
22	10 gal. formaldehyde solution containing 37% formaldehyde	7.037	173.3	0.8451	86.36	84.02
23A	10 gal. acetone, U. S. P.	6.788	191.4	0.8153	86.36	84.25
23E	9 lbs. oil of bitter almonds, U. S. P.; 1 lb. salicylic acid, U. S. P.	6.840	187.1	0.8215	94.04	91.08

(*a*) Approved wood alcohol is wood spirit containing ketones, aldehydes, unsaturated compounds, etc., that render separation very difficult. In order to be approved the wood alcohol must pass general tests for the impurities and must be a wood distillation product. It is for this reason that all uses of Formula 3A are conditional.

(*b*) This formula must be used in a closed and continuous process unless it is shown that it is not practical to do so.

FORMULAS FOR SPECIALLY DENATURED ALCOHOL

Formula Number	Composition	Properties of Finished Formula				
	Giving amounts of denaturant to be added to 100 gallons of 190° proof ethyl alcohol	At 15.6°C		Sp. gr. in vac. 15.6°/15.6°C	% Ethyl Alcohol	
		Wt. in lbs./gal.	Apparent Proof		by vol.	by wt.
23F	3 lbs. salicylic acid, U. S. P.; 1 lb. resorcinol, U. S. P.; 1 gal. oil of bergamot or oil of bay, N. F. (VI)	6.808	189.1	0.8177	93.91	90.91
23G	3.5 gal. methyl propyl ketone and 0.5 gal. methyl isobutyl ketone (*c*)	6.794	190.0	0.8160	91.35	87.45
23H	8 gal. acetone, U. S. P. and 1.5 gal. methyl isobutyl ketone (*d*)	6.785	190.6	0.8149	86.76	81.60
24	29 gal. sulfuric acid	9.137	.....	1.097	73.64	66.37
25	20 lbs. iodine, U. S. P.; 15 lbs. potassium or sodium iodide, U. S. P. (*e*)	7.080	169.5	0.8502	91.69	87.89
25A	Solution composed of 20 lbs. iodine, U. S. P.; 15 lbs. potassium or sodium iodide, U. S. P.; 15 lbs. water (*f*)	7.119	166.2	0.8550	90.93	86.09
27	1 gal. oil of rosemary, U. S. P.; 30 lbs. camphor, U. S. P.	6.846	186.7	0.8222	91.46	87.59
27A	35 lbs. camphor, U. S. P.; 1 gal. oil of cloves, U. S. P.	6.867	185.3	0.8247	90.88	86.83
27B	1 gal. oil of lavender flowers, U. S. P., or oil of cedar leaf, U. S. P.; 100 lbs. soft soap, U. S. P.	7.027	173.7	0.8439	85.30	79.81
28	10 gal. approved benzene	6.843	186.9	0.8219	86.36	81.10
28A	1 gal. gasoline	6.786	190.5	0.8150	94.06	91.11
28A	1 gal. gasoline (with absolute alcohol as a base)	6.605	200.0	0.7933	98.81	98.08

(*c*) Standard formula for rubbing alcohol compounds using specially denatured alcohol No. 23G: S. D. A. No. 23G 98.1 fl. oz.; sucrose octa acetate 0.5 oz. avoir.; water to make 1.0 gal.

(*d*) Standard formula for rubbing alcohol compounds using specially denatured alcohol No. 23H: S. D. A. No. 23H 103.3 fl. oz; sucrose octa acetate 0.5 oz. avoir.; water to make 1.0 gal.

(*e*) Formula for tincture of iodine, U. S. P. using specially denatured alcohol No. 25: iodine 6.50 oz. avoir.; potassium iodide 4.50 oz. avoir.; distilled water 6.40 fl. oz.; S. D. A. No. 25 to make 128.00 fl. oz.

Formula for mild tincture of iodine, U. S. P. using specially denatured alcohol No. 25: iodine 1 oz., 11 grains avoir.; sodium iodide 1 oz., 372 grains avoir.; water 65 fl. oz., 134 minims; S. D. A. No. 25 to make 128.00 fl. oz.

(*f*) Formula for tincture of iodine, U. S. P. using specially denatured alcohol No. 25A: iodine 6.50 oz. avoir.; potassium iodide 4.50 oz. avoir.; distilled water 4.40 fl. oz.; S. D. A. No. 25A to make 128.00 fl. oz.

Formula for mild tincture of iodine, U. S. P. using specially denatured alcohol No. 25A: iodine 1 oz. avoir., 11 grains; sodium iodide 1 oz. avoir., 372 grains; water 64 fl. oz.; S. D. A. No. 25A to make 128.00 fl. oz.

FORMULAS FOR SPECIALLY DENATURED ALCOHOL

Formula Number	Composition	Properties of Finished Formula				
	Giving amounts of denaturant to be added to 100 gallons of 190° proof ethyl alcohol	At 15.6°C		Sp. gr. in vac. 15.6°/15.6°C	% Ethyl Alcohol	
		Wt. in lbs./gal.	Apparent Proof		by vol.	by wt.
29	1 gal. 100% acetaldehyde or 5 gal. of an alcoholic solution of acetaldehyde containing not less than 20% acetaldehyde, or 1 gal. GC-78, or 5 gal. ethyl propionate, or 5 gal. ethylamines, or 5 parts by weight if solid, or volume if liquid, of any chemical produced from ethyl alcohol (*g*)	6.822	188.2	0.8194	94.06	91.11
30	10 gal. pure methyl alcohol	6.785	191.6	0.8149	86.36	81.10
31A	100 lbs. glycerol, U. S. P.; 20 lbs. hard soap, toilet grade containing not in excess of 5% moisture	7.167	162.1	0.8608	84.27	78.55
32	5 gals. ethyl ether	6.769	191.5	0.8130	90.48	86.31
33	30 lbs. methyl violet	6.893	183.4	0.8279	92.15	88.51
35	35 gals. ethyl acetate	6.956	179.0	0.8355	70.37	62.84
35A	5 gals. ethyl acetate	6.821	188.3	0.8193	90.48	86.31
36	3 gals. concentrated ammonia water, U. S. P.	6.837	187.3	0.8211	92.23	88.61
37	45 oz. eucalyptol, U. S. P.; 30 oz. thymol, U. S. P.; 20 oz. menthol, U. S. P.	6.794	190.0	0.8160	94.43	91.62
37A	5 lbs. menthol, U. S. P.; 10 lbs. camphor, U. S. P.	6.814	188.7	0.8184	93.56	90.42
38	5 gal. of a water solution of 60 oz. zinc chloride, U. S. P.; and 10 lbs. of any one of the following: (1) methyl salicylate, U. S. P.; (2) oil of wintergreen, U. S. P.; (3) oil of cassia, U. S. P.; (4) oil of cloves, U. S. P.; (5) oil of peppermint, U. S. P.	6.970	178.0	0.8371	89.94	85.62
38A	5 oz. menthol, U. S. P.; 9 oz. emetine hydrochloride, U. S. P.; 16 lbs. benzoic acid, U. S. P.	6.853	186.2	0.8231	93.38	90.18

(*g*) This formula is restricted to processes where the alcohol loses its identity as alcohol by being converted into other chemicals. Where it is desired to use any chemical produced from ethyl alcohol other than those mentioned as the denaturant for formula 29, the use of such chemical shall be subject to approval by the Commissioner.

FORMULAS FOR SPECIALLY DENATURED ALCOHOL

Formula Number	Composition	Properties of Finished Formula				
	Giving amounts of denaturant to be added to 100 gallons of 190° proof ethyl alcohol	At 15.6°C Wt. in lbs./gal.	At 15.6°C Apparent Proof	Sp. gr. in vac. 15.6°/15.6°C	% Ethyl Alcohol by vol.	% Ethyl Alcohol by wt.
38B	A total of 10 lbs. of a mixture of two or more of the U. S. P. oils and substances listed below (*h*): Benzaldehyde; camphor; chlorothymol; eucalyptol; guaiacol; menthol crystals; oil of bay; oil of bergamot; oil of bitter almonds; oil of cassia or cinnamon; oil of cedar leaf; oil of citronella; oil of cloves or eugenol; oil of eucalyptus; oil of lavender; oil of mustard (volatile); oil of peppermint; oil of pine or pine needles; oil of rosemary; oil of sassafras; oil of spearmint; oil of thyme; oil of turpentine; oil of wintergreen or methyl salicylate; phenol; phenyl salicylate; safrol with a specific gravity not less than 1.096 and not more than 1.110 at 16°C.; thymol (*h*)	6.804	189.4	0.8172	94.04	91.08
38C	160 oz. menthol, U. S. P.; 125 gal. formaldehyde solution containing 37% formaldehyde	6.832	187.7	0.8206	93.22	89.97
38D	40 oz. menthol, U. S. P.; 2.5 gal. formaldehyde solution containing 37% formaldehyde	6.863	185.7	0.8242	93.14	89.85
38E	5 gal. fluid extract ipecac, U. S. P., or 40 lbs. ipecac, U. S. P.	6.924	181.3	0.8316	90.48	86.31
39	9 lbs. sodium salicylate or salicylic acid, U. S. P.; 1.25 gal. fluid extract of quassia, N. F.; ⅛ gal. denaturing grade of tertiary butyl alcohol	6.867	185.3	0.8247	93.33	90.08
39A	60 oz. of any one of the following U. S. P. alkaloids or salts: (1) quinine; (2) quinine bisulfate; (3) quinine hydrochloride; (4) cinchonidine; (5) cinchonidine sulfate; and ⅛ gal. denaturing grade of tertiary butyl alcohol	6.810	189.0	0.8179	94.64	91.92

(*h*) Anyone desiring to use this formula must specify in the application which substances from the list are selected to make up the 10 lbs. of denaturants required. Anyone desiring to use 10 lbs. of only one of the denaturants must request the privilege from the Department setting out the denaturant and the reasons for the particular request so that the matter may be taken under advisement. Upon application the substitution of other essential oils or substances for those listed will be given consideration provided they are efficient denaturants and it is conclusively shown that none of the denaturants listed or any combinations thereof are satisfactory for the manufacture of any particular product.

FORMULAS FOR SPECIALLY DENATURED ALCOHOL

Formula Number	Composition	Properties of Finished Formula				
	Giving amounts of denaturant to be added to 100 gallons of 190° proof ethyl alcohol	At 15.6°C		Sp. gr. in vac. 15.6°/15.6°C	% Ethyl Alcohol	
		Wt. in lbs./gal.	Apparent Proof		by vol.	by wt.
39B	2.5 gal. diethyl phthalate and ⅛ gal. denaturing grade of tertiary butyl alcohol	6.857	186.0	0.8236	92.57	89.07
39C	1 gal. diethyl phthalate (*i*)	6.824	188.1	0.8196	94.06	91.11
39D	1 gal. oil of bay, N. F., and (1) 50 oz. quinine sulfate or quinine bisulfate, U. S. P., or (2) 200 oz. avoir. sodium salicylate, U. S. P.	6.819	188.4	0.8190	93.92	90.92
40	3 oz. of the alkaloid brucine or brucine sulfate; ⅛ gal. denaturing grade of tertiary butyl alcohol	6.795	190.0	0.8161	94.90	92.28
40A	5 lbs. sucrose octa acetate; ⅛ gal. denaturing grade of tertiary butyl alcohol	6.815	188.1	0.8185	94.44	91.64
42	80 grams potassium iodide, U. S. P. and 109 grams red mercuric iodide, U. S. P.; or 95 grams sodium ethyl mercuric thiosalicylate, C. P.; or 76 grams of any one of the following chemicals: (1) phenyl mercuric nitrate, C. P.; (2) phenyl mercuric chloride, C. P.; (3) phenyl mercuric benzoate, C. P.	6.797	189.8	0.8164	94.96	92.36
44	10 gal. normal butyl alcohol	6.790	190.3	0.8155	86.36	81.10
45	300 lbs. of white or orange shellac, arsenic and rosin free	7.545	126.5	0.9061	71.55	64.11
46	25 fluid oz. phenol, U. S. P.; 4 fluid oz. oil of wintergreen or methyl salicylate, U. S. P. (*j*)	6.805	189.3	0.8173	94.82	92.17
47	7 gal. fluid extract arnica flowers, N. F. (4th edition)	6.882	184.3	0.8265	88.79	84.14

(*i*) The diethyl phthalate shall be of the same quality as that specified for use in specially denatured alcohol Formula No. 39B. This formula may be used only in the manufacture of high-grade perfumes, toilet waters, and toilet-preparations containing not less than 2% by weight of essential oils, or their equivalent in perfume materials. The Department will permit the use of this formula only by manufacturers who are properly equipped by reasons of experience and manufacturing facilities to effectively control their manufacturing operations in accordance with the limitations governing the use of this formula.

(*j*) This formula will be authorized only for use by institutions and organizations which are of a semi-public character and engaged in charitable work.

FORMULAS FOR COMPLETELY DENATURED ALCOHOL

Formula Number	Composition	Properties of Finished Formula				
	Giving amounts of denaturant to be added to 100 gallons of ethyl alcohol of not less than 160° proof	At 15.6°C		Sp. gr. in vac. 15.6°/15.6°C	% Ethyl Alcohol	
		Wt. in lbs./gal.	Apparent Proof		by vol.	by wt.
12	4.0 gal. ST-115† or a compound similar thereto; 1.0 gal. Dehydrol-O† or a compound similar thereto; 0.5 gal. acetaldol (hydroxy-butyraldehyde); 1.0 gal. kerosene	6.802	189.5	0.8170	89.20	86.70
12	4.0 gal. ST-115† or a compound similar thereto; 1.0 gal. Dehydrol-O† or a compound similar thereto; 1.5 gal. methyl isobutyl ketone; 1.0 gal. kerosene	6.802	189.5	0.8170	88.37	86.07
13	4.0 gal. ST-115† or a compound similar thereto; 1.5 gal. methyl isobutyl ketone; 0.25 gal. acetaldol (hydroxy-butyraldehyde); 1.0 gal. kerosene	6.802	189.5	0.8170	88.99	86.61
14	3.0 gal. Dehydrol-O† or a compound similar thereto; 1.75 gal. methyl isobutyl ketone; 1.5 gal. kerosene	6.802	189.5	0.8170	89.41	87.00

† These are trade names for denaturants. ST-115 is a product, free from wood alcohol, containing a definite proportion of the pyroligneous bodies produced by the destructive distillation of wood. Dehydrol-O is a product consisting principally of a mixture of higher aliphatic branched chain primary and secondary compounds of characteristic odor and taste.

AUTHORIZED USES OF SPECIALLY DENATURED ALCOHOL FORMULAS

In the Manufacture of:	Formula No.
Acetic acid	18, 29, 35A
Adhesives and binders	1, 3A, 13A, 22, 23A, 30
Alcohol rubbing compounds	23G. 23H
Aldehydes	1, 2B, 13A, 24, 29
Alkaloids and medicinal chemicals	1, 2B, 3A, 12A, 13A, 17, 23A, 30, 35A
Antifreeze, proprietary	1
Antiseptic solutions	37, 38B
Bath salts	1, 3A, 3B, 23A, 31A, 38B, 39, 39A, 39B, 40, 40A
Bay rum	23A, 37, 38B, 39, 39A, 39B, 39D, 40, 40A
Brake fluid	1, 3A
Candy glazes	23A, 35, 35A, 45
Cellulose compound lacquers, etc.	1, 2A, 3A, 13A, 23A, 30
Cellulose dehydration, see Dehydration	
Cellulose intermediates	1, 3A, 13A, 19, 23A, 32
Cellulose plastics	1, 2A, 2B, 3A, 12A, 13A, 23A, 30
Chemical products, various	1, 2B, 3A, 12A, 13A, 23A, 30
Chemicals, various	1, 2B, 3A, 6B, 12A, 13A, 17, 29, 30, 32
Chloroform	20
Cleaning preparations	1, 2A, 3A, 12A, 23A, 23G, 23H, 30, 32, 37
Cleaning purposes	1, 2A, 2B, 23A, 23G, 23H, 30, 32, 37
Cleaning solutions and purposes	13A
Collodion	13A, 19, 32
Cutting oils	1, 3A
Dehydration, cellulose	1, 2B, 12A
Dehydration, sodium hydrosulfite	1, 2B, 12A

AUTHORIZED USES OF DENATURED ALCOHOL FORMULAS

In the Manufacture of:	Formula No.
Dehydration, other	1, 2B, 12A
Deodorants, body	23A, 23G, 23H, 37, 38B, 39, 39A, 39B, 39C, 40, 40A
Digestive ferments and glandular products	1, 2B, 3A, 12A, 13A, 17, 23A, 30, 35A
Disinfectants, insecticides, etc.	1, 3A, 3B, 22, 23A, 23G, 23H, 27, 27B, 31A, 37, 38B, 39, 39A, 39B
Drug products	1, 2B, 3A, 12A, 13A, 23A, 30, 32
Drugs, crude	1, 2B, 3A, 12A, 13A, 17, 23A, 30, 35A
Drugs, miscellaneous including tablets	1, 2B, 3A, 12A, 13A, 17, 23A, 30, 35A
Dye solutions, miscellaneous	1, 3A, 13A, 23A, 30
Dyes and intermediates	1, 2B, 3A, 12A, 13A, 17, 23A, 30
Embalming products	1, 3A, 22, 23A, 30, 38B
Ether, ethyl	1, 2B, 13A, 24, 32
Ethers other than ethyl	1, 2B, 13A, 24, 29
Ethyl acetate	1, 2B, 3A, 6B, 12A, 18, 24, 29, 35A
Ethylamines	29, 36
Ethyl chloride	1, 2B, 3A, 6B, 24
Ethyl esters, other than ethyl acetate	1, 2B, 3A, 6B, 12A, 13A, 17, 24, 29, 39B
Ethylene dibromide	1, 2B, 3A
Ethylene gas	1, 2B, 3A, 17
Experimental purposes	1, 3A, 30
Explosives	1, 2B, 3A, 13A
Face lotions, see Lotions	
Fluid uses, miscellaneous	1, 3A, 13A, 23A, 23G, 23H, 30
Food products, various	1, 2B, 3A, 12A, 13A, 23A, 30, 35A
Fuel, airplane	1, 28, 28A
Fuels, automobile gasoline blends	1, 28, 28A
Fuels, heating (proprietary)	1
Fuels, various	1
Fulminate of mercury	1, 2B, 3A, 6A
Glandular products, see Digestive ferments	
Hair and scalp preparations	3B, 23A, 23F, 23G, 23H, 37, 38B, 39, 39A, 39B, 39C, 39D, 40, 40A
Hand lotions, see Lotions	
Incense	3A
Incense and sprays, theater	1, 23A, 23G, 23H, 37, 38B, 39, 39A, 39B, 39C, 40, 40A
Inks	1, 3A, 13A, 23A, 30, 32
Inks, meat branding	33
Instruments, scientific	1, 3A
Iodine tinctures, see Tincture	
Insecticides, see Disinfectants	
Intermediates for dyes, see Dyes	
Intermediates for cellulose, see Cellulose	
Laboratory purposes	1, 3A, 30
Liniments	27, 27B, 38B
Lotions, face or hand	23A, 23E, 23G, 23H, 27B, 31A, 37, 37A, 38B, 38C, 39, 39A, 39B, 39C, 39D, 40, 40A
Meat branding inks, see Inks	
Medicinal chemicals including alkaloids, see Alkaloids	
Mercury fulminate, see Fulminate of mercury	
Miscellaneous products	1, 2B, 3A, 12A, 13A, 23A, 30
Mouth washes	37, 37A, 38, 38A, 38B, 38C, 38D, 38E
Pectin	1, 2B, 3A, 12A, 13A, 23A, 30, 35A
Perfume and perfume tinctures	38B, 39, 39A, 39B, 39C, 40, 40A
Perfume materials and fixatives	1, 2B, 3A, 12A, 13A, 23A, 30
Petroleum products	1, 2B, 3A, 12A, 13A, 23A, 30
Pharmaceuticals, external (not U. S. P. or N. F.)	1, 23A, 23E, 23F, 23G, 23H, 27, 27A, 27B, 37, 37A, 38, 38B, 39, 39A, 39B, 39D, 40, 40A, 47
Photo-engraving solutions	1, 3A, 13A, 23A, 30
Photographic developers	1, 2B, 3A, 12A, 13A, 23A, 30
Photographic film and emulsions	1, 2B, 3A, 13A, 19, 23A, 30, 32
Plastics, cellulose, see Cellulose	
Plastics containing no cellulose compounds	1, 2A, 2B, 3A, 12A, 23A, 28
Polishes	1, 3A, 23A, 30
Preserving and sterilizing solutions, see Sterilizing	
Refrigerator uses	1, 3A
Rubber, synthetic	29
Scalp and hair preparations, see Hair preparations	
Shaving cream	36
Shampoos	1, 3A, 3B, 23A, 27B, 31A, 38B, 39, 39A, 39B, 40, 40A
Shellac, see Varnish	
Soaps, industrial	1, 3A, 23A, 30
Soaps, toilet	1, 3A, 3B, 23A, 31A, 38B, 39, 39A, 39B, 40, 40A

AUTHORIZED USES OF DENATURED ALCOHOL FORMULAS

In the Manufacture of:	Formula No.
Sodium hydrosulfite dehydration, see Dehydration	
Soldering flux	1, 3A, 23A, 30
Solutions, miscellaneous	1, 3A, 13A, 23A, 30
Solvents, proprietary	1
Solvents and thinners, industrial (other than proprietary solvents)	23A
Solvents and thinners, proprietary and others	1
Special formula, which see	46
Sprays and incense, see Incense	
Stains	1, 3A, 23A, 30
Sterilizing and preserving solutions	1, 3A, 12A, 22, 23A, 30, 37, 39B, 42, 44
Surface coating materials, various	1, 2A, 3A, 23A, 30
Thinners and solvents, see Solvents	
Tinctures of iodine	25, 25A
Tobacco sprays and flavors	4
Toilet preparations	3B
Toilet soaps, see Soaps	
Toilet waters	38B, 39, 39A, 39B, 39C, 40, 40A
Tooth paste and powder	31A, 37, 38, 38B, 38C
Transparent sheeting not photographic	1, 2B, 3A, 13A, 19, 23A, 30, 32
Varnish, shellac	1, 2A, 23A, 30
Varnish, spirit	30
Varnish, natural resin	1, 2A, 3A, 23A
Varnish, synthetic resin	1, 2A, 3A, 23A, 28, 30
Vinegar	18, 29, 35A
Vitamins and related products	1, 2B, 3A, 12A, 13A, 17, 23A, 30, 35A
Xanthates	1, 2B, 3A

DIMENSIONAL FORMULAS

Dimensional formulas show the relation of various physical quantities and their units in terms of the fundamental quantities of mass, length, and time. In these equations l = length; m = mass; t = time; θ = angle; ω = solid angle; T = temperature; ψ = luminous flux; ϵ = dielectric constant; μ = magnetic permeability; and v = volume = l^3. In the electrostatic, or *cgse*, system: l = cm.; m = g.; t = mean solar second; T = absolute degree Centigrade; and ϵ = dielectric constant of a vacuum. In the electromagnetic, or *cgsm*, system ϵ is replaced by μ, magnetic permeability.

Absorptivity; coefficient of absorption $[l^{-1}]$
Acceleration $[lt^{-2}]$
Acceleration, angular $[\theta t^{-2}]$
Action $[ml^2t^{-1}]$
Angle $[\theta]$
Angle, solid $[\omega]$
Area $[l^2]$
Brightness, surface $[\psi l^{-2} \omega^{-1}]$
Bulk modulus, *cf.* stress.
Capacity, electrical $[\epsilon l]$; $[\mu^{-1} l^{-1} t^2]$
Charge $[\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-1}]$; $[\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}}]$
Compressibility $[m^{-1} l t^2]$
Compression, modulus of, *cf.* stress.
Concentration, mass, *cf.* mass concentration.
Concentration, volume, *cf.* density.
Conductivity, electrical mass $[\epsilon m^{-1} l^3 t^{-1}]$; $[\mu^{-1} m^{-1} l t]$
Conductivity, thermal, *cf.* thermal conductivity.
Conductivity, volume $[\epsilon t^{-1}]$; $[\mu^{-1} l^{-2} t]$
Current, electrical $[\epsilon^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-2}]$; $[\mu^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-1}]$
Density $[ml^{-3}]$ or $[mv^{-1}]$
Dielectric constant $[\epsilon]$; $[\mu^{-1} l^{-2} t^2]$
Dielectric strength $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{-\frac{1}{2}} t^{-1}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}} t^{-2}]$
Diffusion, coefficient of $[l^2 t^{-1}]$
Displacement, total electric, *cf.* charge.
Electrical current, *cf.* current, electrical.
Electric displacement, total, *cf.* charge.
Electrical inductivity $[\epsilon]$; $[\mu^{-1} l^{-2} t^2]$
Electrical potential, *cf.* potential, electrical.
Electrical quantity, *cf.* charge.
Energy $[ml^2 t^{-2}]$
Ettinghausen effect, coefficient of $[\epsilon^{-1} m^{-1} l^{-1} t^4 T]$; $[\mu m^{-1} l t^2 T]$
Field intensity, magnetic, *cf.* magnetic field intensity.
Field strength, electrical, *cf.* dielectric strength.
Fluidity $[m^{-1} l t]$
Flux of induction, *cf.* charge.
Flux, luminous, *cf.* luminous flux.
Flux of magnetic induction; magnetic flux $[\epsilon^{-\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{1}{2}}]$; $[\mu^{\frac{1}{2}} m^{\frac{1}{2}} l^{\frac{3}{2}} t^{-1}]$
Force $[mlt^{-2}]$
Force, magnetizing, *cf.* magnetizing force.

DIMENSIONAL FORMULAS (Continued)

Force, magnetomotive, *cf.* magnetomotive force.
Force, moment of, *cf.* torque.
Frequency $[t^{-1}]$
Friction, coefficient of skin, *cf.* skin friction, coefficient of.
Hall effect, coefficient of $[\epsilon^{-\frac{3}{2}}m^{-\frac{1}{2}}l^{-\frac{1}{2}}t^{3}]$; $[\mu^{\frac{3}{2}}m^{-\frac{1}{2}}l^{\frac{5}{2}}]$
Heat, *cf.* energy.
Illumination of a surface $[\psi l^{-2}]$
Inductance, electrical $[\epsilon^{-1}l^{-1}t^{2}]$; $[\mu l]$
Induction, flux of, *cf.* charge.
Induction, magnetic, *cf.* magnetic induction.
Inductivity, *cf.* electrical inductivity.
Intensity, luminous, *cf.* luminous intensity.
Intensity of magnetization, *cf.* magnetic induction.
Intensity of radiation, *cf.* radiation, intensity of.
Ionic mobility $[\epsilon^{\frac{1}{2}}m^{-\frac{1}{2}}l^{\frac{3}{2}}]$; $[\mu^{-\frac{1}{2}}m^{-\frac{1}{2}}l^{\frac{1}{2}}t]$
Kinematic viscosity, *cf.* viscosity, kinematic.
Leduc effect, coefficient of $[\epsilon^{-\frac{1}{2}}m^{-\frac{1}{2}}l^{-\frac{1}{2}}t^{2}]$; $[\mu^{\frac{1}{2}}m^{-\frac{1}{2}}l^{\frac{1}{2}}t]$
Length $[l]$
Luminous flux $[\psi]$
Luminous intensity of a source in a given direction $[\psi\omega^{-1}]$
Magnetic field intensity $[\epsilon^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-2}]$; $[\mu^{-\frac{1}{2}}m^{\frac{1}{2}}l^{-\frac{1}{2}}t^{-1}]$
Magnetic flux, *cf.* flux of magnetic induction.
Magnetic induction $[\epsilon^{-\frac{1}{2}}m^{\frac{1}{2}}l^{-\frac{3}{2}}]$; $[\mu^{\frac{1}{2}}m^{\frac{1}{2}}l^{-\frac{1}{2}}t^{-1}]$
Magnetic induction, flux of, *cf.* flux of magnetic induction.
Magnetic permeability $[\mu]$; $[\epsilon^{-1}l^{-2}t^{2}]$
Magnetic potential, *cf.* magnetomotive potential.
Magnetic potential gradient, *cf.* magnetic field intensity.
Magnetic reluctance $[\epsilon l t^{-2}]$; $[\mu^{-1}l^{-1}]$
Magnetism, quantity of, *cf.* flux of magnetic induction.
Magnetizing force, *cf.* magnetic field intensity.
Magnetomotive force $[\epsilon^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{3}{2}}t^{-2}]$; $[\mu^{-\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-1}]$
Mass $[m]$
Mass concentration $[m_1m_2{}^{-1}]$ (where $m_1 = m_2$, is called titer or is denoted as per cent).
Mass conductivity, electrical, *cf.* conductivity, electrical mass.
Mass resistivity, electrical, *cf.* resistivity, electrical mass.
Mobility, ionic, *cf.* ionic mobility.
Modulus, bulk, *cf.* stress.
Modulus of compression, *cf.* stress.
Modulus of rigidity, *cf.* stress.
Modulus, Young's, *cf.* stress.
Moment of a force, *cf.* torque.
Nernst effect, coefficient of $[\epsilon^{-1}tT^{-1}]$; $[\mu l^{2}t^{-1}T^{-1}]$
Peltier coefficient $[\epsilon^{-\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-1}]$; $[\mu^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{3}{2}}t^{-2}]$
Per cent, *cf.* mass concentration.
Permeability, *cf.* magnetic permeability.
Piezoelectric constant $[\epsilon^{\frac{1}{2}}m^{-\frac{1}{2}}l^{\frac{1}{2}}t]$; $[\mu^{-\frac{1}{2}}m^{-\frac{1}{2}}l^{-\frac{1}{2}}t^{2}]$
Pole strength, *cf.* flux of magnetic induction.

DIMENSIONAL FORMULAS (Continued)

Potential, electrical $[\epsilon^{-\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-1}]$; $[\mu^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{3}{2}}t^{-2}]$
Potential gradient, *cf.* dielectric strength.
Potential gradient, magnetic, *cf.* magnetic potential gradient.
Potential, magnetic, *cf.* magnetomotive potential.
Power $[ml^2t^{-3}]$
Power, thermoelectric, *cf.* thermoelectric power.
Pressure, *cf.* stress.
Quantity, electrical, *cf.* charge.
Quantity of magnetism, *cf.* flux of magnetic induction.
Radiation, intensity of $[mt^{-3}]$ or $[ml^{-1}t^{-2}]$
Reluctance, magnetic, *cf.* magnetic reluctance.
Resistance, electrical $[\epsilon^{-1}l^{-1}t]$; $[\mu lt^{-1}]$
Resistance, electrical volume $[\epsilon^{-1}t]$; $[\mu l^2t^{-1}]$
Resistivity, electrical mass $[\epsilon^{-1}ml^{-3}t]$; $[\mu ml^{-1}t^{-1}]$
Resistivity, surface, *cf.* resistance, electrical.
Rigidity, modulus of, *cf.* stress.
Rotatory power $[\theta l^{-1}]$
Skin friction, coefficient of $[ml^{-1}t^{-2}]$
Solubility (non-gaseous), *cf.* density.
Specific heat of electricity, *cf.* Thomson effect, coefficient of.
Strength, dielectric, *cf.* dielectric strength.
Strength, electrical field, *cf.* dielectric strength.
Strength, pole, *cf.* flux of magnetic induction.
Stress $[ml^{-1}t^{-2}]$
Surface brightness, *cf.* brightness, surface.
Surface resistivity, *cf.* resistance, electrical.
Surface tension $[mt^{-2}]$
Susceptibility, electrical $[\mu]$; $[\epsilon^{-1}l^{-2}t^2]$
Temperature $[T]$
Tension, *cf.* stress.
Tension, surface, *cf.* surface tension.
Thermal conductivity $[mlt^{-3}T^{-1}]$
Thermoelectric power $[\epsilon^{-\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-1}T^{-1}]$; $[\mu^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{3}{2}}t^{-2}T^{-1}]$
Thomson effect, coefficient of $[\epsilon^{-\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{1}{2}}t^{-1}T^{-1}]$; $[\mu^{\frac{1}{2}}m^{\frac{1}{2}}l^{\frac{3}{2}}t^{-2}T^{-1}]$
Time $[t]$
Titer, *cf.* mass concentration.
Torque $[ml^2t^{-2}]$
Twist, *cf.* rotatory power.
Velocity $[lt^{-1}]$
Velocity, angular $[\theta t^{-1}]$
Velocity of a process $[t^{-1}]$
Verdet's constant $[\epsilon^{-\frac{1}{2}}m^{-\frac{1}{2}}l^{-\frac{1}{2}}t^{2}\theta]$; $[\mu^{\frac{1}{2}}m^{-\frac{1}{2}}l^{-\frac{1}{2}}t\theta]$
Viscosity $[ml^{-1}t^{-1}]$; viscosity, kinematic $[l^2t^{-1}]$
Volume $[l^3]$; $[v]$; volume concentration, *cf.* density.
Volume conductivity, *cf.* conductivity, volume.
Volume resistance, electrical, *cf.* resistance, electrical volume.
Work, *cf.* energy.
Young's modulus, *cf.* stress.

PROBABLE VALUES OF THE PHYSICAL CONSTANTS

Values as of August 1941. By Raymond T. Birge, ***Reviews of Modern Physics,*** **13,** ***233, (1941).***

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TABLE A. Principal Constants and Ratios[†]

Velocity of light.......................... $c = (2.99776 \pm 0.00004) \times 10^{10}\ \mathrm{cm \cdot sec^{-1}}$
Gravitation constant.......................... $G = (6.670 \pm 0.005) \times 10^{-8}\ \mathrm{dyne \cdot cm^{2} \cdot g^{-2}}$
Liter (=1000 ml).......................... $l = 1000.028 \pm 0.002\ \mathrm{cm^{3}}$
Volume of ideal gas (0°C, A_0).......................... $V_0 = (22.4146 \pm 0.0006) \times 10^{3}\ \mathrm{cm^{3} \cdot atmos \cdot mole^{-1}}$
$V_0' = 22.4140 \pm 0.0006\ \mathrm{liter \cdot atmos \cdot mole^{-1}}$
Volume of ideal gas (0°C, A_{45}).......................... $V_{45} = (22.4157 \pm 0.0006) \times 10^{3}\ \mathrm{cm^{3} \cdot atmos \cdot mole^{-1}}$
$V_{45}' = 22.4151 \pm 0.0006\ \mathrm{liter \cdot atmos \cdot mole^{-1}}$
International ohm (=p abs-ohm).......................... $p = 1.00048 \pm 0.00002$
International ampere (=q abs-amp).......................... $q = 0.99986 \pm 0.00002$
Atomic weights (*see Table A′*)
Standard atmosphere.......................... $A_0 = (1.013246 \pm 0.000004) \times 10^{6}\ \mathrm{dyne \cdot cm^{-2} \cdot atmos^{-1}}$
45° atmosphere.......................... $A_{45} = (1.013195 \pm 0.000004) \times 10^{6}\ \mathrm{dyne \cdot cm^{-2} \cdot atmos^{-1}}$
Ice-point (absolute scale).......................... $T_0 = 273.16 \pm 0.01\,^{\circ}\mathrm{K}$
Joule equivalent.......................... $J_{15} = 4.1855 \pm 0.0004\ \mathrm{abs\text{-}joule \cdot cal_{15}^{-1}}$
Joule equivalent (electrical).......................... $J_{15}' = 4.1847 \pm 0.0003\ \mathrm{int\text{-}joule \cdot cal_{15}^{-1}}$
Faraday constant
(1) Chemical scale
$F = 96501._{2} \pm 10\ \mathrm{int\text{-}coul \cdot g\text{-}equiv^{-1}}$
$= 96487._{7} \pm 10\ \mathrm{abs\text{-}coul \cdot g\text{-}equiv^{-1}}$
$= 9648.7_{7} \pm 1.0\ \mathrm{abs.\ e.m.u \cdot g\text{-}equiv^{-1}}$
$F' = Fc = (2.89247 \pm 0.00030) \times 10^{14}\ \mathrm{abs.\ e.s.u \cdot g\text{-}equiv^{-1}}$
(2) Physical scale
$F = 96514._{0} \pm 10\ \mathrm{abs\text{-}coul \cdot g\text{-}equiv^{-1}}$
$= 9651.4_{0} \pm 1.0\ \mathrm{abs.\ e.m.u \cdot g\text{-}equiv^{-1}}$
$F' = Fc = (2.89326 \pm 0.00030) \times 10^{14}\ \mathrm{abs.\ e.s.u \cdot g\text{-}equiv^{-1}}$
Avogadro number (chemical scale).......................... $N_0 = (6.0228_{3} \pm 0.0011) \times 10^{23}\ \mathrm{mole^{-1}}$
Electronic charge.......................... $e = F/N_0 = (1.60203_{3} \pm 0.00034) \times 10^{-20}\ \mathrm{abs.\ e.m.u.}$
$e' = ec = (4.8025_{1} \pm 0.0010) \times 10^{-10}\ \mathrm{abs.\ e.s.u.}$
Specific electronic charge.......................... $e/m = (1.7592 \pm 0.0005) \times 10^{7}\ \mathrm{abs.\ e.m.u \cdot g^{-1}}$
$e'/m = ec/m = (5.2736_{6} \pm 0.0015) \times 10^{17}\ \mathrm{abs.\ e.s.u \cdot g^{-1}}$
Planck constant.......................... h (*see Table C*).

TABLE A′. Atomic Weights.

(1) Physical scale ($O^{16} = 16.0000$)
$H^{1} = 1.00813 \pm 0.00001_{7}$ $H^{2} = 2.01473 \pm 0.00001_{9}$
$H = 1.00827_{6} \pm 0.00001_{7}$ (from H^{1}/H^{2} abundance $= 6900 \pm 100$)
$He^{4} = 4.00389 \pm 0.00007$
$C^{12} = 12.00386 \pm 0.00004$ $C^{13} = 13.00761 \pm 0.00015$
$C = 12.01465 \pm 0.00023$ (from C^{12}/C^{13} abundance $= 92 \pm 2$)
$N^{14} = 14.00753 \pm 0.00005$ $N^{15} = 15.0049 \pm 0.0002$
$N = 14.01121 \pm 0.00009_{5}$ (from N^{14}/N^{15} abundance $= 270 \pm 6$)
$O^{16} = 16.0000$ $O^{17} = 17.0045$ $O^{18} = 18.0049$
$O = 16.00435_{7} \pm 0.00008_{6}$ (from abundance $O^{16} : O^{18} : O^{17} = (506 \pm 10) : 1 : (0.204 \pm 0.008)$)

(2) Chemical scale ($O = 16.0000$)
Ratio physical to chemical scale
$r = (16.004357 \pm 0.000086)/16 = 1.000272 \pm 0.000005$
$H^{1} = 1.00785_{6} \pm 0.00001_{8}$ (from physical scale)
$H^{2} = 2.01418_{2} \pm 0.00002_{1}$ (from physical scale)
$H = 1.00800_{2} \pm 0.00001_{8}$ (from physical scale)
$He^{4} = 4.00280 \pm 0.00007$ (from physical scale)
$C = 12.01139 \pm 0.00024$ (from physical scale)
$N = 14.00740 \pm 0.00012$ (from physical scale)
$N = 14.0086 \pm 0.0007$ (direct observation)
$Na = 22.994 \pm 0.003$
$Cl = 35.457 \pm 0.001$
$Ca = 40.080 \pm 0.005$
$Ag = 107.880 \pm 0.002$
$I = 126.915 \pm 0.004$

[†] Unless otherwise specified, all quantities in these tables that involve the mole or the gram equivalent are on the chemical scale of atomic weights.

PROBABLE VALUES OF THE PHYSICAL CONSTANTS

TABLE B. Additional Quantities Evaluated or Used in Connection with TABLE A

Ratio of e.s.u. to e.m.u. (direct)............... $c' = (2.9971_2 \pm 0.0001) \times 10^{10}\ \mathrm{cm}^{\frac{1}{2}} \cdot \mathrm{sec}^{-\frac{1}{2}} \cdot \mathrm{int\text{-}ohm}^{\frac{1}{2}}$
$= (2.9978_4 \pm 0.0001_0) \times 10^{10}\ \mathrm{cm \cdot sec^{-1}}$
Ratio of e.s.u. to e.m.u. (indirect).......... $c' = c = (2.99776 \pm 0.00004) \times 10^{10}\ \mathrm{cm \cdot sec^{-1}}$
Average density of earth...................... $\delta = 5.517 \pm 0.004\ \mathrm{g \cdot cm^{-3}}$
Maximum density of water.............. $\delta_m(H_2O) = 0.999972 \pm 0.000002\ \mathrm{g \cdot cm^{-3}}$
Acceleration of gravity (standard)............. $g_0 = 980.665\ \mathrm{cm \cdot sec^{-2}}$
Acceleration of gravity (45°)................. $g_{45} = 980.616\ \mathrm{cm \cdot sec^{-2}}$
Density of oxygen gas (0°C, A_{45})............ $L_1 = 1.42897 \pm 0.00003\ \mathrm{g \cdot liter^{-1}}$
Limiting density of oxygen gas (0°C, A_{45})..... $L_{\mathrm{lim}} = 1.427609 \pm 0.000037\ \mathrm{g \cdot liter^{-1}}$
Factor converting oxygen (0°C, A_{45}) to ideal gas
$1 - \alpha = 1.000953_5 \pm 0.000009_4$
International coulomb (= q abs-coul)........... $q = 0.99986 \pm 0.00002$
International gauss (= q abs-gauss)
International henry (= p abs-henry)........... $p = 1.00048 \pm 0.00002$
International volt (= pq abs-volt)............. $pq = 1.00034 \pm 0.00003$
International joule (= pq^2 abs-joule).......... $pq^2 = 1.00020 \pm 0.00004_5$
Specific gravity of Hg (0°C, A_0) referred to air-free water at maximum density.................. $\rho_0 = 13.59542 \pm 0.00005$
Density of Hg (0°C, A_0) .... $D_0 = 13.59504_0 \pm 0.00005_7\ \mathrm{g \cdot cm^{-3}}$
Electrochemical equivalents (chemical scale)
silver (apparent) .... $E^*_{\mathrm{Ag}} = 1.11800 \times 10^{-3}\ \mathrm{g \cdot int\text{-}coul^{-1}}$
(corrected)......................... $E_{\mathrm{Ag}} = (1.11807 \pm 0.00012) \times 10^{-3}\ \mathrm{g \cdot abs\text{-}coul^{-1}}$
iodine (apparent)...................... $E^*_{\mathrm{I}} = (1.315026 \pm 0.000025) \times 10^{-3}\ \mathrm{g \cdot int\text{-}coul^{-1}}$
(corrected)......................... $E_{\mathrm{I}} = (1.31535 \pm 0.00014) \times 10^{-3}\ \mathrm{g \cdot abs\text{-}coul^{-1}}$
Effective calcite grating space (18°C.), Siegbahn system................................ $d_{18}'' = 3.02904 \times 10^{-8}\ \mathrm{cm}$
True calcite grating space (20°C.), Siegbahn system................................ $d_{20}' = 3.02951_2 \times 10^{-8}\ \mathrm{cm}$
True calcite grating space (20°C.), c.g.s. system................................ $d_{20} = (3.03567_4 \pm 0.00018) \times 10^{-8}\ \mathrm{cm}$
Ratio of grating and Siegbahn scales of wavelengths.............................. $\lambda_g / \lambda_s = 1.002034 \pm 0.000060$
Density of calcite (20°C.).................... $\rho = 2.71029 \pm 0.00003\ \mathrm{g \cdot cm^{-3}}$
Structural constant of calcite (20°C.)........... $\phi = 1.09594 \pm 0.00001$
Molecular weight of calcite (chemical scale)... $M = 100.091_4 \pm 0.005$
Rydberg constant for hydrogen (H^1)........... $R_{\mathrm{H}} = 109677.581_2 \pm 0.007_5\ \mathrm{cm^{-1}}$ (I. A. scale)
Rydberg constant for deuterium (H^2)......... $R_{\mathrm{D}} = 109707.419_3 \pm 0.007_5\ \mathrm{cm^{-1}}$ (I. A. scale)
Rydberg constant for helium .... $R_{\mathrm{He}} = 109722.263 \pm 0.012\ \mathrm{cm^{-1}}$ (I. A. scale)
Rydberg constant for infinite mass .... $R_\infty = 109737.303 \pm 0.017\ \mathrm{cm^{-1}}$ (I. A. scale)
or $\pm 0.05\ \mathrm{cm^{-1}}$ (c.g.s. system)

TABLE C. Partial List of Derived Quantities.*

Planck constant

$$h = \left\{ \frac{2\pi^2 c^3 F^5}{R_\infty N_0^5 (e/m)} \right\}^{\frac{1}{3}} = (6.624_2 \pm 0.002_4) \times 10^{-27}\ \mathrm{erg \cdot sec}$$

$$h/e = \left\{ \frac{2\pi^2 c^3 F^2}{R_\infty N_0^2 (e/m)} \right\}^{\frac{1}{3}} = (4.1349_0 \pm 0.0007_1) \times 10^{-7}\ \mathrm{erg \cdot sec \cdot abs.\ e.m.u.^{-1}}$$

$$h/e' = h/ec = \left\{ \frac{2\pi^2 F^2}{R_\infty N_0^2 (e/m)} \right\}^{\frac{1}{3}} = (1.3793_3 \pm 0.0002_3) \times 10^{-17}\ \mathrm{erg \cdot sec \cdot abs.\ e.s.u.^{-1}}$$

Atomic weight of electron........................ $E = F/(e/m)$
(physical scale) $= 5.4862_4 \pm 0.0017) \times 10^{-4}$
(chemical scale) $= (5.4847_5 \pm 0.0017) \times 10^{-4}$

Band spectra constant connecting wave number and moment of inertia

$$h/8\pi^2 c = \left\{ \frac{F^5}{256\pi^4 R_\infty N_0^5 (e/m)} \right\}^{\frac{1}{3}} = (27.98_{65} \pm 0.01_0) \times 10^{-40}\ \mathrm{g \cdot cm}$$

Boltzmann constant....... $k = R_0/N_0 = V_0 A_0 / T_0 N_0 = (1.38047_4 \pm 0.00026) \times 10^{-16}\ \mathrm{erg \cdot deg^{-1}}$
Charge in electrolysis of one gram of H...... $F/H = 9572.1_{73} \pm 1.0$ abs. e.m.u$\cdot$g^{-1}
Charge in electrolysis of one gram of H^1........................ $e/M_{\mathrm{H}^1} = F/H^1 = 9573.5_{60} \pm 1.0$ abs. e.m.u$\cdot$g^{-1}

$$\text{Compton shift at } 90° \ldots h/mc = \left\{ \frac{2\pi^2 F^2 (e/m)^2}{R_\infty N_0^2} \right\}^{\frac{1}{3}} = (0.024265_{14} \pm 0.000005_7) \times 10^{-8}\ \mathrm{cm}$$

Energy in ergs of one abs-volt-electron.................. $E_0 = 10^8 e = 10^8 F/N_0 = (1.60203_3 \pm 0.00034) \times 10^{-12}\ \mathrm{erg}$

PROBABLE VALUES OF THE PHYSICAL CONSTANTS

Energy in calories per mole for one abs-volt-electron per molecule

$$\frac{F(\text{abs. coul. per gram equiv})}{J_{15}(\text{abs. joules per cal})} = 23052._{85} \pm 3._{2}\ \text{cal}_{15}\cdot\text{mole}^{-1}$$

Fine structure constant. . . . $\alpha = 2\pi(e')^2/hc = \left\{\dfrac{4\pi R_\infty F(e/m)}{N_0}\right\}^{\frac{1}{3}} = (7.2976_6 \pm 0.0008_6)\times 10^{-3}$

$1/\alpha = 137.030_2 \pm 0.016$

$\alpha^2 = (5.3256 \pm 0.0013)\times 10^{-5}$

Gas constant per mole . . . . $R_0 = V_0A_0/T_0 = (8.31436 \pm 0.00038)\times 10^7\ \text{erg}\cdot\text{deg}^{-1}\cdot\text{mole}^{-1}$

$R_0' = R_0\cdot 10^{-7}/J_{15} = 1.98646_7 \pm 0.00021\ \text{cal}_{15}\cdot\text{deg}^{-1}\cdot\text{mole}^{-1}$

$R_0'' = V_0'/T_0 = (8.20544_7 \pm 0.00037)\times 10^{-2}\ \text{liter}\cdot\text{atmos}\cdot\text{deg}^{-1}\cdot\text{mole}^{-1}$

$R_0''' = R_0/A_0 = V_0/T_0 = 82.0566_7 \pm 0.0037\ \text{cm}^3\cdot\text{atmos}\cdot\text{deg}^{-1}\cdot\text{mole}^{-1}$

also $R_0T_0 = V_0A_0 = (2.27115_0 \pm 0.00006)\times 10^{10}\ \text{erg}\cdot\text{mole}^{-1}$

Loschmidt number (0°C, A_0) . . . . $n_0 = N_0/V_0 = (2.6870_{12} \pm 0.0005_0)\times 10^{19}\ \text{atmos}^{-1}\ \text{cm}^{-3}$

Magnetic moment of one Bohr magneton . . . . $\mu_1 = (h/4\pi)(e/m) = \dfrac{1}{4\pi}\left\{\dfrac{2\pi^2c^3F^5(e/m)^2}{R_\infty N_0^5}\right\}^{\frac{1}{3}}$

$= (0.9273_{45} \pm 0.0003_7)\times 10^{-20}\ \text{erg}\cdot\text{gauss}^{-1}$

Magnetic moment per mole for one Bohr magneton per molecule . . . . . . $\mu_1N_0 = \dfrac{1}{4\pi}\left\{\dfrac{2\pi^2c^3F^5(e/m)^2}{R_\infty N_0^2}\right\}^{\frac{1}{3}} = 5585.2_4 \pm 1.6\ \text{erg. gauss}^{-1}\cdot\text{mole}^{-1}$

Mass of α-particle . . . . $M\alpha = (\text{He} - 2E)/N_0 = (6.6442_2 \pm 0.0012) = 10^{-24}$ g

Mass of atom of unit atomic weight. . . . $M_0 = 1/N_0 = (1.66035 \pm 0.00031)\times 10^{-24}$ g

Mass of electron. . $m = e/(e/m) = (F/N_0)/(e/m) = (9.1066_0 \pm 0.0032)\times 10^{-28}$ g

Mass of H¹ atom. . . . . $M_{\text{H}^1} = \text{H}^1/N_0 = (1.67339_3 \pm 0.00031)\times 10^{-24}$ g

Mass of proton . . . . $M_p = (\text{H}^1 - E)/N_0 = (1.67248_2 \pm 0.00031)\times 10^{-24}$ g

Radiation density constant. . . . . . . $a = 8\pi^5k^4/15c^3h^3 = \left(\dfrac{V_0A_0}{T_0}\right)^4\dfrac{4\pi^3N_0R_\infty(e/m)}{15c^6F^5}$

$= (7.569_{42} \pm 0.004_9)\times 10^{-15}\ \text{erg}\cdot\text{cm}^{-3}\cdot\text{deg}^{-4}$

Ratio mass H¹ atom to mass electron . . . . $M_{\text{H}^1}/m = (e/m)(\text{H}^1/F) = 1837.5_{61} \pm 0.5_6$

Ratio mass proton to mass electron . . . . $M_p/m = (e/m)\left(\dfrac{\text{H}^1 - E}{F}\right) = 1836.5_{61} \pm 0.5_6$

Second radiation constant. . . . $c_2 = hc/k = \dfrac{c^2T_0}{V_0A_0}\left\{\dfrac{2\pi^2F^5}{R_\infty N_0^2(e/m)}\right\}^{\frac{1}{3}} = 1.4384_8 \pm 0.0003_4\ \text{cm}\cdot\text{deg}$

Specific charge of α-particle. . . $2e/M\alpha = \dfrac{2F}{\text{He} - 2E} = 4822.3_3 \pm 0.5_1$ abs. e.m.u $\cdot$ g^{-1}

Specific charge of proton. . . . . $e/M_p = \dfrac{F}{\text{H}^1 - E} = 9578.7_7 \pm 1.0$ abs. e.m.u $\cdot$ g^{-1}

Stefan-Boltzmann constant . . . . $\sigma = ac/4 = 2\pi^5k^4/15c^2h^3 = \left(\dfrac{V_0A_0}{T_0}\right)^4\dfrac{\pi^3N_0R_\infty(e/m)}{15(Fc)^5}$

$= (5.672_{83} \pm 0.003_7)\times 10^{-5}\ \text{erg}\cdot\text{cm}^{-2}\cdot\text{deg}^{-4}\cdot\text{sec}^{-1}$

Wave-length associated with one abs-volt**

$$\lambda_0 = 10^{-8}c^2(h/e') = \frac{c^2}{10^8}\left\{\frac{2\pi^2F^2}{R_\infty N_0^2(e/m)}\right\}^{\frac{1}{3}} = (12395._4 \pm 2._1)\times 10^{-8}\ \text{cm}\cdot\text{abs-volt}$$

Wave number associated with one abs-volt

$$s_0 = 1/\lambda_0 = \frac{10^8}{c^2}\left\{\frac{R_\infty N_0^2(e/m)}{2\pi^2F^2}\right\}^{\frac{1}{3}} = 8067.4_9 \pm 1.4\ \text{cm}^{-1}\cdot\text{abs-volt}^{-1}$$

Wien's displacement law constant*** . . . . $A = c_2/4.965114 = 0.28971_8 \pm 0.00007\ \text{cm}\cdot\text{deg}$

Zeeman displacement per gauss. . . . . . . $(e/m)/4\pi c = (4.6699_1 \pm 0.0013)\times 10^{-5}\ \text{cm}^{-1}\cdot\text{gauss}^{-1}$

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* In order to be able to calculate, by propagation of errors, the probable error in a derived quantity, it is necessary to express the quantity explicitly in terms of the various fundamental quantities of Table A, or of Table B, and that has been done in each case. Since in this paper e and h are treated as derived quantities, they do not therefore appear in such explicit expressions. But in calculating *numerical* values of derived quantities, the work can often be greatly simplified by using the values of other previously calculated derived quantities—in particular e and h. In order to show how certain derived quantities depend on quantities like e and h, such alternative expressions are given in many cases.

** The factor 10^{-8} was accidentally omitted in G.C. 1929, in the equation for λ_0.

*** The factor 4.965114 is the root of $e^{-\beta} + (\beta/5) - 1 = 0$.

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Abamperes	amperes	10.0000
Abamperes	statampere	2.99796×10^{10}
Abampere-turns	ampere-turns	10
Abampere-turns	gilberts	12.566
Abcoulombs	coulombs (Abs.)	10.0000
Abcoulombs	statcoulombs	2.99796×10^{10}
Abcoulombs/kg.	statcoulombs/dynes	30577
Abcoulombs/pound	statcoulombs/dyne	6.7411×10^{4}
Abfarads	farads (Abs.)	1.0000×10^{9}
Abfarads	microfarads	1×10^{15}
Abfarads	statfarads	8.98776×10^{20}
Abhenries	henries (Abs.)	1.0000×10^{-9}
Abhenries	millihenries	1×10^{-6}
Abhenries	stathenries	1.11263×10^{-21}
Abmhos/cm. cube	megmhos/cm. cube	1000
Abmhos/cm. cube	mhos, International/cm. cube	1.00052×10^{9}
Abmhos/cm. cube	mhos/mil foot	166.2
Abohms	megohms	1×10^{-15}
Abohms	microhms	0.001
Abohms	ohms (Abs.)	1.0000×10^{-9}
Abohms	statohms	1.11263×10^{-21}
Abvolts	microvolts	0.010000
Abvolts	statvolts	3.33560×10^{-1}
Abvolts	volts (Abs.)	1.0000×10^{-8}
Abvolts/cm.	volts (Abs.)/cm.	1.0000×10^{-8}
Abvolts/°F	microvolts/°C	0.018000
Abvolts/inch	volts (Abs.)/cm.	3.9370×10^{-9}
Acre feet	cubic feet	43560
Acre feet	cubic meters	1233.49
Acre feet	gallons (U. S.)	325851
Acres	hectares	0.4047
Acres (British)	roods (British)	4
Acres (British)	square meters	4046.849
Acres (British)	square yards (British)	4840
Acres (U. S.)	ares (sq. dekameters)	40.46873
Acres (U. S.)	hectares (sq. hectometers)	0.4046873
Acres (U. S.)	sq. chains (Gunter's)	10
Acres (U. S.)	sq. feet	43560
Acres (U. S.)	sq. links (Gunter's)	1×10^{5}
Acres (U. S.)	sq. meters	4046.873
Acres (U. S.)	sq. miles	0.0015625
Acres (U. S.)	sq. rods	160
Acres (U. S.)	sq. yards	4840
Amperes (Abs.)	abamperes	0.1
Amperes (Abs.)	amperes (International) (a)	1.00007
Amperes (Abs.)	amperes (International) (v)	1.00010
Amperes (Abs.)	faradays/sec.	1.0363×10^{-5}
Amperes (Abs.)	statamperes	2.99796×10^{9}
Amperes (International); (England before 1906)	amperes (International) (v)	0.99870
Amperes (International); (England 1906-1908)	ampere (International) (v)	0.99894
Amperes (International); (England 1909-1910)	amperes (International) (v)	0.99990
Amperes (International); (France before 1911)	amperes (International) (v)	0.9998

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Amperes (International); (Germany before 1911)	amperes (International) (v)	0.99968
Amperes (International); (U. S. before 1911)	amperes (International) (v)	0.99916
Amperes (International) (a); based on deposit of 0.00111800 grams of silver per second	amperes (Abs.)	0.99993
Amperes (International) (v) Defined by international volt and ohm	amperes (Abs.)	0.99990
Ampere-hours (Abs.)	coulombs (Abs.)	3600.0
Ampere-turns	abampere-turns	0.1
Ampere-turns	gilberts	1.2566
Ampere-turns/cm.	gauss	1.2566
Ampere-turns/inch	gauss	0.49474
Angstrom units	inches	3.937×10^{-9}
Angstrom units	meters	1×10^{-10}
Angstrom units	micro-microns	100
Angstrom units	microns	1×10^{-4}
Angstrom units	milli-microns	0.1
Apothecaries' see troy	....	....
Ares	acres (U. S.)	0.02471044
Ares	hectares	0.01
Ares	sq. feet	1076.4
Ares	sq. meters	100
Ares	sq. miles	3.8610×10^{-5}
Ares	sq. yards	119.60
Astronomical units	kilometers	1.495×10^{8}
Atmosphere (Normal) is the pressure exerted by 760 mm of mercury having a density 13.5951 g/cm³ where gr. ac. is 980.665 cm/sec²	....	....
Atmospheres	bars	1.0133
Atmospheres	cm. of mercury at 0°C	76
Atmospheres	dynes/cm²	1.01325×10^{6}
Atmospheres	feet of water at 39.1°F	33.899
Atmospheres	grams/sq. cm.	1033.3
Atmospheres	inches of mercury at 32°F	29.921
Atmospheres	kg./sq. meter	10333
Atmospheres	microns of mercury	760000
Atmospheres	mm. of mercury	760
Atmospheres	pounds/sq. ft.	2116.32
Atmospheres	pounds/sq. in.	14.696
Atmospheres	tons (short)/sq. ft.	1.0581
Atmospheres	tons (short)/sq. in.	0.0073482
Bags (British)	bushels (British)	3
Bags (British)	cu. meters	0.109107
Bags, cement	pounds of cement	94
Barleycorns (British)	centimeters	0.84667
Barleycorns (British)	inches	1/3
Barrels (British, dry)	cu. meters	0.16366
Barrels (British, dry)	gallons (British)	36
Barrels, cement	pounds of cement	376
Barrels, oil	gallons (U. S.)	42
Barrels (U. S., dry)	bushels	3.281
Barrels (U. S., dry)	cu. inches	7056

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Barrels (cranberry)	cu. inches	5826
Barrels (U. S., dry)	cu. meters	0.11562
Barrels (U. S., dry)	quarts (dry)	105.0
Barrels (U. S., liquid)	cu. meters	0.11924
Barrels (U. S., liquid)	gallons	31.5
Bars	atmospheres	0.98692
Bars	dynes/sq. cm.	1.000×10^6
Bars	kg./sq. meter	1.01971×10^4
Bars	pounds/sq. inch	14.504
Barye	dynes/sq. cm.	1.000
Board feet	cu. cm.	2359.8
Board feet	cu. feet	1/12
Board feet	cu. inches	144
Board of trade units (England before 1903)	ohms (International)	0.9984
Boiler horse power	B. T. U./hour	33479
Boiler horse power	K. W.	9.803
Bolt (U. S., cloth)	linear feet	120
Bolt (U. S., cloth)	meters	36.576
Bougie decimale	candles (International)	1.0
B. T. U.	calories (gram)	252
B. T. U.	foot poundals	25030
B. T. U.	foot pounds	777.9
B. T. U.	horse-power hours	3.929×10^{-4}
B. T. U.	joules	1055
B. T. U.	kilogram meters	107.565
B. T. U.	liter atmospheres	10.41
B. T. U.	pounds carbon to CO_2	6.88×10^{-5}
B. T. U.	pounds water evaporated from and at 212°F (100°C.)	0.001036
B. T. U./min.	foot pounds/sec.	12.96
B. T. U. (mean)	calories, gram (mean)	251.98
B. T. U. (mean)	calories, kg.	0.25198
B. T. U. (mean)	cubic foot-atmospheres	0.3676
B. T. U. (mean)	ergs	1.0548×10^{10}
B. T. U. (mean)	foot-poundals	25030.7
B. T. U. (mean)	foot pounds	777.98
B. T. U. (mean)	horse-power hours	3.9292×10^{-4}
B. T. U. (mean)	joules (Abs.)	1054.8
B. T. U. (mean)	kilowatt-hours	2.930×10^{-4}
B. T. U. (mean)	kg. meters	107.56
B. T. U. (mean)	liter atmospheres	10.409
B. T. U. (mean)	watt-hours	0.2930
B. T. U. (mean)	watt-seconds	1054.8
B. T. U. (mean)/min.	horse power	0.023575
B. T. U. (mean)/min.	watts (Abs.)	17.580
B. T. U. (mean)/pound	calories, gram (mean)/gram	0.5556
B. T. U. (mean)/pound	joules/gram	2.3255
B. T. U. (mean)/pound/°F	calories, gram/gram/°C	1
B. T. U. (mean)/pound/°F	joules/gram/°C	4.186
B. T. U. (mean)/sec.	horse power	1.4145
B. T. U. (mean)/sec.	watts (Abs.)	1054.8
B. T. U. (mean)/sq. ft./minute	watts/sq. inch	0.12208
B. T. U. (mean)/sq. ft./minute	kilowatts/sq. ft.	0.17580
B. T. U. (mean)/sq. ft./minute	horse power/sq. ft.	0.023575

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
B. T. U. (mean)/sq. ft./sec. for a temp. gradient of 1°F per inch	calories, gram (15°C)/sq. cm. per sec. for a temp. gradient of 1°C per centimeter	1.2404
B. T. U. (mean)/sq. ft./sec. for a temperature gradient of 1°F/inch	joules (Abs.)/sq. cm./sec. for a temperature gradient of 1°C/cm.	5.191
B. T. U. (60°F)	joules (Abs.)	1054.6
B. T. U. (60°F)/deg. F	calories, gram/deg. C	453.59
B. T. U. (60°F)/deg. F	joules/deg. C	1898.3
B. T. U. (60°F)/sec.	watts (Abs.)	1054.6
B. T. U. (39°F)	joules (Abs.)	1060.4
B. T. U. (39°F)/sec.	watts (Abs.)	1060.4
Buckets (British, dry)	cu. cm.	1.8184×10^4
Buckets (British, dry)	gallons (British)	4
Bushels (British, dry)	bags (British)	1/3
Bushels (British, dry)	bushels (U. S.)	1.03205
Bushels (British, dry)	cu. cm.	36369
Bushels (British, dry)	cu. ft.	1.2843
Bushels (British, dry)	cu. inches	2219.3
Bushels (British, dry)	gallons (British)	8
Bushels (British, dry)	liters	36.3677048
Bushels (British, dry)	quarters (British capacity)	0.125
Bushels (U. S., dry)	barrels	0.304785
Bushels (U. S., dry)	bushels (British)	0.968946
Bushels (U. S., dry)	cu. cm.	35239
Bushels (U. S., dry)	cu. ft.	1.2444
Bushels (U. S., dry)	cu. inches	2150.42
Bushels (U. S., dry)	cu. meters	0.035239
Bushels (U. S., dry)	hectoliters	0.35238329
Bushels (U. S. ,dry)	liters	35.238329
Bushels (U. S., dry)	pecks	4
Bushels (U. S., dry)	pints (dry)	64
Bushels (U. S., dry)	quarts (dry)	32
Bushels (U. S., dry)/acre	hectoliters/hectare	0.870754
Butts (British, dry)	cu. meters	0.57281
Butts (British, dry)	gallons	126
Cable lengths (U. S.; British)	feet	720
Cable lengths (U. S.; British)	meters	219.46
Calories, gram	B. T. U.	3.968×10^{-3}
Calories, gram (mean)	B. T. U. (mean)	3.9685×10^{-3}
Calories, gram (mean)	cu. ft. atmospheres	0.001459
Calories, gram	foot-poundals	99.31
Calories, gram (mean)	foot-poundals	99.334
Calories, gram	foot-pounds	3.087
Calories, gram (mean)	foot-pounds	3.0874
Calories, gram	horse-power hours	1.5591×10^{-6}
Calories, gram (mean)	horse-power hours	1.5593×10^{-6}
Calories, gram	joules	4.185
Calories, gram (15°C)	joules (Abs.)	4.185
Calories, gram (20°C)	joules (Abs.)	4.181
Calories, gram (mean)	joules (Abs.)	4.186
Calories, gram	kilogram-meters	0.4267
Calories, gram (mean)	kilogram-meters	0.42685
Calories, gram	liter-atmospheres	4.130×10^{-2}
Calories, gram (mean)	liter-atmospheres	4.1311×10^{-2}
Calories, gram (mean)	watt hours	0.0011628
Calorie (15°C) seconds	quanta	6.3854×10^{33}
Calories (15°C)/ampere-hour	joules/electromagnetic unit quantity (abcoulomb)	0.011625

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Calories (15°C)/coulomb	joules/abcoulomb	41.850
Calories, gram (15°C)/deg. C	B. T. U. (60°F)/deg. F	0.0022046
Calories, gram (15°C)/deg. C	joules/deg. C	4.185
Calories, gram (mean)/gram	B. T. U. (mean)/pound	1.8
Calories, gram (mean)/gram	joules/gram	4.186
Calories, gram (mean)/gram/deg. C	B. T. U. (60°F)/pound/deg. F	1
Calories, gram (mean)/gram/deg. C	joules/gram/deg. C	4.186
Calorie (15°C)seconds/N_0. #	quanta	1.0535×10^{10}
Calories, gram (15°C)/sq. cm./sec. for a temp. gradient of 1°C/cm.	B. T. U. (mean)/sq. ft./sec. for a temp. gradient of 1°F/inch	0.80620
Calories, gram (15°C)/sq. cm./sec. for a temp. gradient of 1°C/cm.	joules (Abs.)/sq. cm./sec. for a temp. gradient of 1°C/cm.	4.185
Calories, kg. or large (mean)	B. T. U. (mean)	3.9685
Calories, kg. (mean)	calories, gram (mean)	1000
Calories, kg. (mean)	ergs	4.186×10^{10}
Calories, kg. (mean)	foot pounds	3087.4
Calories, kg. (mean)	gram centimeters	4.2686×10^{7}
Calories, kg. (mean)	horse power hours	0.0015593
Calories, kg. (mean)	joules	4186
Calories, kg. (mean)	kg. meters	426.85
Calories, kg. (mean)	K. W. hours	0.0011628
Calories, kg. (mean)	watt hours	1.1628
Calories, kg. (mean)/min.	foot pounds/sec.	51.457
Calories, kg. (mean)/min.	horse power	0.093558
Calories, kg. (mean)/min.	watts	69.769
Calories, kg. (mean)/sec.	kilowatts	4.186
Candles (International)	candles (English sperm)	1 (approx.)
Candles (International)	candles (pentane)	1 (approx.)
Candles (International)	carcel units	0.104 (approx.)
Candles (International)	Hefner units	1.11 (approx.)
Candles (International)	lumens (International)/steradian	1.0000
Candle power (spherical)	lumens	12.566
Candles/sq. cm.	lamberts	3.1416
Candles/sq. cm.	millilamberts	3141.6
Candles/sq. inch	lamberts	0.48695
Candles/sq. inch	millilamberts	486.95
Carats (1877)	grains	3.168
Carats (1877)	milligrams	205.29
Carats (metric)	grams	0.2
Carats (metric)	grains	3.08648
Carcel units	candles (International)	9.6 (approx.)
Centals	pounds	100
Centare cf. sq. meter	....	....
Centigrade degrees	Fahrenheit, cf. special table	....
Centigrade thermal unit (C. T. U.) (15°C)	joules (Abs.)	1898.3
Centimeters	angstrom units	1×10^{8}
Centimeters	feet (British or U. S.)	0.032808
Centimeters	inches (U. S.)	0.393700
Centimeters	lignes (Paris lignes)	4.4330
Centimeters	microns	10000
Centimeters	mils	393.70
Centimeters	yards (British)	0.01093614
Centimeters	yards (U. S.)	0.01093611
Cm. of mercury at 0°C	atmospheres	0.013158

#N_0. = Avogadro's number = number of molecules per gram mole.

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Cm. of mercury at 0°C	dynes/sq. cm.	1.33322×10^{4}
Cm. of mercury at 0°C	feet of water at 39.1°F	0.44604
Cm. of mercury at 0°C	kg./sq. meter	135.95
Cm. of mercury at 0°C	pounds/sq. ft.	27.845
Cm. of mercury at 0°C	pounds/sq. inch	0.19337
Centimeters/sec.	feet/min.	1.9685
Centimeters/sec	kilometers/hour	0.03600
Centimeters/sec.	meters/min.	0.6000
Centimeters/sec.	miles/hour	0.02237
Centimeters/sec.	miles/min.	3.728×10^{-4}
Centimeters/sec.^{2}	kilometers/hr./sec.	0.036
Centimeters/sec.^{2}	miles/hr./sec.	0.02237
Centimeter dyne cf. erg	....	....
Chains (engineers' or Ramden's)	feet	100
Chains (engineers' or Ramden's)	meters	30.4801
Chains (surveyors' or Gunter's)	feet	66
Chains (surveyors' or Gunter's)	furlongs	0.1
Chains (surveyors' or Gunter's)	meters	20.117
Chains (surveyors' or Gunter's)	miles	0.0125
Chains (surveyors' or Gunter's)	rods	4
Chains (surveyors' or Gunter's)	yards	22
Chaldrons (British, dry)	bushels (British)	32 (variable)
Chaldrons (British, dry)	cubic meters	1.1638
Chaldorns (U. S. , dry)	bushels (U. S.)	36
Chaldrons (U. S. ,dry)	cubic meters	1.2686
Cheval-vapeurs	watts	735.499
Cheval-vapeur heure	joules (Abs.)	2.6478×10^{6}
Cheval-vapeur cf. horse power metric	....	....
Circles	degrees	360
Circles	radians	6.28319
Circles	signs	12
Circular inches	sq. cm.	5.0671
Circular inches	sq. inches	0.78540
Circular millimeters	sq. millimeters	0.78540
Circular mils	sq. cm.	5.0671×10^{-6}
Circular mils	sq. inches	7.854×10^{-7}
Circular mils	sq. mils	0.78540
Circumferences	degrees	360
Circumferences	grades	400
Circumferences	radians	6.28319
Cloves or customary stones (British)	kilograms	3.6287
Cloves or customary stones (British)	pounds	8
Coombs (British, dry)	bushels (British)	4
Coombs (British, dry)	cubic meters	0.14548
Cords	cord feet	8
Cords	cu. feet	128
Cords	cu. meters	3.625
Cord feet	cords	0.125
Cord feet	cu. feet	16
Coulombs (Abs.)	abcoulombs or electromagnetic cgs units	0.1000
Coulombs (Abs.)	coulombs (International) (v)	1.00010
Coulombs (Abs.)	coulombs (International) (a)	1.00007
Coulombs (Abs.)	electronic charges	6.281×10^{18}
Coulombs (Abs.)	electrostatic cgs units or statcoulombs	2.99796×10^{9}
Coulombs (International) (a)	coulombs (Abs.)	0.99993
Coulombs (International) (v)	coulombs (Abs.)	0.99990

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Coulombs/kg.	statcoulombs/dyne	3057.7
Cubic cm.	board feet	4.2372×10^{-4}
Cubic cm.	bushels (British)	2.7496×10^{-5}
Cubic cm.	bushels (U. S.)	2.83776×10^{-5}
Cubic cm.	cubic ft. (British)	3.531477×10^{-5}
Cubic cm.	cubic ft. (U. S.)	3.531445×10^{-5}
Cubic cm.	cubic inches	0.061023
Cubic cm.	cubic yards	1.3079×10^{-6}
Cubic cm.	drachms (British, fluid)	0.28157
Cubic cm.	drams (U. S., fluid)	0.27053
Cubic cm.	gallons (British)	2.1997×10^{-4}
Cubic cm.	gallons (U. S.)	2.6417×10^{-4}
Cubic cm.	liters	9.9997×10^{-4}
Cubic cm.	minims (British)	16.894
Cubic cm.	minims (U. S.)	16.231
Cubic cm.	ounces (British, fluid)	0.035196
Cubic cm.	ounces (U. S., fluid)	0.033814
Cubic cm.	pints (U. S., dry)	0.0018162
Cubic cm.	pints (U. S., liquid)	0.0021134
Cubic cm.	quarts (U. S., dry)	9.0808×10^{-4}
Cubic cm.	quarts (British, liquid)	8.7988×10^{-4}
Cubic cm.	quarts (U. S., liquid)	0.0010567
Cubic cm. atmospheres (normal)	joules (Abs.)	0.101325
Cubic cm./sec.	cubic ft./min.	0.0021186
Cubic ft. (British)	cubic meters	0.02831677
Cubic ft. (U. S.)	board ft.	12
Cubic ft. (U. S.)	bushels (British)	0.77661
Cubic ft. (U. S.)	bushels (U. S.)	0.80357
Cubic ft. (U. S.)	cords	0.0078125
Cubic ft. (U. S.)	cord feet	0.0625
Cubic ft. (U. S.)	cubic cm.	28317
Cubic ft. (U. S.)	cubic inches	1728
Cubic ft. (U. S.)	cubic meters	0.02831701
Cubic ft. (U. S.)	cubic yards	0.037037
Cubic ft. (U. S.)	gallons (British)	6.229
Cubic ft. (U. S.)	gallons (U. S.)	7.481
Cubic ft. (U. S.)	liters	28.316
Cubic ft. (U. S.)	quarts (U. S., dry)	25.714
Cubic ft. (U. S.)	quarts (U. S., liquid)	29.922
Cubic ft. (U. S.)	register tons (British)	0.01
Cu. ft. atmospheres	B. T. U. (mean)	2.7203
Cu. ft. atmospheres	calories, gram (mean)	680.74
Cu. ft. atmospheres	foot pounds	2116.3
Cu. ft. atmospheres	joules (Abs.)	2869.4
Cu. ft. atmospheres	kg. meters	292.59
Cu. ft. atmospheres	liter atmospheres	28.316
Cu. ft. of common brick	pounds	120
Cu. ft. of water (60°F)	pounds	62.37
Cu. ft./min.	cu. cm./sec.	472.0
Cu. ft./min.	gallons/sec.	0.1247
Cu. ft./min.	liters/sec.	0.4720
Cu. ft./sec.	gallons/min.	448.831
Cu. ft./sec.	liters/min.	1698.96
Cu. ft./sec.	cu. yards/min.	2.22222
Cu. hectometers	cubic meters	1×10^{6}
Cu. inches (U. S.)	board feet	0.00694444
Cu. inches (British)	bushels (British)	1.5081×10^{-4}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Cu. inches (U. S.)	bushels (U. S.)	4.65025×10^{-4}
Cu. inches (British)	cubic cm.	16.3870253
Cu. inches (U. S.)	cubic cm.	16.387162
Cu. inches (British)	cu. ft. (British)	5.7870×10^{-4}
Cu. inches (U. S.)	cu. ft. (U. S.)	5.78704×10^{-4}
Cu. inches (U. S.)	cubic meters	1.63871×10^{-5}
Cu. inches (U. S.)	cu. yards	2.143347×10^{-5}
Cu. inches (U. S.)	drams (fluid)	4.43322
Cu. inches (British)	gallons (British)	0.003606
Cu. inches (U. S.)	gallons (U. S.)	0.0043290
Cu. inches (U. S.)	liters	0.0163868
Cu. inches (U. S.)	ounces (fluid) (U. S.	0.5541
Cu. inches (British)	pecks (British)	0.0018031
Cu. inches (U. S.)	pecks (U. S.)	0.00186010
Cu. inches (U. S.)	pints (U. S., dry)	0.0297616
Cu. inches (U. S.)	quarts (U. S., dry)	0.0148808
Cu. inches (U. S.)	quarts (U. S., liquid)	0.017316
Cu. kilometers	cubic meters	1×10^{9}
Cubic meters	bushels (U. S.)	28.3776
Cubic meters	cords	0.2759
Cubic meters	cubic cm.	1×10^{6}
Cubic meters	cubic ft. (British)	35.31477
Cubic meters	cubic ft. (U. S.)	35.314445
Cubic meters	cubic inches	61023
Cubic meters	cubic yards (British)	1.307954
Cubic meters	cubic yards (U. S.)	1.3079428
Cubic meters	gallons (U. S.)	264.173
Cubic meters	liters	999.973
Cubic meters	pints (U. S., liquid)	2113.4
Cubic meters	quarts (U. S., liquid)	1056.7
Cubic meters	steres	1
Cu. millimeters	cubic inches	6.1023×10^{-5}
Cu. millimeters	cubic meters	1×10^{-9}
Cu. millimeters	minims (British)	0.016894
Cu. millimeters	minims (U. S.)	0.016231
Cubic yards	cubic cm.	764559.45
Cubic yds. (British)	cubic ft.	27
Cubic yds (U. S.)	cubic ft.	27
Cubic yds. (U. S.)	cubic inches	46656
Cubic yds. (British)	cubic meters	0.76455285
Cubic yds. (U. S.)	cubic meters	0.76455945
Cubic yds. (U. S.)	gallons (British)	168.18
Cubic yds. (U. S.)	gallons (U. S.)	202.0
Cubic yds.	liters	764.54
Cubic yds. (U. S.)	pints (U. S., liquid)	1616
Cubic yds. of sand	pounds	2700
Cubic yds (U. S.)	quarts (U. S., liquid)	807.9
Cubic yds./min.	cubic ft./sec.	0.45
Cubic yds./min.	gallons/sec.	3.367
Cubic yds/min.	liters/sec.	12.74
Cubits	centimeters	45.72009
Cubits	feet	1.5
Cubits	inches	18
Daltons	grams	1.6498×10^{-24}
Daltons	mass of an atom of oxygen	1/16
Days (mean solar)	hours (mean solar)	24
Days (mean solar)	minutes (mean solar)	1440

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Days (mean solar)	seconds (mean solar)	86400
Days (siderial)	seconds (mean solar)	86164
Decigrams	grams	0.1
Decisteres	cubic meters	0.1
Degrees	circumferences	0.00277778
Degrees	minutes	60
Degrees	quadrants	1/90
Degrees	radians	0.0174533
Degrees	revolutions	0.00277778
Degrees	seconds	3600
Degrees centigrade cf. special table	....	....
Degrees Fahrenheit cf. special table	....	....
Degree/foot	radians/cm.	5.7261×10^{-4}
Degrees/inch	radians/cm.	0.0068714
Degrees/sec.	radians/sec.	0.017453
Degrees/sec.	revolutions/min.	0.1667
Degrees/sec.	revolutions/sec.	0.002778
Degrees Reaumur cf. special table	....	....
Dekagrams	grams	10
Drachms (British, fluid)	cubic cm.	3.5515
Drachms (British, fluid)	minims (British)	60
Drachms (British, fluid)	ounces (British, fluid)	0.125
Drachms (U. S., fluid) cf. Drams (U. S., fluid)		
Drams (apothecaries' or troy)	drams (avoirdupois)	2.194286
Drams (apothecaries' or troy)	grains	60
Drams (apothecaries' or troy)	grams	3.8879351
Drams (apothecaries' or troy)	ounces (avoirdupois)	0.1371429
Drams (apothecaries' or troy)	ounces (troy)	0.125
Drams (troy)	pennyweights	2.5
Drams (apothecaries' or troy)	pounds (avoirdupois)	0.008571429
Drams (apothecaries' or troy)	pounds (troy)	1/96
Drams (apothecaries')	scruples	3
Drams (avoirdupois)	drams (apothecaries' or troy)	0.4557292
Drams (avoirdupois)	grains	27.34375
Drams (avoirdupois)	grams	1.771845
Drams (avoirdupois)	milligrams	1771.845
Drams (avoirdupois)	ounces (avoirdupois)	0.0625
Drams (avoirdupois)	ounces (troy)	0.056966146
Drams (avoirdupois)	pennyweights	1.139323
Drams (avoirdupois)	pounds (avoirdupois)	1/256
Drams (avoirdupois)	pounds (troy)	0.0047471788
Drams (avoirdupois)	scruples	1.3671875
Drams (U. S., fluid or apoth.)	cubic cm.	3.6967
Drams (U. S., fluid or apoth.)	cubic inches	0.225570
Drams (U. S., fluid or apoth.)	gills (U. S.)	0.03125
Drams (U. S., fluid or apoth.)	milliliters	3.6966
Drams (U. S., fluid or apoth.)	minims (U. S., fluid)	60
Drams (U. S., fluid or apoth.)	ounces (fluid)	0.125
Drams (U. S., fluid or apoth.)	pints (U. S., liquid)	0.0078125
Drams (U. S., fluid or apoth.)	quarts (U. S., liquid)	0.00390625
Dynes	grains	0.015368
Dynes	grams	0.00101972
Dynes	poundals	7.2332×10^{-5}
Dynes	pounds	2.2481×10^{-6}
Dyne-cm. (torque)	kg.-meters	1.0197×10^{-8}
Dyne-cm. (torque)	poundal-feet	2.3731×10^{-6}
Dyne-cm. (torque)	pound-feet	7.3757×10^{-8}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Dyne-cm. (torque)	pound-inches	8.8511×10^{-7}
Dynes/cm.	ergs/sq. cm.	1
Dynes/cm.	ergs/sq. millimeter	0.01
Dynes/cm.	milligrams/inch	2.5901
Dynes/cm.	milligrams/millimeter	0.10197
Dynes/sq. cm.	atmospheres	9.8692×10^{-7}
Dynes/sq. cm.	bars	1×10^{-6}
Dynes/sq. cm.	cm. of water at 4°C (39.2° F.)	0.00101974
Dynes/sq. cm.	grams/sq. cm.	0.00101972
Dynes/sq. cm.	inches of mercury at 32°F	2.9530×10^{-5}
Dynes/sq. cm.	inches of water at 39.2° F. (4°C.)	4.0148×10^{-4}
Dynes/sq. cm.	kg./sq. meter	0.0101971
Dynes/sq. cm.	millimeters of mercury	7.5006×10^{-4}
Dynes/sq. cm.	pounds/sq. ft.	0.0020886
Dynes/sq. cm.	pounds/sq. inch	1.4504×10^{-5}
Electromagnetic cgs unit of capacity cf. abfarad	....	....
Electromagnetic cgs unit of field strength	gauss (Abs.)	1.0000
Electromagnetic cgs unit of inductance cf. abhenry	....	....
Electromagnetic cgs units of megnetic induction	maxwells (Abs.)/sq. cm.	1.00000
Electromagnetic cgs units of magnetic permeability	electrostatic cgs units of magnetic permeability	8.9916×10^{20}
Electromagnetic cgs units of magnetomotive force	gilberts	1.00000
Electromagnetic cgs units of mass resistance	ohm, International-meter-gram	9.9948×10^{-6}
Electromagnetic cgs units of pole strength	maxwells (Abs.)	1.0000
Electromagnetic cgs unit of potential cf. abvolt	....	....
Electromagnetic cgs units of reluctance	oersteds (Abs.)	1.0000
Electromagnetic cgs unit of resistance cf. abohm	....	....
Electromagnetic ft. lb. sec. units of magnetic permeability	electromagnetic cgs units of magnetic permeability	0.0010764
Electromagnetic ft. lb. sec. units of magnetic permeability	electrostatic cgs units of magnetic permeability	9.6786×10^{17}
Electronic charges	abcoulombs	1.5921×10^{-20}
Electronic charges	coulombs (Abs.)	1.5921×10^{-19}
Electronic charges	statcoulombs	4.774×10^{-10}
Electrons/kg.	statcoulombs/dyne	4.868×10^{-16}
Electrostatic cgs units* of capacity cf. statfarad	....	....
Electrostatic cgs unit of charge cf. statcoulomb	....	....
Electrostatic cgs units of field strength	gauss (Abs.)	3.33560×10^{-11}
Electrostatic cgs units of Hall effect	electromagnetic cgs units of Hall effect	2.6962×10^{31}

*All electrostatic cgs units are based on the velocity of light in air equal to 2.99796×10^{10} cm./s[illegible]

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Electrostatic cgs unit of inductance cf. stathenry	....	....
Electrostatic cgs units of magnetic induction	maxwells (Abs.)/sq. cm.	2.9986×10^{10}
Electrostatic cgs units of magnetomotive force	gilberts (Abs.)	3.33560×10^{-11}
Electrostatic cgs units of mass resistance	ohm, International-meter-gram	8.9869×10^{15}
Electrostatic cgs units of pole strength	maxwells (Abs.)	2.99796×10^{10}
Electrostatic cgs unit of potential cf. statvolt	....	....
Electrostatic cgs units of reluctance	oersteds (Abs.)	1.1122×10^{-21}
Electrostatic cgs unit of resistance cf. statohm	....	....
Electrostatic ft. lb. sec. units of charge	abcoulombs	117.58
Electrostatic ft. lb. sec. units of charge	coulombs (Abs.)	1.1952×10^{-6}
Electrostatic ft. lb. sec. units of charge	statcoulombs	3583.9
Electrostatic ft. lb. sec. units of magnetic permeability	electrostatic cgs units of magnetic permeability	1.0000
Ells	cm.	114.30
Ells	inches	45
Ems, pica (printing)	cm.	0.42333
Ems, pica (printing)	inches	1/6
Ergs	B. T. U. (mean)	9.4805×10^{-11}
Ergs	calories, gram (mean)	2.3889×10^{-8}
Ergs	calories, kg. (mean)	2.3889×10^{-11}
Ergs	foot poundals	2.3730×10^{-6}
Ergs	foot pounds	7.3756×10^{-8}
Ergs	gram centimeters	0.00101972
Ergs	joules	1×10^{-7}
Ergs	kg. meters	1.0197×10^{-8}
Ergs/sec.	B. T. U. (mean)/min.	5.6883×10^{-9}
Ergs/sec.	calories, kg. (mean)/min.	1.4333×10^{-9}
Ergs/sec.	foot pounds/min.	4.4254×10^{-6}
Ergs/sec.	foot pounds/sec.	7.3756×10^{-8}
Ergs/sec.	horse power	1.3410×10^{-10}
Ergs/sec.	K. W.	1×10^{-10}
Ergs/sec.	watts	1×10^{-7}
Ergs/sq. cm.	dynes/cm.	1
Ergs/sq. cm.	ergs/sq. mm.	0.01
Ergs/sq. mm.	dynes/cm.	100
Ergs/sq. mm.	ergs/sq. cm.	100
Fahrenheit degrees	centigrade, cf. special table	....
Faradays	coulombs (Abs.)	9.6500×10^{4}
Faradays	coulombs (International) (a)	9.6507×10^{4}
Faradays	coulombs (International) (v)	96510
Faradays/kg.	statcoulombs/dyne	2.9507×10^{8}
Faradays/sec.	amperes (Abs.)	96500
Farads (Abs.)	Abfarads	1×10^{-9}
Farads (Abs.)	farads (International)	1.00052
Farads (Abs.)	microfarads	1×10^{6}
Farads (Abs.)	statfarads	8.98776×10^{11}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Farads (International)	farads (Abs.)	0.99948
Fathoms	feet	6
Fathoms	meters	1.828804
Feet (British)	cm.	30.47997
Feet (British)	paces (British)	0.4
Feet (U. S.)	centimeters	30.48006096
Feet (U. S.)	chains (Gunter's)	0.0151515
Feet (U. S.)	fathoms	1/6
Feet (U. S.)	furlongs	0.00151515
Feet (U. S.)	inches (U. S.)	12
Feet (U. S.)	meters	0.3048006096
Feet (U. S.)	miles (nautical)	1.6447×10^{-4}
Feet (U. S.)	miles (statute)	1.893939×10^{-4}
Feet (U. S.)	rods	0.0606061
Feet (U. S.)	wave lengths of red line of cadmium	473404
Feet (U. S.)	yards (U. S.)	1/3
Feet of water at 39.2° F. (4°C)	atmospheres	0.029499
Feet of water at 39.2° F. (4°C)	inches of mercury at 32° F. (0°C)	0.88265
Feet of water at 39.2° F. (4°C)	kg./sq. meter	304.79
Feet of water at 39.2° F. (4°C)	pounds/sq. inch	0.43352
Feet of water at 39.2° F. (4°C)	pounds/sq. foot	62.427
Feet/min.	cm./sec.	0.508001
Feet/min.	kilometers/hour	0.01829
Feet/min.	meters/sec.	0.00508001
Feet/min.	miles/hour	0.011364
Feet/sec.	kilometers/hour	1.0973
Feet/sec.	knots (per hour)	0.5921
Feet/sec.	meters/min.	18.29
Feet/sec.	miles/hour	0.6818
Feet/sec.	miles/min.	0.011364
Feet/sec.^{2}	kilometers/hour/sec.	1.0973
Firkins (British)	gallons (British)	9
Firkins (British)	liters	40.914
Firkins (U. S.)	gallons (U. S.)	9
Firkins (U. S.)	liters	34.068
Fluid ounce cf. ounce, fluid	....	....
Foot (paris) cf. pied	....	....
Foot candles	lumen incident/sq. ft.	1
Foot candles	lumens/sq. meter	10.764
Foot candles	lux	10.764
Foot candles	milliphots	1.0764
Foot poundals	B. T. U. (mean)	3.9951×10^{-5}
Foot poundals	calories, gram (mean)	0.010067
Foot poundals	ergs	4.21402×10^{5}
Foot poundals	joules	0.0421402
Foot poundals	kg. meters	0.0042972
Foot poundals	liter atmospheres (normal)	4.1588×10^{-4}
Foot pounds	B. T. U. (mean)	0.0012854
Foot pounds	calories, gram (mean)	0.32389
Foot pounds	calories, kg. (mean)	3.2389×10^{-4}
Foot pounds	cu. ft. atmospheres	4.7253×10^{-4}
Foot pounds	ergs	1.35582×10^{7}
Foot pounds	foot poundals	32.174
Foot pounds	gram cm.	1.3825×10^{4}
Foot pounds	horse power hours	5.0505×10^{-7}
Foot pounds	joules (Abs.)	1.35582
Foot pounds	kg. meters	0.138255

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Foot pounds	K. W. hours	3.7662×10^{-7}
Foot pounds	liter atmospheres	0.013381
Foot pounds	watt hours	3.7661×10^{-4}
Foot pounds/min.	B. T. U. (mean)/min.	0.0012854
Foot pounds/min.	calories, kg. (mean)/min.	3.2389×10^{-4}
Foot pounds/min.	foot pounds/sec.	0.016667
Foot pounds/min.	horse power	3.0303×10^{-5}
Foot pounds/min.	horse power (metric)	3.0723×10^{-5}
Foot pounds/min.	K. W.	2.2597×10^{-5}
Foot pounds/min.	watts	0.022597
Foot pounds/sec.	B. T. U. (mean)/min.	0.077124
Foot pounds/ sec.	calories, kg., (mean)/min.	0.0194334
Foot pounds/sec.	horse power	0.0018182
Foot pounds/sec.	K. W.	0.00135582
Foot pounds/sec.	watts (Abs.)	1.35582
Force de cheval cf. horse power, metric	....	....
Furlongs	chains (Gunter's)	10
Furlongs	meters	201.168
Furlongs	miles (U. S.)	0.125
Furlongs	rods	40
Furlongs	yards	220
Gallons (British)	barrels (British, dry)	0.027778
Gallons (British)	bushels (British, dry)	0.125
Gallons (British)	cubic cm.	4546.0858
Gallons (British)	cubic feet	0.16054
Gallons (British)	cubic inches	277.41
Gallons (British)	gallons (U. S.)	1.20094
Gallons (British)	gills (British)	32
Gallons (British)	liters	4.5459631
Gallons (British)	ounces (British, fluid)	160
Gallons (British)	pecks (British)	0.5
Gallons (British)	pints (British, liquid)	8
Gallons (British)	pounds (avoirdupois) of water at 62° F (16.7° C.)	10
Gallons (British)	quarts (British, liquid)	4
Gallons, Imperial cf. gallons, British	....	....
Gallons (U. S.)	barrels (U. S., liquid)	0.031746
Gallons (U. S.)	cubic cm.	3785.4
Gallons (U. S.)	cubic feet	0.13368
Gallons (U. S.)	cubic inches	231
Gallons (U. S.)	cubic meters	0.0037854
Gallons (U. S.)	cubic yards	0.004951
Gallons (U. S.)	gallons (British)	0.83268
Gallons (U. S.)	gills (U. S.)	32
Gallons (U. S.)	liters	3.78533
Gallons (U. S.)	minims	61440
Gallons (U. S.)	ounces (U. S., fluid)	128
Gallons (U. S.)	pints (U. S., liquid)	8
Gallons (U. S.)	pounds (avoirdupois) of water at 60° F. (15.6° C.)	8.3370
Gallons (U. S.)	quarts (U. S., liquid)	4
Gallons (U. S.,) water/min.	tons water/24 hours	6.0024
Gallons (U. S.)/min.	cu. ft./hour	8.0208
Gallons (U. S.)/min.	cu. ft./sec.	0.002228
Gallons (U. S.)/min.	liters/sec.	0.06308
Gallons (U. S.)/sec.	cubic yards/min.	0.29706
Gammas	gauss	1.0000×10^{-5}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Gauss (Abs.)	ampere turns/cm.	0.79580
Gauss (Abs.)	ampere turns/inch	2.0213
Gauss (Abs.)	electromagnetic cgs units of field strength	1.0000
Gauss (Abs.)	electrostatic cgs units of field strength	2.99859×10^{10}
Gauss (Abs.)	gammas	1×10^{5}
Gauss (Abs.)	gauss (International) (a)	1.00007
Gauss (Abs.)	gauss (International) (v)	1.00010
Gauss (Abs.)	gilberts/cm.	1.00
Gauss (Abs.)	lines/sq. inch	6.452
Gauss (International) (a)	gauss (Abs.)	0.99993
Gauss (International) (v)	gauss (Abs.)	0.99990
Geepound cf. slug	....	....
Gilberts (Abs.)	abampere turns	0.07958
Gilberts (Abs.)	ampere turns	0.7958
Gilberts (Abs.)	gilberts (International) (a)	1.00007
Gilberts (Abs.)	gilberts (International) (v)	1.00010
Gilberts (International) (a)	gilberts (Abs.)	0.99993
Gilberts (International) (v)	gilberts (Abs.)	0.99990
Gilberts/cm.	gauss	1.0000
Gills (British)	cubic cm.	142.07
Gills (British)	gallons (British)	0.03125
Gills (British)	liters	0.14206
Gills (British)	ounces (British, liquid)	5
Gills (British)	pints (British, liquid)	0.25
Gills (U. S.)	cubic cm.	118.294
Gills (U. S.)	cubic inches	7.21875
Gills (U. S.)	drams (fluid)	32
Gills (U. S.)	gallons (U. S.)	0.03125
Gills (U. S.)	liters	0.118292
Gills (U. S.)	minims	1920
Gills (U. S.)	ounces (U. S., fluid)	4
Gills (U. S.)	pints (U. S., liquid)	0.25
Gills (U. S.)	quarts (U. S., liquid)	0.125
Grades	centesimal minutes	100
Grades	circumferences	0.0025
Grades	degrees	0.9
Grades	radians	0.01570797
Grains	carats (metric)	0.3240
Grains	drams (avoirdupois)	0.03657143
Grains	drams (troy)	0.016667
Grains	dynes	63.5453
Grains	grams	0.064798918
Grains	milligrams	64.798918
Grains	ounces (avoirdupois)	0.0022857
Grains	ounces (troy)	0.0020833
Grains	pennyweights (troy)	0.0416667
Grains	pounds (avoirdupois)	1/7000
Grains	pounds (troy)	1/5760
Grains	scruples	0.05000
Grains/gallon (British)	part per million	14.254
Grains/gallon (U. S.)	parts per million	17.118
Grains/gallon (U. S.)	pounds/million gallons (U. S.)	142.86
Grams	carats (metric)	5
Grams	drams (avoirdupois)	0.564383
Grams	drams (troy)	0.257206

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Grams	dynes	980.665
Grams	grains	15.4324
Grams	micrograms	1×10^{6}
Grams	milligrams	1000
Grams	myriagrams	1×10^{-4}
Grams	ounces (avoirdupois)	0.0352739
Grams	ounces (troy)	0.0321507
Grams	pennyweights	0.6430149
Grams	poundals	0.0709314
Grams	pounds (avoirdupois)	0.00220462
Grams	pounds (troy)	0.00267923
Grams	scruples	0.771618
Grams	tons (metric)	1×10^{-6}
Gram centimeters	B. T. U. (mean)	9.29667×10^{-8}
Gram centimeters	calories, gram (mean)	2.3427×10^{-5}
Gram centimeters	calories, kg. (mean)	2.3427×10^{-8}
Gram centimeters	ergs	980.665
Gram centimeters	foot pounds	7.233×10^{-5}
Gram centimeters	joules (Abs.)	9.80665×10^{-5}
Grams centimeters	kilogram meters	1×10^{-5}
Gram centimeters/sec.	watts (Abs.)	9.80665×10^{-5}
Gram cm.^{2} (moment of inertia)	pound sq. ft.	2.37305×10^{-6}
Gram cm.^{2} (moment of inertia)	pound sq. inch	3.4172×10^{-4}
Grams/cubic cm.	pounds/cu. ft.	62.43
Grams/cubic cm.	pounds/cu. inch	0.03613
Grams/cubic cm.	pounds/gallon (British)	10.0224
Grams/cubic cm.	pounds/gallon (U. S.)	8.3454
Grams/cubic meter	grains/cubic ft.	0.437
Grams/liter	grains/gallon (U. S.)	58.417
Grams/liter	parts per million	1000
Grams/liter	pounds/cu. foot	0.062427
Grams/liter	pounds/1000 gallons (U. S.)	8.345
Grams/milliliter	grams/cubic cm.	0.999973
Grams/ton (long)	milligrams/kg.	0.9842
Grams/ton (short)	milligrams/kg.	1.1023
Grams/sq. cm.	atmospheres	9.6784×10^{-4}
Grams/sq. cm.	dynes/sq. cm.	980.665
Grams/sq. cm.	kg./sq. meter	10
Grams/sq. cm.	millimeters of mercury at 0°C	0.73556
Grams/sq. cm.	pounds/sq. ft.	2.04817
Grams/sq. cm.	pounds/sq. inch	0.0142234
Gram weight sec./sq. cm.	poises	980.665
Gravity	centimeters/sec.^{2}	980.665
Gravity	feet/sec.^{2}	32.174
Hands	centimeters	10.160
Hands	inches	4
Hectares	acres (British)	2.471058
Hectares	acres (U. S.)	2.471044
Hectares	ares	100
Hectares	sq. ft.	107640
Hectares	sq. meters	10000
Hectares	sq. rods (U. S.)	395.367
Hectares	sq. yards (U. S.)	11959.85
Hectograms	grams	100
Hectograms	ounces (avoirdupois)	3.52739
Hectoliters	bushels (British)	2.7497
Hectoliters	bushels (U. S.)	2.837819

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Hectoliters	liters	100
Hectoliters/hectare	U. S. bushels/acre	1.14843
Hectometers	meters	100
Hectometers	rods	19.8838
Hectometers	yards (British)	109.3614
Hectometers	yards (U. S.)	109.3611
Hectowatts	watts	100
Hefner units	candles (International)	0.90 (approx.)
Hemispheres	spheres	0.5
Hemispheres	spherical right angles	4
Hemispheres	steradians	6.2832
Henries (Abs.)	abhenries	1×10^{9}
Henries (Abs.)	henries (International)	0.99948
Henries (Abs.)	millihenries	1000
Henries (Abs.)	stathenries	1.11263×10^{-12}
Henries (International)	henries (Abs.)	1.00052
Hogsheads (British)	cubic ft.	10.114
Hogsheads (British)	cubic meters	0.28640
Hogsheads (British)	gallons (British)	63
Hogsheads (U. S.)	cubic ft.	8.42184
Hogsheads (U. S.)	cubic meters	0.23848
Hogsheads (U. S.)	gallons (U. S.)	63
Horse power	B. T. U. (mean)/min.	42.418
Horse power	B. T. U. (mean)/hour	2545.08
Horse power	B. T. U. (mean)/sec.	0.70697
Horse power	calories, kg. (mean)/min.	10.688
Horse power	foot pounds/min.	33000
Horse power	foot pounds/sec.	550
Horse power	horse power (metric)	1.0139
Horse power	K. W. (g = 980)	0.7452
Horse power	K. W. (g = 980.665)	0.74570
Horse power	pounds carbon to CO_2/hour	0.175
Horse power	pounds water evaporated per hour from and at 212°F. (100°C.)	2.64
Horse power	watts (g = 980)	745.2
Horse power	watts (g = 980.665)	745.70
Horse power, boiler cf. boiler horse power	....	....
Horse power, electrical (U. S. or British)	watts (Abs.)	746.00
Horse power (metric)	foot pounds/min.	32549
Horse power (metric)	horse power (U. S.)	0.98632
Horse power (metric)	kg. meters/sec.	75
Horse power hours	B. T. U. (mean)	2545.08
Horse power hours	calories, kg. (mean)	641.304
Horse power hours	foot pounds	1.9800×10^{6}
Horse power hours	joules (Abs.)	2.6845×10^{6}
Horse power hours	kg. meters	2.7374×10^{5}
Horse power hours	K. W. hours	0.7457
Horse power hours	pounds carbon to CO_2	0.175
Horse power hours	pounds water evaporated from and at 212°F. (100°C.)	2.64
Horse power hours	pounds water raised from 62°F. to 212°F.	17.0
Horse power hours	watt hours	745.7
Horse power hours, electrical (U. S. or British)	joules (Abs.)	2.6856×10^{6}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Hours (mean solar)	days (mean solar)	0.041667
Hours (mean solar)	minutes (mean solar)	60
Hours (mean solar)	seconds (mean solar)	3600
Hours (mean solar)	weeks	0.0059524
Hundredweights (long)	kilograms	50.8023
Hundredweights (long)	pounds	112
Hundredweights (long)	tons (long)	0.05
Hundredweights (short)	kilograms	45.3592
Hundredweights (short)	ounces (avoirdupois)	1600
Hundredweights (short)	pounds	100
Hundredweights (short)	tons (metric)	0.0453592
Hundredweights (short)	tons (long)	0.0446429
Inches (British)	centimeters	2.539998
Inches (British)	spans	1/9
Inches (British)	yards (British)	1/36
Inches (U. S.)	angstrom units	2.5400×10^{8}
Inches (U. S.)	centimeters	2.540005
Inches (U. S.)	chains (Gunter's)	0.00126263
Inches (U. S.)	feet (U. S.)	1/12
Inches (U. S.)	links (Gunter's)	0.126263
Inches (U. S.)	miles	1.57828×10^{-5}
Inches (U. S.)	mils	1000
Inches (U. S.)	points (printers' type)	72
Inches (U. S.)	rods	0.00505051
Inches (U. S.)	wave length of the red line of cadmium	39450.45
Inches (U. S.)	yards	1/36
Inches of mercury at 32°F	atmospheres	0.033421
Inches of mercury at 32°F	dynes/sq. cm.	3.38639×10^{4}
Inches of mercury at 32°F	feet of water at 39.1°F	1.13299
Inches of mercury at 32°F	kg./sq. meter	345.31
Inches of mercury at 32°F	pounds/sq. ft.	70.727
Inches of mercury at 32°F	pounds/sq. inch	0.49116
Inches of water at 39.2°F. (4°C.)	atmospheres	0.0024583
Inches of water at 39.2°F. (4°C.)	dynes/sq. cm.	2490.82
Inches of water at 39.2°F. (4°C.)	inches of mercury	0.073554
Inches of water at 39.2°F. (4°C.)	kg./sq. meter	25.399
Inches of water at 39.2°F. (4°C.)	ounces/sq. inch	0.57818
Inches of water at 39.2°F. (4°C.)	pounds/sq. ft.	5.2022
Inches of water at 39.2°F. (4°C.)	pounds/sq. inch	0.036136
Inch, Paris cf. pouce	....	....
International annealed copper standard (20°C)	micromhos/cm. cube	0.5800
Joules (Abs.)	B. T. U. (mean)	9.480×10^{-4}
Joules (Abs.)	calories, gram (mean)	0.23889
Joules (Abs.)	calories, gram (15°C)	0.23895
Joules (Abs.)	calories, gram (20°C)	0.23918
Joules (Abs.)	calories, kg. (mean)	2.3889×10^{-4}
Joules (Abs.)	cubic foot atmospheres	3.485×10^{-4}
Joules (Abs.)	ergs	1×10^{7}
Joules (Abs.)	foot poundals	23.730
Joules (Abs.)	foot pounds	0.73756
Joules (Abs.)	gram centimeters	1.0197×10^{4}
Joules (Abs.)	horse power hours	3.72508×10^{-7}
Joules (Abs.)	joules (International) (v)	0.999680
Joules (Abs.)	kg. meters	0.101972
Joules (Abs.)	K. W. hours	2.77778×10^{-7}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Joules (Abs.)	liter atmospheres	0.0098689
Joules (Abs.)	watt hours	2.77778×10^{-4}
Joules (Abs.)	watt seconds	1.0
Joules (International)(v)	joules (Abs.)	1.00032
Joules /abcoulombs/deg. F	joules/coulomb/deg.C	0.1800
Joules (Abs.)/ampere hour	joules/abcoulomb	0.0027778
Joules (Abs.)/ampere hour	joules/statcoulombs	9.2636×10^{-14}
Joules/coulomb	joules/abcoulomb	10.000
Joules/coulomb/deg. F	joules/coulomb/deg. C	1.8000
Joules/deg. C	B. T. U. (60°F)/deg. F	5.2679×10^{-4}
Joules/deg. C	calories, gram/deg. C	0.23889
Joules/electron	joules/abcoulomb	6.2811×10^{19}
Joules/electron/deg. C	joules/coulombs/deg. C	6.2811×10^{18}
Joules/faraday	joules/abcoulomb	1.0363×10^{-4}
Joules/faraday/deg. C	joules/coulomb/deg. C	1.0363×10^{-5}
Joules/gram	B. T. U. (mean)/pound	0.43006
Joules/gram	calories, gram (mean)/gram	0.23889
Joules/gram/deg. C	B. T. U. (mean)/pound/deg. F	0.23889
Joules/gram/deg. C	calories, gram (mean)/gram/deg. C	0.23889
Joules/statcoulomb/deg. C	joules/coulomb/deg. C	2.9986×10^{9}
Joules/statcoulomb/deg. F	joules/coulomb/deg. C	5.3975×10^{9}
Joules /sq.cm./sec. for a temperature gradient of 1°C/cm.	B. T. U./sq. ft./sec. for a temperature gradient of 1°F/inch	0.1926
Joules/sq. cm./sec. for a temperature gradient of 1°C/cm.	calories, gram (15°C)/sq. cm./sec. for a temperature gradient of 1°C/cm.	0.23895
Joule seconds	quanta	1.5258×10^{33}
Joule seconds/N_0 #	quanta	2.5173×10^{9}
Karats (1 of gold to 24 of mixture)	milligrams/gram	41.667
Kilderkins (British)	cubic meters	0.081830
Kilderkins (British)	gallons (British)	18
Kilograms	drams (avoirdupois)	564.383
Kilograms	drams (troy)	257.206
Kilograms	dynes	9.80665×10^{5}
Kilograms	grains	15432.4
Kilograms	grams	1000
Kilograms	hundredweights (long)	0.0196841
Kilograms	hundredweights (short)	0.022046223
Kilograms	ounces (avoirdupois)	35.273957
Kilograms	ounces (troy)	32.150742
Kilograms	pennyweights	643.0149
Kilograms	poundals	70.9314
Kilograms	pounds (avoirdupois)	2.204622341
Kilograms	pounds (troy)	2.6792285
Kilograms	scruples	771.618
Kilograms	tons (long)	9.84207×10^{-4}
Kilograms	tons (metric)	0.001
Kilograms	tons (short)	0.0011023112
Kg. cm.^{2} (moment of inertia)	pounds ft.^{2}	0.00237305
Kg. cm.^{2} (moment of inertia)	pounds in.^{2}	0.341719
Kg. meters	B. T. U. (mean)	0.00929667
Kg. meters	calories, gram (mean)	2.3427
Kg. meters	cu. ft. atmospheres	0.0034177
Kg. meters	ergs	9.80665×10^{7}
Kg. meters	foot poundals	232.71
Kg. meters	foot pounds	7.2330

#N_0 = Avogrado's number = number of molecules per gram mole.

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Kg. meters	gram centimetérs	1×10^5
Kg. meters	horse power hours	3.6529×10^{-6}
Kg. meters	joules (Abs.)	9.80665
Kg. meters	K. W. hours	$2.72407 \times 10^{-}$
Kg. meters	liter atmospheres	0.096781
Kg. meters	watt hours	0.00272407
Kg. meters/sec.	watts (Abs.)	9.80665
Kg. meters (torque)	dyne cm.	9.8066×10^7
Kilograms/cu. meter	grams/cubic cm.	0.001
Kilograms/cubic meter	pounds/cu. ft.	0.06243
Kilograms/cu. meter	pounds/cu. inch	3.613×10^{-5}
Kilograms/meter	pounds/foot	0.67197
Kilograms/sq. cm.	centimeters of mercury at 0°C	73.556
Kilograms/sq. cm.	pounds/sq. inch	14.223
Kilograms/sq. meter	atmospheres	9.6777×10^{-5}
Kilograms/sq. meter	dynes/sq. cm.	98.0665
Kilograms/sq. meter	feet of water	0.0032809
Kilograms/sq. meter	grams/sq. cm.	0.1
Kilograms/sq. meter	inches of mercury	0.0028959
Kilograms/sq. meter	millimeters of mercury	0.073556
Kilograms/sq. meter	pounds/sq. ft.	0.204817
Kilograms/sq. meter	pounds/sq. inch	0.00142234
Kilograms/sq. mm.	dynes/sq. cm.	9.80665×10^7
Kilograms/sq. mm.	tons (short)/sq. in.	0.71117
Kilolines	maxwells	1000
Kiloliters	cu. ft.	35.317
Kiloliters	cu. meters	1.000027
Kiloliters	cu. yards	1.3080
Kiloliters	gallons (U. S., liquid)	264.18
Kiloliters	liters	1000
Kilometers	centimeters	1×10^5
Kilometers	feet	3280.83
Kilometers	light years	1.0567×10^{-13}
Kilometers	meters	1000
Kilometers	miles (nautical)	0.539593
Kilometers	miles (U. S.)	0.6213699495
Kilometers	myriameters	0.1
Kilometers	yards	1093.6
Kilometers/hour	centimeters/sec.	27.7778
Kilometers/hour	feet/min.	54.68
Kilometers/hour	feet/sec.	0.9113
Kilometers/hour	knots (per hour)	0.5396
Kilometers/hour	meters/min.	16.667
Kilometers/hour	meters/sec.	0.27778
Kilometers/hour/sec.	centimeters/sec.^{2}	27.778
Kilometers/hour/sec.	feet/sec.^{2}	0.9113
Kilometers/hour/sec.	meters/sec.^{2}	0.27778
Kilometers/min.	centimeters/sec.	1666.7
Kilometers/min.	miles/hour	37.2822
Kilowatt hours	B. T. U. (mean)	3413.0
Kilowatt hours	calories, gram (mean)	8.6001×10^5
Kilowatt hours	foot pounds	2.6552×10^6
Kilowatt hours	horse power hours	1.3410
Kilowatt hours	joules (Abs.)	3.6000×10^6
Kilowatt hours	kg. meters	3.6709×10^5
Kilowatt hours	pounds carbon to CO_2	0.235

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Kilowatt hours	pounds water evaporated from and at 212°F. (100°C.)	3.53
Kilowatt hours	pounds water raised from 62°F. (16.7°C.) to 212°F. (100°C.)	22.75
Kilowatt hours	watt hours	1000
Kilowatts	B. T. U. (mean)/min.	56.884
Kilowatts	B. T. U. (mean)/hour	3413.04
Kilowatts	B. T. U. (mean)/sec.	0.948068
Kilowatts	calories, kg. (mean)/min.	14.3334
Kilowatts	calories, kg. (mean)/sec.	0.23889
Kilowatts	foot pounds/hour	2.6552×10^6
Kilowatts	foot pounds/min.	44254
Kilowatts	foot pounds/sec.	737.56
Kilowatts	horse power	1.3410
Kilowatts	horse power (metric)	1.3596
Kilowatts	pounds carbon to CO_2/hour	0.2275
Kilowatts	pounds water evaporated per hour from and at 212°F. (100°C.)	3.53
Kilowatts	watts	1000
Knot as a unit of length cf. nautical mile	....	....
Knots (per hour)	centimeters/sec.	51.479
Knots (per hour)	feet/hour	6080.20
Knots (per hour)	feet/sec.	1.6889
Knots (per hour)	kilometers/hour	1.85325
Knots (per hour)	miles/hour	1.15155
Lamberts	candles/sq. cm.	0.3183
Lamberts	candles/sq. inch	2.054
Lamberts	lumens emitted/sq. cm. of a perfectly diffusing surface	1
Lasts (British)	bushels (British)	80 (variable)
Lasts (British)	cu. meters	2.9095
Leagues (nautical)	kilometers	5.55975
Leagues (nautical)	nautical miles	3
Leagues (statute)	kilometers	4.82804
Leagues (statute)	statute miles	3
Light years	kilometers	9.4637×10^{12}
Light years	miles	5.88×10^{12}
Lignes (Paris lines)	centimeters	0.225583
Lignes (Paris lines)	pouces (Paris inches)	1/12
Lines (British, obsolete)	centimeters	0.21167
Lines (British, obsolete)	inches	1/12
Lines	maxwells (Abs.)	1.0000
Lines/sq. cm.	gauss	1.0
Lines/sq. inch	gauss	0.1550
Links (engineers' or Ramden's)	chains (engineers')	0.01
Links (engineers' or Ramden's)	feet	1
Links (surveyors' or Gunter's)	centimeters	20.11684
Links (surveyors' or Gunter's)	chains (Gunter's)	0.01
Links (surveyors' or Gunter's)	feet	0.66
Links (surveyors' or Gunter's)	inches	7.92
Links (surveyors' or Gunter's)	rods	0.04000
Links (surveyors' or Gunter's)	miles	1.2500×10^{-4}
Links (surveyors' or Gunter's)	yards	0.22
Liter atmospheres (normal)	B. T. U. (mean)	0.096064
Liter atmospheres (normal)	calories, gram (mean)	24.206
Liter atmospheres (normal)	cu. ft. atmospheres	0.035316

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Liter atmospheres (normal)	foot poundals	2404.5
Liter atmospheres (normal)	foot pounds	74.735
Liter atmospheres (normal)	horse power hours	3.7745×10^{-5}
Liter atmospheres (normal)	joules (Abs.)	101.328
Liter atmospheres (normal)	kg. meters	10.333
Liter atmospheres (lat. 45°, g 980.616)	joules (Abs.)	101.323
Liters	bushels (British)	0.027497
Liters	bushels (U. S.)	0.028378
Liters	cubic cm.	1000.027
Liters	cubic ft.	0.035316
Liters	cubic inches	61.025
Liters	cubic meters	0.001000027
Liters	cubic yards	0.0013080
Liters	drams (U. S., fluid)	270.5179
Liters	gallons (British)	0.219976
Liters	gallons (U. S.)	0.26417762
Liters	gills (British)	7.03923
Liters	gills (U. S.)	8.45368
Liters	ounces (British, fluid)	35.196
Liters	ounces (U. S., fluid)	33.8143
Liters	pecks (British)	0.109988
Liters	pecks (U. S.)	0.113512
Liters	pints (British, liquid)	1.7598
Liters	pints (U. S., dry)	1.816192
Liters	pints (U. S., liquid)	2.11336
Liters	quarts (British, liquid)	0.87990
Liters	quarts (U. S., dry)	0.908096
Liters	quarts (U. S., liquid)	1.056681869
Liters/cm./day	sq. cm. /sec.	0.011574
Liters/min.	cu. ft./sec.	5.886×10^{-4}
Liters/min.	gallons/sec.	0.004403
Liters/sec.	cu. ft./min.	2.11896
Liters/sec.	gallons (U. S.)/min.	15.8507
Liters/sec.	cu. yards/min.	0.07848
Lumens	watts	0.001496
Lumens/sq. cm./steradian	lamberts	3.1416
Lumens/sq. ft.	foot candles	1
Lumens/sq. ft.	lumens/sq. meter	10.764
Lumens/sq. ft./steradian	millilamberts	3.3816
Lumens/sq. meter	foot candles or lumens/sq. ft.	0.092902
Lumens/sq. meter	phots	1×10^{-4}
Lux	foot candles	0.092902
Lux	lumens/sq. meter	1.000
Lux	milliphots	0.1
Lux	phots	1×10^{-4}
Maxwells (Abs.)	electrostatic cgs units of pole strength	3.3356×10^{-11}
Maxwells (Abs.)	maxwells (International) (a)	0.99955
Maxwells (Abs.)	maxwells (International) (v)	0.99958
Maxwells (International) (a)	maxwells (Abs.)	1.00045
Maxwells (International) (a)/cm.^{2}	maxwells (Abs.)/cm.^{2}	1.00045
Maxwells (International) (v)	maxwells (Abs.)	1.00042
Maxwells (International) (v)/cm.^{2}	maxwells (Abs.)/cm.^{2}	1.00042
Maxwells/sq. in.	maxwells/sq. cm.	0.1550
Megalergs	ergs	1×10^6
Megalines	maxwells	1×10^6

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Megameters	meters	1×10^{6}
Megmhos	abmohs	0.001
Megmhos/cm. cube	megmhos/inch cube	2.540
Megmhos/cm. cube	microhms^{-1}/cm. cube	1
Megmhos/cm. cube	mhos/mil foot	0.1662
Megmhos/inch cube	megmhos/cm. cube	0.39370
Megmhos/inch cube	microhms^{-1}/inch cube	1
Megohms	ohms	1×10^{6}
Mercury at 0°C	grams /cubic cm.	13.5951
Meter candles	lumens/sq. meter	1.000
Meter kilograms cf. kg. meters	....	....
Meters	angstrom units	1×10^{10}
Meters	centimeters	100
Meters	chains (Gunter's)	0.0497096
Meters	fathoms	0.54681
Meters	feet (British)	3.280843
Meters	feet (U. S.)	3.280833333
Meters	furlongs	0.00497096
Meters	inches (British)	39.370113
Meters	inches (U. S.)	39.3700
Meters	kilometers	0.001
Meters	links (Gunter's)	4.970960
Meters	megameters	1×10^{-6}
Meters	miles (nautical)	5.39593×10^{-4}
Meters	miles (statute)	6.2137×10^{-4}
Meters	millimicrons	1×10^{9}
Meters	millionth microns	1×10^{12}
Meters	pieds (French feet)	3.07834
Meters	rods (U. S.)	0.198838
Meters	wave lengths of the red line of cadmium	1.55316412×10^{5}
Meters	yards (British)	1.093614
Meters	yards (U. S.)	1.093611
Meters/min.	centimeters/sec.	1.6667
Meters/min.	feet/ sec.	0.05468
Meters/min.	kilometers/hour	0.06
Meters/min.	miles/hour	0.03728
Meters/sec.	feet/min.	196.8
Meters/sec.	kilometers/hour	3.6000
Meters/sec.	kilometers/min.	0.060000
Meters/sec.	miles/hour	2.2369
Meters/sec.	miles/min.	0.03728
Meters/sec.^{2}	kilometers/hour/sec.	3.6
Meters/sec.^{2}	miles/hour/sec.	2.2369
Metric carat cf. carat, metric	....	....
Metric horsepower cf. horse power, metric	....	....
Metric ton cf. ton, metric	....	....
Mho centimeter cube	ohm^{-1} centimeter^{-1}	1
Mhos, International/cm. cube	mhos (Abs.)/cm. cube	0.99948
Microfarads	abfarads	1×10^{-15}
Microfarads	farads	1×10^{-6}
Microfarads	statfarads	8.98776×10^{5}
Micrograms	grams	1×10^{-6}
Micrograms	milligrams	0.001
Microhms	abohms	1000
Microhms	megohms	1×10^{-12}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Microhms	ohms	1×10^{-6}
Microhms	statohms	1.11263×10^{-18}
Microliters	liters	1×10^{-6}
Micromicrofarads	farads	1×10^{-12}
Micro-microns or millionth micron	angstrom units	0.01
Micro-microns	centimeters	1×10^{-10}
Micro-microns	meters	1×10^{-12}
Microns	angstrom units	1×10^{4}
Microns	centimeters	1×10^{-4}
Microns	inches	3.937×10^{-5}
Microns	meters	1×10^{-6}
Microns	millimeters	0.001
Microns	millimicrons or micro-millimeters	1000
Microns	mils	0.039370
Microvolts	abvolts	100
Microvolts	volts	1.000×10^{-6}
Microvolts/deg. F	microvolts/deg. C	1.8000
Miles (British)	kilometers	1.60934
Miles (nautical)	feet	6080.20
Miles (nautical)	kilometers	1.85325
Miles (nautical)	leagues (nautical)	1/3
Miles (nautical)	miles (U. S., statute)	1.1516
Miles (nautical)	yards	2026.73
Miles (U. S., statute)	chains (Gunter's)	80
Miles (U. S., statute)	furlongs	8
Miles (U. S., statute)	inches	63360
Miles (U. S., statute)	feet	5280
Miles (U. S., statute)	kilometers	1.609347219
Miles (U. S., statute)	light years	1.691×10^{-13}
Miles (U. S., statute)	links (Gunter's)	8000
Miles (U. S., statute)	meters	1609.35
Miles (U. S., statute)	miles (nautical)	0.86836
Miles (U. S., statute)	myriameters	0.160935
Miles (U. S., statute)	rods	320
Miles (U. S., statute)	yards	1760
Miles/hour	centimeters/sec.	44.7041
Miles/hour	feet/min.	88
Miles/hour	feet/sec.	1.4667
Miles/hour	knots (per hour)	0.8684
Miles /hour	meters/min.	26.82
Miles/hour	miles/min.	0.0166667
Miles/hour/min.	centimeters/sec.^{2}	0.74507
Miles/hour/sec.	centimeters/sec.^{2}	44.704
Miles/hour/sec.	feet/sec.^{2}	1.4667
Miles/hour/sec.	meters/sec.^{2}	0.44704
Miles/min.	centimeters/sec.	2682.2
Miles/min.	feet/sec.	88
Miles/min.	knots (per hour)	52.1016
Millier cf. ton (metric)	....	....
Milligrams	carats (metric)	0.005
Milligrams	grains	0.01543236
Milligrams	drams (avoirdupois)	5.64383×10^{-4}
Milligrams	drams (troy)	2.57206×10^{-4}
Milligrams	grams	0.001
Milligrams	kilograms	1×10^{-6}
Milligrams	ounces (avoirdupois)	3.52739×10^{-5}
Milligrams	ounces (troy)	3.215074×10^{-5}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Milligrams	pennyweights	6.43015×10^{-4}
Milligrams	pounds (avoirdupois)	2.2046×10^{-6}
Milligrams	pounds (troy)	2.67923×10^{-6}
Milligrams	scruples	7.71618×10^{-4}
Milligrams/assay ton or one troy ounce/2000 pounds avoirdupois	milligrams/kilogram	34.286
Milligrams/inch	dynes/cm.	0.38609
Milligrams/kilogram	ounces (avoirdupois)/short ton	0.0320
Milligrams/kilogram	pounds (avoirdupois)/short ton	0.0020
Milligrams/liter	parts per million	1.0
Milligrams/millimeter	dynes/cm.	9.80665
Millihenries	abhenries	1×10^{6}
Millihenries	henries	0.001
Millihenries	stathenries	1.11263×10^{-15}
Millilamberts	lumens emitted/sq. ft. with perfect diffusion	0.929
Milliliters	cubic cm.	1.000027
Milliliters	cubic inches	0.061025
Milliliters	drams (U. S., fluid)	0.2705179
Milliliters	gills (U. S.)	0.00845368
Milliliters	liters	0.001
Milliliters	minims (U. S.)	16.2311
Milliliters	ounces (British, fluid)	0.035196
Milliliters	ounces (U. S., fluid)	0.0338147
Millimeters	centimeters	0.1
Millimeters	inches (British)	0.0393701
Millimeters	inches (U. S.)	0.0393700
Millimeters	meters	0.001
Millimeters	microns	1000
Millimeters	mils	39.37
Millimeters of mercury at 0°C	atmospheres	0.00131579
Millimeters of mercury at 0°C	dynes/sq. cm.	1333.22
Millimeters of mercury at 0°C	grams/sq. cm.	1.3595
Millimeters of mercury at 0°C	kilograms/sq. meter	13.595
Millimeters of mercury at 0°C	microns of mercury at 0°C	1000
Millimeters of mercury at 0°C	pounds /sq. ft.	2.7845
Millimeters of mercury at 0°C	pounds /sq. inch	0.019337
Millimicrons or micro-millimeters	angstrom units	10
Millimicrons	centimeters	1×10^{-7}
Millimicrons	meters	1×10^{-9}
Millimicrons	microns	0.001
Million gallons (U. S.)/day	cubic feet/sec.	1.54723
Milliphots	foot candles	0.92902
Milliphots	phots	0.001
Mils	centimeters	0.00254001
Mils	inches	0.001
Mils	microns	25.4001
Miner's inches	cubic ft./min.	1.2 to 1.53
Minims (British)	cubic cm.	0.059192
Minims (U. S., fluid)	cubic cm.	0.061612
Minims (U. S.)	cubic mm.	61.612
Minims (U. S.)	drams (U. S., fluid)	1/60
Minims (U. S.)	gallons (U. S.)	1.6276×10^{-5}
Minims (U. S.)	gills (U. S.)	5.20833×10^{-4}
Minims (U. S.)	milliliters	0.0616102
Minims (U. S.)	ounces (U. S., fluid)	1/480
Minims (U. S.)	pints (U. S., liquid)	1.30208×10^{-4}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Minutes (angle)	degrees	1/60
Minutes (angle)	quadrants	1.85185×10^{-4}
Minutes (angle)	radians	2.90888×10^{-4}
Minutes (angle)	seconds	60
Minutes (time)	days	6.94444×10^{-4}
Minutes (time)	hours	1/60
Minutes (time)	seconds	60
Minutes (time)	weeks	9.9206×10^{-5}
Minutes/cm.	radians/cm.	2.9089×10^{-4}
Months (lunar)	days, hours, minutes	29d., 12hr., 44m.
Months (mean calender)	days	30.4202
Months (mean calender)	hours	730.085
Months (mean calender)	minutes	43805.1
Months (mean calender)	seconds	2.6283×10^{6}
Myriagrams	grams	10000
Myriagrams	kilograms	10
Myriagrams	pounds (avoirdupois)	22.04622
Myriameters	kilometers	10
Myriameters	meters	10000
Myriameters	miles	6.21370
Nails (British)	centimeters	5.715
Nails (British)	inches	2.25
Noggins (British)	cubic cm.	142.07
Noggins (British)	gallons (British)	1/32
Oersteds (Abs.)	oersteds (International)	1.00052
Oersteds (International)	oersteds (Abs.)	0.99948
Ohm-mile-pounds	ohm-meter-grams	1.7513×10^{-4}
Ohms (Abs.)	abohms	1×10^{9}
Ohms (Abs.)	megohms (Abs.)	1×10^{-6}
Ohms (Abs.)	microhms (Abs.)	1×10^{6}
Ohms (Abs.)	ohms (International)	0.99951
Ohms (Abs.)	statohms	1.11263×10^{-12}
Ohms (International)	Board of trade units, (England before 1903)	1.00016
Ohms (International)	ohms (Abs.)	1.00049
Ohms (International)	siemens unit	1.0630
Ohms (International) (France before 1911)	ohms (International)	0.9999
Ohms, "legal" (England, 1884)	ohms (International)	0.99718
Ounces (avoirdupois)	drams (avoirdupois)	16
Ounces (avoirdupois)	drams (troy or apoth.)	7.29166
Ounces (avoirdupois)	grains	437.5
Ounces (avoirdupois)	grams	28.349527
Ounces (avoirdupois)	hundredweights (short)	6.25×10^{-4}
Ounces (avoirdupois)	ounces (troy or apoth.)	0.9114583
Ounces (avoirdupois)	pennyweights	18.22917
Ounces (avoirdupois)	pounds (avoirdupois)	1/16
Ounces (avoirdupois)	pounds (troy)	0.075954861
Ounces (avoirdupois)	scruples	21.875
Ounces (avoirdupois)	tons (long)	2.790179×10^{-5}
Ounces (avoirdupois)	tons (metric)	2.83495×10^{-5}
Ounces (avoirdupois)	tons (short)	3.125×10^{-5}
Ounces (avoirdupois)/ton (long)	milligrams/kg.	27.9018
Ounces (avoirdupois)/ton (short)	milligrams/kg.	31.2500
Ounces (avoirdupois)/sq. in.	dynes/sq. cm.	4309.2
Ounces (British, fluid)	cubic cm.	28.4130

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Ounces (British, fluid)	drachms (British, fluid)	8
Ounces (British, fluid)	gallons (British)	0.006250
Ounces (British, fluid)	minims (British)	480
Ounces (troy or apoth.)	drams (avoirdupois)	17.55428
Ounces (troy or apoth.)	drams (troy or apoth.)	8
Ounces (troy or apoth.)	grains	480
Ounces (troy or apoth.)	grams	31.103481
Ounces (troy or apoth.)	milligrams	31103.481
Ounces (troy or apoth.)	ounces (avoirdupois)	1.09714
Ounces (troy)	pennyweights	20
Ounces (troy or apoth.)	pounds (avoirdupois)	0.06857143
Ounces (troy or apoth.)	pounds (troy)	1/12
Ounces (troy or apoth.)	scruples	24
Ounces (troy or apoth.)	tons (short)	3.42857×10^{-5}
Ounces (U. S., fluid)	cubic cm.	29.5737
Ounces (U. S., fluid)	cubic inches	1.80469
Ounces (U. S., fluid)	drams (fluid)	8
Ounces (U. S., fluid)	gallons (U. S.)	1/128
Ounces (U. S., fluid)	gills (U. S.)	0.25
Ounces (U. S., fluid)	liters	0.0295729
Ounces (U. S., fluid)	milliliters	29.5729
Ounces (U. S., fluid)	minims (U. S.)	480
Ounces (U. S., fluid)	pints (U. S., liquid)	1/16
Ounces (U. S., fluid)	quarts (U. S., liquid)	0.03125
Paces	centimeters	76.2
Paces	feet	2.5
Paces	inches	30
Palms (British)	centimeters	7.62
Palms (British)	inches	3
Parsecs	kilometers	3.084×10^{13}
Parsecs	miles	1.9163×10^{13}
Parts per million	grains per gallon (U. S.)	0.0584
Parts per million	grains/gallon (British)	0.07016
Parts per million	pounds/million gallons (U. S.)	8.345
Pecks (British)	cubic inches	554.6
Pecks (British)	gallons (British)	2
Pecks (British)	liters	9.091901
Pecks (U. S.)	bushels	0.25
Pecks (U. S.)	cubic inches	537.605
Pecks (U. S.)	liters	8.809582
Pecks (U. S.)	pints (dry)	16
Pecks (U. S.)	quarts (dry)	8
Pennyweights	drams (avoirdupois)	0.8777143
Pennyweights	grains	24
Pennyweights	grams	1.55517
Pennyweights	milligrams	1555.17
Pennyweights	ounces (avoirdupois)	0.0548571
Pennyweights	ounces (troy)	0.05
Pennyweights	pounds (avoirdupois)	0.003428571
Pennyweights	pounds (troy)	0.00416667
Perch (British and U. S.) cf. rod	....	....
Perches (Masonry)	cubic ft.	24.75
Phots	lumens incident/sq. cm.	1
Phots	lumens/sq. meter	10000
Phots	lux	10000
Phots	milliphots	1000
Pieds (French feet)	meters	0.32485

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Pieds (French feet)	Paris inches	12
Pieds (French feet)	toises (French)	1/6
Pints (British, liquid)	cubic cm.	568.26
Pints (British, liquid)	gallons (British)	0.125
Pints (British, liquid)	gills (British)	4
Pints (British, liquid)	quarts (British)	0.5
Pints (U. S., dry)	bushels (U. S.)	0.015625
Pints (U. S., dry)	cubic cm.	550.61
Pints (U. S., dry)	cubic inches	33.6003
Pints (U. S., dry)	liters	0.550599
Pints (U. S., dry)	pecks (U. S.)	0.0625
Pints (U. S., dry)	quarts (U. S., dry)	0.5
Pints (U. S., liquid)	cubic cm.	473.179
Pints (U. S., liquid)	cubic feet	0.016711
Pints (U. S., liquid)	cubic inches	28.875
Pints (U. S., liquid)	cubic yards	6.1881×10^{-4}
Pints (U. S., liquid)	drams (fluid)	128
Pints (U. S., liquid)	gallons (U. S.)	0.125
Pints (U. S., liquid)	gills	4
Pints (U. S., liquid)	liters	0.473168
Pints (U. S., liquid)	minims (U. S.)	7680
Pints (U. S., liquid)	ounces (U. S., fluid)	16
Pints (U. S., liquid)	quarts (U. S., liquid)	0.5
Plank's quanta	erg seconds	6.554×10^{-27}
Points (Printers' type)	centimeters	0.035278
Points (Printers' type)	inches	0.0138889
Poise cm. cubed/gram	sq. cm./sec.	1.000
Poise feet cubed/pound	sq. cm./sec.	62.43
Poise inch cubed/gram	sq. cm./sec.	16.387
Poises	grams/cm./sec.	1.000
Pole (British) cf. rod	....	....
Pottles (British)	cubic cm.	2273.04
Pottles (British)	gallons (British)	0.5
Pouces (Paris inches)	centimeters	2.70700
Pouces (Paris inches)	lignes or Paris lines	12
Pouces (Paris inches)	pieds (Paris feet)	0.083333
Poundals	dynes	1.3825×10^{4}
Poundal feet (torque)	dyne cm.	4.2140×10^{5}
Poundals	grams	14.098
Poundals	pounds	0.031081
Pounds (avoirdupois)	cubic inches of water at 4°C and 760 mm mercury press.	27.6873
Pounds (avoirdupois)	drams (avoirdupois)	256
Pounds (avoirdupois)	drams (troy)	116.6667
Pounds (avoirdupois)	dynes	4.44822×10^{5}
Pounds (avoirdupois)	grains	7000
Pounds (avoirdupois)	grams	453.5924277
Pounds (avoirdupois)	hundredweights (long)	0.00892857
Pounds (avoirdupois)	hundredweights (short)	0.01
Pounds (avoirdupois)	kilograms	0.4535924277
Pounds (avoirdupois)	ounces (avoirdupois)	16
Pounds (avoirdupois)	ounces (troy)	14.5833
Pounds (avoirdupois)	pennyweights	291.6667
Pounds	poundals	32.174
Pounds (avoirdupois)	pounds (troy)	1.2152778
Pounds (avoirdupois)	scruples	350.0000
Pounds (avoirdupois)	tons (long)	4.464286×10^{-4}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Pounds (avoirdupois)	tons (metric)	4.5359243×10^{-4}
Pounds (avoirdupois)	tons (short)	5×10^{-4}
Pounds (troy)	drams (avoirdupois)	210.6514
Pounds (troy)	drams (troy)	96
Pounds (troy)	grains	5760
Pounds (troy)	grams	373.2418
Pounds (troy)	kilograms	0.3732418
Pounds (troy)	ounces (avoirdupois)	13.165714
Pounds (troy)	ounces (troy)	12
Pounds (troy)	pennyweights	240
Pounds (troy)	pounds (avoirdupois)	0.822857
Pounds (troy)	scruples	288
Pounds (troy)	tons (long)	3.6735×10^{-4}
Pounds (troy)	tons (metric)	3.7324×10^{-4}
Pounds (troy)	tons (short)	4.1143×10^{-4}
Pounds of carbon to CO_2	B. T. U.	14544
Pounds of carbon to CO_2	cubic ft. illuminating gas burned	21
Pounds of carbon to CO_2	foot pounds	11315000
Pounds of carbon to CO_2	horse power hours	5.71
Pounds of carbon to CO_2	kilowatt hours	4.26
Pounds of carbon to CO_2	pounds anthracite coal burned	1.11
Pounds of carbon to CO_2	pounds dry wood burned	2.5
Pounds of carbon to CO_2	pounds water evaporated from and at 212°F. (100°C.)	15
Pounds of water (62°F.)	cubic feet	0.016033
Pounds of water	cubic inches	27.68
Pounds of water	gallons (U. S.)	0.1198
Pounds of water evaporated from and at 212°F. (100°C.)	B. T. U.	965.7
Pounds of water evaporated from and at 212°F. (100°C.)	foot pounds	751300
Pounds of water evaporated from and at 212°F. (100°C.)	horse power hours	0.379
Pounds of water evaporated from and at 212°F. (100°C.)	joules	1019000
Pounds of water evaporated from and at 212°F. (100°C.)	kilowatt hours	0.283
Pounds of water evaporated from and at 212°F. (100°C.)	kilogram meters	103900
Pounds of water evaporated from and at 212°F. (100°C.)	pounds carbon to CO_2	0.0664
Pounds/cu. inch	grams/cu. cm.	27.68
Pounds/foot	kg./meter	1.48816
Pounds/inch	grams/centimeter	178.6
Pounds-sq. ft. (moment of inertia)	grams-sq. cm.	4.2140×10^{5}
Pounds-sq. ft. (moment of inertia)	kg.-sq. cm.	421.40
Pounds-sq. ft. (moment of inertia)	pounds-sq. inch	144
Pound feet (torque)	dyne cm.	1.3558×10^{7}
Pounds-sq. inch (moment of inertia)	grams-sq. cm.	2926.4
Pounds-sq. inch (moment of inertia)	kg.-sq. cm.	2.9264
Pounds-sq. inch (moment of inertia)	pounds-sq. ft.	0.00694444
Pound inches (torque)	dyne cm.	1.1298×10^{6}
Pounds of water/min.	cubic ft./min.	0.016021
Pounds of water/minute	cu. ft./sec.	2.670×10^{-4}
Pounds/cu. ft.	grams/cubic cm.	0.016018
Pounds/cu. ft.	kg./cubic meter	16.018
Pounds/cu. ft.	pounds/cubic inch	5.787×10^{-4}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Pounds/cubic inch	grams/cubic cm.	27.679742
Pounds/cu. inch	kg./cu. meter	2.768×10^4
Pounds/gallon (British)	grams/cubic cm.	0.099776
Pounds/gallon (U. S.)	grams/cubic cm.	0.119826
Pounds/circular mil foot	grams/cubic cm.	2.93696×10^6
Pounds/sq. ft.	atmospheres	4.7252×10^{-4}
Pounds/sq. ft.	bars	4.7880×10^{-4}
Pounds/sq. ft.	dynes/sq. cm.	478.78
Pounds/sq. ft.	feet of water at 39.1°F	0.016018
Pounds/sq. ft.	grams/sq. cm.	0.48824
Pounds/sq. ft.	kg./sq. meter	4.8824
Pounds/sq. ft.	mm. of mercury at 0°C	0.35913
Pounds/sq. ft.	pound/sq. inch	0.0069445
Pounds/sq. inch	atmospheres	0.068046
Pounds/sq. inch	bars	0.068947
Pounds/sq. inch	cm. of mercury at 0°C	5.1715
Pounds/sq. inch	dynes/sq. cm.	68947
Pounds/sq. inch	feet of water at 39.1°F	2.3066
Pounds/sq. inch	grams/sq. cm.	70.307
Pounds/sq. inch	inches of mercury at 32°F	2.0360
Pounds/sq. inch	inches of water at 39.2°F. (4°C)	27.673
Pounds/sq. inch	kg./sq. cm.	0.070307
Pounds/sq. inch	kg./sq. meter	703.07
Pounds/sq. inch	millimeters of mercury	51.715
Pounds/sq. inch	pounds/sq. ft.	144
Pounds/sq. inch	tons (short)/sq. inch	5×10^{-4}
Pounds (avoirdupois)/ton (short)	milligrams/kg	500
Pound weight sec./sq. ft.	poises	478.8
Pound weight sec./sq. inch	poises	6.895×10^4
Puncheons (British)	cubic meters	0.31823
Puncheons (British)	gallons (British)	70
Puncheons (British)	wine gallons	84
Quadrants	degrees	90
Quadrants	minutes	5400
Quadrants	radians	1.57080
Quarterns (British, dry)	cubic cm.	2273.1
Quarterns (British, dry)	gallons	0.5
Quarterns (British, liquid)	cubic cm.	142.07
Quarterns (British, liquid)	gallons (British)	0.03125
Quarters (British, capacity)	bushels (British)	8
Quarters (British, capacity)	liters	290.94
Quarters (British, linear) cf. span	....	....
Quarters (British, mass)	pounds	25 or 28
Quarters (U. S., mass)	pounds	500 or 560
Quarts (British, liquid)	cubic cm.	1136.521
Quarts (British, liquid)	gallons (British)	0.25
Quarts (British, liquid)	liters	1.13650
Quarts (British, liquid)	pints (British, liquid)	2
Quarts (U. S., dry)	bushels (U. S.)	0.03125
Quarts (U. S., dry)	cubic cm.	1101.23
Quarts (U. S., dry)	cubic ft.	0.038889
Quarts (U. S., dry)	cubic inches	67.2006
Quarts (U. S., dry)	liters	1.10120
Quarts (U. S., dry)	pecks (U. S.)	0.125
Quarts (U. S., dry)	pints (dry)	2
Quarts (U. S., liquid)	cubic cm.	946.358
Quarts (U. S., liquid)	cubic inches	57.749

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Quarts (U. S., liquid)	cubic ft.	0.033420
Quarts (U. S., liquid)	drams (fluid)	256.00
Quarts (U. S., liquid)	gallons (U. S.)	0.25
Quarts (U. S., liquid)	gills (U. S.)	8
Quarts (U. S., liquid)	liters	0.946333
Quarts (U. S., liquid)	ounces (fluid, U. S.)	32
Quarts (U. S., liquid)	pints (U. S., liquid)	2
Quintals (metric)	hundredweights (long)	1.96841
Quintals (metric)	kilograms	100
Quintals (metric)	pounds (avoirdupois)	220.46
Quintals (U. S. or British)	pounds	100 or 112
Quires	sheets	24
Radians	circumferences	0.15916
Radians	degrees	57.29578
Radians	degrees, min., sec.	57°, 17′, 44.8″
Radians	minutes	3437.75
Radians	quadrants	0.637
Radians	revolutions	0.15916
Radians	seconds	206265
Radians/cm.	degrees/cm.	57.296
Radians/cm.	degrees/foot	1746.4
Radians/cm.	degrees/inch	145.53
Radians/cm.	minutes/cm.	3437.75
Radians/sec.	revolutions/min.	9.549
Radians/sec.^{2}	revolutions/min.^{2}	572.96
Radians/sec.^{2}	revolutions/min./sec.	9.549
Reams	sheets	480
Register tons (British)	cubic feet (British)	100
Register tons (British)	cubic meters	2.8317
Revolutions	degrees	360
Revolutions	quadrants	4
Revolutions	radians	6.2832
Revolutions/day	radians/sec.	7.2722×10^{-5}
Revolutions/min.	degrees/sec.	6
Revolutions/min.	radians/sec.	0.10472
Revolutions/min.^{2}	radians/sec.^{2}	0.0017453
Revolutions/min.^{2}	revolutions/sec.^{2}	2.778×10^{-4}
Revolutions/min./sec.	radians/sec.^{2}	0.10420
Revolutions/sec.^{2}	revolutions/min.^{2}	3600
Rods (British, volume)	cubic ft.	1000
Rods (British, volume)	cubic meters	28.317
Rods (Surveyors' measure)	chains (Gunter's)	0.25
Rods (Surveyors' measure)	feet	16.5
Rods (Surveyors' measure)	furlongs	0.025
Rods (Surveyors' measure)	inches	198
Rods (Surveyors' measure)	links (Gunter's)	25
Rods (Surveyors' measure)	meters	5.029216
Rods (Surveyors' measure)	miles	0.003125
Rods (Surveyors' measure)	perches	1
Rods (Surveyors' measure)	yards	5.5
Roods (British)	acres	0.25
Roods (British)	ares	10.117
Roods (British)	sq. perches	40
Roods (British)	sq. yards	1210
Ropes (British)	feet	20
Ropes (British)	meters	6.0960
Sacks (British)	bushels (British)	3

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Sacks (British)	cubic meters	0.10911
Scruples (apothecary)	drams (avoirdupois)	0.7314286
Scruples	drams (troy or apothecary)	0.33333
Scruples	grains	20
Scruples	grams	1.2959784
Scruples	milligrams	1295.9784
Scruples	ounces (avoirdupois)	0.0457143
Scruples	ounces (troy or apothecary)	0.0416667
Scruples	pennyweights	0.833333
Scruples	pounds (avoirdupois)	0.00285714
Scruples	pounds (troy or apothecary)	0.003472222
Seams (British)	bushels (British)	8
Seams (British)	cubic meters	0.29095
Seconds	minutes	1/60
Seconds (angle)	degrees	2.77778×10^{-4}
Seconds (angle)	radians	4.84814×10^{-6}
Seconds (time, sidereal)	seconds (mean, solar)	0.997270
Siemens units	ohms (International)	0.94073
Signs	degrees	30
Skeins	feet	360
Skeins	meters	109.728
Slugs	geepounds	1
Slugs	kilograms	14.594
Slugs	pounds	32.174
Slugs/cu. ft.	grams/cubic cm.	0.5154
Space, entire (solid angle)	steradians	12.5664
Spans	centimeters	22.86005
Spans	fathoms	0.125
Spans	inches	9
Spans	yards	0.25
Spheres (solid angle)	hemispheres	2
Spheres (solid angle)	steradians	12.5664
Spherical right angles	hemispheres	0.25
Spherical right angles	spheres	0.125
Spherical right angles	steradians	1.5708
Square cm.	circular millimeters	127.32
Square cm.	circular mils	197350
Square cm.	sq. chains	2.47107×10^{-7}
Square cm.	sq. decimeters	0.01
Square cm.	sq. ft.	0.0010764
Sq. cm.	sq. inches	0.15500
Sq. cm.	sq. links (Gunter's)	0.00247107
Sq. cm.	sq. meters	1×10^{-4}
Sq. cm.	sq. millimeters	100
Sq. cm.	sq. mils	155000
Sq. cm.	sq. rods	3.95367×10^{-6}
Sq. cm.	sq. yards	1.1960×10^{-4}
Sq. cm.-cm.^{2} (moment of area)	sq. in.-in.^{2}	0.024025
Sq. cm./day	sq. cm./sec.	1.1574×10^{-5}
Sq. chains (Gunter's)	acres	0.1
Sq. chains (Gunter's)	sq. feet	4356
Sq. chains (Gunter's)	sq. inches	627264
Sq. chains (Gunter's)	sq. links (Gunter's)	1×10^{4}
Sq. chains (Gunter's)	sq. meters	404.689
Sq. chains (Gunter's)	sq. miles	1.5625×10^{-4}
Sq. chains (Gunter's)	sq. rods	16
Sq. chains (Gunter's)	sq. yards	484

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Sq. decimeters	sq. cm.	100
Sq. decimeters	sq. inches	15.500
Sq. decimeters	sq. meters	0.01
Sq. degrees	steradians	3.0462×10^{-4}
Sq. dekameters	acres (U. S.)	0.02471044
Sq. dekameters	sq. meters	100
Sq. dekameters	sq. yards	119.60
Sq. feet (British)	sq. meters	0.09290289
Sq. feet (U. S.)	acres	2.29568×10^{-5}
Sq. feet (U. S.)	ares	9.290341×10^{-4}
Sq. feet	sq. cm.	929.0341
Sq. feet (U. S.)	sq. chains (Gunter's)	2.29568×10^{-4}
Sq. feet (U. S.)	sq. inches	144
Sq. feet (U. S.)	sq. links (Gunter's)	2.29568
Sq. feet (U. S.)	sq. meters	0.09290341
Sq. feet (U. S.)	sq. miles	3.58701×10^{-8}
Sq. feet (U. S.)	sq. rods	0.00367309
Sq. feet (U. S.)	sq. yards (U. S.)	1/9
Sq. foot-ft.^{2} (moment of area)	sq. in.-in.^{2}	20736
Sq. hectometers	acres (British)	2.471058
Sq. hectometers	acres (U. S.)	2.471044
Sq. inches (U. S.)	circular mils	1273240
Sq. inches (British)	sq. cm.	6.4515898
Sq. inches (U. S.)	sq. cm.	6.4516258
Sq. inches (U. S.)	sq. chains (Gunter's)	1.59423×10^{-4}
Sq. inches (U. S.)	sq. feet (U. S.)	1/144
Sq. inches (U. S.)	sq. links (Gunter's)	0.0159423
Sq. inches (U. S.)	sq. meters	6.4516258×10^{-4}
Sq. inches (U. S.)	sq. mils	1×10^{6}
Sq. inches (U. S.)	sq. yards (U. S.)	1/1296
Sq. in.-in.^{2} (moment of area)	sq. cm.-cm.^{2}	41.623
Sq. in.-in.^{2} (moment of area)	sq. ft.-ft.^{2}	4.8225×10^{-5}
Sq. in./sec.	sq. cm./sec.	6.4516
Sq. kilometers	acres (British)	247.1058
Sq. kilometers	acres (U. S.)	247.1044
Sq. kilometers	sq. feet	1.0764×10^{7}
Sq. kilometers	sq. meters	1×10^{6}
Sq. kilometers	sq. miles (U. S.)	0.3861006
Sq. kilometers	sq. yards	1.1960×10^{6}
Sq. links (Gunter's)	acres (U. S.)	1×10^{-5}
Sq. links (Gunter's)	sq. cm.	404.68
Sq. links (Gunter's)	sq. chains (Gunter's)	1×10^{-4}
Sq. links (Gunter's)	sq. feet	0.4356
Sq. links (Gunter's)	sq. inches	62.7264
Sq. links (Gunter's)	sq. meters	0.040468
Sq. links (Gunter's)	sq. rods	0.0016
Sq. links (Gunter's)	sq. yards	0.0484
Sq. meters	acres (British)	2.471058×10^{-4}
Sq. meters	acres (U. S.)	2.471044×10^{-4}
Sq. meters	ares	0.01
Sq. meters	sq. cm.	1×10^{4}
Sq. meters	sq. chains (Gunter's)	0.00247107
Sq. meters	sq. feet (British)	10.76390
Sq. meters	sq. feet (U. S.)	10.76387
Sq. meters	sq. inches	1550.0
Sq. meters	sq. kilometers	1×10^{-6}
Sq. meters	sq. links (Gunter's)	24.7107

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Sq. meters	sq. millimeters	1×10^{6}
Sq. meters	sq. miles	3.8610×10^{-7}
Sq. meters	sq. rods	0.0395367
Sq. meters	sq. yards (British)	1.195992
Sq. meters	sq. yards (U. S.)	1.195985
Sq. miles	acres	640
Sq. miles	sq. chains (Gunter's)	6400
Sq. miles	sq. feet	2.78784×10^{7}
Sq. miles	sq. kilometers	2.589998
Sq. miles	sq. meters	2589998
Sq. miles	sq. rods	102400
Sq. miles	sq. yards	3.0976×10^{6}
Sq. millimeters	circular millimeters	1.27324
Sq. millimeters	circular mils	1973.5
Sq. millimeters	sq. cm.	0.01
Sq. millimeters	sq. inches	0.0015500
Sq. millimeters	sq. meters	1×10^{-6}
Sq. millimeters	sq. mils	1550.0
Sq. mils	circular mils	1.27324
Sq. mils	sq. cm.	6.4516×10^{-6}
Sq. mils	sq. inches	1×10^{-6}
Sq. mils	sq. millimeters	6.4516×10^{-4}
Sq. perches (British and U. S.) cf. sq. rods	....	....
Sq. poles (British)	sq. yards	30.25
Sq. rods	acres	0.00625
Sq. rods	sq. chains (Gunter's)	0.0625
Sq. rods	sq. feet	272.25
Sq. rods	sq. inches	39204
Sq. rods	sq. links (Gunter's)	625
Sq. rods	sq. meters	25.293
Sq. rods	sq. miles	9.765625×10^{-6}
Sq. rods	sq. yards	30.25
Sq. yards (British)	acres (British)	2.0661×10^{-4}
Sq. yards (British)	roods (British)	8.2645×10^{-4}
Sq. yards (British)	sq. meters	0.836126
Sq. yards (U. S.)	acres (U. S.)	2.06612×10^{-4}
Sq. yards (U. S.)	ares	0.0083613
Sq. yards (U. S.)	sq. cm.	8361.31
Sq. yards (U. S.)	sq. chains (Gunter's)	0.00206612
Sq. yards (U. S.)	sq. feet	9
Sq. yards (U. S.)	sq. inches	1296
Sq. yards (U. S.)	sq. links (Gunter's)	20.6612
Sq. yards (U. S.)	sq. meters	0.83613
Sq. yards (U. S.)	sq. miles	3.22831×10^{-7}
Sq. yards (U. S.)	sq. rods	0.0330579
Statamperes	abamperes	3.33560×10^{-11}
Statamperes	amperes (Abs.)	3.33560×10^{-10}
Statcoulombs	abcoulombs	3.33560×10^{-11}
Statcoulombs	coulombs (Abs.)	3.33560×10^{-10}
Statcoulombs	electronic charges	2.0947×10^{9}
Statcoulombs/kg.	statcoulombs/dyne	1.0197×10^{-6}
Statcoulombs/pound	statcoulombs/dyne	2.2481×10^{-6}
Statfarads (or centimeters)	abfarads	1.11263×10^{-21}
Statfarads	farads (Abs.)	1.11263×10^{-12}
Statfarads	microfarads	1.11263×10^{-6}
Stathenries	abhenries	8.98776×10^{20}

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Stathenries	henries (Abs.)	8.98776×10^{11}
Stathenries	millihenries	8.98776×10^{14}
Statmhos	mohs, International/cm. cube	1.11263×10^{-12}
Statohms	abohms	8.98776×10^{20}
Statohms	ohms (Abs.)	8.98776×10^{11}
Statvolts	abvolts	2.99796×10^{10}
Statvolts	volts (Abs.)	299.796
Statvolts/cm.	volts (Abs.)/cm.	299.796
Statvolts/deg. C	microvolts (Abs.)/deg. C	2.9986×10^{8}
Statvolts/deg. F	microvolts (Abs.)/deg. C	5.3975×10^{8}
Statvolts/inch	volts/cm.	118.05
Steradians	hemispheres	0.15916
Steradians	solid angles	0.07958
Steradians	spheres	0.07958
Steradians	spherical right angles	0.63664
Steradians	sq. degrees	3282.8
Steres	cubic meters	1
Steres	liters	999.973
Stones (British)	kilograms	6.3503
Stones (British)	pounds (avoirdupois)	14
Strikes (British)	bushels (British)	2
Strikes (British)	cubic meters	0.072738
Toises (French)	meters (legal 1799)	1.9490365
Toises (French)	meters (measured 1887)	1.949090
Toises (French)	Paris feet	6
Tonne cf. ton (metric)	....	....
Tons (long)	dynes	9.9640×10^{8}
Tons (long)	hundredweights (short)	22.400
Tons (long)	kilograms	1016.0470
Tons (long)	ounces (avoirdupois)	35840
Tons (long)	pounds (avoirdupois)	2240
Tons (long)	pounds (troy)	2722.22
Tons (long)	tons (metric)	1.0160470
Tons (long)	tons (short)	1.12000
Tons (long)/sq. foot	dynes/sq. cm.	10.7251×10^{5}
Tons (long)/sq. inch	dynes/sq. cm.	1.5444×10^{8}
Tons (long)/sq. inch	kilograms/sq. mm.	1.5755
Tons (metric)	grams	1×10^{6}
Tons (metric)	hundredweights (short)	22.046223
Tons (metric)	kilograms	1000
Tons (metric)	ounces (avoirdupois)	35273.96
Tons (metric)	pounds (avoirdupois)	2204.62
Tons (metric)	pounds (troy)	2679.23
Tons (metric)	tons (long)	0.984207
Tons (metric)	tons (short)	1.10231
Tons (short)	dynes	8.8964×10^{8}
Tons (short)	hundredweights (short)	20
Tons (short)	kilograms	907.18486
Tons (short)	ounces (avoirdupois)	32000
Tons (short)	ounces (troy)	29166.66
Tons (short)	pounds (avoirdupois)	2000
Tons (short)	pounds (troy)	2430.56
Tons (short)	tons (long)	0.892857
Tons (short)	tons (metric)	0.907185
Tons (short) of water/24 hours	cu. ft./hour	1.3349
Tons (short) of water/24 hrs.	gallons (U. S.)/min.	0.16643
Tons (short)/sq. ft.	atmospheres	0.94509

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Tons (short)/sq. ft.	dynes/sq. cm.	9.5760×10^5
Tons (short)/sq. ft.	kg./sq. meter	9764.8
Tons (short)/sq. ft.	pounds/sq. inch	13.8889
Tons (short)/sq. inch	dynes/sq. cm.	1.3789×10^8
Tons (short)/sq. inch	kg./sq. meter	1406131
Tons (short)/sq. inch	kg./sq. mm.	1.406131
Tons (short)/24 hours	pounds/hour	83.333
Townships (U. S.)	acres	23040
Townships (U. S.)	sq. kilometers	93.240
Townships (U. S.)	sq. miles	36
Tuns	gallons	252
Volts (Abs.)	abvolts	1×10^8
Volts/deg. C	joules/coulomb/deg. C	1.0000
Volts	microvolts	1×10^6
Volts (Abs.)	statvolts	0.0033356
Volts (Abs.)	volts (International) (a)	0.99966
Volts (Abs.)	volts (International) (v)	0.99958
Volts (International) (a) based on international ohm and ampere	volts (Abs.)	1.00034
Volts (International) (v) based on the electromotive force of a Weston cell as 1.0183 volts at 20°C	volts (Abs.)	1.00042
Volts (International) England before 1906	volts (International) (v)	0.99870
Volts (International) England 1906-1908	volts (International) (v)	0.99894
Volts (International) England 1909-1910	volts (International) (v)	0.99990
Volts (International) Germany and France before 1911	volts (International) (v)	0.99968
Volts (International) U. S. before 1911	volts (International) (v)	0.99916
Volt cm./ampere gauss (Abs.)	electromagnetic cgs units of Hall effect	1.0000×10^9
Volt electronic charge sec.	quanta	2.4292×10^{14}
Volt faraday sec.	quanta	1.4724×10^{38}
Volt inch/ampere gauss (Abs.)	electromagnetic cgs units of Hall effect	2.5400×10^9
Volt seconds	maxwells	1×10^8
Watt hours	B. T. U. (mean)	3.4130
Watt hours	calories, gram (mean)	860.01
Watt hours	calories, kg. (mean)	0.86001
Watt hours	foot pounds	2655.3
Watt hours	horse power hours	0.0013410
Watt hours	joules	3600
Watt hours	kg. meters	367.09
Watt hours	K. W. hours	0.001
Watts (Abs.)	B. T. U. (mean)/hour	3.41304
Watts (Abs.)	B. T. U. (mean)/min.	0.056884
Watts (Abs.)	calories, kg. (mean)/min.	0.014333
Watts (Abs.)	ergs/sec.	1×10^7
Watts (Abs.)	foot pounds/min.	44.254
Watts (Abs.)	foot pounds/sec.	0.73756
Watts (Abs.)	horse power	0.0013410
Watts (Abs.)	horse power (metric)	0.0013596
Watts (Abs.)	joules/sec.	1
Watts (Abs.)	K. W.	0.001

A TABLE OF CONVERSION FACTORS

To convert from	To	Multiply by
Watts (International) (v)	watts (Abs.)	1.00032
Watts of max. visibility radiation	lumens	668
Watts/sq. in.	B. T. U./sq. ft./minute	8.1913
Watts/sq. in.	foot pounds /sq. ft./minute	6372.6
Watts/sq. in.	horse power/sq. ft.	0.19310
Webers	maxwells	1×10^8
Weeks	hours	168
Weeks	minutes	10080
Weeks	seconds	604800
Weys (British, capacity)	bushels (British)	40 (variable)
Weys (British, mass)	pounds	252 (variable)
Yards (British)	centimeters	91.43992
Yards (British)	meters	0.9143992
Yards (British)	poles (British)	0.181818
Yards (British)	quarters (British, linear)	4
Yards (British)	wave lengths of the red line of cadmium	1420212
Yards (U. S.)	centimeters	91.440183
Yards (U. S.)	chains (Gunter's)	0.0454545
Yards (U. S.)	feet	3
Yards (U. S.)	furlongs	1/220
Yards (U. S.)	inches	36
Yards (U. S.)	links (Gunter's)	4.54545
Yards (U. S.)	meters	0.91440183
Yards (U. S.)	miles	5.68182×10^{-4}
Yards (U. S.)	rods	0.181818
Years (leap)	days	366
Years (leap)	hours	8784
Years (sidereal)	days (mean solar)	365.256
Years (sidereal)	hours (mean solar)	8766.144
Years (tropical, mean solar)	days	365.2422
Years (tropical, mean solar)	hours (mean solar)	8765.8128
Years (tropical, mean solar)	seconds (mean solar)	3.15569×10^7

TABLE OF PRESSURE CONVERSIONS

Compiled by F. M. Whitacre.

Expressed in ⟶	Pounds per sq. inch	Pounds per sq. foot	Inches of mercury	Millimeters of mercury	Centimeters of mercury	Feet of water	Inches of water
Based on ⟶	14.7	2116.8	29.92	760.0	76.0	33.91	406.9
	1.0	144.0	2.036	51.706	5.1706	2.307	27.68
	0.00694	1.0	0.01413	0.359	0.0359	0.01602	0.19224
	0.4913	70.75	1.0	25.40	2.54	1.1322	13.59
	0.01934	2.785	0.03937	1.0	0.10	0.0446	0.5352
	0.1934	27.85	0.3937	10.0	1.0	0.446	5.352
	0.433	62.40	0.8819	22.40	2.24	1.0	12.00
	0.03611	5.20	0.0735	1.866	0.1866	0.0833	1.0

TANK AND PIPE CAPACITIES

VERTICAL TANKS

Cf. McCrea, *News Ed., Ind. Eng. Chem. 18, 451 (1940)* by permission.

Cylindrical tanks of diameter D and depth d in inches:

$$(1)\ \text{Gallons} = (0.00340 \times D^2) \times d$$
$$(2)\ \text{Liters} = (0.01288 \times D^2) \times d$$

Rectangular tanks of base area A and depth d in inches:

$$(1)\ \text{Gallons} = (0.00433 \times A) \times d$$
$$(2)\ \text{Liters} = (0.0164 \times A) \times d$$

For any one tank the expression within the parentheses is a constant. The constant multiplied by any liquid depth gives the liquid contents. This is particularly advantageous in setting a gauge for fluctuating volumes.

HORIZONTAL CYLINDRICAL TANKS

Cf. Davis, *Chemist Analyst 25, No. 4, p. 87 (1936)* by permission.

The volume of liquid contents in a cylindrical tank resting upon its side in a horizontal position is equal to the product of the length of the tank multiplied by the area of the "wetted" portion of an end. This area is that of a segment of a circle and is $\frac{1}{2}R^2(\theta - \sin\theta)$ where θ in radians, is equal to $2\cos^{-1}[(R-d)/R]$ and where R is the radius of the circle and d is the depth of the segment as in figure 1a.

Figure 1b on the following page can be used for converting percentage diameter to percentage volume.

Example. To find the liquid contents of a cylindrical tank 6 ft., 8 in. ($6\frac{2}{3}$ ft. $= 20/3$ ft. $= 80$ in.) in diameter and 10 ft. long resting upon its side in a horizontal position with liquid contents to a depth of 24 inches.

The total volume of this tank is $\frac{1}{4}\pi(20/3)^2 \times 10 = 349$ cu. ft. The liquid depth is 24/80 or 30% of the diameter. On figure 1b, opposite 30% on the diameter scale is read 25% on the volume scale. This means that the liquid contents are 25% of 349 cu. ft. or 87.3 cu. ft.

Example. To find the depth of liquid when this same tank contains 241 cu. ft. of liquid contents.

Two hundred and forty-one cu. ft. is 241/349 or 69% of the total capacity of the tank. Reference to figure 1b shows that 69% of the volume corresponds to 65.0% of the diameter. This means that 241 cu. ft. of liquid will show a depth of 65% of 80 inches or 52.0 inches.

PIPES

Cf. Schaphorst, *News Ed., Ind. Eng. Chem. 18, 109 (1940)* by permission.

Figure 2 on the following page can be used to find the volume in U. S. gallons of any given length of all the standard pipe sizes from ⅛ inch to 15 inches. In this figure, line A shows the standard pipe sizes, line B shows lengths of pipe from 0.1 to 800,000 feet, and line C shows volumes from 1 to 1000 gallons. A straight line through the pipe size on line A and through the length of pipe on line B will intersect line C at the number of gallons contained. Thus, the broken line in the figure is representative of a 2½-inch pipe (on A) of 400 feet length (on B) which intersects C at 100 gallons, the capacity of the pipe line. In the same manner, knowing any of two other variables, the third may be found. Even values lying at points beyond the limits of the figure may be found, as for example: To determine the volume of a ½-inch pipe 1 foot long, a straight line is run through the ½-inch point on A and the 10,000-point on B. The intersection on C shows 160 gallons which is the capacity of a pipe 10,000 feet in length. By merely dividing this capacity by 10,000 will give 0.016 gallons as the volume of a 1 foot length.

For conversion of U. S. Gallons into other units of capacity, see special table of *Conversion Factors.*

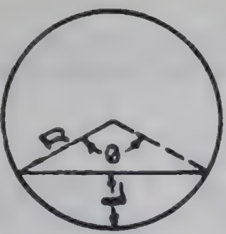

Fig.1a

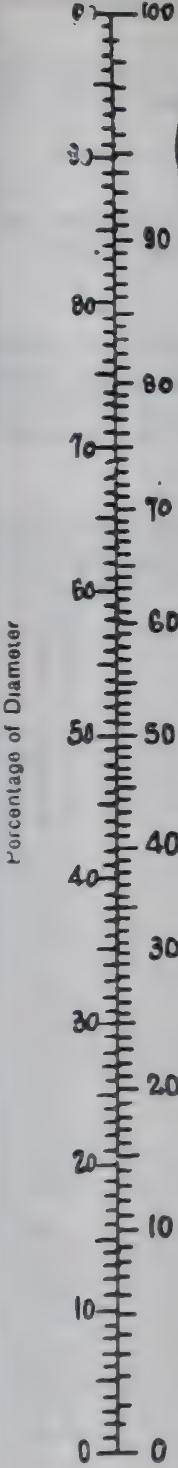

Figure 1b

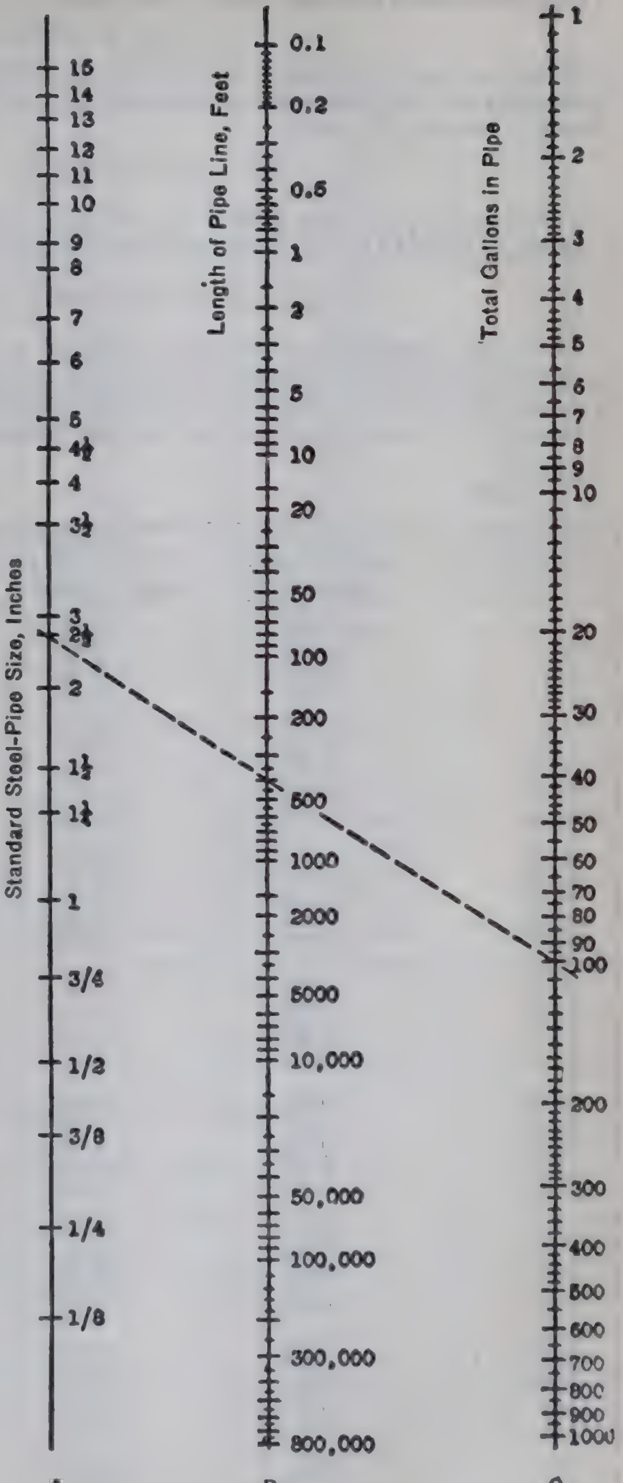

Figure 2

CONVERSION OF WEIGHINGS IN AIR TO WEIGHINGS IN VACUO

If the mass of a substance in air is M_f, its density D_m, the density of weights used in making the weighing D_w, and the density* of air D_a, the true mass of the substance is vacuo, M_{vac} is

$$M_{vac}=M_f+D_aM_f\left(\frac{1}{D_m}-\frac{1}{D_w}\right)$$

For most purposes it is sufficient to assume a density of 8.4 for brass weights, and a density of 0.0012 for air under ordinary conditions. The equation then becomes

$$M_{vac}=M_f+0.0012M_f\left(\frac{1}{D_m}-\frac{1}{8.4}\right)$$

This table which follows gives the values of k (buoyancy reduction factor), which is the correction necessary because of the buoyant effect of the air upon the object weighed; the table is computed for air with the density of 0.0012; m is the weight in grams of the object when weighed in air; weight of object reduced to "in vacuo" $=m+\frac{km}{1000}$

Density of object weighed	Buoyancy reduction factor, *k*			
	Brass weights, density = 8.4	Pt or Pt-Ir weights, density = 21.5	Al or quartz weights, density = 2.7	Gold weights, density = 17
0.2	5.89	5.98	5.58	5.97
0.3	3.87	3.96	3.56	3.95
0.4	2.87	2.95	2.55	2.94
0.5	2.26	2.35	1.95	2.34
0.6	1.86	1.95	1.55	1.93
0.7	1.57	1.66	1.26	1.65
0.75	1.46	1.55	1.15	1.53
0.80	1.36	1.45	1.05	1.43
0.82	1.32	1.41	1.01	1.39
0.84	1.29	1.37	0.98	1.36
0.86	1.25	1.34	0.94	1.33
0.88	1.22	1.31	0.91	1.29
0.90	1.19	1.28	0.88	1.26
0.92	1.16	1.25	0.85	1.24
0.94	1.13	1.22	0.82	1.21
0.96	1.11	1.20	0.80	1.18
0.98	1.08	1.17	0.77	1.16
1.00	1.06	1.15	0.75	1.13
1.02	1.03	1.12	0.72	1.11
1.04	1.01	1.10	0.70	1.08
1.06	0.99	1.08	0.68	1.06
1.08	0.97	1.06	0.66	1.04
1.10	0.95	1.04	0.64	1.02
1.12	0.93	1.02	0.62	1.00
1.14	0.91	1.00	0.60	0.98
1.16	0.89	0.98	0.58	0.96
1.18	0.87	0.96	0.56	0.95
1.20	0.86	0.95	0.55	0.93
1.25	0.82	0.91	0.51	0.89
1.30	0.78	0.87	0.47	0.85
1.35	0.75	0.83	0.44	0.82
1.40	0.71	0.80	0.40	0.79
1.50	0.66	0.74	0.35	0.73
1.6	0.61	0.69	0.30	0.68
1.7	0.56	0.65	0.25	0.64
1.8	0.52	0.61	0.21	0.60
1.9	0.49	0.58	0.18	0.56
2.0	0.46	0.54	0.15	0.53
2.2	0.40	0.49	0.09	0.48
2.4	0.36	0.44	0.05	0.43

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*See special table: *Specific Gravity of Air.*

CONVERSION OF WEIGHINGS IN AIR TO WEIGHINGS IN VACUO

Density of object weighed	Buoyancy reduction factor, k			
	Brass weights, density = 8.4	Pt or Pt-Ir weights, density = 21.5	Al or quartz weights density = 2.7	Gold weights, density = 17
2.6	0.32	0.41	0.01	0.39
2.8	0.29	0.37	−0.02	0.36
3.0	0.26	0.34	−0.05	0.33
3.5	0.20	0.29	−0.11	0.27
4	0.16	0.24	−0.15	0.23
5	0.10	0.18	−0.21	0.17
6	0.06	0.14	−0.25	0.13
7	0.03	0.12	−0.28	0.10
8	0.01	0.09	−0.30	0.08
9	−0.01	0.08	−0.32	0.06
10	−0.02	0.06	−0.33	0.05
12	−0.04	0.04	−0.35	0.03
14	−0.06	0.03	−0.37	0.02
16	−0.07	0.02	−0.38	0.00
18	−0.08	0.01	−0.39	0.00
20	−0.08	0.00	−0.39	−0.01
22	−0.09	0.00	−0.40	−0.02

USE OF COINS AS WEIGHTS

(Approximate values for United States coins.)

One 50¢ piece = 12.5 grams = 200 grains (avoir.)
One 25¢ piece = 6.25 grams = 100 grains (avoir.)
One 10¢ piece = 2.5 grams = 40 grains (avoir.)
One 5¢ piece = 5 grams = 80 grains (avoir.)
One 1¢ piece = 3.1 grams = 50 grains (avoir.)
One 10¢ piece + two 50¢ pieces = 27.5 grams = 440 grains, or approximately one ounce; i. e. 437.5 grains.

HOUSEHOLD UNITS

(Approximate values.)

1 Pint = 2 cups = 0.47 liter
1 Cup = 16 tablespoons = 0.5 pint = 237 ml
1 Tablespoon = 3 teaspoons = 15 ml
1 Teaspoon = 4.9 ml

FACTORS FOR REDUCING GAS VOLUMES TO NORMAL

Examples:—(a) 20 cc of dry gas at 22°C. and 730 mm = 20×0.8888 = 17.78 cc at 0°C. and 750 mm. (b) 20 cc of a gas over water at 22° and 730 mm = 20× (factor corrected for aqueous tension; i.e. 730 − 19.8 or 710.2 mm) = 20 cc of dry

Pressure mm of mercury	Temperature °C							
	10°	11°	12°	13°	14°	15°	16°	17°
670	0.8504	0.8474	0.8445	0.8415	0.8386	0.8357	0.8328	0.8299
672	0.8530	0.8500	0.8470	0.8440	0.8411	0.8382	0.8353	0.8324
674	0.8555	0.8525	0.8495	0.8465	0.8436	0.8407	0.8377	0.8349
676	0.8580	0.8550	0.8520	0.8490	0.8461	0.8431	0.8402	0.8373
678	0.8606	0.8576	0.8545	0.8516	0.8486	0.8456	0.8427	0.8398
680	0.8631	0.8601	0.8571	0.8541	0.8511	0.8481	0.8452	0.8423
682	0.8657	0.8626	0.8596	0.8566	0.8536	0.8506	0.8477	0.8448
684	0.8682	0.8651	0.8621	0.8591	0.8561	0.8531	0.8502	0.8472
686	0.8707	0.8677	0.8646	0.8616	0.8586	0.8556	0.8527	0.8497
688	0.8733	0.8702	0.8672	0.8641	0.8611	0.8581	0.8551	0.8522
690	0.8758	0.8727	0.8697	0.8666	0.8636	0.8606	0.8576	0.8547
692	0.8784	0.8763	0.8722	0.8691	0.8661	0.8631	0.8601	0.8571
694	0.8809	0.8778	0.8747	0.8717	0.8686	0.8656	0.8626	0.8596
696	0.8834	0.8803	0.8772	0.8742	0.8711	0.8681	0.8651	0.8621
698	0.8860	0.8828	0.8798	0.8767	0.8736	0.8706	0.8676	0.8646
700	0.8885	0.8854	0.8823	0.8792	0.8761	0.8731	0.8700	0.8671
702	0.8910	0.8879	0.8848	0.8817	0.8786	0.8756	0.8725	0.8695
704	0.8936	0.8904	0.8873	0.8842	0.8811	0.8781	0.8750	0.8720
706	0.8961	0.8930	0.8898	0.8867	0.8836	0.8806	0.8775	0.8745
708	0.8987	0.8955	0.8924	0.8892	0.8861	0.8831	0.8800	0.8770
710	0.9012	0.8980	0.8949	0.8917	0.8886	0.8856	0.8825	0.8794
712	0.9037	0.9006	0.8974	0.8943	0.8911	0.8880	0.8850	0.8819
714	0.9063	0.9031	0.8999	0.8968	0.8936	0.8905	0.8875	0.8844
716	0.9088	0.9056	0.9024	0.8993	0.8961	0.8930	0.8899	0.8869
718	0.9114	0.9081	0.9050	0.9018	0.8987	0.8955	0.8924	0.8894
720	0.9139	0.9107	0.9075	0.9043	0.9012	0.8980	0.8949	0.8918
722	0.9164	0.9132	0.9100	0.9068	0.9037	0.9005	0.8974	0.8943
724	0.9190	0.9157	0.9125	0.9093	0.9062	0.9030	0.8999	0.8968
726	0.9215	0.9183	0.9151	0.9118	0.9087	0.9055	0.9024	0.8993
728	0.9241	0.9208	0.9176	0.9144	0.9112	0.9080	0.9049	0.9017
730	0.9266	0.9233	0.9201	0.9169	0.9137	0.9105	0.9073	0.9042
732	0.9291	0.9259	0.9226	0.9194	0.9162	0.9130	0.9098	0.9067
734	0.9317	0.9284	0.9251	0.9219	0.9187	0.9155	0.9123	0.9092
736	0.9342	0.9309	0.9277	0.9244	0.9212	0.9180	0.9148	0.9117
738	0.9368	0.9334	0.9302	0.9269	0.9237	0.9205	0.9173	0.9141
740	0.9393	0.9360	0.9327	0.9294	0.9262	0.9230	0.9198	0.9166
742	0.9418	0.9385	0.9352	0.9319	0.9287	0.9255	0.9223	0.9191
744	0.9444	0.9410	0.9377	0.9345	0.9312	0.9280	0.9248	0.9216
746	0.9469	0.9436	0.9403	0.9370	0.9337	0.9305	0.9272	0.9240
748	0.9494	0.9461	0.9428	0.9395	0.9362	0.9329	0.9297	0.9265
750	0.9520	0.9486	0.9453	0.9420	0.9387	0.9354	0.9322	0.9290
752	0.9545	0.9511	0.9478	0.9445	0.9412	0.9379	0.9347	0.9315
754	0.9571	0.9537	0.9504	0.9470	0.9437	0.9404	0.9372	0.9339
756	0.9596	0.9562	0.9529	0.9495	0.9462	0.9429	0.9397	0.9364
758	0.9621	0.9587	0.9554	0.9520	0.9487	0.9454	0.9422	0.9389
760	0.9647	0.9613	0.9579	0.9546	0.9512	0.9479	0.9446	0.9414
762	0.9672	0.9638	0.9604	0.9571	0.9537	0.9504	0.9471	0.9439
764	0.9698	0.9663	0.9630	0.9596	0.9562	0.9529	0.9496	0.9463
766	0.9723	0.9689	0.9655	0.9620	0.9587	0.9554	0.9521	0.9488
768	0.9748	0.9714	0.9680	0.9646	0.9612	0.9579	0.9546	0.9513
770	0.9774	0.9739	0.9705	0.9671	0.9637	0.9604	0.9571	0.9538
772	0.9799	0.9764	0.9730	0.9696	0.9662	0.9629	0.9596	0.9562
774	0.9825	0.9790	0.9756	0.9721	0.9687	0.9654	0.9620	0.9587
776	0.9850	0.9815	0.9781	0.9746	0.9712	0.9679	0.9645	0.9612
778	0.9875	0.9840	0.9806	0.9772	0.9737	0.9704	0.9670	0.9637
780	0.9901	0.9866	0.9831	0.9797	0.9763	0.9729	0.9695	0.9662
782	0.9926	0.9891	0.9856	0.9822	0.9788	0.9754	0.9720	0.9686
784	0.9952	0.9916	0.9882	0.9847	0.9813	0.9778	0.9745	0.9711
786	0.9977	0.9942	0.9907	0.9872	0.9838	0.9803	0.9770	0.9736
788	1.0002	0.9967	0.9932	0.9897	0.9863	0.9828	0.9794	0.9761

TEMPERATURE (°C.) AND PRESSURE (760 mm Hg)

as at 22° and 710.2 mm = 20×0.86465 = 17.29 cc at 0°C. and 760 mm. Weight milligrams of 1 cc of gas at N. T. P.:—acetylene, 1.173; carbon dioxide, 1.9769; ydrogen, 0.0899; nitric oxide (NO), 1.3402; nitrogen, 1.25057; oxygen, 1.42904.

Pressure mm of mercury	Temperature °C 18°	19°	20°	21°	22°	23°	24°	25°
670	0.8270	0.8242	0.8214	0.8186	0.8158	0.8131	0.8103	0.8076
672	0.8295	0.8267	0.8239	0.8211	0.8183	0.8155	0.8128	0.8100
674	0.8320	0.8291	0.8263	0.8235	0.8207	0.8179	0.8152	0.8124
676	0.8345	0.8316	0.8288	0.8259	0.8231	0.8204	0.8176	0.8149
678	0.8369	0.8341	0.8312	0.8284	0.8256	0.8228	0.8200	0.8173
680	0.8394	0.8365	0.8337	0.8308	0.8280	0.8252	0.8224	0.8197
682	0.8419	0.8390	0.8361	0.8333	0.8304	0.8276	0.8249	0.8221
684	0.8443	0.8414	0.8386	0.8357	0.8329	0.8301	0.8273	0.8245
686	0.8468	0.8439	0.8410	0.8382	0.8353	0.8325	0.8297	0.8269
688	0.8493	0.8464	0.8435	0.8406	0.8378	0.8349	0.8321	0.8293
690	0.8517	0.8488	0.8459	0.8430	0.8402	0.8373	0.8345	0.8317
692	0.8542	0.8513	0.8484	0.8455	0.8426	0.8398	0.8369	0.8341
694	0.8567	0.8537	0.8508	0.8479	0.8451	0.8422	0.8394	0.8366
696	0.8591	0.8562	0.8533	0.8504	0.8475	0.8446	0.8418	0.8390
698	0.8616	0.8587	0.8557	0.8528	0.8499	0.8471	0.8442	0.8414
700	0.8641	0.8611	0.8582	0.8553	0.8524	0.8495	0.8466	0.8438
702	0.8665	0.8636	0.8606	0.8577	0.8547	0.8519	0.8490	0.8462
704	0.8690	0.8660	0.8631	0.8602	0.8572	0.8543	0.8515	0.8486
706	0.8715	0.8685	0.8655	0.8626	0.8597	0.8568	0.8539	0.8510
708	0.8740	0.8710	0.8680	0.8650	0.8621	0.8592	0.8563	0.8534
710	0.8764	0.8734	0.8704	0.8675	0.8645	0.8616	0.8587	0.8558
712	0.8789	0.8759	0.8729	0.8699	0.8670	0.8640	0.8611	0.8582
714	0.8814	0.8783	0.8753	0.8724	0.8694	0.8665	0.8636	0.8607
716	0.8838	0.8808	0.8778	0.8748	0.8718	0.8689	0.8660	0.8631
718	0.8863	0.8833	0.8802	0.8773	0.8743	0.8713	0.8684	0.8655
720	0.8888	0.8857	0.8827	0.8797	0.8767	0.8738	0.8708	0.8679
722	0.8912	0.8882	0.8852	0.8821	0.8792	0.8762	0.8732	0.8703
724	0.8937	0.8906	0.8876	0.8846	0.8816	0.8786	0.8757	0.8727
726	0.8962	0.8931	0.8901	0.8870	0.8840	0.8810	0.8781	0.8751
728	0.8986	0.8956	0.8925	0.8895	0.8865	0.8835	0.8805	0.8775
730	0.9011	0.8980	0.8950	0.8919	0.8889	0.8859	0.8829	0.8799
732	0.9036	0.9005	0.8974	0.8944	0.8913	0.8883	0.8853	0.8824
734	0.9060	0.9029	0.8999	0.8968	0.8938	0.8907	0.8877	0.8848
736	0.9085	0.9054	0.9023	0.8992	0.8962	0.8932	0.8902	0.8872
738	0.9110	0.9079	0.9048	0.9017	0.8986	0.8956	0.8926	0.8896
740	0.9135	0.9103	0.9072	0.9041	0.9011	0.8980	0.8950	0.8920
742	0.9159	0.9128	0.9097	0.9066	0.9035	0.9005	0.8974	0.8944
744	0.9184	0.9153	0.9121	0.9090	0.9059	0.9029	0.8998	0.8968
746	0.9209	0.9177	0.9146	0.9115	0.9084	0.9053	0.9023	0.8992
748	0.9233	0.9202	0.9170	0.9139	0.9108	0.9077	0.9047	0.9016
750	0.9258	0.9226	0.9195	0.9164	0.9132	0.9102	0.9071	0.9041
752	0.9283	0.9251	0.9219	0.9188	0.9157	0.9126	0.9095	0.9065
754	0.9307	0.9276	0.9244	0.9212	0.9181	0.9150	0.9119	0.9089
756	0.9332	0.9300	0.9268	0.9237	0.9206	0.9174	0.9144	0.9113
758	0.9357	0.9325	0.9293	0.9261	0.9230	0.9199	0.9168	0.9137
760	0.9381	0.9349	0.9317	0.9286	0.9254	0.9223	0.9192	0.9161
762	0.9406	0.9374	0.9342	0.9310	0.9279	0.9247	0.9216	0.9185
764	0.9431	0.9399	0.9366	0.9335	0.9303	0.9272	0.9240	0.9209
766	0.9456	0.9423	0.9391	0.9359	0.9327	0.9296	0.9265	0.9233
768	0.9480	0.9448	0.9415	0.9383	0.9352	0.9320	0.9289	0.9258
770	0.9505	0.9472	0.9440	0.9408	0.9376	0.9344	0.9313	0.9282
772	0.9530	0.9497	0.9464	0.9432	0.9400	0.9369	0.9337	0.9306
774	0.9554	0.9522	0.9489	0.9457	0.9425	0.9393	0.9361	0.9330
776	0.9579	0.9546	0.9514	0.9481	0.9449	0.9417	0.9385	0.9354
778	0.9604	0.9571	0.9538	0.9506	0.9473	0.9441	0.9410	0.9378
780	0.9628	0.9595	0.9563	0.9530	0.9498	0.9466	0.9434	0.9402
782	0.9653	0.9620	0.9587	0.9555	0.9522	0.9490	0.9458	0.9426
784	0.9678	0.9645	0.9612	0.9579	0.9546	0.9514	0.9482	0.9450
786	0.9702	0.9669	0.9636	0.9603	0.9571	0.9538	0.9506	0.9474
788	0.9727	0.9694	0.9661	0.9628	0.9595	0.9563	0.9531	0.9499

FACTORS FOR REDUCING GAS VOLUMES TO NORMAL

Pressure mm of mercury	Temperature °C							
	26°	27°	28°	29°	30°	31°	32°	33°
670	0.8049	0.8022	0.7996	0.7969	0.7943	0.7917	0.7891	0.7865
672	0.8073	0.8046	0.8020	0.7993	0.7967	0.7940	0.7914	0.7889
674	0.8097	0.8070	0.8043	0.8017	0.7990	0.7964	0.7938	0.7912
676	0.8121	0.8094	0.8067	0.8041	0.8014	0.7988	0.7962	0.7936
678	0.8145	0.8118	0.8091	0.8064	0.8038	0.8011	0.7985	0.7959
680	0.8169	0.8142	0.8115	0.8088	0.8061	0.8035	0.8009	0.7982
682	0.8193	0.8166	0.8139	0.8112	0.8085	0.8059	0.8032	0.8006
684	0.8217	0.8190	0.8163	0.8136	0.8109	0.8082	0.8056	0.8029
686	0.8241	0.8214	0.8187	0.8160	0.8133	0.8106	0.8079	0.8053
688	0.8265	0.8238	0.8211	0.8183	0.8156	0.8129	0.8103	0.8076
690	0.8289	0.8262	0.8234	0.8207	0.8180	0.8153	0.8126	0.8100
692	0.8313	0.8286	0.8258	0.8231	0.8204	0.8177	0.8150	0.8123
694	0.8338	0.8310	0.8282	0.8255	0.8227	0.8200	0.8174	0.8147
696	0.8362	0.8334	0.8306	0.8278	0.8251	0.8224	0.8197	0.8170
698	0.8386	0.8358	0.8330	0.8302	0.8275	0.8248	0.8221	0.8194
700	0.8410	0.8382	0.8354	0.8326	0.8299	0.8271	0.8244	0.8217
702	0.8434	0.8406	0.8378	0.8350	0.8322	0.8295	0.8268	0.8241
704	0.8458	0.8429	0.8401	0.8374	0.8346	0.8319	0.8291	0.8264
706	0.8482	0.8453	0.8425	0.8397	0.8370	0.8342	0.8315	0.8288
708	0.8506	0.8477	0.8449	0.8421	0.8393	0.8366	0.8338	0.8311
710	0.8530	0.8501	0.8473	0.8445	0.8417	0.8389	0.8362	0.8335
712	0.8554	0.8525	0.8497	0.8469	0.8441	0.8413	0.8386	0.8358
714	0.8578	0.8549	0.8521	0.8493	0.8465	0.8437	0.8409	0.8382
716	0.8602	0.8573	0.8545	0.8516	0.8488	0.8460	0.8433	0.8405
718	0.8626	0.8597	0.8569	0.8540	0.8512	0.8484	0.8456	0.8429
720	0.8650	0.8621	0.8592	0.8564	0.8536	0.8508	0.8480	0.8452
722	0.8674	0.8645	0.8616	0.8588	0.8559	0.8531	0.8503	0.8475
724	0.8698	0.8669	0.8640	0.8612	0.8583	0.8555	0.8527	0.8499
726	0.8722	0.8693	0.8664	0.8635	0.8607	0.8579	0.8550	0.8522
728	0.8746	0.8717	0.8688	0.8659	0.8631	0.8602	0.8574	0.8546
730	0.8770	0.8741	0.8712	0.8683	0.8654	0.8626	0.8598	0.8569
732	0.8794	0.8765	0.8736	0.8707	0.8678	0.8649	0.8621	0.8593
734	0.8818	0.8789	0.8759	0.8730	0.8702	0.8673	0.8645	0.8616
736	0.8842	0.8813	0.8783	0.8754	0.8725	0.8697	0.8668	0.8640
738	0.8866	0.8837	0.8807	0.8778	0.8749	0.8720	0.8692	0.8663
740	0.8890	0.8861	0.8831	0.8802	0.8773	0.8744	0.8715	0.8687
742	0.8914	0.8884	0.8855	0.8826	0.8796	0.8768	0.8739	0.8710
744	0.8938	0.8908	0.8879	0.8849	0.8820	0.8791	0.8762	0.8734
746	0.8962	0.8932	0.8903	0.8873	0.8844	0.8815	0.8786	0.8757
748	0.8986	0.8956	0.8927	0.8897	0.8868	0.8838	0.8809	0.8781
750	0.9010	0.8980	0.8950	0.8921	0.8891	0.8862	0.8833	0.8804
752	0.9034	0.9004	0.8974	0.8945	0.8915	0.8886	0.8857	0.8828
754	0.9058	0.9028	0.8998	0.8968	0.8939	0.8909	0.8880	0.8851
756	0.9082	0.9052	0.9022	0.8992	0.8962	0.8933	0.8904	0.8875
758	0.9106	0.9076	0.9046	0.9016	0.8986	0.8957	0.8927	0.8898
760	0.9130	0.9100	0.9070	0.9040	0.9010	0.8980	0.8951	0.8922
762	0.9154	0.9124	0.9094	0.9064	0.9034	0.9004	0.8974	0.8945
764	0.9178	0.9148	0.9118	0.9087	0.9057	0.9028	0.8998	0.8969
766	0.9202	0.9172	0.9141	0.9111	0.9081	0.9051	0.9021	0.8992
768	0.9227	0.9196	0.9165	0.9135	0.9105	0.9075	0.9045	0.9015
770	0.9251	0.9220	0.9189	0.9159	0.9128	0.9098	0.9069	0.9039
772	0.9275	0.9244	0.9213	0.9182	0.9152	0.9122	0.9092	0.9062
774	0.9299	0.9268	0.9237	0.9206	0.9176	0.9146	0.9116	0.9086
776	0.9323	0.9292	0.9261	0.9230	0.9200	0.9169	0.9139	0.9109
778	0.9347	0.9316	0.9285	0.9254	0.9223	0.9193	0.9163	0.9133
780	0.9371	0.9340	0.9308	0.9278	0.9247	0.9217	0.9186	0.9156
782	0.9395	0.9363	0.9332	0.9301	0.9271	0.9240	0.9210	0.9180
784	0.9419	0.9387	0.9356	0.9325	0.9294	0.9264	0.9233	0.9203
786	0.9443	0.9411	0.9380	0.9349	0.9318	0.9287	0.9257	0.9227
788	0.9467	0.9435	0.9404	0.9373	0.9342	0.9311	0.9281	0.9250

TEMPERATURE (°C.) AND PRESSURE (760 mm Hg)

Pressure mm of mercury	Temperature °C. 34°	35°	36°
670	0.7839	0.7814	0.7789
672	0.7863	0.7837	0.7812
674	0.7886	0.7861	0.7835
676	0.7910	0.7884	0.7858
678	0.7933	0.7907	0.7882
680	0.7956	0.7931	0.7905
682	0.7980	0.7954	0.7928
684	0.8003	0.7977	0.7951
686	0.8027	0.8001	0.7975
688	0.8050	0.8024	0.7998
690	0.8073	0.8047	0.8021
692	0.8097	0.8071	0.8044
694	0.8120	0.8094	0.8068
696	0.8144	0.8117	0.8091
698	0.8167	0.8141	0.8114
700	0.8190	0.8164	0.8137
702	0.8214	0.8187	0.8161
704	0.8237	0.8211	0.8184
706	0.8261	0.8234	0.8207
708	0.8284	0.8257	0.8230
710	0.8307	0.8281	0.8254
712	0.8331	0.8304	0.8277
714	0.8354	0.8327	0.8300
716	0.8378	0.8350	0.8323
718	0.8401	0.8374	0.8347
720	0.8424	0.8397	0.8370
722	0.8448	0.8420	0.8393
724	0.8471	0.8444	0.8416
726	0.8495	0.8467	0.8440
728	0.8518	0.8490	0.8463
730	0.8541	0.8514	0.8486
732	0.8565	0.8537	0.8509
734	0.8588	0.8560	0.8533
736	0.8612	0.8584	0.8556
738	0.8635	0.8607	0.8579
740	0.8658	0.8630	0.8602
742	0.8682	0.8654	0.8626
744	0.8705	0.8677	0.8649
746	0.8729	0.8700	0.8672
748	0.8752	0.8724	0.8695
750	0.8775	0.8747	0.8719
752	0.8799	0.8770	0.8742
754	0.8822	0.8794	0.8765
756	0.8846	0.8817	0.8788
758	0.8869	0.8840	0.8812
760	0.8892	0.8864	0.8835
762	0.8916	0.8887	0.8858
764	0.8939	0.8910	0.8881
766	0.8963	0.8934	0.8905
768	0.8986	0.8957	0.8928
770	0.9009	0.8980	0.8951
772	0.9033	0.9004	0.8974
774	0.9056	0.9027	0.8998
776	0.9080	0.9050	0.9021
778	0.9103	0.9074	0.9044
780	0.9127	0.9097	0.9067
782	0.9150	0.9120	0.9091
784	0.9173	0.9144	0.9114
786	0.9197	0.9167	0.9137
788	0.9220	0.9190	0.9160

Aqueous Tension of Pure Water, Potassium Hydroxide Solutions and Saturated Salt Solution.

Deg. C.	10°	11°	12°	13°	14°	15°	16°	17°
H_2O	9.2	9.8	10.5	11.2	12.0	12.8	13.6	14.5
10KOH:100H_2O	8.6	9.2	9.8	10.5	11.2	11.9	12.7	13.6
20KOH:100H_2O	8.0	8.6	9.2	9.8	10.4	11.1	11.8	12.6
30KOH:100H_2O	7.3	7.8	8.3	8.9	9.5	10.1	10.8	11.5
40KOH:100H_2O	6.5	6.9	7.4	7.9	8.4	9.0	9.6	10.2
Satd. Aq. NaCl	6.9	7.4	7.9	8.5	9.1	9.7	10.3	11.0

Deg. C.	18°	19°	20°	21°	22°	23°	24°	25°
H_2O	15.5	16.5	17.5	18.7	19.8	21.1	22.4	23.8
10KOH:100H_2O	14.5	15.4	16.4	17.4	18.5	19.7	20.9	22.2
20KOH:100H_2O	13.4	14.3	15.2	16.2	17.2	18.3	19.5	20.7
30KOH:100H_2O	12.3	13.3	13.9	14.8	15.8	16.8	17.8	18.9
40KOH:100H_2O	10.9	11.6	12.4	13.2	14.0	14.9	15.8	16.8
Satd. Aq. NaCl	11.7	12.4	13.2	14.1	15.0	15.9	16.9	17.9

CONVERSION OF THERMOMETER SCALES

The following abbreviations are used: F, degrees Fahrenheit; C, degrees Centigrade; R, degrees Reaumur; A.K, degrees Kelvin; A.R, degrees Rankine; Z, degrees on any scale; (f. p.)"Z", the freezing point of water on the Z scale; (b. p.) "Z", the boiling point of water on the Z scale. Cf. Dodds, *Chemical and Metallurgical Engineering*, Vol. 38, p. 476 (1931).

$$\frac{F-32}{180}=\frac{C}{100}=\frac{R}{80}=\frac{A_K-273}{100}=\frac{A_R-460}{180}=\frac{Z-(\text{f.p.})\text{“}Z\text{”}}{(\text{b.p.})\text{“}Z\text{”}-(\text{f.p.})\text{“}Z\text{”}}$$

Examples: (1) To find the Fahrenheit temperature corresponding to −20°C:

$$\frac{F-32}{180}=\frac{C}{100}\text{ or }\frac{F-32}{180}=\frac{-20}{100}\text{: i.e., }-20°\text{C}=-4°\text{F}$$

(2) To find the Reaumur temperature corresponding to 20°F:

$$\frac{F-32}{180}=\frac{R}{80}\text{ or }\frac{20-32}{180}=\frac{R}{80}\text{; i.e., }20°\text{F}=-5.33°\text{R}$$

(3) To find the correct temperature on a thermometer reading 80°C and which shows a reading of −0.30°C in melting ice and 99.0°C. in steam at 760mm pressure:

$$\frac{C}{100}=\frac{Z-(\text{f.p.})\text{“}Z\text{”}}{(\text{b.p.})\text{“}Z\text{”}-(\text{f.p.})\text{“}Z\text{”}}=\frac{80-(-0.30)}{99.0-(0.30)}\text{; i.e., C}=80.87°\text{ (corrected)}$$

The reading of any inaccurate thermometer can be corrected and converted in this manner into a reading on any of the other scales; thus, in the example (3) above, to convert into a Fahrenheit scale:

$$\frac{F-32}{180}=\frac{80-(-0.30)}{99\ 0-(-0.30)}\text{; i.e., F}=177.56°\text{ (corrected)}$$

Centigrade to Fahrenheit

Formula: (°C×9/5)+32=°F Examples: (1) To convert 60°C to °F, (60×9/5)+32=140°F
(2) To convert −20°C to °F, (−20×9/5)+32=−4°F
(See also special table)

Centigrade to Reaumur

Formula: °C×4/5=°R Examples: (1) To convert 40°C to °R, 40×4/5=32°R
(2) To convert −30°C to °R, −30×4/5=−24°R

Centigrade to Centigrade Absolute or Kelvin

Formula: °C+273.1=°K Examples: (1) To convert 20°C to °K, 20+273.1=293.1°K
(2) To convert −20°C to °K, −20+273.1=253.1°K

Fahrenheit to Centigrade

Formula: (°F−32)×5/9=°C Examples: (1) To convert 140°F to °C, (140−32)×5/9=60°C
(2) To convert −76°F to °C, (−76−32)×5/9=−60°C
(See also special table)

Fahrenheit to Reaumur

Formula: (°F−32)×4/9=°R Examples: (1) To convert 41°F to °R, (41−32)×4/9=4°R
(2) To convert −13°F to °R, (−13−32)×4/9=−20°R

Fahrenheit to Fahrenheit Absolute or Rankine

Formula: °F+459.58=°R′ Examples: (1) To convert 20°F to °R′, 20+459.58=479.58°R′
(2) To convert −20°F to °R′. −20+459.58=439.58°R′

Reaumur to Centigrade

Formula: °R×5/4=°C Examples: (1) To convert 32°R to °C, 32×5/4=40°C
(2) To convert −24°R to °C, −24×5/4=−30°C

Reaumur to Fahrenheit

Formula: (°R×9/4)+32=°F Examples: (1) To convert 8°R to °F, (8×9/4)+32=50°F
(2) To convert −8°R to °F, (−8×9/4)+32=14°F
(3) To convert −20°R to °F, (−20×9/4)+32=−13°F

TEMPERATURE CONVERSION TABLES

The column of figures in bold and which is headed "Reading in °F. or °C. to be converted" refers to the temperature either in degrees Fahrenheit or Centigrade which it is desired to convert into the other scale. If converting from Fahrenheit degrees to Centigrade degrees the equivalent temperature will be found in the column headed "°C." while if converting from degrees Centigrade to degrees Fahrenheit, the equivalent temperature will be found in the column headed "°F." This arrangement is very similar to that of Sauveur and Boylston, copyrighted 1920 and is published with their permission.

°F.	Reading in °F. or °C. to be converted	°C.
....	**−458**	−272.22
....	**−456**	−271.11
....	**−454**	−270.00
....	**−452**	−268.89
....	**−450**	−267.78
....	**−448**	−266.67
....	**−446**	−265.56
....	**−444**	−264.44
....	**−442**	−263.33
....	**−440**	−262.22
....	**−438**	−261.11
....	**−436**	−260.00
....	**−434**	−258.89
....	**−432**	−257.78
....	**−430**	−256.67
....	**−428**	−255.56
....	**−426**	−254.44
....	**−424**	−253.33
....	**−422**	−252.22
....	**−420**	−251.11
....	**−418**	−250.00
....	**−416**	−248.89
....	**−414**	−247.78
....	**−412**	−246.67
....	**−410**	−245.56
....	**−408**	−244.44
....	**−406**	−243.33
....	**−404**	−242.22
....	**−402**	−241.11
....	**−400**	−240.00
....	**−398**	−238.89
....	**−396**	−237.78
....	**−394**	−236.67
....	**−392**	−235.56
....	**−390**	−234.44
....	**−388**	−233.33
....	**−386**	−232.22
....	**−384**	−231.11
....	**−382**	−230.00
....	**−380**	−228.89
....	**−378**	−227.78
....	**−376**	−226.67
....	**−374**	−225.56
....	**−372**	−224.44
....	**−370**	−223.33
....	**−368**	−222.22
....	**−366**	−221.11
....	**−364**	−220.00
....	**−362**	−218.89
....	**−360**	−217.78
....	**−358**	−216.67
....	**−356**	−215.56
....	**−354**	−214.44
....	**−352**	−213.33
....	**−350**	−212.22
....	**−348**	−211.11
....	**−346**	−210.00
....	**−344**	−208.89
....	**−342**	−207.78
....	**−340**	−206.67
....	**−338**	−205.56
....	**−336**	−204.44
....	**−334**	−203.33
....	**−332**	−202.22
....	**−330**	−201.11
....	**−328**	−200.00
....	**−326**	−198.89
......	**−324**	−197.78
....	**−322**	−196.67
....	**−320**	−195.56
....	**−318**	−194.44
....	**−316**	−193.33
....	**−314**	−192.22
....	**−312**	−191.11
....	**−310**	−190.00
....	**−308**	−188.89
....	**−306**	−187.78
....	**−304**	−186.67
....	**−302**	−185.56
....	**−300**	−184.44
....	**−298**	−183.33
....	**−296**	−182.22
....	**−294**	−181.11
....	**−292**	−180.00
....	**−290**	−178.89
....	**−288**	−177.78
....	**−286**	−176.67
....	**−284**	−175.56
....	**−282**	−174.44
....	**−280**	−173.33
....	**−278**	−172.22
....	**−276**	−171.11
....	**−274**	−170.00
−457.6	**−272**	−168.89
−454.0	**−270**	−167.78
−450.4	**−268**	−166.67
−446.8	**−266**	−165.56
−443.2	**−264**	−164.44
−439.6	**−262**	−163.33
−436.0	**−260**	−162.22

TEMPERATURE CONVERSION TABLES

°F.	Reading in °F. or °C. to be converted	°C.
+224.6	+107	+41.67
+226.4	+108	+42.22
+228.2	+109	+42.78
+230.0	+110	+43.33
+231.8	+111	+43.89
+233.6	+112	+44.44
+235.4	+113	+45.00
+237.2	+114	+45.56
+239.0	+115	+46.11
+240.8	+116	+46.67
+242.6	+117	+47.22
+244.4	+118	+47.78
+246.2	+119	+48.33
+248.0	+120	+48.89
+249.8	+121	+49.44
+251.6	+122	+50.00
+253.4	+123	+50.56
+255.2	+124	+51.11
+257.0	+125	+51.67
+258.8	+126	+52.22
+260.6	+127	+52.78
+262.4	+128	+53.33
+264.2	+129	+53.89
+266.0	+130	+54.44
+267.8	+131	+55.00
+269.6	+132	+55.56
+271.4	+133	+56.11
+273.2	+134	+56.67
+275.0	+135	+57.22
+276.8	+136	+57.78
+278.6	+137	+58.33
+280.4	+138	+58.89
+282.2	+139	+59.44
+284.0	+140	+60.00
+285.8	+141	+60.56
+287.6	+142	+61.11
+289.4	+143	+61.67
+291.2	+144	+62.22
+293.0	+145	+62.78
+294.8	+146	+63.33
+296.6	+147	+63.89
+298.4	+148	+64.44
+300.2	+149	+65.00
+302.0	+150	+65.56
+303.8	+151	+66.11
+305.6	+152	+66.67
+307.4	+153	+67.22
+309.2	+154	+67.78
+311.0	+155	+68.33
+312.8	+156	+68.89
+314.6	+157	+69.44
+316.4	+158	+70.00
+318.2	+159	+70.56
+320.0	+160	+71.11
+321.8	+161	+71.67
+323.6	+162	+72.22
+325.4	+163	+72.78
+327.2	+164	+73.33
+329.0	+165	+73.89
+330.8	+166	+74.44

°F.	Reading in °F. or °C. to be converted	°C.
+332.6	+167	+75.00
+334.4	+168	+75.56
+336.2	+169	+76.11
+338.0	+170	+76.67
+339.8	+171	+77.22
+341.6	+172	+77.78
+343.4	+173	+78.33
+345.2	+174	+78.89
+347.0	+175	+79.44
+348.8	+176	+80.00
+350.6	+177	+80.56
+352.4	+178	+81.11
+354.2	+179	+81.67
+356.0	+180	+82.22
+357.8	+181	+82.78
+359.6	+182	+83.33
+361.4	+183	+83.89
+363.2	+184	+84.44
+365.0	+185	+85.00
+366.8	+186	+85.56
+368.6	+187	+86.11
+370.4	+188	+86.67
+372.2	+189	+87.22
+374.0	+190	+87.78
+375.8	+191	+88.33
+377.6	+192	+88.89
+379.4	+193	+89.44
+381.2	+194	+90.00
+383.0	+195	+90.56
+384.8	+196	+91.11
+386.6	+197	+91.67
+388.4	+198	+92.22
+390.2	+199	+92.78
+392.0	+200	+93.33
+393.8	+201	+93.89
+395.6	+202	+94.44
+397.4	+203	+95.00
+399.2	+204	+95.56
+401.0	+205	+96.11
+402.8	+206	+96.67
+404.6	+207	+97.22
+406.4	+208	+97.78
+408.2	+209	+98.33
+410.0	+210	+98.89
+411.8	+211	+99.44
+413.6	+212	+100.00
+415.4	+213	+100.56
+417.2	+214	+101.11
+419.0	+215	+101.67
+420.8	+216	+102.22
+422.6	+217	+102.78
+424.4	+218	+103.33
+426.2	+219	+103.89
+428.0	+220	+104.44
+431.6	+222	+105.56
+435.2	+224	+106.67
+438.8	+226	+107.78
+442.4	+228	+108.89
+446.0	+230	+110.00
+449.6	+232	+111.11

TEMPERATURE CONVERSION TABLES

°F.	Reading in °F. or °C. to be converted	°C.
+453.2	+234	+112.22
+456.8	+236	+113.33
+460.4	+238	+114.44
+464.0	+240	+115.56
+467.6	+242	+116.67
+471.2	+244	+117.78
+474.8	+246	+118.89
+478.4	+248	+120.00
+482.0	+250	+121.11
+485.6	+252	+122.22
+489.2	+254	+123.33
+492.8	+256	+124.44
+496.4	+258	+125.56
+500.0	+260	+126.67
+503.6	+262	+127.78
+507.2	+264	+128.89
+510.8	+266	+130.00
+514.4	+268	+131.11
+518.0	+270	+132.22
+521.6	+272	+133.33
+525.2	+274	+134.44
+528.8	+276	+135.56
+532.4	+278	+136.67
+536.0	+280	+137.78
+539.6	+282	+138.89
+543.2	+284	+140.00
+546.8	+286	+141.11
+550.4	+288	+142.22
+554.0	+290	+143.33
+557.6	+292	+144.44
+561.2	+294	+145.56
+564.8	+296	+146.67
+568.4	+298	+147.78
+572.0	+300	+148.89
+575.6	+302	+150.00
+579.2	+304	+151.11
+582.8	+306	+152.22
+586.4	+308	+153.33
+590.0	+310	+154.44
+593.6	+312	+155.56
+597.2	+314	+156.67
+600.8	+316	+157.78
+604.4	+318	+158.89
+608.0	+320	+160.00
+611.6	+322	+161.11
+615.2	+324	+162.22
+618.8	+326	+163.33
+622.4	+328	+164.44
+626.0	+330	+165.56
+629.6	+332	+166.67
+633.2	+334	+167.78
+636.8	+336	+168.89
+640.4	+338	+170.00
+644.0	+340	+171.11
+647.6	+342	+172.22
+651.2	+344	+173.33
+654.8	+346	+174.44
+658.4	+348	+175.56
+662.0	+350	+176.67
+665.6	+352	+177.78

°F.	Reading in °F. or °C. to be converted	°C.
+669.2	+354	+178.89
+672.8	+356	+180.00
+676.4	+358	+181.11
+680.0	+360	+182.22
+683.6	+362	+183.33
+687.2	+364	+184.44
+690.8	+366	+185.56
+694.4	+368	+186.67
+698.0	+370	+187.78
+701.6	+372	+188.89
+705.2	+374	+190.00
+708.8	+376	+191.11
+712.4	+378	+192.22
+716.0	+380	+193.33
+719.6	+382	+194.44
+723.2	+384	+195.56
+726.8	+386	+196.67
+730.4	+388	+197.78
+734.0	+390	+198.89
+737.6	+392	+200.00
+741.2	+394	+201.11
+744.8	+396	+202.22
+748.4	+398	+203.33
+752.0	+400	+204.44
+755.6	+402	+205.56
+759.2	+404	+206.67
+762.8	+406	+207.78
+766.4	+408	+208.89
+770.0	+410	+210.00
+773.6	+412	+211.11
+777.2	+414	+212.22
+780.8	+416	+213.33
+784.4	+418	+214.44
+788.0	+420	+215.56
+791.6	+422	+216.67
+795.2	+424	+217.78
+798.8	+426	+218.89
+802.4	+428	+220.00
+806.0	+430	+221.11
+809.6	+432	+222.22
+813.2	+434	+223.33
+816.8	+436	+224.44
+820.4	+438	+225.56
+824.0	+440	+226.67
+827.6	+442	+227.78
+831.2	+444	+228.89
+834.8	+446	+230.00
+838.4	+448	+231.11
+842.0	+450	+232.22
+845.6	+452	+233.33
+849.2	+454	+234.44
+852.8	+456	+235.56
+856.4	+458	+236.67
+860.0	+460	+237.78
+863.6	+462	+238.89
+867.2	+464	+240.00
+870.8	+466	+241.11
+874.4	+468	+242.22
+878.0	+470	+243.33
+881.6	+472	+244.44

TEMPERATURE CONVERSION TABLES

°F.	Reading in °F. or °C. to be converted	°C.
+885.2	+474	+245.56
+888.8	+476	+246.67
+892.4	+478	+247.78
+896.0	+480	+248.89
+899.6	+482	+250.00
+903.2	+484	+251.11
+906.8	+486	+252.22
+910.4	+488	+253.33
+914.0	+490	+254.44
+917.6	+492	+255.56
+921.2	+494	+256.67
+924.8	+496	+257.78
+928.4	+498	+258.89
+932.0	+500	+260.00
+935.6	+502	+261.11
+939.2	+504	+262.22
+942.8	+506	+263.33
+946.4	+508	+264.44
+950.0	+510	+265.56
+953.6	+512	+266.67
+957.2	+514	+267.78
+960.8	+516	+268.89
+964.4	+518	+270.00
+968.0	+520	+271.11
+971.6	+522	+272.22
+975.2	+524	+273.33
+978.8	+526	+274.44
+982.4	+528	+275.56
+986.0	+530	+276.67
+989.6	+532	+277.78
+993.2	+534	+278.89
+996.8	+536	+280.00
+1000.4	+538	+281.11
+1004.0	+540	+282.22
+1007.6	+542	+283.33
+1011.2	+544	+284.44
+1014.8	+546	+285.56
+1018.4	+548	+286.67
+1022.0	+550	+287.78
+1025.6	+552	+288.89
+1029.2	+554	+290.00
+1032.8	+556	+291.11
+1036.4	+558	+292.22
+1040.0	+560	+293.33
+1043.6	+562	+294.44
+1047.2	+564	+295.56
+1050.8	+566	+296.67
+1054.4	+568	+297.78
+1058.0	+570	+298.89
+1061.6	+572	+300.00
+1065.2	+574	+301.11
+1068.8	+576	+302.22
+1072.4	+578	+303.33
+1076.0	+580	+304.44
+1079.6	+582	+305.56
+1083.2	+584	+306.67
+1086.8	+586	+307.78
+1090.4	+588	+308.89
+1094.0	+590	+310.00
+1097.6	+592	+311.11

°F.	Reading in °F. or °C. to be converted	°C.
+1101.2	+594	+312.22
+1104.8	+596	+313.33
+1108.4	+598	+314.44
+1112.0	+600	+315.56
+1115.6	+602	+316.67
+1119.2	+604	+317.78
+1122.8	+606	+318.89
+1126.4	+608	+320.00
+1130.0	+610	+321.11
+1133.6	+612	+322.22
+1137.2	+614	+323.33
+1140.8	+616	+324.44
+1144.4	+618	+325.56
+1148.0	+620	+326.67
+1151.6	+622	+327.78
+1155.2	+624	+328.89
+1158.8	+626	+330.00
+1162.4	+628	+331.11
+1166.0	+630	+332.22
+1169.6	+632	+333.33
+1173.2	+634	+334.44
+1176.8	+636	+335.56
+1180.4	+638	+336.67
+1184.0	+640	+337.78
+1187.6	+642	+338.89
+1191.2	+644	+340.00
+1194.8	+646	+341.11
+1198.4	+648	+342.22
+1202.0	+650	+343.33
+1205.6	+652	+344.44
+1209.2	+654	+345.56
+1212.8	+656	+346.67
+1216.4	+658	+347.78
+1220.0	+660	+348.89
+1223.6	+662	+350.00
+1227.2	+664	+351.11
+1230.8	+666	+352.22
+1234.4	+668	+353.33
+1238.0	+670	+354.44
+1241.6	+672	+355.56
+1245.2	+674	+356.67
+1248.8	+676	+357.78
+1252.4	+678	+358.89
+1256.0	+680	+360.00
+1259.6	+682	+361.11
+1263.2	+684	+362.22
+1266.8	+686	+363.33
+1270.4	+688	+364.44
+1274.0	+690	+365.56
+1277.6	+692	+366.67
+1281.2	+694	+367.78
+1284.8	+696	+368.89
+1288.4	+698	+370.00
+1292.0	+700	+371.11
+1295.6	+702	+372.22
+1299.2	+704	+373.33
+1302.8	+706	+374.44
+1306.4	+708	+375.56
+1310.0	+710	+376.67
+1313.6	+712	+377.78

TEMPERATURE CONVERSION TABLES

°F.	Reading in °F. or °C. to be converted	°C.
+1317.2	+714	+378.89
+1320.8	+716	+380.00
+1324.4	+718	+381.11
+1328.0	+720	+382.22
+1331.6	+722	+383.33
+1335.2	+724	+384.44
+1338.8	+726	+385.56
+1342.4	+728	+386.67
+1346.0	+730	+387.78
+1349.6	+732	+388.89
+1353.2	+734	+390.00
+1356.8	+736	+391.11
+1360.4	+738	+392.22
+1364.0	+740	+393.33
+1367.6	+742	+394.44
+1371.2	+744	+395.56
+1374.8	+746	+396.67
+1378.4	+748	+397.78
+1382.0	+750	+398.89
+1385.6	+752	+400.00
+1389.2	+754	+401.11
+1392.8	+756	+402.22
+1396.4	+758	+403.33
+1400.0	+760	+404.44
+1403.6	+762	+405.56
+1407.2	+764	+406.67
+1410.8	+766	+407.78
+1414.4	+768	+408.89
+1418.0	+770	+410.00
+1421.6	+772	+411.11
+1425.2	+774	+412.22
+1428.8	+776	+413.33
+1432.4	+778	+414.44
+1436.0	+780	+415.56
+1439.6	+782	+416.67
+1443.2	+784	+417.78
+1446.8	+786	+418.89
+1450.4	+788	+420.00
+1454.0	+790	+421.11
+1457.6	+792	+422.22
+1461.2	+794	+423.33
+1464.8	+796	+424.44
+1468.4	+798	+425.56
+1472.0	+800	+426.67
+1475.6	+802	+427.78
+1479.2	+804	+428.89
+1482.8	+806	+430.00
+1486.4	+808	+431.11
+1490.0	+810	+432.22
+1493.6	+812	+433.33
+1497.2	+814	+434.44
+1500.8	+816	+435.56
+1504.4	+818	+436.67
+1508.0	+820	+437.78
+1511.6	+822	+438.89
+1515.2	+824	+440.00
+1518.8	+826	+441.11
+1522.4	+828	+442.22
+1526.0	+830	+443.33
+1529.6	+832	+444.44

°F.	Reading in °F. or °C. to be converted	°C.
+1533.2	+834	+445.56
+1536.8	+836	+446.67
+1540.4	+838	+447.78
+1544.0	+840	+448.89
+1547.6	+842	+450.00
+1551.2	+844	+451.11
+1554.8	+846	+452.22
+1558.4	+848	+453.33
+1562.0	+850	+454.44
+1565.6	+852	+455.56
+1569.2	+854	+456.67
+1572.8	+856	+457.78
+1576.4	+858	+458.89
+1580.0	+860	+460.00
+1583.6	+862	+461.11
+1587.2	+864	+462.22
+1590.8	+866	+463.33
+1594.4	+868	+464.44
+1598.0	+870	+465.56
+1601.6	+872	+466.67
+1605.2	+874	+467.78
+1608.8	+876	+468.89
+1612.4	+878	+470.00
+1616.0	+880	+471.11
+1619.6	+882	+472.22
+1623.2	+884	+473.33
+1626.8	+886	+474.44
+1630.4	+888	+475.56
+1634.0	+890	+476.67
+1637.6	+892	+477.78
+1641.2	+894	+478.89
+1644.8	+896	+480.00
+1648.4	+898	+481.11
+1652.0	+900	+482.22
+1655.6	+902	+483.33
+1659.2	+904	+484.44
+1662.8	+906	+485.56
+1666.4	+908	+486.67
+1670.0	+910	+487.78
+1673.6	+912	+488.89
+1677.2	+914	+490.00
+1680.8	+916	+491.11
+1684.4	+918	+492.22
+1688.0	+920	+493.33
+1691.6	+922	+494.44
+1695.2	+924	+495.56
+1698.8	+926	+496.67
+1702.4	+928	+497.78
+1706.0	+930	+498.89
+1709.6	+932	+500.00
+1713.2	+934	+501.11
+1716.8	+936	+502.22
+1720.4	+938	+503.33
+1724.0	+940	+504.44
+1727.6	+942	+505.56
+1731.2	+944	+506.67
+1734.8	+946	+507.78
+1738.4	+948	+508.89
+1742.0	+950	+510.00
+1745.6	+952	+511.11

TEMPERATURE CONVERSION TABLES

°F.	Reading in °F or °C. to be converted	°C.
+1749.2	+954	+512.22
+1752.8	+956	+513.33
+1756.4	+958	+514.44
+1760.0	+960	+515.56
+1763.6	+962	+516.67
+1767.2	+964	+517.78
+1770.8	+966	+518.89
+1774.4	+968	+520.00
+1778.0	+970	+521.11
+1781.6	+972	+522.22
+1785.2	+974	+523.33
+1788.8	+976	+524.44
+1792.4	+978	+525.56
+1796.0	+980	+526.67
+1799.6	+982	+527.78
+1803.2	+984	+528.89
+1806.8	+986	+530.00
+1810.4	+988	+531.11
+1814.0	+990	+532.22
+1817.6	+992	+533.33
+1821.2	+994	+534.44
+1824.8	+996	+535.56
+1828.4	+998	+536.67
+1832.0	+1000	+537.78
+1850.0	+1010	+543.33
+1868.0	+1020	+548.89
+1886.0	+1030	+554.44
+1904.0	+1040	+560.00
+1922.0	+1050	+565.56
+1940.0	+1060	+571.11
+1958.0	+1070	+576.67
+1976.0	+1080	+582.22
+1994.0	+1090	+587.78
+2012.0	+1100	+593.33
+2030.0	+1110	+598.89
+2048.0	+1120	+604.44
+2066.0	+1130	+610.00
+2084.0	+1140	+615.56
+2102.0	+1150	+621.11
+2120.0	+1160	+626.67
+2138.0	+1170	+632.22
+2156.0	+1180	+637.78
+2174.0	+1190	+643.33
+2192.0	+1200	+648.89
+2210.0	+1210	+654.44
+2228.0	+1220	+660.00
+2246.0	+1230	+665.56
+2264.0	+1240	+671.11
+2282.0	+1250	+676.67
+2300.0	+1260	+682.22
+2318.0	+1270	+687.78
+2336.0	+1280	+693.33
+2354.0	+1290	+698.89
+2372.0	+1300	+704.44
+2390.0	+1310	+710.00
+2408.0	+1320	+715.56
+2426.0	+1330	+721.11
+2444.0	+1340	+726.67
+2462.0	+1350	+732.22
+2480.0	+1360	+737.78

°F.	Reading in °F or °C. to be converted	°C.
+2498.0	+1370	+743.33
+2516.0	+1380	+748.89
+2534.0	+1390	+754.44
+2552.0	+1400	+760.00
+2570.0	+1410	+765.56
+2588.0	+1420	+771.11
+2606.0	+1430	+776.67
+2624.0	+1440	+782.22
+2642.0	+1450	+787.78
+2660.0	+1460	+793.33
+2678.0	+1470	+798.89
+2696.0	+1480	+804.44
+2714.0	+1490	+810.00
+2732.0	+1500	+815.56
+2750.0	+1510	+821.11
+2768.0	+1520	+826.67
+2786.0	+1530	+832.22
+2804.0	+1540	+837.78
+2822.0	+1550	+843.33
+2840.0	+1560	+848.89
+2858.0	+1570	+854.44
+2876.0	+1580	+860.00
+2894.0	+1590	+865.56
+2912.0	+1600	+871.11
+2930.0	+1610	+876.67
+2948.0	+1620	+882.22
+2966.0	+1630	+887.78
+2984.0	+1640	+893.33
+3002.0	+1650	+898.89
+3020.0	+1660	+904.44
+3038.0	+1670	+910.00
+3056.0	+1680	+915.56
+3074.0	+1690	+921.11
+3092.0	+1700	+926.67
+3110.0	+1710	+932.22
+3128.0	+1720	+937.78
+3146.0	+1730	+943.33
+3164.0	+1740	+948.89
+3182.0	+1750	+954.44
+3200.0	+1760	+960.00
+3218.0	+1770	+965.56
+3236.0	+1780	+971.11
+3254.0	+1790	+976.67
+3272.0	+1800	+982.22
+3290.0	+1810	+987.78
+3308.0	+1820	+993.33
+3326.0	+1830	+998.89
+3344.0	+1840	+1004.4
+3362.0	+1850	+1010.0
+3380.0	+1860	+1015.6
+3398.0	+1870	+1021.1
+3416.0	+1880	+1026.7
+3434.0	+1890	+1032.2
+3452.0	+1900	+1037.8
+3470.0	+1910	+1043.3
+3488.0	+1920	+1048.9
+3506.0	+1930	+1054.4
+3524.0	+1940	+1060.0
+3542.0	+1950	+1065.6
+3560.0	+1960	+1071.1

TEMPERATURE CONVERSION TABLES

°F.	Reading in °F. or °C. to be converted	°C.
−3578.0	−1970	−1076.7
−3596.0	−1980	−1082.2
−3614.0	−1990	−1087.8
−3632.0	−2000	−1093.3
−3650.0	−2010	−1098.9
−3668.0	−2020	−1104.4
−3686.0	−2030	−1110.0
−3704.0	−2040	−1115.6
−3722.0	−2050	−1121.1
−3740.0	−2060	−1126.7
−3758.0	−2070	−1132.2
−3776.0	−2080	−1137.8
−3794.0	−2090	−1143.3
−3812.0	−2100	−1148.9
−3830.0	−2110	−1154.4
−3848.0	−2120	−1160.0
−3866.0	−2130	−1165.6
−3884.0	−2140	−1171.1
−3902.0	−2150	−1176.7
−3920.0	−2160	−1182.2
−3938.0	−2170	−1187.8
−3956.0	−2180	−1193.3
−3974.0	−2190	−1198.9
−3992.0	−2200	−1204.4
−4010.0	−2210	−1210.0
−4028.0	−2220	−1215.6
−4046.0	−2230	−1221.1
−4064.0	−2240	−1226.7
−4082.0	−2250	−1232.2
−4100.0	−2260	−1237.8
−4118.0	−2270	−1243.3
−4136.0	−2280	−1248.9
−4154.0	−2290	−1254.4
−4172.0	−2300	−1260.0
−4190.0	−2310	−1265.6
−4208.0	−2320	−1271.1
−4226.0	−2330	−1276.7
−4244.0	−2340	−1282.2
−4262.0	−2350	−1287.8
−4280.0	−2360	−1293.3
−4298.0	−2370	−1298.9
−4316.0	−2380	−1304.4
−4334.0	−2390	−1310.0
−4352.0	−2400	−1315.6
−4370.0	−2410	−1321.1
−4388.0	−2420	−1326.7
−4406.0	−2430	−1332.2
−4424.0	−2440	−1337.8
−4442.0	−2450	−1343.3
−4460.0	−2460	−1348.9
−4478.0	−2470	−1354.4
−4496.0	−2480	−1360.0
−4514.0	−2490	−1365.6
−4532.0	−2500	−1371.1
−4550.0	−2510	−1376.7
−4568.0	−2520	−1382.2
−4586.0	−2530	−1387.8

°F.	Reading in °F. or °C. to be converted	°C.
−4604.0	−2540	−1393.3
−4622.0	−2550	−1398.9
−4640.0	−2560	−1404.4
−4658.0	−2570	−1410.0
−4676.0	−2580	−1415.6
−4694.0	−2590	−1421.1
−4712.0	−2600	−1426.7
−4730.0	−2610	−1432.2
−4748.0	−2620	−1437.8
−4766.0	−2630	−1443.3
−4784.0	−2640	−1448.9
−4802.0	−2650	−1454.4
−4820.0	−2660	−1460.0
−4838.0	−2670	−1465.6
−4856.0	−2680	−1471.1
−4874.0	−2690	−1476.7
−4892.0	−2700	−1482.2
−4910.0	−2710	−1487.8
−4928.0	−2720	−1493.3
−4946.0	−2730	−1498.9
−4964.0	−2740	−1504.4
−4982.0	−2750	−1510.0
−5000.0	−2760	−1515.6
−5018.0	−2770	−1521.1
−5036.0	−2780	−1526.7
−5054.0	−2790	−1532.2
−5072.0	−2800	−1537.8
−5090.0	−2810	−1543.3
−5108.0	−2820	−1548.9
−5126.0	−2830	−1554.4
−5144.0	−2840	−1560.0
−5162.0	−2850	−1565.6
−5180.0	−2860	−1571.1
−5198.0	−2870	−1576.7
−5216.0	−2880	−1582.2
−5234.0	−2890	−1587.8
−5252.0	−2900	−1593.3
−5270.0	−2910	−1598.9
−5288.0	−2920	−1604.4
−5306.0	−2930	−1610.0
−5324.0	−2940	−1615.6
−5342.0	−2950	−1621.1
−5360.0	−2960	−1626.7
−5378.0	−2970	−1632.2
−5396.0	−2980	−1637.8
−5414.0	−2990	−1643.3
−5432.0	−3000	−1648.9
−5450.0	−3010	−1654.4
−5468.0	−3020	−1660.0
−5486.0	−3030	−1665.6
−5504.0	−3040	−1671.1
−5522.0	−3050	−1676.7
−5540.0	−3060	−1682.2
−5558.0	−3070	−1687.8
−5576.0	−3080	−1693.3
−5594.0	−3090	−1698.9
−5612.0	−3100	−1704.4

HYDROMETER CONVERSION TABLES

This table gives the relation between density (C.G.S.) and degrees on the Baumé and Twaddell scales. The Twaddell scale is never used for densities less than unity. See also section on *Hydrometers*.

Density	Degrees Baumé Bu. Stand. Scale	Degrees Baumé A.P.I. Scale
0.600	103.33	104.33
0.605	101.40	102.38
0.610	99.51	100.47
0.615	97.64	98.58
0.620	95.81	96.73
0.625	94.00	94.90
0.630	92.22	93.10
0.635	90.47	91.33
0.640	88.75	89.59
0.645	87.05	87.88
0.650	85.38	86.19
0.655	83.74	84.53
0.660	82.12	82.89
0.665	80.52	81.28
0.670	78.95	79.69
0.675	77.41	78.13
0.680	75.88	76.59
0.685	74.38	75.07
0.690	72.90	73.57
0.695	71.43	72.10
0.700	70.00	70.64
0.705	68.57	69.21
0.710	67.18	67.80
0.715	65.80	66.40
0.720	64.44	65.03
0.725	63.10	63.67
0.730	61.78	62.34
0.735	60.48	61.02
0.740	59.19	59.72
0.745	57.92	58.43
0.750	56.67	57.17
0.755	55.43	55.92
0.760	54.21	54.68
0.765	53.01	53.47
0.770	51.82	52.27
0.775	50.65	51.08
0.780	49.49	49.91
0.785	48.34	48.75
0.790	47.22	47.61
0.795	46.10	46.49
0.800	45.00	45.38
0.805	43.91	44.28
0.810	42.84	43.19
0.815	41.78	42.12
0.820	40.73	41.06
0.825	39.70	40.02
0.830	38.68	38.98
0.835	37.66	37.96
0.840	36.67	36.95
0.845	35.68	35.96
0.850	34.71	34.97
0.855	33.74	34.00
0.860	32.79	33.03
0.865	31.85	32.08
0.870	30.92	31.14
0.875	30.00	30.21
0.880	29.09	29.30
0.885	28.19	28.39
0.890	27.30	27.49
0.895	26.42	26.60
0.900	25.56	25.72
0.905	24.70	24.85
0.910	23.85	23.99
0.915	23.01	23.14
0.920	22.17	22.30
0.925	21.35	21.47
0.930	20.54	20.65
0.935	19.73	19.84
0.940	18.94	19.03
0.945	18.15	18.24
0.950	17.37	17.45
0.955	16.60	16.67
0.960	15.83	15.90
0.965	15.08	15.13
0.970	14.33	14.38
0.975	13.59	13.63
0.980	12.86	12.89
0.985	12.13	12.15
0.990	11.41	11.43
0.995	10.70	10.71
1.000	10.00	10.00

DENSITIES GREATER THAN UNITY

Density	Degrees Baumé Bu. Stand. Scale	Degrees Twaddell
1.00	0.00	0
1.01	1.44	2
1.02	2.84	4
1.03	4.22	6
1.04	5.58	8
1.05	6.91	10
1.06	8.21	12
1.07	9.49	14
1.08	10.78	16
1.09	11.97	18
1.10	13.18	20
1.11	14.37	22
1.12	15.54	24
1.13	16.68	26
1.14	17.81	28
1.15	18.91	30
1.16	20.00	32
1.17	21.07	34
1.18	22.12	36
1.19	23.15	38
1.20	24.17	40
1.21	25.16	42
1.22	26.15	44
1.23	27.11	46
1.24	28.06	48
1.25	29.00	50
1.26	29.92	52
1.27	30.83	54
1.28	31.72	56
1.29	32.60	58
1.30	33.46	60
1.31	34.31	62

HYDROMETER CONVERSION TABLES

Density	Degrees Baumé Bu. Stand. Scale	Degrees Twaddell
1.32	35.15	64
1.33	35.98	66
1.34	36.79	68
1.35	37.59	70
1.36	38.38	72
1.37	39.16	74
1.38	39.93	76
1.39	40.68	78
1.40	41.43	80
1.41	42.16	82
1.42	42.89	84
1.43	43.60	86
1.44	44.31	88
1.45	45.00	90
1.46	45.68	92
1.47	46.36	94
1.48	47.03	96
1.49	47.68	98
1.50	48.33	100
1.51	48.97	102
1.52	49.60	104
1.53	50.23	106
1.54	50.84	108
1.55	51.45	110
1.56	52.05	112
1.57	52.64	114
1.58	53.23	116
1.59	53.80	118
1.60	54.38	120
1.61	54.94	122
1.62	55.49	124
1.63	56.04	126
1.64	56.58	128
1.65	57.12	130
1.66	57.65	132
1.67	58.17	134
1.68	58.69	136
1.69	59.20	138
1.70	59.71	140
1.71	60.20	142
1.72	60.70	144
1.73	61.18	146
1.74	61.67	148
1.75	62.14	150
1.76	62.61	152
1.77	63.08	154
1.78	63.54	156
1.79	63.99	158
1.80	64.44	160
1.81	64.89	162
1.82	65.31	164
1.83	65.77	166
1.84	66.20	168
1.85	66.62	170
1.86	67.04	172
1.87	67.46	174
1.88	67.87	176
1.89	68.28	178
1.90	68.68	180
1.91	69.08	182
1.92	69.48	184
1.93	69.87	186
1.94	70.26	188
1.95	70.64	190
1.96	71.02	192
1.97	71.40	194
1.98	71.77	196
1.99	72.14	198
2.00	72.50	200

CONVERSION TABLE FOR QUEVENNE AND NEW YORK BOARD OF HEALTH LACTOMETER READINGS TO SPECIFIC GRAVITY

New York Board of Health Lactometer	Specific Gravity	Quevenne Lactometer
60	1.0174	17.4
61	1.0177	17.7
62	1.0180	18.0
63	1.0183	18.3
64	1.0186	18.6
65	1.0188	18.8
66	1.0191	19.1
67	1.0194	19.4
68	1.0197	19.7
69	1.0200	20.0
70	1.0203	20.3
71	1.0206	20.6
72	1.0209	20.9
73	1.0212	21.2
74	1.0215	21.5
75	1.0217	21.7
76	1.0220	22.0
77	1.0223	22.3
78	1.0226	22.6
79	1.0229	22.9
80	1.0232	23.2
81	1.0235	23.5
82	1.0238	23.8
83	1.0241	24.1
84	1.0244	24.4
85	1.0246	24.6
86	1.0249	24.9
87	1.0252	25.2
88	1.0255	25.5
89	1.0258	25.8
90	1.0261	26.1
91	1.0264	26.4
92	1.0267	26.7
93	1.0270	27.0
94	1.0273	27.3
95	1.0276	27.6
96	1.0278	27.8
97	1.0281	28.1
98	1.0284	28.4
99	1.0287	28.7
100	1.0290	29.0
101	1.0293	29.3
102	1.0296	29.6
103	1.0299	29.9
104	1.0302	30.2
105	1.0305	30.5
106	1.0307	30.7
107	1.0310	31.0
108	1.0313	31.3
109	1.0316	31.6
110	1.0319	31.9
111	1.0322	32.2
112	1.0325	32.5
113	1.0328	32.8
114	1.0331	33.1
115	1.0334	33.4
116	1.0336	33.6
117	1.0339	33.9
118	1.0342	34.2
119	1.0345	34.5

VISCOSITY CONVERSION TABLE

Poise = c. g. s. unit of absolute viscosity. Centipoise = 0.01 poise.
Stoke = c. g. s. unit of kinematic viscosity. Centistoke = 0.01 stoke.
Centipoises = centistokes × density (at temperature under consideration).
Reyn (1 lb. sec. per sq. in.) = 69×10^5 centipoises.

CENTISTOKES TO SAYBOLT, REDWOOD AND ENGLER UNITS

Cf. *Jour. Inst. Pet. Tech., Vol. 22, p. 21 (1936); Reports of A. S. T. M. Committee D-2, 1936 and 1937.*

Centistokes	Saybolt Seconds at			Redwood Seconds at			Engler Degrees at all Temps.
	100°F.	130°F.	210°F.	70°F.	140°F.	200°F.	
2.0	32.6	32.7	32.8	30.2	31.0	31.2	1.14
3.0	36.0	36.1	36.3	32.7	33.5	33.7	1.22
4.0	39.1	39.2	39.4	35.3	36.0	36.3	1.31
5.0	42.3	42.4	42.6	37.9	38.5	38.9	1.40
6.0	45.5	45.6	45.8	40.5	41.0	41.5	1.48
7.0	48.7	48.8	49.0	43.2	43.7	44.2	1.56
8.0	52.0	52.1	52.4	46.0	46.4	46.9	1.65
9.0	55.4	55.5	55.8	48.9	49.1	49.7	1.75
10	58.8	58.9	59.2	51.7	52.0	52.6	1.84
11	62.3	62.4	62.7	54.8	55.0	55.6	1.93
12	65.9	66.0	66.4	57.9	58.1	58.8	2.02
14	73.4	73.5	73.9	64.4	64.6	65.3	2.22
16	81.1	81.3	81.7	71.0	71.4	72.2	2.43
18	89.2	89.4	89.8	77.9	78.5	79.4	2.64
20	97.5	97.7	98.2	85.0	85.8	86.9	2.87
22	106.0	106.2	106.7	92.4	93.3	94.5	3.10
24	114.6	114.8	115.4	99.9	100.9	102.2	3.34
26	123.3	123.5	124.2	107.5	108.6	110.0	3.58
28	132.1	132.4	133.0	115.3	116.5	118.0	3.82
30	140.9	141.2	141.9	123.1	124.4	126.0	4.07
32	149.7	150.0	150.8	131.0	132.3	134.1	4.32
34	158.7	159.0	159.8	138.9	140.2	142.2	4.57
36	167.7	168.0	168.9	146.9	148.2	150.3	4.83
38	176.7	177.0	177.9	155.0	156.2	158.3	5.08
40	185.7	186.0	187.0	163.0	164.3	166.7	5.34
42	194.7	195.1	196.1	171.0	172.3	175.0	5.59
44	203.8	204.2	205.2	179.1	180.4	183.3	5.85
46	213.0	213.4	214.5	187.1	188.5	191.7	6.11
48	222.2	222.6	223.8	195.2	196.6	200.0	6.37
50	231.4	231.8	233.0	203.3	204.7	208.3	6.63
60	277.4	277.9	279.3	243.5	245.3	250.0	7.90
70	323.4	324.0	325.7	283.9	286.0	291.7	9.21
80	369.6	370.3	372.2	323.9	326.6	333.4	10.53
90	415.8	416.6	418.7	364.4	367.4	375.0	11.84
100*	462.0	462.9	465.2	404.9	408.2	416.7	13.16

* At higher values use the same ratio as above for 100 centistokes; *e.g.*, 102 centistokes = 102 × 4.620 Saybolt seconds at 100°F.

To obtain the Saybolt Universal viscosity equivalent to a kinematic viscosity determined at *t*°F., multiply the equivalent Saybolt Universal viscosity at 100°F. by 1 + (t − 100) 0.000064; *e.g.*, 10 centistokes at 210°F are equivalent to 58.8 × 1.0070, or 59.2 Saybolt Universal seconds at 210°F.

CHEMICAL

Compiled by Byron A. Soule,

Year	Am. Chem. J.*	Am. J. Sci.	Analyst	Ann.	Ann. chim. phys.	Ber.	Bull. soc. chim.	C.A.	Chem. News
1880	2	3, 19-20	5	200-5	5, 19-21	13	2, 33-4		41-2
1	2-3	21-2	6	206-10	22-4	14	35-6		43-4
2	3-4	23-4	7	211-15	25-7	15	37-8		45-6
3	4-5	25-6	8	216-21	28-30	16	39-40		47-8
4	5-6	27-8	9	222-6	6, 1-3	17	41-2		49-50
1885	6-7	29-30	10	227-31	4-6	18	43-4		51-2
6	7-8	31-2	11	232-6	7-9	19	45-6		53-4
7	9	33-4	12	237-42	10-12	20	47-8		55-6
8	10	35-6	13	243-9	13-15	21	49-50		57-8
9	11	37-8	14	250-5	16-18	22	3, 1-2		59-60
1890	12	39-40	15	256-60	19-21	23	3-4		61-2
1	13	41-2	16	261-6	22-4	24	5-6		63-4
2	14	43-4	17	267-71	25-7	25	7-8		65-6
3	15	45-6	18	272-7	28-30	26	9-10		67-8
4	16	47-8	19	278-83	7, 1-3	27	11-12		69-70
1895	17	49-50	20	284-8	4-6	28	13-14		71-2
6	18	4, 1-2	21	289-93	7-9	29	15-16		73-4
7	19	3-4	22	294-8	10-12	30	17-18		75-6
8	20	5-6	23	299-303	13-15	31	19-20		77-8
9	21-2	7-8	24	304-9	16-18	32	21-2		79-80
1900	23-4	9-10	25	310-13	19-21	33	23-4		81-2
1	25-6	11-12	26	314-19	22-4	34	25-6		83-4
2	27-8	13-14	27	320-5	25-7	35	27-8		85-6
3	29-30	15-16	28	326-9	28-30	36	29-30		87-8
4	31-2	17-18	29	330-7	8, 1-3	37	31-2		89-90
1905	33-4	4, 19-20	30	338-43	4-6	38	33-4		91-2
6	35-6	21-2	31	344-50	7-9	39	35-6		93-4
7	37-8	23-4	32	351-7	10-12	40	4, 1-2	1	95-6
8	39-40	25-6	33	358-63	13-15	41	3-4	2	97-8
9	41-2	27-8	34	364-71	16-18	42	5-6	3	99-100
1910	43-4	29-30	35	372-7	19-21	43	7-8	4	101-2
11	45-6	31-2	36	378-85	22-4	44	9-10	5	103-4
12	47-8	33-4	37	386-94	25-7	45	11-12	6	105-6
13	49-50	35-6	38	395-401	28-30	46	13-14	7	107-8
14	.....	37-8	39	402-6	9, 1-2	47	15-16	8	109-10
1915	Combined with J. Am. Chem. Soc. in 1914	39-40	40	407-10	3-4	48	17-18	9	111-12
16		41-2	41	411	5-6	49	19-20	10	113-14
17		43-4	42	412-13	7-8	50	21-2	11	115-16
18		45-6	43	414-17	9-10	51	23-4	12	117
19		47-8	44	418-19	11-12	52	25-6	13	118-19
1920		49-50	45	420-1	13-14	53	27-8	14	120-1
1		5, 1-2	46	422-5	15-16	54	29-30	15	122-3
2		3-4	47	426-9	17-18	55	31-2	16	124-5
3		5-6	48	430-4	19-20	56	33-4	17	126-7
4		7-8	49	435-40	10, 1-2	57	35-6	18	128-9
1925		9-10	50	441-5	3-4	58	37-8	19	130-1
6		11-12	51	446-50	5-6	59	39-40	20	132-3
7		13-14	52	451-9	7-8	60	41-2	21	134-5
8		15-16	53	460-7	9-10	61	43-4	22	136-7
9		17-18	54	468-76	11-12	62	45-6	23	138-9
1930		19-20	55	477-84	13-14	63	47-8	24	140-1
1		21-2	56	485-92	15-16	64	49-50	25	142-3
2		23-4	57	493-99	17-18	65	51-2	26	144-5
3		25-6	58	500-8	19-20	66	53-4	27	**
4		27-	59	509-	21-	67	55-	28	

*Title abbreviations are those used by Chemical Abstracts.

**Ceased publication Oct. 1932

JOURNALS

University of Michigan.

Chem. Zentr.	Chem. Ztg.	Compt. rend.	Gazz. chim. ital.	Ind. Eng. Chem.	J. Am. Chem. Soc.	J. Biol. Chem.	J. Chem. Soc.	J. chim. phys.	Year
3, 11	4	90-1	10		2		37-8		1880
12	5	92-3	11		3		39-40		1
13	6	94-5	12		4		41-2		2
14	7	96-7	13.		5		43-4		3
15	8	98-9	14		6		45-6		4
16	9	100-1	15		7		47-8		1885
17	10	102-3	16		8		49-50		6
18	11	104-5	17		9		51-2		7
19	12	106-7	18		10		53-4		8
4, 1 (60)	13	108-9	19		11		55-6		9
2 (61)	14	110-11	20		12		57-8		1890
3 (62)	15	112-13	21		13		59-60		1
4 (63)	16	114-15	22		14		61-2		2
5 (64)	17	116-17	23		15		63-4		3
6 (65)	18	118-19	24		16		65-6		4
7 (66)	19	120-1	25		17		67-8		1895
8 (67)	20	122-3	26		18		69-70		6
5, 1 (68)	21	124-5	27		19		71-2		7
2 (69)	22	126-7	28		20		73-4		8
3 (70)	23	128-9	29		21		75-6		9
4 (71)	24	130-1	30		22		77-8		1900
5 (72)	25	132-3	31		23		79-80		1
6 (73)	26	134-5	32		24		81-2		2
7 (74)	27	136-7	33		25		83-4	1	3
8 (75)	28	138-9	34		26		85-6	2	4
5, 9 (76)	29	140-1	35		27	1	87-8	3	1905
10 (77)	30	142-3	36		28	1-2	89-90	4	6
11 (78)	31	144-5	37		29	2-3	91-2	5	7
12 (79)	32	146-7	38		30	4-5	93-4	6	8
13 (80)	33	148-9	39	1	31	6-7	95-6	7	9
14 (81)	34	150-1	40	2	32	7-8	97-8	8	1910
15 (82)	35	152-3	41	3	33	9-10	99-100	9	11
16 (83)	36	154-5	42	4	34	11-13	101-2	10	12
17 (84)	37	156-7	43	5	35	14-16	103-4	11	13
18 (85)	38	158-9	44	6	36	17-19	105-6	12	14
19 (86)	39	160-1	45	7	37	20-3	107-8	13	1915
20 (87)	40	162-3	46	8	38	24-8	109-10	14	16
21 (88)	41	164-5	47	9	39	29-32	111-12	15	17
22 (89)	42	166-7	48	10	40	33-6	113-14	16	18
6, 1 (90)	43	168-9	49	11	41	37-40	115-16	17	19
2 (91)	44	170-1	50	12	42	41-5	117-18	18	1920
3 (92)	45	172-3	51	13	43	46-9	119-20	19	1
4 (93)	46	174-5	52	14	44	50-4	121-2	20	2
5 (94)	47	176-7	53	15	45	55-8	123-4	20	3
6 (95)	48	178-9	54	16	46	59-62	125-6	21	4
7 (96)	49	180-1	55	17	47	63-6	127-8	22	1925
97	50	182-3	56	18	48	67-71	1926	23	6
98	51	184-5	57	19	49	72-5	1927	24	7
99	52	186-7	58	20	50	76-80	1928	25	8
100	53	188-9	59	21	51	81-4	1929	26	9
101	54	190-1	60	22	52	85-9	1930	27	1930
102	55	192-3	61	23	53	90-4	1931	28	1
103	56	194-5	62	24	54	94-9	1932	29	2
104	57	196-7	63	25	55	100-	1933	30	3
105	58	198-	64	26	56		1934	31	4

Year	J. Phys. Chem.	J. prakt. Chem.	J. Russ. Phys. Chem. Soc.	J. Soc. Chem. Ind.	J. Soc. Dyers Colourists	Kolloid Beihefte	Kolloid Z.	Monatsh.	Nature	Phil. Mag.	Proc. Roy. Soc. (London) (A)
1880		N.F.*21-2	12					1	21-3	5, 9-10	30-1
1		23-4	13					2	23-5	11-12	31-3
2		25-6	14	1				3	25-7	13-14	33-4
3		27-8	15	2				4	27-9	15-16	34-6
4		29-30	16	3				5	29-31	17-18	36-8
1885		31-2	17	4	1			6	31-3	19-20	38-9
6		33-4	18	5	2			7	33-5	21-2	40-1
7		35-6	19	6	3			8	35-7	23-4	42-3
8		37-8	20	7	4			9	37-9	25-6	43-5
9		39-40	21	8	5			10	39-41	27-8	45-7
1890		41-2	22	9	6			11	41-3	29-30	47-9
1		43-4	23	10	7			12	43-5	31-2	49-50
2		45-6	24	11	8			13	45-7	33-4	50-2
3		47-8	25	12	9			14	47-9	35-6	52-4
4		49-50	26	13	10			15	49-51	37-8	55-7
1895		51-2	27	14	11			16	51-3	39-40	57-9
6	1	53-4	28	15	12			17	53-5	41-2	59-60
7	1	55-6	29	16	13			18	55-7	43-4	60-2
8	2	57-8	30	17	14			19	57-9	45-6	62-4
9	3	59-60	31	18	15			20	59-61	47-8	64-6
1900	4	61-2	32	19	16			21	61-3	49-50	66-7
1	5	63-4	33	20	17			22	63-5	6, 1-2	68-9
2	6	65-6	34	21	18			23	65-7	3-4	69-70
3	7	67-8	35	22	19			24	67-9	5-6	71-2
4	8	69-70	36	23	20			25	69-71	7-8	72-4
1905	9	71-2	37	24	21			26	71-3	9-10	74-6
6	10	73-4	38	25	22		1	27	73-5	11-12	77-8
7	11	75-6	39	26	23		1-2	28	75-7	13-14	78-80
8	12	77-8	40	27	24		2-3	29	77-9	15-16	80-1
9	13	79-80	41	28	25	1	4-5	30	79-82	17-18	82-3
1910	14	81-2	42	29	26	1-2	6-7	31	82-5	19-20	83-4
11	15	83-4	43	30	27	2-3	8-9	32	85-8	21-2	84-6
12	16	85-6	44	31	28	3-4	10-11	33	88-90	23-4	86-7
13	17	87-8	45	32	29	4-5	12-13	34	90-2	25-6	88-9
14	18	89-90	46	33	30	5-6	14-15	35	92-4	27-8	89-90
1915	19	91-2	47	34	31	7	16-17	36	94-6	29-30	91-2
16	20	93-4	48	35	32	8	18-19	37	96-8	31-2	92-3
17	21	95-6	49	36	33	9	20-1	38	98-100	33-4	93-4
18	22	97-8	50	37	34	9-10	22-3	39	100-2	35-6	94-5
19	23	99	51	38	35	10-11	24-5	40	102-4	37-8	95-6
1920	24	100	51-2	39	36	12-13	26-7	41	104-6	39-40	96-8
1	25	101-2	53	40	37	13-14	28-9	42	106-8	41-2	98-100
2	26	103-5	54-5	41	38	15-16	30-1	43	109-10	43-4	100-2
3	27	105-6		42	39	17-18	32-3	44	111-12	45-6	102-4
4	28	107-8		43	40	19-20	34-5	45	113-14	47-8	105-6
1925	29	109-11	56-7	44	41	21	36-7	46	115-16	49-50	107-9
6	30	112-14	58	45	42	22	38-40	47	117-18	7, 1-2	110-13
7	31	115-17	59	46	43	23-5	41-3	48	119-20	3-4	113-17
8	32	118-20	60	47	44	26-7	44-6	49-50	121-2	5-6	117-21
9	33	121-4	61	48	45	28-30	47-9	51-4	123-4	7-8	122-6
1930	34	124-8	62	49	46	30-1	50-3	55-6	125-6	9-10	126-30
1	35	129-31	63(N.S.1)	50	47	32-4	54-7	57-8	127-8	11-12	130-4
2	36	132-5	64	51	48	34-7	58-61	59-60	129-30	13-14	134-8
3	37	136-8	65	52	49	37-9	61-5	61-2	131-2	15-16	138-42
4	38	139-	66	53	50	39-	66-	63-	133-	17-	

*For the whole numbers add 108 since there were 108 volumes in the first series.

JOURNALS

Rec. trav. chim.	Science	Trans. Electro-chem. Soc.	Trans. Faraday Soc.	Trans. Roy. Soc. (London) (A)	Z. anal. Chem.	Z. angew. Chem.	Z anorg. allgem. Chem.	Z. Elektro-chem.	Z. Physik. Chem.	Year
				171	19					1880
				172	20					1
1, 1				173	21					2
2	1-2			174	22					3
3	3-4			175	23					4
4	5-6			....	24					1885
5	7-8			176-7	25					6
6	9-10			177	26				1	7
7	11-12			178	27	1			2	8
8	13-14			179	28	2			3-4	9
9	15-16			180	29	3			5-6	1890
10	17-18			181	30	4			7-8	1
11	19-20			182	31	5	1-2		9-10	2
12	21-2			183	32	6	3-4		11-12	3
13	23			184-5	33	7	5-7	1	13-15	4
14	N.S. 1-2			185-6	34	8	8-10	1-2	16-18	1895
15	3-4			186, 188	35	9	11-12	2-3	19-21	6
2, 1(16)	5-6			187, 189	36	10	13-15	3-4	22-4	7
2(17)	7-8			190-1	37	11	16-18	4-5	25-7	8
3(18)	9-10			192	38	12	19-21	5-6	28-31	9
4(19)	11-12			193-4	39	13	22-5	6-7	32-5	1900
5(20)	13-14			195-7	40	14	26-8	7	36-8	1
6(21)	15-16	1-2		198-9	41	15	29-32	8	39-41	2
7(22)	17-18	3-4		200-1	42	16	33-36	9	42-6	3
8(23)	19-20	5-6		202-3	43	17	37-42	10	47-50	4
9(24)	21-2	7-8	1	204	44	18	43-7	11	51-4	1905
10(25)	23-4	9-10	1-2	205-6	45	19	48-51	12	54-6	6
11(26)	25-6	11-12	2-3	207	46	20	52-5	13	57-60	7
12(27)	27-8	13-14	3-4	207-9	47	21	56-60	14	61-4	8
13(28)	29-30	15-16	4-5	209-10	48	22	61-4	15	65-9	9
14(29)	31-2	17-18	5-6	210	49	23	65-8	16	70-4	1910
15(30)	33-4	19-20	6-7	210-11	50	24	69-72	17	75-7	11
16(31)	35-6	21-2	7-8	211-12	51	25	73-8	18	78-80	12
3, 2(32)	37-8	23-4	9	212-13	52	26	79-83	19	81-6	13
3(33)	39-40	25-6	10	213-14	53	27	84-9	20	86-8	14
4-5(34-5)	41-2	27-8	10-11	215-16	54	28	90-3	21	89-90	1915
6(36)	43-4	29-30	11-12	216-17	55	29	94-8	22	91-2	16
7(37)	45-6	31-2	12-13	217	56	30	99-101	23	92	17
7(37)	47-8	33-4	13	217	57	31	102-4	24	92-3	18
8(38)	49-50	35-6	14-15	218-19	58	32	105-8	25	93	19
4, 1(39)	51-2	37-8	15-16	220	59	33	109-14	26	94-6	1920
2(40)	53-4	39-40	16-17	221	60	34	115-19	27	97-9	1
3(41)	55-6	41-2	17-18	222	61	35	120-5	28	100-3	2
4(42)	57-8	43-4	18-19	223	62-3	36	126-31	29	103-7	3
5(43)	59-60	45-6	19-20	224	64-5	37	132-141	30	108-14	4
6(44)	61-2	47-8	20-1	225	65-7	38	141-150	31	114-18	1925
7(45)	63-4	49-50	21-2	226	67-9	39	150-9	32	119-24	6
8(46)	65-6	51-2	23	226-7	70-2	40	159-68	33	125-31	7
9(47)	67-8	53-4	24	227-8	73-5	41	168-77	34	131-9	8
10(48)	69-70	55-6	25	228	76-8	42	177-86	35	140-5	9
11(49)	71-2	57-8	26	229	79, 80-2	43	186-95	36	146-52	1930
12(50)	73-4	59-60	27	230	83-7	44	195-204	37	152-7	1
13(51)	75-6	61-2	28	230-1	87-90	45	204-9	38	158-62	2
14(52)	77-8	63-4	29	231-	91-95	46	210-16	39	163-7	3
15(53)	79-	65-	30		96-	47	217-	40	167-	4

THREE HUNDRED YEAR CALENDAR

1753 to 2052

To find the day of the week:—First find the year in the table and then in the same horizontal column to the right find the month where the number is given which refers to the corresponding column of days in the table which follows.

Example:—To find the day of the week corresponding to Armistice Day, November 11, 1918 find the year 1918 and in the horizontal column to the right under November is the figure 5 which refers to column 5 which is the calendar for November of 1918 which shows that November 11, 1918 was on Monday.

	January	February	March	April	May	June	July	August	September	October	November	December
1761 1767 1778 1789 1795 1801 1807 1818 1829 1835 1846 1857 1863 1874 1885 1891 1903 1914 1925 1931 1942 1953 1959 1970 1981 1987 1998 2009 2015 2026 2037 2043	4	7	7	3	5	1	3	6	2	4	7	2
1762 1773 1779 1790 1802 1813 1819 1830 1841 1847 1858 1869 1875 1886 1897 1909 1915 1926 1937 1943 1954 1965 1971 1982 1993 1999 2010 2021 2027 2038 2049	5	1	1	4	6	2	4	7	3	5	1	3
1757 1763 1774 1785 1791 1803 1814 1825 1831 1842 1853 1859 1870 1881 1887 1898 1910 1921 1927 1938 1949 1955 1966 1977 1983 1994 2005 2011 2022 2033 2039 2050	6	2	2	5	7	3	5	1	4	6	2	4
1754 1765 1771 1782 1793 1799 1805 1811 1822 1833 1839 1850 1861 1867 1878 1889 1895 1901 1907 1918 1929 1935 1946 1957 1963 1974 1985 1991 2002 2013 2019 2030 2041 2047	2	5	5	1	3	6	1	4	7	2	5	7
1755 1766 1777 1783 1794 1800 1806 1817 1823 1834 1845 1851 1862 1873 1879 1890 1902 1913 1919 1930 1941 1947 1958 1969 1975 1986 1997 2003 2014 2025 2031 2042	3	6	6	2	4	7	2	5	1	3	6	1
1758 1769 1775 1786 1797 1809 1815 1826 1837 1843 1854 1865 1871 1882 1893 1899 1905 1911 1922 1933 1939 1950 1961 1967 1978 1989 1995 2006 2017 2023 2034 2045 2051	7	3	3	6	1	4	6	2	5	7	3	5
1753 1759 1770 1781 1787 1798 1810 1821 1827 1838 1849 1855 1866 1877 1883 1894 1900 1906 1917 1923 1934 1945 1951 1962 1973 1979 1990 2001 2007 2018 2029 2035 2046	1	4	4	7	2	5	7	3	6	1	4	6
Leap Years												
1764 1792 1804 1832 1860 1888 1928 1956 1984 2012 2040	7	3	4	7	2	5	7	3	6	1	4	6
1768 1796 1808 1836 1864 1892 1904 1932 1960 1988 2016 2044	5	1	2	5	7	3	5	1	4	6	2	4
1772 1812 1840 1868 1896 1908 1936 1964 1992 2020 2048	3	6	7	3	5	1	3	6	2	4	7	2
1776 1816 1844 1872 1912 1940 1968 1996 2024 2052	1	4	5	1	3	6	1	4	7	2	5	7
1780 1820 1848 1876 1916 1944 1972 2000 2028	6	2	3	6	1	4	6	2	5	7	3	5
1756 1784 1824 1852 1880 1920 1948 1976 2004 2032	4	7	1	4	6	2	4	7	3	5	1	3
1760 1788 1828 1856 1884 1924 1952 1980 2008 2036	2	5	6	2	4	7	2	5	1	3	6	1

THREE HUNDRED YEAR CALENDAR

1		2		3		4		5		6		7	
Monday	1	Tuesday	1	Wednesday	1	Thursday	1	Friday	1	Saturday	1	SUNDAY	1
Tuesday	2	Wednesday	2	Thursday	2	Friday	2	Saturday	2	SUNDAY	2	Monday	2
Wednesday	3	Thursday	3	Friday	3	Saturday	3	SUNDAY	3	Monday	3	Tuesday	3
Thursday	4	Friday	4	Saturday	4	SUNDAY	4	Monday	4	Tuesday	4	Wednesday	4
Friday	5	Saturday	5	SUNDAY	5	Monday	5	Tuesday	5	Wednesday	5	Thursday	5
Saturday	6	SUNDAY	6	Monday	6	Tuesday	6	Wednesday	6	Thursday	6	Friday	6
SUNDAY	7	Monday	7	Tuesday	7	Wednesday	7	Thursday	7	Friday	7	Saturday	7
Monday	8	Tuesday	8	Wednesday	8	Thursday	8	Friday	8	Saturday	8	SUNDAY	8
Tuesday	9	Wednesday	9	Thursday	9	Friday	9	Saturday	9	SUNDAY	9	Monday	9
Wednesd.	10	Thursday	10	Friday	10	Saturday	10	SUNDAY	10	Monday	10	Tuesday	10
Thursday	11	Friday	11	Saturday	11	SUNDAY	11	Monday	11	Tuesday	11	Wednesd.	11
Friday	12	Saturday	12	SUNDAY	12	Monday	12	Tuesday	12	Wednesd.	12	Thursday	12
Saturday	13	SUNDAY	13	Monday	13	Tuesday	13	Wednesd.	13	Thursday	13	Friday	13
SUNDAY	14	Monday	14	Tuesday	14	Wednesd.	14	Thursday	14	Friday	14	Saturday	14
Monday	15	Tuesday	15	Wednesd.	15	Thursday	15	Friday	15	Saturday	15	SUNDAY	15
Tuesday	16	Wednesd.	16	Thursday	16	Friday	16	Saturday	16	SUNDAY	16	Monday	16
Wednesd.	17	Thursday	17	Friday	17	Saturday	17	SUNDAY	17	Monday	17	Tuesday	17
Thursday	18	Friday	18	Saturday	18	SUNDAY	18	Monday	18	Tuesday	18	Wednesd.	18
Friday	19	Saturday	19	SUNDAY	19	Monday	19	Tuesday	19	Wednesd.	19	Thursday	19
Saturday	20	SUNDAY	20	Monday	20	Tuesday	20	Wednesd.	20	Thursday	20	Friday	20
SUNDAY	21	Monday	21	Tuesday	21	Wednesd.	21	Thursday	21	Friday	21	Saturday	21
Monday	22	Tuesday	22	Wednesd.	22	Thursday	22	Friday	22	Saturday	22	SUNDAY	22
Tuesday	23	Wednesd.	23	Thursday	23	Friday	23	Saturday	23	SUNDAY	23	Monday	23
Wednesd.	24	Thursday	24	Friday	24	Saturday	24	SUNDAY	24	Monday	24	Tuesday	24
Thursday	25	Friday	25	Saturday	25	SUNDAY	25	Monday	25	Tuesday	25	Wednesd.	25
Friday	26	Saturday	26	SUNDAY	26	Monday	26	Tuesday	26	Wednesd.	26	Thursday	26
Saturday	27	SUNDAY	27	Monday	27	Tuesday	27	Wednesd.	27	Thursday	27	Friday	27
SUNDAY	28	Monday	28	Tuesday	28	Wednesd.	28	Thursday	28	Friday	28	Saturday	28
Monday	29	Tuesday	29	Wednesd.	29	Thursday	29	Friday	29	Saturday	29	SUNDAY	29
Tuesday	30	Wednesd.	30	Thursday	30	Friday	30	Saturday	30	SUNDAY	30	Monday	30
Wednesd.	31	Thursday	31	Friday	31	Saturday	31	SUNDAY	31	Monday	31	Tuesday	31

Greek Alphabet

Α	α	Alpha	Ν	ν	Nu
Β	β	Beta	Ξ	ξ	Xi
Γ	γ	Gamma	Ο	ο	Omicron
Δ	δ	Delta	Π	π	Pi
Ε	ϵ	Epsilon	Ρ	ρ	Rho
Ζ	ζ	Zeta	Σ	σ	Sigma
Η	η	Eta	Τ	τ	Tau
Θ	θ	Theta	Υ	υ	Upsilon
Ι	ι	Iota	Φ	ϕ	Phi
Κ	κ	Kappa	Χ	χ	Chi
Λ	λ	Lambda	Ψ	ψ	Psi
Μ	μ	Mu	Ω	ω	Omega

$+$	Plus or Positive
$-$	Minus or Negative
$\pm$	Plus or minus Positive or negative
$\mp$	Minus or plus Negative or positive
$\times$ or $\cdot$	Multiplied by
$\div$ or $:$	Divided by
$=$ or $::$	Equals, as
$\neq$, ⧧	Does not equal
$\cong$	Equals approximately Congruent
$>$	Greater than
$<$	Less than
$\geqq$	Greater than or equal to
$\leqq$	Less than or equal to
$\backsim$	Similar to
$\therefore$	Therefore
$\sqrt{\ }$	Square root
$\sqrt[n]{\ }$	*n*th root
a^n	*n*th power of *a*
log or $\log_{10}$	Common logarithm Briggsian "
ln or $\log_e$ or log	Natural logarithm Hyperbolic " Napierian "
e or ϵ	Base (2.718) of natural system of logarithms
π	Pi (3.1416)
$\angle$	Angle
$\perp$	Perpendicular to
$\parallel$	Parallel to
a°	*a* degrees (angle)
a'	*a* minutes (angle) *a* prime
a''	*a* seconds (angle) *a* second *a* double-prime
a'''	*a* third *a* triple-prime
a_n	*a* sub *n*
sin	Sine
cos	Cosine
tan	Tangent
cot or ctn	Cotangent

sec	Secant
csc	Cosecant
vers	Versed sine
covers	Coversed sine
exsec	Exsecant
$\sin^{-1}a$ or arc sin a	Anti-sine *a* Angle whose sine is *a* Inverse sine *a*
sinh	Hyperbolic sine
cosh	Hyperbolic cosine
tanh	Hyperbolic tangent
$\sinh^{-1}a$ or arc sinh a	Anti-hyperbolic sine *a* Number whose hyperbolic sine is *a*
$P\ (x,y)$	Rect. coörd. of point *P*
$P(r,\ \theta)$	Polar coörd. of point *P*
$f(x), F(x)$ or $\Phi\ (x)$	Function of *x*
Δy	Increment of *y*
$\doteq$ or $\rightarrow$	Approaches as a limit
Σ	Summation of
∞	Infinity
dy	Differential of *y*
$\frac{dy}{dx}$ or $f'(x)$	Derivative of $y = f(x)$ with respect to *x*
$\frac{d^2y}{dx^2}$ or $f''(x)$	Second deriv. of $y = f(x)$ with respect to *x*
$\frac{d^ny}{dx^n}$ or $f^{(n)}(x)$	*n*th deriv. of $y = f(x)$ with respect to *x*
$\frac{\partial z}{\partial x}$	Partial derivative of *z* with respect to *x*
$\frac{\partial^2 z}{\partial x\, \partial y}$	Second partial deriv. of *z* with respect to *y* and *x*
$\int$	Integral of
$\int_a^b$	Integral between the limits *a* and *b*
j or i	Imaginary quantity ($\sqrt{-1}$), $i^2 = -1$
$x = a + jb$	Symbolic vector notation
$n! = 1 \cdot 2 \cdot 3 \cdots n$	

SURFACE AREAS AND VOLUMES*

Let a, b, c, d, and s denote lengths, A denote areas, and V denote volumes.

Triangle.

$A = bh/2$, where b denotes the base and h the altitude.

Rectangle.

$A = ab$, where a and b denote the lengths of the sides.

Parallelogram (opposite sides parallel).

$A = ah = ab \sin \theta$, where a and b denote the sides, h the altitude and θ the angle between the sides.

Trapezoid (four sides, two parallel).

$A = \frac{1}{2}h(a + b)$, where a and b are the sides and h the altitude.

Regular Polygon of n Sides. (Fig. 1).

$\mathrm{A} = \dfrac{1}{4} n\ a^2 \operatorname{ctn} \dfrac{180°}{n}$, where a is length of side.

$\mathrm{R} = \dfrac{a}{2} \csc \dfrac{180°}{n}$, where R is radius of circumscribed circle.

$r = \dfrac{a}{2} \operatorname{ctn} \dfrac{180°}{n}$, where r is radius of inscribed circle.

$\alpha = \dfrac{360°}{n} = \dfrac{2\pi}{n}$, radians,

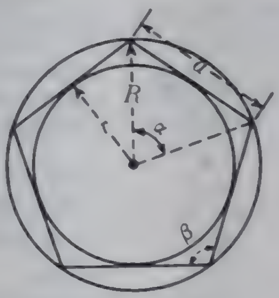

Fig. 1

$\beta = \left(\dfrac{n-2}{n}\right) \cdot 180° = \left(\dfrac{n-2}{n}\right)\pi$ radians where α and β are the angles indicated in Fig. 1.

$a = 2\,r \tan \dfrac{\alpha}{2} = 2R \sin \dfrac{\alpha}{2}$.

Circle. (Fig. 2).

Let C = circumference,
R = radius,
D = diameter,
A = area,
S = length of arc subtended by θ,
l = chord subtended by arc S,
h = rise,
θ = central angle in radians.

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* Adapted by permission from Burington's Handbook of Mathematical Tables and Formulas, Handbook Publishers, Inc., Sandusky, Ohio.

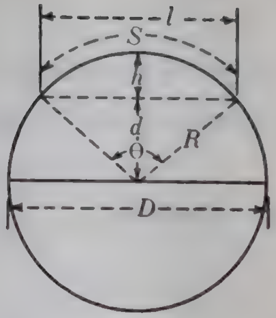

Fig. 2

$$C = 2\pi R = \pi D, \quad \pi = 3.14159\cdots.$$

$$S = R\theta = \tfrac{1}{2}D\theta = D\cos^{-1}\frac{d}{R}.$$

$$l = 2\sqrt{R^2 - d^2} = 2R\sin\frac{\theta}{2} = 2d\tan\frac{\theta}{2}.$$

$$d = \tfrac{1}{2}\sqrt{4R^2 - l^2} = R\cos\frac{\theta}{2} = \tfrac{1}{2}\,l\operatorname{ctn}\frac{\theta}{2}.$$

$$h = R - d.$$

$$\theta = \frac{S}{R} = \frac{2S}{D} = 2\cos^{-1}\frac{d}{R} = 2\tan^{-1}\frac{l}{2d} = 2\sin^{-1}\frac{l}{D}.$$

$$A\text{ (circle)} = \pi R^2 = \tfrac{1}{4}\pi D^2.$$

$$A\text{ (sector)} = \tfrac{1}{2}Rs = \tfrac{1}{2}R^2\theta.$$

$$A\text{ (segment)} = A\text{ (sector)} - A\text{ (triangle)} = \tfrac{1}{2}R^2(\theta - \sin\theta)$$

$$= R^2\cos^{-1}\frac{(R-h)}{R} - (R-h)\sqrt{2Rh - h^2}.$$

Perimeter of a n-side regular polygon inscribed in a circle

$$= 2nR\sin\frac{\pi}{n}.$$

Area of inscribed polygon $= \tfrac{1}{2}nR^2\sin\dfrac{2\pi}{n}.$

Perimeter of a n-side regular polygon circumscribed about a circle

$$= 2nR\tan\frac{\pi}{n}.$$

Area of circumscribed polygon $= nR^2\tan\dfrac{\pi}{n}.$

Radius of circle inscribed in a triangle of sides a, b, and c is

$$r = \sqrt{\frac{(s-a)(s-b)(s-c)}{s}}, \quad s = \tfrac{1}{2}(a+b+c).$$

Radius of circle circumscribed about a triangle is

$$R = \frac{abc}{4\sqrt{s(s-a)(s-b)(s-c)}}.$$

38. Ellipse. (Fig. 3).

$A = \pi ab$, where a and b are lengths of semi-major and semi-minor axes respectively.

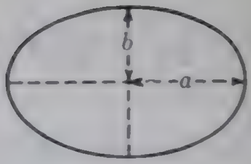

Fig. 3

39. Parabola. (Fig. 4).

$$A = 2ld/3.$$

$$\text{Height of } d_1 = \frac{d}{l^2}(l^2 - l_1^2).$$

$$\text{Width of } l_1 = l\sqrt{\frac{d-d_1}{d}}.$$

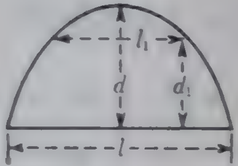

Fig. 4

$$\text{Length of arc} = l\left[1 + \frac{2}{3}\left(\frac{2d}{l}\right)^2 - \frac{2}{5}\left(\frac{2d}{l}\right)^4 + \cdots\right].$$

Area by Approximation. (Fig. 5). If $y_0, y_1, y_2, \cdots, y_n$ be the lengths of a series of equally spaced parallel chords, and if h be their distance apart, the area enclosed by boundary is given approximately by any one of the following formulae:

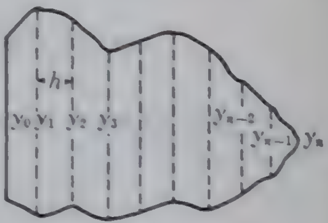

Fig. 5

$$A_T = h\left[\tfrac{1}{2}(y_0 + y_n) + y_1 + y_2 + \cdots + y_{n-1}\right]. \text{ (Trapezoidal Rule.)}$$

$$A_D = h\left[0.4(y_0 + y_n) + 1.1(y_1 + y_{n-1}) + y_2 + y_3 + \cdots + y_{n-2}\right].$$

(Durand's Rule.)

$$A_S = \tfrac{1}{3}h\left[(y_0 + y_n) + 4(y_1 + y_3 + \cdots + y_{n-1}) + 2(y_2 + y_4 + \cdots + y_{n-2})\right]. \text{ (n even, Simpson's Rule.)}$$

In general, A_S gives the most accurate approximation.

The greater the value of n, the greater the accuracy of approximation.

Cube.

$V = a^3$; $a = a\sqrt{3}$; total surface area $= 6a^2$, where a is length of side and d is length of diagonal.

Rectangular Parallelopiped.

$V = abc$; $d = \sqrt{a^2 + b^2 + c^2}$; total surface area $= 2\,(ab + bc + ca)$, where a, b, and c are the lengths of the sides and d is length of diagonal.

Prism or Cylinder. $V =$ (area of base) · (altitude).

Lateral area = (perimeter of right section) · (lateral edge).

Pyramid or Cone. $V = \frac{1}{3}$ (area of base) · (altitude).

Lateral area of regular pyramid
$= \frac{1}{2}$ (perimeter of base) · (slant height).

Frustum of Pyramid or Cone.

$V = \frac{1}{3}(A_1 + A_2 + \sqrt{\mathrm{A}_1 \cdot A_2})\,h$, where h is the altitude and A_1 and A_2 are the areas of the bases.

Lateral area of a regular figure
$= \frac{1}{2}$ (sum of perimeters of base) · (slant height).

Prismoid. $V = \dfrac{h}{6}(A_1 + A_2 + 4A_3)$, where h = altitude, A_1 and A_2 are the areas of the bases, and A_3 is the area of the midsection parallel to bases.

Area of Surface and Volume of Regular Polyhedra of edge l.

Name	Type of Surface	Area of Surface	Volume
Tetrahedron	4 equilateral triangles	$1.73205l^2$	$0.11785l^3$
Hexahedron (cube)	6 squares	$6.00000l^2$	$1.00000l^3$
Octahedron	8 equilateral triangles	$3.46410l^2$	$0.47140l^3$
Dodecahedron	12 pentagons	$20.64578l^2$	$7.66312l^3$
Icosahedron	20 equilateral triangles	$8.66025l^2$	$2.18170l^3$

Sphere. (Fig. 6).

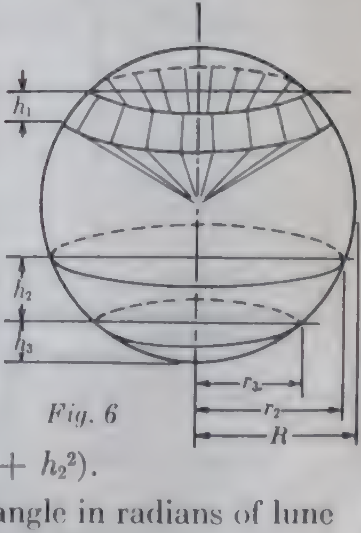

Fig. 6

A (sphere) $= 4\pi R^2 = \pi D^2$.

A (zone) $= 2\pi R h_1 = \pi D h_1$.

V (sphere) $= \frac{4}{3}\pi R^3 = \frac{1}{6}\pi D^3$.

V (spherical sector) $= \frac{2}{3}\pi R^2 h_1 = \frac{1}{6}\pi D^2 h_1$.

V (spherical segment of one base) $= \frac{1}{6}\pi h_3\,(3r_3^2 + h_3^2)$.

V (spherical segment of two bases) $= \frac{1}{6}\pi h_2\,(3r_3^2 + 3r_2^2 + h_2^2)$.

A (lune) $= 2R^2\theta$, where θ is angle in radians of lune

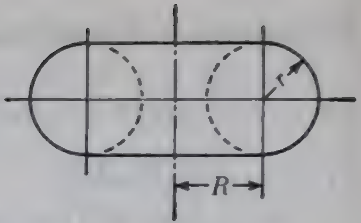

Fig. 7

Ellipsoid.

$V = \frac{4}{3}\pi abc$, where a, b, and c are the lengths of the semi-axes.

Torus. (Fig. 7). $V = 2\pi^2Rr^2$.

Area of surface $= S = 4\pi^2Rr$.

Theorems of Pappus:

(**a**) If a plane area A be rotated about a line l in the plane of A and not cutting A, the volume of the solid generated is equal to the product of A and the distance traveled by the center of gravity of A.

(**b**) If a plane curve C be rotated about a line l in the plane of C and not cutting C, the area of the surface generated is equal to the product of the length of C and the distance traveled by the center of gravity of C.

IMPORTANT CONSTANTS

N	$\log_{10}$ N	N	$\log_{10}$ N
$\pi = 3.14159265$	0.4971499	$\pi^2 = 9.86960440$	0.9942997
$2\pi = 6.28318531$	0.7981799	$\frac{1}{\pi^2} = 0.10132118$	9.0057003–10
$4\pi = 12.56637061$	1.0992099	$\sqrt{\pi} = 1.77245385$	0.2485749
$\frac{\pi}{2} = 1.57079633$	0.1961199	$\frac{1}{\sqrt{\pi}} = 0.56418958$	9.7514251–10
$\frac{\pi}{3} = 1.04719755$	0.0200286	$\sqrt{\frac{3}{\pi}} = 0.97720502$	9.9899857–10
$\frac{4\pi}{3} = 4.18879020$	0.6220886	$\sqrt{\frac{4}{\pi}} = 1.12837917$	0.0524551
$\frac{\pi}{4} = 0.78539816$	9.8950899–10		
$\frac{\pi}{6} = 0.52359878$	9.7189986–10	$\sqrt[3]{\pi} = 1.46459189$	0.1657166
$\frac{1}{\pi} = 0.31830989$	9.5028501–10	$\frac{1}{\sqrt[3]{\pi}} = 0.68278406$	9.8342834–10
$\frac{1}{2\pi} = 0.15915494$	9.2018201–10	$\sqrt[3]{\pi^2} = 2.14502940$	0.3314332
$\frac{3}{\pi} = 0.95492966$	9.9799714–10	$\sqrt[3]{\frac{3}{4\pi}} = 0.62035049$	9.7926371–10
$\frac{4}{\pi} = 1.27323954$	0.1049101	$\sqrt[3]{\frac{\pi}{6}} = 0.80599598$	9.9063329–10

Constant	Number	$\log_{10}$ of Number
Pi (π)	3.14159 26535 89793 23846	0.49714 98726 94133 85435
Napierian Base (e)	2.71828 18284 59045 23536	0.43429 448
$M = \log_{10}e$	0.43429 44819 03251 82765	9.63778 43113 00536 78912 −10
$1 \div M = \log_e 10$	2.30258 50929 94045 68402	0.36221 569
$180 \div \pi$ = degrees in 1 radian	57.2957 795	1.75812 263
$\pi \div 180$ = radians in 1°	0.01745 329	8.24187 737 −10
$\pi \div 10800$ = radians in 1′	0.00029 08882	6.46372 612 −10
$\pi \div 648000$ = radians in 1″	0.00000 48481 36811 095	4.68557 487 −10

Trigonometric Functions of an Angle α. (Fig. 8).

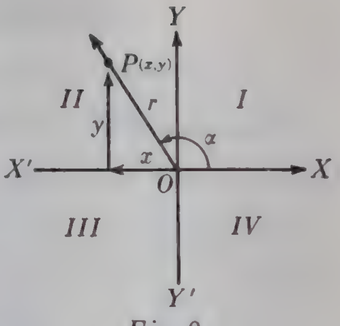

Fig. 8

Let α be any angle whose initial side lies on the positive x-axis and whose vertex is at the origin, and (x, y) be any point on the terminal side of the angle. (x is positive if measured along OX to the right, from the y-axis; and negative, if measured along OX' to the left from the y-axis. Likewise, y is positive if measured parallel to OY, and negative if measured parallel to OY'.) Let r be the positive distance from the origin to the point. The trigonometric functions of an angle are defined as follows:

sine α = sin α = $\frac{y}{r}$.

cosine α = cos α = $\frac{x}{r}$.

tangent α = tan α = $\frac{y}{x}$.

cotangent α = ctn α = cot α = $\frac{x}{y}$.

secant α = sec α = $\frac{r}{x}$.

cosecant α = csc α = $\frac{r}{y}$.

exsecant α = exsec α = sec α -1 .

versine α = vers α = $1 -$ cos α .

coversine α = covers α = $1 -$ sin α .

haversine α = hav α = $\frac{1}{2}$ vers α .

Signs of the Functions.

Quadrant	sin	cos	tan	ctn	sec	csc
I.	+	+	+	+	+	+
II	+	−	−	−	−	+
III.	−	−	+	+	−	−
IV	−	+	−	−	+	−

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
1	1	1	1.000 000	3.162 278	1.000 000	2.154 435	4.641 589
2	4	8	1.414 214	4.472 136	1.259 921	2.714 418	5.848 035
3	9	27	1.732 051	5.477 226	1.442 250	3.107 233	6 694 330
4	16	64	2.000 000	6.324 555	1.587 401	3.419 952	7.368 063
5	25	125	2.236 068	7.071 068	1.709 976	3.684 031	7.937 005
6	36	216	2.449 490	7.745 967	1.817 121	3.914 868	8.434 327
7	49	343	2.645 751	8.366 600	1.912 931	4.121 285	8 879 040
8	64	512	2.828 427	8 944 272	2.000 000	4.308 869	9.283 178
9	81	729	3.000 000	9.486 833	2.080 084	4.481 405	9.654 894
10	100	1 000	3.162 278	10.000 00	2.154 435	4.641 589	10.000 00
11	121	1 331	3.316 625	10 488 09	2.223 980	4.791 420	10.322 80
12	144	1 728	3.464 102	10.954 45	2.289 428	4.932 424	10.626 59
13	169	2 197	3.605 551	11.401 75	2.351 335	5.065 797	10.913 93
14	196	2 744	3 741 657	11.832 16	2.410 142	5.192 494	11.186 89
15	225	3 375	3 872 983	12.247 45	2 466 212	5.313 293	11.447 14
16	256	4 096	4 000 000	12.649 11	2 519 842	5 428 835	11.696 07
17	289	4 913	4.123 106	13.038 40	2.571 282	5.539 658	11.934 83
18	324	5 832	4.242 641	13.416 41	2 620 741	5 646 216	12.164 40
19	361	6 859	4 358 899	13.784 05	2.668 402	5.748 897	12.385 62
20	400	8 000	4.472 136	14.142 14	2.714 418	5.848 035	12.599 21
21	441	9 261	4.582 576	14.491 38	2.758 924	5.943 922	12.805 79
22	484	10 648	4.690 416	14.832 40	2.802 039	6.036 811	13.005 91
23	529	12 167	4.795 832	15.165 75	2.843 867	6.126 926	13.200 06
24	576	13 824	4.898 979	15.491 93	2.884 499	6.214 465	13.388 66
25	625	15 625	5.000 000	15.811 39	2.924 018	6.299 605	13.572 09
26	676	17 576	5.099 020	16.124 52	2.962 496	6.382 504	13.750 69
27	729	19 683	5.196 152	16.431 68	3.000 000	6 463 304	13.924 77
28	784	21 952	5.291 503	16.733 20	3.036 589	6.542 133	14.094 60
29	841	24 389	5.385 165	17.029 39	3.072 317	6.619 106	14.260 43
30	900	27 000	5.477 226	17.320 51	3.107 233	6.694 330	14.422 50
31	961	29 791	5 567 764	17.606 82	3.141 381	6.767 899	14.581 00
32	1 024	32 768	5.656 854	17.888 54	3.174 802	6.839 904	14.736 13
33	1 089	35 937	5.744 563	18.165 90	3.207 534	6.910 423	14.888 06
34	1 156	39 304	5.830 952	18.439 09	3.239 612	6.979 532	15.036 95
35	1 225	42 875	5.916 080	18.708 29	3.271 066	7.047 299	15.182 94
36	1 296	46 656	6 000 000	18.973 67	3.301 927	7.113 787	15.326 19
37	1 369	50 653	6.082 763	19.235 38	3.332 222	7.179 054	15.466 80
38	1 444	54 872	6.164 414	19.493 59	3.361 975	7.243 156	15.604 91
39	1 521	59 319	6.244 998	19.748 42	3.391 211	7.306 144	15.740 61
40	1 600	64 000	6.324 555	20.000 00	3.419 952	7.368 063	15.874 01
41	1 681	68 921	6.403 124	20.248 46	3.448 217	7.428 959	16.005 21
42	1 764	74 088	6.480 741	20.493 90	3.476 027	7.488 872	16.134 29
43	1 849	79 507	6 557 439	20.736 44	3.503 398	7.547 842	16.261 33
44	1 936	85 184	6.633 250	20.976 18	3.530 348	7.605 905	16.386 43
45	2 025	91 125	6.708 204	21.213 20	3.556 893	7.663 094	16.509 64
46	2 116	97 336	6.782 330	21.447 61	3.583 048	7.719 443	16.631 03
47	2 209	103 823	6.855 655	21.679 48	3.608 826	7.774 980	16.750 69
48	2 304	110 592	6.928 203	21 908 90	3.634 241	7.829 735	16 868 65
49	2 401	117 649	7.000 000	22.135 94	3.659 306	7.883 735	16.984 99

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
50	2 500	125 000	7.071 068	22.360 68	3.684 031	7.937 005	17.099 76
51	2 601	132 651	7.141 428	22.583 18	3.708 430	7.989 570	17.213 01
52	2 704	140 608	7.211 103	22.803 51	3.732 511	8.041 452	17.324 78
53	2 809	148 877	7.280 110	23.021 73	3.756 286	8.092 672	17.435 13
54	2 916	157 464	7.348 469	23.237 90	3.779 763	8.143 253	17.544 11
55	3 025	166 375	7.416 198	23.452 08	3.802 952	8.193 213	17.651 74
56	3 136	175 616	7.483 315	23.664 32	3.825 862	8.242 571	17.758 08
57	3 249	185 193	7.549 834	23.874 67	3.848 501	8.291 344	17.863 16
58	3 364	195 112	7.615 773	24.083 19	3.870 877	8.339 551	17.967 02
59	3 481	205 379	7.681 146	24.289 92	3.892 996	8.387 207	18.069 69
60	3 600	216 000	7.745 967	24.494 90	3.914 868	8.434 327	18.171 21
61	3 721	226 981	7.810 250	24.698 18	3.936 497	8.480 926	18.271 60
62	3 844	238 328	7.874 008	24.899 80	3.957 892	8.527 019	18.370 91
63	3 969	250 047	7.937 254	25.099 80	3.979 057	8.572 619	18.469 15
64	4 096	262 144	8.000 000	25.298 22	4.000 000	8.617 739	18.566 36
65	4 225	274 625	8.062 258	25.495 10	4.020 726	8.662 391	18.662 56
66	4 356	287 496	8.124 038	25.690 47	4.041 240	8.706 588	18.757 77
67	4 489	300 763	8.185 353	25.884 36	4.061 548	8.750 340	18.852 04
68	4 624	314 432	8.246 211	26.076 81	4.081 655	8.793 659	18.945 36
69	4 761	328 509	8.306 624	26.267 85	4.101 566	8.836 556	19.037 78
70	4 900	343 000	8.366 600	26.457 51	4.121 285	8.879 040	19.129 31
71	5 041	357 911	8.426 150	26.645 83	4.140 818	8.921 121	19.219 97
72	5 184	373 248	8.485 281	26.832 82	4.160 168	8.962 809	19.309 79
73	5 329	389 017	8.544 004	27.018 51	4.179 339	9.004 113	19.398 77
74	5 476	405 224	8.602 325	27.202 94	4.198 336	9.045 042	19.486 95
75	5 625	421 875	8.660 254	27.386 13	4.217 163	9.085 603	19.574 34
76	5 776	438 976	8.717 798	27.568 10	4.235 824	9.125 805	19.660 95
77	5 929	456 533	8.774 964	27.748 87	4.254 321	9.165 656	19.746 81
78	6 084	474 552	8.831 761	27.928 48	4.272 659	9.205 164	19.831 92
79	6 241	493 039	8.888 194	28.106 94	4.290 840	9.244 335	19.916 32
80	6 400	512 000	8.944 272	28.284 27	4.308 869	9.283 178	20.000 00
81	6 561	531 441	9.000 000	28.460 50	4.326 749	9.321 698	20.082 99
82	6 724	551 368	9.055 385	28.635 64	4.344 481	9.359 902	20.165 30
83	6 889	571 787	9.110 434	28.809 72	4.362 071	9.397 796	20.246 94
84	7 056	592 704	9.165 151	28.982 75	4.379 519	9.435 388	20.327 93
85	7 225	614 125	9.219 544	29.154 76	4.396 830	9.472 682	20.408 28
86	7 396	636 056	9.273 618	29.325 76	4.414 005	9.509 685	20.488 00
87	7 569	658 503	9.327 379	29.495 76	4.431 048	9.546 403	20.567 10
88	7 744	681 472	9.380 832	29.664 79	4.447 960	9.582 840	20.645 60
89	7 921	704 969	9.433 981	29.832 87	4.464 745	9.619 002	20.723 51
90	8 100	729 000	9.486 833	30.000 00	4.481 405	9.654 894	20.800 84
91	8 281	753 571	9.539 392	30.166 21	4.497 941	9.690 521	20.877 59
92	8 464	778 688	9.591 663	30.331 50	4.514 357	9.725 888	20.953 79
93	8 649	804 357	9.643 651	30.495 90	4.530 655	9.761 000	21.029 44
94	8 836	830 584	9.695 360	30.659 42	4.546 836	9.795 861	21.104 54
95	9 025	857 375	9.746 794	30.822 07	4.562 903	9.830 476	21.179 12
96	9 216	884 736	9.797 959	30.983 87	4.578 857	9.864 848	21.253 17
97	9 409	912 673	9.848 858	31.144 82	4.594 701	9.898 983	21.326 71
98	9 604	941 192	9.899 495	31.304 95	4.610 436	9.932 884	21.399 75
99	9 801	970 299	9.949 874	31.464 27	4.626 065	9.966 555	21.472 29

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
100	10 000	1 000 000	10.000 00	31.622 78	4.641 589	10.000 00	21.544 35
101	10 201	1 030 301	10.049 88	31.780 50	4.657 010	10.033 22	21.615 92
102	10 404	1 061 208	10.099 50	31.937 44	4.672 329	10.066 23	21.687 03
103	10 609	1 092 727	10.148 89	32.093 61	4.687 548	10.099 02	21.757 67
104	10 816	1 124 864	10.198 04	32.249 03	4.702 669	10.131 59	21.827 86
105	11 025	1 157 625	10.246 95	32.403 70	4.717 694	10.163 96	21.897 60
106	11 236	1 191 016	10.295 63	32.557 64	4.732 623	10.196 13	21.966 89
107	11 449	1 225 043	10.344 08	32.710 85	4.747 459	10.228 09	22.035 75
108	11 664	1 259 712	10.392 30	32.863 35	4.762 203	10.259 86	22.104 19
109	11 881	1 295 029	10.440 31	33.015 15	4.776 856	10.291 42	22.172 20
110	12 100	1 331 000	10.488 09	33.166 25	4.791 420	10.322 80	22.239 80
111	12 321	1 367 631	10.535 65	33.316 66	4.805 896	10.353 99	22.306 99
112	12 544	1 404 928	10.583 01	33.466 40	4.820 285	10.384 99	22.373 78
113	12 769	1 442 897	10.630 15	33.615 47	4.834 588	10.415 80	22.440 17
114	12 996	1 481 544	10.677 08	33.763 89	4.848 808	10.446 44	22.506 17
115	13 225	1 520 875	10.723 81	33.911 65	4.862 944	10.476 90	22.571 79
116	13 456	1 560 896	10.770 33	34.058 77	4.876 999	10.507 18	22.637 02
117	13 689	1 601 613	10.816 65	34.205 26	4.890 973	10.537 28	22.701 89
118	13 924	1 643 032	10.862 78	34.351 13	4.904 868	10.567 22	22.766 38
119	14 161	1 685 159	10.908 71	34.496 38	4.918 685	10.596 99	22.830 51
120	14 400	1 728 000	10.954 45	34.641 02	4.932 424	10.626 59	22.894 28
121	14 641	1 771 561	11.000 00	34.785 05	4.946 087	10.656 02	22.957 70
122	14 884	1 815 848	11.045 36	34.928 50	4.959 676	10.685 30	23.020 78
123	15 129	1 860 867	11.090 54	35.071 36	4.973 190	10.714 41	23.083 50
124	15 376	1 906 624	11.135 53	35.213 63	4.986 631	10.743 37	23.145 89
125	15 625	1 953 125	11.180 34	35.355 34	5.000 000	10.772 17	23.207 94
126	15 876	2 000 376	11.224 97	35.496 48	5.013 298	10.800 82	23.269 67
127	16 129	2 048 383	11.269 43	35.637 06	5.026 526	10.829 32	23.331 07
128	16 384	2 097 152	11.313 71	35.777 09	5.039 684	10.857 67	23.392 14
129	16 641	2 146 689	11.357 82	35.916 57	5.052 774	10.885 87	23.452 90
130	16 900	2 197 000	11.401 75	36.055 51	5.065 797	10.913 93	23.513 35
131	17 161	2 248 091	11.445 52	36.193 92	5.078 753	10.941 84	23.573 48
132	17 424	2 299 968	11.489 13	36.331 80	5.091 643	10.969 61	23.633 32
133	17 689	2 352 637	11.532 56	36.469 17	5.104 469	10.997 24	23.692 85
134	17 956	2 406 104	11.575 84	36.606 01	5.117 230	11.024 74	23.752 08
135	18 225	2 460 375	11.618 95	36.742 35	5.129 928	11.052 09	23.811 02
136	18 496	2 515 456	11.661 90	36.878 18	5.142 563	11.079 32	23.869 66
137	18 769	2 571 353	11.704 70	37.013 51	5.155 137	11.106 41	23.928 03
138	19 044	2 628 072	11.747 34	37.148 35	5.167 649	11.133 36	23.986 10
139	19 321	2 685 619	11.789 83	37.282 70	5.180 101	11.160 19	24.043 90
140	19 600	2 744 000	11.832 16	37.416 57	5.192 494	11.186 89	24.101 42
141	19 881	2 803 221	11.874 34	37.549 97	5.204 828	11.213 46	24.158 67
142	20 164	2 863 288	11.916 38	37.682 89	5.217 103	11.239 91	24.215 65
143	20 449	2 924 207	11.958 26	37.815 34	5.229 322	11.266 23	24.272 36
144	20 736	2 985 984	12.000 00	37.947 33	5.241 483	11.292 43	24.328 81
145	21 025	3 048 625	12.041 59	38.078 87	5.253 588	11.318 51	24.384 99
146	21 316	3 112 136	12.083 05	38.209 95	5.265 637	11.344 47	24.440 92
147	21 609	3 176 523	12.124 36	38.340 58	5.277 632	11.370 31	24.496 60
148	21 904	3 241 792	12.165 53	38.470 77	5.289 572	11.396 04	24.552 02
149	22 201	3 307 949	12.206 56	38.600 52	5.301 459	11.421 65	24.607 19

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
150	22 500	3 375 000	12.247 45	38.729 83	5.313 293	11.447 14	24.662 12
151	22 801	3 442 951	12.288 21	38.858 72	5.325 074	11.472 52	24.716 80
152	23 104	3 511 808	12.328 83	38.987 18	5.336 803	11.497 79	24.771 25
153	23 409	3 581 577	12.369 32	39.115 21	5.348 481	11.522 95	24.825 45
154	23 716	3 652 264	12.409 67	39.242 83	5.360 108	11.548 00	24.879 42
155	24 025	3 723 875	12.449 90	39.370 04	5.371 685	11.572 95	24.933 15
156	24 336	3 796 416	12.490 00	39.496 84	5.383 213	11.597 78	24.986 66
157	24 649	3 869 893	12.529 96	39.623 23	5.394 691	11.622 51	25.039 94
158	24 964	3 944 312	12.569 81	39.749 21	5.406 120	11.647 13	25.092 99
159	25 281	4 019 679	12.609 52	39.874 80	5.417 502	11.671 65	25.145 81
160	25 600	4 096 000	12.649 11	40.000 00	5.428 835	11.696 07	25.198 42
161	25 921	4 173 281	12.688 58	40.124 81	5.440 122	11.720 39	25.250 81
162	26 244	4 251 528	12.727 92	40.249 22	5.451 362	11.744 60	25.302 98
163	26 569	4 330 747	12.767 15	40.373 26	5.462 556	11.768 72	25.354 94
164	26 896	4 410 944	12.806 25	40.496 91	5.473 704	11.792 74	25.406 68
165	27 225	4 492 125	12.845 23	40.620 19	5.484 807	11.816 66	25.458 22
166	27 556	4 574 296	12.884 10	40.743 10	5.495 865	11.840 48	25.509 54
167	27 889	4 657 463	12.922 85	40.865 63	5.506 878	11.864 21	25.560 67
168	28 224	4 741 632	12.961 48	40.987 80	5.517 848	11.887 84	25.611 58
169	28 561	4 826 809	13.000 00	41.109 61	5.528 775	11.911 38	25.662 30
170	28 900	4 913 000	13.038 40	41.231 06	5.539 658	11.934 83	25.712 82
171	29 241	5 000 211	13.076 70	41.352 15	5.550 499	11.958 19	25.763 13
172	29 584	5 088 448	13.114 88	41.472 88	5.561 298	11.981 45	25.813 26
173	29 929	5 177 717	13.152 95	41.593 27	5.572 055	12.004 63	25.863 19
174	30 276	5 268 024	13.190 91	41.713 31	5.582 770	12.027 71	25.912 92
175	30 625	5 359 375	13.228 76	41.833 00	5.593 445	12.050 71	25.962 47
176	30 976	5 451 776	13.266 50	41.952 35	5.604 079	12.073 62	26.011 83
177	31 329	5 545 233	13.304 13	42.071 37	5.614 672	12.096 45	26.061 00
178	31 684	5 639 752	13.341 66	42.190 05	5.625 226	12.119 18	26.109 99
179	32 041	5 735 339	13.379 09	42.308 39	5.635 741	12.141 84	26.158 79
180	32 400	5 832 000	13.416 41	42.426 41	5.646 216	12.164 40	26.207 41
181	32 761	5 929 741	13.453 62	42.544 09	5.656 653	12.186 89	26.255 86
182	33 124	6 028 568	13.490 74	42.661 46	5.667 051	12.209 29	26.304 12
183	33 489	6 128 487	13.527 75	42.778 50	5.677 411	12.231 61	26.352 21
184	33 856	6 229 504	13.564 66	42.895 22	5.687 734	12.253 85	26.400 12
185	34 225	6 331 625	13.601 47	43.011 63	5.698 019	12.276 01	26.447 86
186	34 596	6 434 856	13.638 18	43.127 72	5.708 267	12.298 09	26.495 43
187	34 969	6 539 203	13.674 79	43.243 50	5.718 479	12.320 09	26.542 83
188	35 344	6 644 672	13.711 31	43.358 97	5.728 654	12.342 01	26.590 06
189	35 721	6 751 269	13.747 73	43.474 13	5.738 794	12.363 86	26.637 12
190	36 100	6 859 000	13.784 05	43.588 99	5.748 897	12.385 62	26.684 02
191	36 481	6 967 871	13.820 27	43.703 55	5.758 965	12.407 31	26.730 75
192	36 864	7 077 888	13.856 41	43.817 80	5.768 998	12.428 93	26.777 32
193	37 249	7 189 057	13.892 44	43.931 77	5.778 997	12.450 47	26.823 73
194	37 636	7 301 384	13.928 39	44.045 43	5.788 960	12.471 94	26.869 97
195	38 025	7 414 875	13.964 24	44.158 80	5.798 890	12.493 33	26.916 06
196	38 416	7 529 536	14.000 00	44.271 89	5.808 786	12.514 65	26.961 99
197	38 809	7 645 373	14.035 67	44.384 68	5.818 648	12.535 90	27.007 77
198	39 204	7 762 392	14.071 25	44.497 19	5.828 477	12.557 07	27.053 39
199	39 601	7 880 599	14.106 74	44.609 42	5.838 272	12.578 18	27.098 86

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
200	40 000	8 000 000	14.142 14	44.721 36	5.848 035	12.599 21	27.144 18
201	40 401	8 120 601	14.177 45	44.833 02	5.857 766	12.620 17	27.189 34
202	40 804	8 242 408	14.212 67	44.944 41	5.867 464	12.641 07	27.234 36
203	41 209	8 365 427	14.247 81	45.055 52	5.877 131	12.661 89	27.279 22
204	41 616	8 489 664	14.282 86	45.166 36	5.886 765	12.682 65	27.323 94
205	42 025	8 615 125	14.317 82	45.276 93	5.896 369	12.703 34	27.368 52
206	42 436	8 741 816	14.352 70	45.387 22	5.905 941	12.723 96	27.412 95
207	42 849	8 869 743	14.387 49	45.497 25	5.915 482	12.744 52	27.457 23
208	43 264	8 998 912	14.422 21	45.607 02	5.924 992	12.765 01	27.501 38
209	43 681	9 129 329	14.456 83	45.716 52	5.934 472	12.785 43	27.545 38
210	44 100	9 261 000	14.491 38	45.825 76	5.943 922	12.805 79	27.589 24
211	44 521	9 393 931	14.525 84	45.934 74	5.953 342	12.826 09	27.632 96
212	44 944	9 528 128	14.560 22	46.043 46	5.962 732	12.846 32	27.676 55
213	45 369	9 663 597	14.594 52	46.151 92	5.972 093	12.866 48	27.720 00
214	45 796	9 800 344	14.628 74	46.260 13	5.981 424	12.886 59	27.763 31
215	46 225	9 938 375	14.662 88	46.368 09	5.990 726	12.906 63	27.806 49
216	46 656	10 077 696	14.696 94	46.475 80	6.000 000	12.926 61	27.849 53
217	47 089	10 218 313	14.730 92	46.583 26	6.009 245	12.946 53	27.892 44
218	47 524	10 360 232	14.764 82	46.690 47	6.018 462	12.966 38	27.935 22
219	47 961	10 503 459	14.798 65	46.797 44	6.027 650	12.986 18	27.977 87
220	48 400	10 648 000	14.832 40	46.904 16	6.036 811	13.005 91	28.020 39
221	48 841	10 793 861	14.866 07	47.010 64	6.045 944	13.025 59	28.062 78
222	49 284	10 941 048	14.899 66	47.116 88	6.055 049	13.045 21	28.105 05
223	49 729	11 089 567	14.933 18	47.222 88	6.064 127	13.064 77	28.147 18
224	50 176	11 239 424	14.966 63	47.328 64	6.073 178	13.084 27	28.189 19
225	50 625	11 390 625	15.000 00	47.434 16	6.082 202	13.103 71	28.231 08
226	51 076	11 543 176	15.033 30	47.539 46	6.091 199	13.123 09	28.272 84
227	51 529	11 697 083	15.066 52	47.644 52	6.100 170	13.142 42	28.314 48
228	51 984	11 852 352	15.099 67	47.749 35	6.109 115	13.161 69	28.356 00
229	52 441	12 008 989	15.132 75	47.853 94	6.118 033	13.180 90	28.397 39
230	52 900	12 167 000	15.165 75	47.958 32	6.126 926	13.200 06	28.438 67
231	53 361	12 326 391	15.198 68	48.062 46	6.135 792	13.219 16	28.479 83
232	53 824	12 487 168	15.231 55	48.166 38	6.144 634	13.238 21	28.520 86
233	54 289	12 649 337	15.264 34	48.270 07	6.153 449	13.257 21	28.561 78
234	54 756	12 812 904	15.297 06	48.373 55	6.162 240	13.276 14	28.602 59
235	55 225	12 977 875	15.329 71	48.476 80	6.171 006	13.295 03	28.643 27
236	55 696	13 144 256	15.362 29	48.579 83	6.179 747	13.313 86	28.683 84
237	56 169	13 312 053	15.394 80	48.682 65	6.188 463	13.332 64	28.724 30
238	56 644	13 481 272	15.427 25	48.785 24	6.197 154	13.351 36	28.764 64
239	57 121	13 651 919	15.459 62	48.887 63	6.205 822	13.370 04	28.804 87
240	57 600	13 824 000	15.491 93	48.989 79	6.214 465	13.388 66	28.844 99
241	58 081	13 997 521	15.524 17	49.091 75	6.223 084	13.407 23	28.885 00
242	58 564	14 172 488	15.556 35	49.193 50	6.231 680	13.425 75	28.924 89
243	59 049	14 348 907	15.588 46	49.295 03	6 240 251	13.444 21	28.964 68
244	59 536	14 526 784	15.620 50	49.396 36	6.248 800	13.462 63	29.004 36
245	60 025	14 706 125	15.652 48	49.497 47	6.257 325	13.481 00	29.043 93
246	60 516	14 886 936	15.684 39	49.598 39	6.265 827	13.499 31	29.083 39
247	61 009	15 069 223	15.716 23	49.699 09	6.274 305	13.517 58	29.122 75
248	61 504	15 252 992	15.748 02	49.799 60	6.282 761	13.535 80	29.161 99
249	62 001	15 438 249	15.779 73	49.899 90	6.291 195	13.553 97	29.201 14

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
250	62 500	15 625 000	15.811 39	50.000 00	6.299 605	13.572 09	29.240 18
251	63 001	15 813 251	15.842 98	50.099 90	6.307 994	13.590 16	29.279 11
252	63 504	16 003 008	15.874 51	50.199 60	6.316 360	13.608 18	29.317 94
253	64 009	16 194 277	15.905 97	50.299 11	6.324 704	13.626 16	29.356 67
254	64 516	16 387 064	15.937 38	50.398 41	6.333 026	13.644 09	29.395 30
255	65 025	16 581 375	15.968 72	50.497 52	6.341 326	13.661 97	29.433 83
256	65 536	16 777 216	16.000 00	50.596 44	6.349 604	13.679 81	29.472 25
257	66 049	16 974 593	16.031 22	50.695 17	6.357 861	13.697 60	29.510 58
258	66 564	17 173 512	16.062 38	50.793 70	6.366 097	13.715 34	29.548 80
259	67 081	17 373 979	16.093 48	50.892 04	6.374 311	13.733 04	29.586 93
260	67 600	17 576 000	16.124 52	50.990 20	6.382 504	13.750 69	29.624 96
261	68 121	17 779 581	16.155 49	51.088 16	6.390 677	13.768 30	29.662 89
262	68 644	17 984 728	16.186 41	51.185 94	6.398 828	13.785 86	29.700 73
263	69 169	18 191 447	16.217 27	51.283 53	6.406 959	13.803 37	29.738 47
264	69 696	18 399 744	16.248 08	51.380 93	6.415 069	13.820 85	29.776 11
265	70 225	18 609 625	16.278 82	51.478 15	6.423 158	13.838 28	29.813 66
266	70 756	18 821 096	16.309 51	51.575 19	6.431 228	13.855 66	29.851 11
267	71 289	19 034 163	16.340 13	51.672 04	6.439 277	13.873 00	29.888 47
268	71 824	19 248 832	16.370 71	51.768 72	6.447 306	13.890 30	29.925 74
269	72 361	19 465 109	16.401 22	51.865 21	6.455 315	13.907 55	29.962 92
270	72 900	19 683 000	16.431 68	51.961 52	6.463 304	13.924 77	30.000 00
271	73 441	19 902 511	16.462 08	52.057 66	6.471 274	13.941 94	30.036 99
272	73 984	20 123 648	16.492 42	52.153 62	6.479 224	13.959 06	30.073 89
273	74 529	20 346 417	16.522 71	52.249 40	6.487 154	13.976 15	30.110 70
274	75 076	20 570 824	16.552 95	52.345 01	6.495 065	13.993 19	30.147 42
275	75 625	20 796 875	16.583 12	52.440 44	6.502 957	14.010 20	30.184 05
276	76 176	21 024 576	16.613 25	52.535 70	6.510 830	14.027 16	30.220 60
277	76 729	21 253 933	16.643 32	52.630 79	6.518 684	14.044 08	30.257 05
278	77 284	21 484 952	16.673 33	52.725 71	6.526 519	14.060 96	30.293 42
279	77 841	21 717 639	16.703 29	52.820 45	6.534 335	14.077 80	30.329 70
280	78 400	21 952 000	16.733 20	52.915 03	6.542 133	14.094 60	30.365 89
281	78 961	22 188 041	16.763 05	53.009 43	6.549 912	14.111 36	30.402 00
282	79 524	22 425 768	16.792 86	53.103 67	6.557 672	14.128 08	30.438 02
283	80 089	22 665 187	16.822 60	53.197 74	6.565 414	14.144 76	30.473 95
284	80 656	22 906 304	16.852 30	53.291 65	6.573 138	14.161 40	30.509 81
285	81 225	23 149 125	16.881 94	53.385 39	6.580 844	14.178 00	30.545 57
286	81 796	23 393 656	16.911 53	53.478 97	6.588 532	14.194 56	30.581 26
287	82 369	23 639 903	16.941 07	53.572 38	6.596 202	14.211 09	30.616 86
288	82 944	23 887 872	16.970 56	53.665 63	6.603 854	14.227 57	30.652 38
289	83 521	24 137 569	17.000 00	53.758 72	6.611 489	14.244 02	30.687 81
290	84 100	24 389 000	17.029 39	53.851 65	6.619 106	14.260 43	30.723 17
291	84 681	24 642 171	17.058 72	53.944 42	6.626 705	14.276 80	30.758 44
292	85 264	24 897 088	17.088 01	54.037 02	6.634 287	14.293 14	30.793 63
293	85 849	25 153 757	17.117 24	54.129 47	6.641 852	14.309 44	30.828 75
294	86 436	25 412 184	17.146 43	54.221 77	6.649 400	14.325 70	30.863 78
295	87 025	25 672 375	17.175 56	54.313 90	6.656 930	14.341 92	30.898 73
296	87 616	25 934 336	17.204 65	54.405 88	6.664 444	14.358 11	30.933 61
297	88 209	26 198 073	17.233 69	54.497 71	6.671 940	14.374 26	30.968 40
298	88 804	26 463 592	17.262 68	54.589 38	6.679 420	14.390 37	31.003 12
299	89 401	26 730 899	17.291 62	54.680 89	6.686 883	14.406 45	31.037 76

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
300	90 000	27 000 000	17.320 51	54.772 26	6.694 330	14.422 50	31.072 33
301	90 601	27 270 901	17.349 35	54.863 47	6.701 759	14.438 50	31.106 81
302	91 204	27 543 608	17.378 15	54.954 53	6.709 173	14.454 47	31.141 22
303	91 809	27 818 127	17.406 90	55.045 44	6.716 570	14.470 41	31.175 56
304	92 416	28 094 464	17.435 60	55.136 20	6.723 951	14.486 31	31.209 82
305	93 025	28 372 625	17.464 25	55.226 81	6.731 315	14.502 18	31.244 00
306	93 636	28 652 616	17.492 86	55.317 27	6.738 664	14.518 01	31.278 11
307	94 249	28 934 443	17.521 42	55.407 58	6.745 997	14.533 81	31.312 14
308	94 864	29 218 112	17.549 93	55.497 75	6.753 313	14.549 57	31.346 10
309	95 481	29 503 629	17.578 40	55.587 77	6.760 614	14.565 30	31.379 99
310	96 100	29 791 000	17.606 82	55.677 64	6.767 899	14.581 00	31.413 81
311	96 721	30 080 231	17.635 19	55.767 37	6.775 169	14.596 66	31.447 55
312	97 344	30 371 328	17.663 52	55.856 96	6.782 423	14.612 29	31.481 22
313	97 969	30 664 297	17.691 81	55.946 40	6.789 661	14.627 88	31.514 82
314	98 596	30 959 144	17.720 05	56.035 70	6.796 884	14.643 44	31.548 34
315	99 225	31 255 875	17.748 24	56.124 86	6.804 092	14.658 97	31.581 80
316	99 856	31 554 496	17.776 39	56.213 88	6.811 285	14.674 47	31.615 18
317	100 489	31 855 013	17.804 49	56.302 75	6.818 462	14.689 93	31.648 50
318	101 124	32 157 432	17.832 55	56.391 49	6.825 624	14.705 36	31.681 74
319	101 761	32 461 759	17.860 57	56.480 08	6.832 771	14.720 76	31.714 92
320	102 400	32 768 000	17.888 54	56.568 54	6.839 904	14.736 13	31.748 02
321	103 041	33 076 161	17.916 47	56.656 86	6.847 021	14.751 46	31.781 06
322	103 684	33 386 248	17.944 36	56.745 04	6.854 124	14.766 76	31.814 03
323	104 329	33 698 267	17.972 20	56.833 09	6.861 212	14.782 03	31.846 93
324	104 976	34 012 224	18.000 00	56.921 00	6.868 285	14.797 27	31.879 76
325	105 625	34 328 125	18.027 76	57.008 77	6.875 344	14.812 48	31.912 52
326	106 276	34 645 976	18.055 47	57.096 41	6.882 389	14.827 66	31.945 22
327	106 929	34 965 783	18.083 14	57.183 91	6.889 419	14.842 80	31.977 85
328	107 584	35 287 552	18.110 77	57.271 28	6.896 434	14.857 92	32.010 41
329	108 241	35 611 289	18.138 36	57.358 52	6.903 436	14.873 00	32.042 91
330	108 900	35 937 000	18.165 90	57.445 63	6.910 423	14.888 06	32.075 34
331	109 561	36 264 691	18.193 41	57.532 60	6.917 396	14.903 08	32.107 71
332	110 224	36 594 368	18.220 87	57.619 44	6.924 356	14.918 07	32.140 01
333	110 889	36 926 037	18.248 29	57.706 15	6.931 301	14.933 03	32.172 25
334	111 556	37 259 704	18.275 67	57.792 73	6.938 232	14.947 97	32.204 42
335	112 225	37 595 375	18.303 01	57.879 18	6.945 150	14.962 87	32.236 53
336	112 896	37 933 056	18.330 30	57.965 51	6.952 053	14.977 74	32.268 57
337	113 569	38 272 753	18.357 56	58.051 70	6.958 943	14.992 59	32.300 55
338	114 244	38 614 472	18.384 78	58.137 77	6.965 820	15.007 40	32.332 47
339	114 921	38 958 219	18.411 95	58.223 71	6.972 683	15.022 19	32.364 33
340	115 600	39 304 000	18.439 09	58.309 52	6.979 532	15.036 95	32.396 12
341	116 281	39 651 821	18.466 19	58.395 21	6.986 368	15.051 67	32.427 85
342	116 964	40 001 688	18.493 24	58.480 77	6.993 191	15.066 37	32.459 52
343	117 649	40 353 607	18.520 26	58.566 20	7.000 000	15.081 04	32.491 12
344	118 336	40 707 584	18.547 24	58.651 51	7.006 796	15.095 68	32.522 67
345	119 025	41 063 625	18.574 18	58.736 70	7.013 579	15.110 30	32.554 15
346	119 716	41 421 736	18.601 08	58.821 76	7.020 349	15.124 88	32.585 57
347	120 409	41 781 923	18.627 94	58.906 71	7.027 106	15.139 44	32.616 94
348	121 104	42 144 192	18.654 76	58.991 52	7.033 850	15.153 97	32.648 24
349	121 801	42 508 549	18.681 54	59.076 22	7.040 581	15.168 47	32.679 48

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
350	122 500	42 875 000	18.708 29	59.160 80	7.047 299	15.182 94	32.710 66
351	123 201	43 243 551	18.734 99	59.245 25	7.054 004	15.197 39	32.741 79
352	123 904	43 614 208	18.761 66	59.329 59	7.060 697	15.211 81	32.772 85
353	124 609	43 986 977	18.788 29	59.413 80	7.067 377	15.226 20	32.803 86
354	125 316	44 361 864	18.814 89	59.497 90	7.074 044	15.240 57	32.834 80
355	126 025	44 738 875	18.841 44	59.581 88	7.080 699	15.254 90	32.865 69
356	126 736	45 118 016	18.867 96	59.665 74	7.087 341	15.269 21	32.896 52
357	127 449	45 499 293	18.894 44	59.749 48	7.093 971	15.283 50	32.927 30
358	128 164	45 882 712	18.920 89	59.833 10	7.100 588	15.297 75	32.958 01
359	128 881	46 268 279	18.947 30	59.916 61	7.107 194	15.311 98	32.988 67
360	129 600	46 656 000	18.973 67	60.000 00	7.113 787	15.326 19	33.019 27
361	130 321	47 045 881	19.000 00	60.083 28	7.120 367	15.340 37	33.049 82
362	131 044	47 437 928	19.026 30	60.166 44	7.126 936	15.354 52	33.080 31
363	131 769	47 832 147	19.052 56	60.249 48	7.133 492	15.368 64	33.110 74
364	132 496	48 228 544	19.078 78	60.332 41	7.140 037	15.382 73	33.141 12
365	133 225	48 627 125	19.104 97	60.415 23	7.146 569	15.396 82	33.171 44
366	133 956	49 027 896	19.131 13	60.497 93	7.153 090	15.410 87	33.201 70
367	134 689	49 430 863	19.157 24	60.580 52	7.159 599	15.424 89	33.231 91
368	135 424	49 836 032	19.183 33	60.663 00	7.166 096	15.438 89	33.262 07
369	136 161	50 243 409	19.209 37	60.745 37	7.172 581	15.452 86	33.292 17
370	136 900	50 653 000	19.235 38	60.827 63	7.179 054	15.466 80	33.322 22
371	137 641	51 064 811	19.261 36	60.909 77	7.185 516	15.480 73	33.352 21
372	138 384	51 478 848	19.287 30	60.991 80	7.191 966	15.494 62	33.382 15
373	139 129	51 895 117	19.313 21	61.073 73	7.198 405	15.508 49	33.412 04
374	139 876	52 313 624	19.339 08	61.155 54	7.204 832	15.522 34	33.441 87
375	140 625	52 734 375	19.364 92	61.237 24	7.211 248	15.536 16	33.471 65
376	141 376	53 157 376	19.390 72	61.318 84	7.217 652	15.549 96	33.501 37
377	142 129	53 582 633	19.416 49	61.400 33	7.224 045	15.563 73	33.531 05
378	142 884	54 010 152	19.442 22	61.481 70	7.230 427	15.577 48	33.560 67
379	143 641	54 439 939	19.467 92	61.562 98	7.236 797	15.591 21	33.590 24
380	144 400	54 872 000	19.493 59	61.644 14	7.243 156	15.604 91	33.619 75
381	145 161	55 306 341	19.519 22	61.725 20	7.249 505	15.618 58	33.649 22
382	145 924	55 742 968	19.544 82	61.806 15	7.255 842	15.632 24	33.678 63
383	146 689	56 181 887	19.570 39	61.886 99	7.262 167	15.645 87	33.708 00
384	147 456	56 623 104	19.595 92	61.967 73	7.268 482	15.659 47	33.737 31
385	148 225	57 066 625	19.621 42	62.048 37	7.274 786	15.673 05	33.766 57
386	148 996	57 512 456	19.646 88	62.128 90	7.281 079	15.686 61	33.795 78
387	149 769	57 960 603	19.672 32	62.209 32	7.287 362	15.700 14	33.824 94
388	150 544	58 411 072	19.697 72	62.289 65	7.293 633	15.713 66	33.854 05
389	151 321	58 863 869	19.723 08	62.369 86	7.299 894	15.727 14	33.883 10
390	152 100	59 319 000	19.748 42	62.449 98	7.306 144	15.740 61	33.912 11
391	152 881	59 776 471	19.773 72	62.529 99	7.312 383	15.754 05	33.941 07
392	153 664	60 236 288	19.798 99	62.609 90	7.318 611	15.767 47	33.969 99
393	154 449	60 698 457	19.824 23	62.689 71	7.324 829	15.780 87	33.998 85
394	155 236	61 162 984	19.849 43	62.769 42	7.331 037	15.794 24	34.027 66
395	156 025	61 629 875	19.874 61	62.849 03	7.337 234	15.807 59	34.056 42
396	156 816	62 099 136	19.899 75	62.928 53	7.343 420	15.820 92	34.085 14
397	157 609	62 570 773	19.924 86	63.007 94	7.349 597	15.834 23	34.113 81
398	158 404	63 044 792	19.949 94	63.087 24	7.355 762	15.847 51	34.142 42
399	159 201	63 521 199	19.974 98	63.166 45	7.361 918	15.860 77	34.171 00

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
400	160 000	64 000 000	20.000 00	63.245 55	7.368 063	15.874 01	34.199 52
401	160 801	64 481 201	20.024 98	63.324 56	7.374 198	15.887 23	34.227 99
402	161 604	64 964 808	20.049 94	63.403 47	7.380 323	15.900 42	34.256 42
403	162 409	65 450 827	20.074 86	63.482 28	7.386 437	15.913 60	34.284 80
404	163 216	65 939 264	20.099 75	63.560 99	7.392 542	15.926 75	34.313 14
405	164 025	66 430 125	20.124 61	63.639 61	7.398 636	15.939 88	34.341 43
406	164 836	66 923 416	20.149 44	63.718 13	7.404 721	15.952 99	34.369 67
407	165 649	67 419 143	20.174 24	63.796 55	7.410 795	15.966 07	34.397 86
408	166 464	67 917 312	20.199 01	63.874 88	7.416 860	15.979 14	34.426 01
409	167 281	68 417 929	20.223 75	63.953 11	7.422 914	15.992 18	34.454 12
410	168 100	68 921 000	20.248 46	64.031 24	7.428 959	16.005 21	34.482 17
411	168 921	69 426 531	20.273 13	64.109 28	7.434 994	16.018 21	34.510 18
412	169 744	69 934 528	20.297 78	64.187 23	7.441 019	16.031 19	34.538 15
413	170 569	70 444 997	20.322 40	64.265 08	7.447 034	16.044 15	34.566 07
414	171 396	70 957 944	20.346 99	64.342 83	7.453 040	16.057 09	34.593 95
415	172 225	71 473 375	20.371 55	64.420 49	7.459 036	16.070 01	34.621 78
416	173 056	71 991 296	20.396 08	64.498 06	7.465 022	16.082 90	34.649 56
417	173 889	72 511 713	20.420 58	64.575 54	7.470 999	16.095 78	34.677 31
418	174 724	73 034 632	20.445 05	64.652 92	7.476 966	16.108 64	34.705 00
419	175 561	73 560 059	20.469 49	64.730 21	7.482 924	16.121 47	34.732 66
420	176 400	74 088 000	20.493 90	64.807 41	7.488 872	16.134 29	34.760 27
421	177 241	74 618 461	20.518 28	64.384 51	7.494 811	16.147 08	34.787 83
422	178 084	75 151 448	20.542 64	64.961 53	7.500 741	16.159 86	34.815 35
423	178 929	75 686 967	20.566 96	65.038 45	7.506 661	16.172 61	34.842 83
424	179 776	76 225 024	20.591 26	65.115 28	7.512 572	16.185 34	34.870 27
425	180 625	76 765 625	20.615 53	65.192 02	7.518 473	16.198 06	34.897 66
426	181 476	77 308 776	20.639 77	65.268 68	7.524 365	16.210 75	34.925 01
427	182 329	77 854 483	20.663 98	65.345 24	7.530 248	16.223 43	34.952 32
428	183 184	78 402 752	20.688 16	65.421 71	7.536 122	16.236 08	34.979 58
429	164 041	78 953 589	20.712 32	65.498 09	7.541 987	16.248 72	35.006 80
430	184 900	79 507 000	20.736 44	65.574 39	7.547 842	16.261 33	35.033 98
431	185 761	80 062 991	20.760 54	65.650 59	7.553 689	16.273 93	35.061 12
432	186 624	80 621 568	20.784 61	65.726 71	7.559 526	16.286 51	35.088 21
433	187 489	81 182 737	20.808 65	65.802 74	7.565 355	16.299 06	35.115 27
434	188 356	81 746 504	20.832 67	65.878 68	7.571 174	16.311 60	35.142 28
435	189 225	82 312 875	20.856 65	65.954 53	7.576 985	16.324 12	35.169 25
436	190 096	82 881 856	20.880 61	66.030 30	7.582 787	16.336 62	35.196 18
437	190 969	83 453 453	20.904 54	66.105 98	7.588 579	16.349 10	35.223 07
438	191 844	84 027 672	20.928 45	66.181 57	7.594 363	16.361 56	35.249 91
439	192 721	84 604 519	20.952 33	66.257 08	7.600 139	16.374 00	35.276 72
440	193 600	85 184 000	20.976 18	66.332 50	7.605 905	16.386 43	35.303 48
441	194 481	85 766 121	21.000 00	66.407 83	7.611 663	16.398 83	35.330 21
442	195 364	86 350 888	21.023 80	66.483 08	7.617 412	16.411 22	35.356 89
443	196 249	86 938 307	21.047 57	66.558 25	7.623 152	16.423 58	35.383 54
444	197 136	87 528 384	21.071 31	66.633 32	7.628 884	16.435 93	35.410 14
445	198 025	88 121 125	21.095 02	66.708 32	7.634 607	16.448 26	35.436 71
446	198 916	88 716 536	21.118 71	66.783 23	7.640 321	16.460 57	35.463 23
447	199 809	89 314 623	21.142 37	66.858 06	7.646 027	16.472 87	35.489 71
448	200 704	89 915 392	21.166 01	66.932 80	7.651 725	16.485 14	35.516 16
449	201 601	90 518 849	21.189 62	67.007 46	7.657 414	16.497 40	35.542 57

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
450	202 500	91 125 000	21.213 20	67.082 04	7.663 094	16.509 64	35.568 93
451	203 401	91 733 851	21.236 76	67.156 53	7.668 766	16.521 86	35.595 26
452	204 304	92 345 408	21.260 29	67.230 95	7.674 430	16.534 06	35.621 55
453	205 209	92 959 677	21.283 80	67.305 27	7.680 086	16.546 24	35.647 80
454	206 116	93 576 664	21.307 28	67.379 52	7.685 733	16.558 41	35.674 01
455	207 025	94 196 375	21.330 73	67.453 69	7.691 372	16.570 56	35.700 18
456	207 936	94 818 816	21.354 16	67.527 77	7.697 002	16.582 69	35.726 32
457	208 849	95 443 993	21.377 56	67.601 78	7.702 625	16.594 80	35.752 42
458	209 764	96 071 912	21.400 93	67.675 70	7.708 239	16.606 90	35.778 48
459	210 681	96 702 579	21.424 29	67.749 54	7.713 845	16.618 97	35.804 50
460	211 600	97 336 000	21.447 61	67.823 30	7.719 443	16.631 03	35.830 48
461	212 521	97 972 181	21.470 91	67.896 98	7.725 032	16.643 08	35.856 42
462	213 444	98 611 128	21.494 19	67.970 58	7.730 614	16.655 10	35.882 33
463	214 369	99 252 847	21.517 43	68.044 10	7.736 188	16.667 11	35.908 20
464	215 296	99 897 344	21.540 66	68.117 55	7.741 753	16.679 10	35.934 04
465	216 225	100 544 625	21.563 86	68.190 91	7.747 311	16.691 08	35.959 83
466	217 156	101 194 696	21.587 03	68.264 19	7.752 861	16.703 03	35.985 59
467	218 089	101 847 563	21.610 18	68.337 40	7.758 402	16.714 97	36.011 31
468	219 024	102 503 232	21.633 31	68.410 53	7.763 936	16.726 89	36.037 00
469	219 961	103 161 709	21.656 41	68.483 57	7.769 462	16.738 80	36.062 65
470	220 900	103 823 000	21.679 48	68.556 55	7.774 980	16.750 69	36.088 26
471	221 841	104 487 111	21.702 53	68.629 44	7.780 490	16.762 56	36.113 84
472	222 784	105 154 048	21.725 56	68.702 26	7.785 993	16.774 41	36.139 38
473	223 729	105 823 817	21.748 56	68.775 00	7.791 488	16.786 25	36.164 88
474	224 676	106 496 424	21.771 54	68.847 66	7.796 975	16.798 07	36.190 35
475	225 625	107 171 875	21.794 49	68.920 24	7.802 454	16.809 88	36.215 78
476	226 576	107 850 176	21.817 42	68.992 75	7.807 925	16.821 67	36.241 18
477	227 529	108 531 333	21.840 33	69.065 19	7.813 389	16.833 44	36.266 54
478	228 484	109 215 352	21.863 21	69.137 54	7.818 846	16.845 19	36.291 87
479	229 441	109 902 239	21.886 07	69.209 83	7.824 294	16.856 93	36.317 16
480	230 400	110 592 000	21.908 90	69.282 03	7.829 735	16.868 65	36.342 41
481	231 361	111 284 641	21.931 71	69.354 16	7.835 169	16.880 36	36.367 63
482	232 324	111 980 168	21.954 50	69.426 22	7.840 595	16.892 05	36.392 82
483	233 289	112 678 587	21.977 26	69.498 20	7.846 013	16.903 72	36.417 97
484	234 256	113 379 904	22.000 00	69.570 11	7.851 424	16.915 38	36.443 08
485	235 225	114 084 125	22.022 72	69.641 94	7.856 828	16.927 02	36.468 17
486	236 196	114 791 256	22.045 41	69.713 70	7.862 224	16.938 65	36.493 21
487	237 169	115 501 303	22.068 08	69.785 39	7.867 613	16.950 26	36.518 22
488	238 144	116 214 272	22.090 72	69.857 00	7.872 994	16.961 85	36.543 20
489	239 121	116 930 169	22.113 34	69.928 53	7.878 368	16.973 43	36.568 15
490	240 100	117 649 000	22.135 94	70.000 00	7.883 735	16.984 99	36.593 06
491	241 081	118 370 771	22.158 52	70.071 39	7.889 095	16.996 54	36.617 93
492	242 064	119 095 488	22.181 07	70.142 71	7.894 447	17.008 07	36.642 78
493	243 049	119 823 157	22.203 60	70.213 96	7.899 792	17.019 59	36.667 58
494	244 036	120 553 784	22.226 11	70.285 13	7.905 129	17.031 08	36.692 36
495	245 025	121 287 375	22.248 60	70.356 24	7.910 460	17.042 57	36.717 10
496	246 016	122 023 936	22.271 06	70.427 27	7.915 783	17.054 04	36.741 81
497	247 009	122 763 473	22.293 50	70.498 23	7.921 099	17.065 49	36.766 49
498	248 004	123 505 992	22.315 91	70.569 12	7.926 408	17.076 93	36.791 13
499	249 001	124 251 499	22.338 31	70.639 93	7.931 710	17.088 35	36.815 74

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
500	250 000	125 000 000	22.360 68	70.710 68	7.937 005	17.099 76	36.840 31
501	251 001	125 751 501	22.383 03	70.781 35	7.942 293	17.111 15	36.864 86
502	252 004	126 506 008	22.405 36	70.851 96	7.947 574	17.122 53	36.889 37
503	253 009	127 263 527	22.427 66	70.922 49	7.952 848	17.133 89	36.913 85
504	254 016	128 024 064	22.449 94	70.992 96	7.958 114	17.145 24	36.938 30
505	255 025	128 787 625	22.472 21	71.063 35	7.963 374	17.156 57	36.962 71
506	256 036	129 554 216	22.494 44	71.133 68	7.968 627	17.167 89	36.987 09
507	257 049	130 323 843	22.516 66	71.203 93	7.973 873	17.179 19	37.011 44
508	258 064	131 096 512	22.538 86	71.274 12	7.979 112	17.190 48	37.035 76
509	259 081	131 872 229	22.561 03	71.344 24	7.984 344	17.201 75	37.060 04
510	260 100	132 651 000	22.583 18	71.414 28	7.989 570	17.213 01	37.084 30
511	261 121	133 432 831	22.605 31	71.484 26	7.994 788	17.224 25	37.108 52
512	262 144	134 217 728	22.627 42	71.554 18	8.000 000	17.235 48	37.132 71
513	263 169	135 005 697	22.649 50	71.624 02	8.005 205	17.246 69	37.156 87
514	264 196	135 796 744	22.671 57	71.693 79	8.010 403	17.257 89	37.181 00
515	265 225	136 590 875	22.693 61	71.763 50	8.015 595	17.269 08	37.205 09
516	266 256	137 388 096	22.715 63	71.833 14	8.020 779	17.280 25	37.229 16
517	267 289	138 188 413	22.737 63	71.902 71	8.025 957	17.291 40	37.253 19
518	268 324	138 991 832	22.759 61	71.972 22	8.031 129	17.302 54	37.277 20
519	269 361	139 798 359	22.781 57	72.041 65	8.036 293	17.313 67	37.301 17
520	270 400	140 608 000	22.803 51	72.111 03	8.041 452	17.324 78	37.325 11
521	271 441	141 420 761	22.825 42	72.180 33	8.046 603	17.335 88	37.349 02
522	272 484	142 236 648	22.847 32	72.249 57	8.051 748	17.346 96	37.372 90
523	273 529	143 055 667	22.869 19	72.318 74	8.056 886	17.358 04	37.396 75
524	274 576	143 877 824	22.891 05	72.387 84	8.062 018	17.369 09	37.420 57
525	275 625	144 703 125	22.912 88	72.456 88	8.067 143	17.380 13	37.444 36
526	276 676	145 531 576	22.934 69	72.525 86	8.072 262	17.391 16	37.468 12
527	277 729	146 363 183	22.956 48	72.594 77	8.077 374	17.402 18.	37.491 85
528	278 784	147 197 952	22.978 25	72.663 61	8.082 480	17.413 18	37.515 55
529	279 841	148 035 889	23.000 00	72.732 39	8.087 579	17.424 16	37.539 22
530	280 900	148 877 000	23.021 73	72.801 10	8.092 672	17.435 13	37.562 86
531	281 961	149 721 291	23.043 44	72.869 75	8.097 759	17.446 09	37.586 47
532	283 024	150 568 768	23.065 13	72.938 33	8.102 839	17.457 04	37.610 05
533	284 089	151 419 437	23.086 79	73.006 85	8.107 913	17.467 97	37.633 60
534	285 156	152 273 304	23.108 44	73.075 30	8.112 980	17.478 89	37.657 12
535	286 225	153 130 375	23.130 07	73.143 69	8.118 041	17.489 79	37.680 61
536	287 296	153 990 656	23.151 67	73.212 02	8.123 096	17.500 68	37.704 07
537	288 369	154 854 153	23.173 26	73.280 28	8.128 145	17.511 56	37.727 51
538	289 444	155 720 872	23.194 83	73.348 48	8.133 187	17.522 42	37.750 91
539	290 521	156 590 819	23.216 37	73.416 62	8.138 223	17.533 27	37.774 29
540	291 600	157 464 000	23.237 90	73.484 69	8.143 253	17.544 11	37.797 63
541	292 681	158 340 421	23.259 41	73.552 70	8.148 276	17.554 93	37.820 95
542	293 764	159 220 088	23.280 89	73.620 65	8.153 294	17.565 74	37.844 24
543	294 849	160 103 007	23.302 36	73.688 53	8.158 305	17.576 54	37.867 50
544	295 936	160 989 134	23.323 81	73.756 36	8.163 310	17.587 32	37.890 73
545	297 025	161 878 625	23.345 24	73.824 12	8.168 309	17.598 09	37.913 93
546	298 116	162 771 336	23.366 64	73.891 81	8.173 302	17.608 85	37.937 11
547	299 209	163 667 323	23.388 03	73.959 45	8.178 289	17.619 59	37.960 25
548	300 304	164 566 592	23.409 40	74.027 02	8.183 269	17.630 32	37.983 37
549	301 401	165 469 149	23.430 75	74.094 53	8.188 244	17.641 04	38.006 46

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
550	302 500	166 375 000	23.452 08	74.161 98	8.193 213	17.651 74	38.029 52
551	303 601	167 284 151	23.473 39	74.229 37	8.198 175	17.662 43	38.052 56
552	304 704	168 196 608	23.494 68	74.296 70	8.203 132	17.673 11	38.075 57
553	305 809	169 112 377	23.515 95	74.363 97	8.208 082	17.683 78	38.098 54
554	306 916	170 031 464	23.537 20	74.431 18	8.213 027	17.694 43	38.121 49
555	308 025	170 953 875	23.558 44	74.498 32	8.217 966	17.705 07	38.144 42
556	309 136	171 879 616	23.579 65	74.565 41	8.222 899	17.715 70	38.167 31
557	310 249	172 808 693	23.600 85	74.632 43	8.227 825	17.726 31	38.190 18
558	311 364	173 741 112	23.622 02	74.699 40	8.232 746	17.736 91	38.213 02
559	312 481	174 676 879	23.643 18	74.766 30	8.237 661	17.747 50	38.235 84
560	313 600	175 616 000	23.664 32	74.833 15	8.242 571	17.758 08	38.258 62
561	314 721	176 558 481	23.685 44	74.899 93	8.247 474	17.768 64	38.281 38
562	315 844	177 504 328	23.706 54	74.966 66	8.252 372	17.779 20	38.304 12
563	316 969	178 453 547	23.727 62	75.033 33	8.257 263	17.789 73	38.326 82
564	318 096	179 406 144	23.748 68	75.099 93	8.262 149	17.800 26	38.349 50
565	319 225	180 362 125	23.769 73	75.166 48	8.267 029	17.810 77	38.372 15
566	320 356	181 321 496	23.790 75	75.232 97	8.271 904	17.821 28	38.394 78
567	321 489	182 284 263	23.811 76	75.299 40	8.276 773	17.831 77	38.417 37
568	322 624	183 250 432	23.832 75	75.365 77	8.281 635	17.842 24	38.439 95
569	323 761	184 220 009	23.853 72	75.432 09	8.286 493	17.852 71	38.462 49
570	324 900	185 193 000	23.874 67	75.498 34	8.291 344	17.863 16	38.485 01
571	326 041	186 169 411	23.895 61	75.564 54	8.296 190	17.873 60	38.507 50
572	327 184	187 149 248	23.916 52	75.630 68	8.301 031	17.884 03	38.529 97
573	328 329	188 132 517	23.937 42	75.696 76	8.305 865	17.894 44	38.552 41
574	329 476	189 119 224	23.958 30	75.762 79	8.310 694	17.904 85	38.574 82
575	330 625	190 109 375	23.979 16	75.828 75	8.315 517	17.915 24	38.597 21
576	331 776	191 102 976	24.000 00	75.894 66	8.320 335	17.925 62	38.619 58
577	332 929	192 100 033	24.020 82	75.960 52	8.325 148	17.935 99	38.641 91
578	334 084	193 100 552	24.041 63	76.026 31	8.329 954	17.946 34	38.664 22
579	335 241	194 104 539	24.062 42	76.092 05	8.334 755	17.956 69	38.686 51
580	336 400	195 112 000	24.083 19	76.157 73	8.339 551	17.967 02	38.708 77
581	337 561	196 122 941	24.103 94	76.223 36	8.344 341	17.977 34	38.731 00
582	338 724	197 137 368	24.124 68	76.288 92	8.349 126	17.987 65	38.753 21
583	339 889	198 155 287	24.145 39	76.354 44	8.353 905	17.997 94	38.775 39
584	341 056	199 176 704	24.166 09	76.419 89	8.358 678	18.008 23	38.797 55
585	342 225	200 201 625	24.186 77	76.485 29	8.363 447	18.018 50	38.819 68
586	343 396	201 230 056	24.207 44	76.550 64	8.368 209	18.028 76	38.841 79
587	344 569	202 262 003	24.228 08	76.615 93	8.372 967	18.039 01	38.863 87
588	345 744	203 297 472	24.248 71	76.681 16	8.377 719	18.049 25	38.885 93
589	346 921	204 336 469	24.269 32	76.746 34	8.382 465	18.059 47	38.907 96
590	348 100	205 379 000	24.289 92	76.811 46	8.387 207	18.069 69	38.929 96
591	349 281	206 425 071	24.310 49	76.876 52	8.391 942	18.079 89	38.951 95
592	350 464	207 474 688	24.331 05	76.941 54	8.396 673	18.090 08	38.973 90
593	351 649	208 527 857	24.351 59	77.006 49	8.401 398	18.100 26	38.995 84
594	352 836	209 584 584	24.372 12	77.071 40	8.406 118	18.110 43	39.017 74
595	354 025	210 644 875	24.392 62	77.136 24	8.410 833	18.120 59	39.039 63
596	355 216	211 708 736	24.413 11	77.201 04	8.415 542	18.130 74	39.061 49
597	356 409	212 776 173	24.433 58	77.265 78	8.420 246	18.140 87	39.083 32
598	357 604	213 847 192	24.454 04	77.330 46	8.424 945	18.150 99	39.105 13
599	358 801	214 921 799	24.474 48	77.395 09	8.429 638	18.161 11	39.126 92

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
600	360 000	216 000 000	24.494 90	77.459 67	8.434 327	18.171 21	39 148 68
601	361 201	217 081 801	24.515 30	77.524 19	8.439 010	18.181 30	39.170 41
602	362 404	218 167 208	24.535 69	77.588 66	8.443 688	18.191 37	39.192 13
603	363 609	219 256 227	24.556 06	77.653 07	8.448 361	18.201 44	39.213 82
604	364 816	220 348 864	24.576 41	77.717 44	8.453 028	18.211 50	39.235 48
605	366 025	221 445 125	24.596 75	77.781 75	8.457 691	18.221 54	39.257 12
606	367 236	222 545 016	24.617 07	77.846 00	8.462 348	18.231 58	39.278 74
607	368 449	223 648 543	24.637 37	77.910 20	8.467 000	18.241 60	39.300 33
608	369 664	224 755 712	24.657 66	77.974 35	8.471 647	18.251 61	39.321 90
609	370 881	225 866 529	24.677 93	78.038 45	8.476 289	18.261 61	39.343 45
610	372 100	226 981 000	24.698 18	78.102 50	8.480 926	18.271 60	39.364 97
611	373 321	228 099 131	24.718 41	78.166 49	8.485 558	18.281 58	39.386 47
612	374 544	229 220 928	24.738 63	78.230 43	8.490 185	18.291 55	39.407 95
613	375 769	230 346 397	24.758 84	78.294 32	8.494 807	18.301 51	39.429 40
614	376 996	231 475 544	24.779 02	78.358 15	8.499 423	18.311 45	39.450 83
615	378 225	232 608 375	24.799 19	78.421 94	8.504 035	18.321 39	39.472 23
616	379 456	233 744 896	24.819 35	78.485 67	8.508 642	18.331 31	39.493 62
617	380 689	234 885 113	24.839 48	78.549 35	8.513 243	18.341 23	39.514 98
618	381 924	236 029 032	24.859 61	78.612 98	8.517 840	18.351 13	39.536 31
619	383 161	237 176 659	24.879 71	78.676 55	8.522 432	18.361 02	39.557 63
620	384 400	238 328 000	24.899 80	78.740 08	8.527 019	18.370 91	39.578 92
621	385 641	239 483 061	24.919 87	78.803 55	8.531 601	18.380 78	39.600 18
622	386 884	240 641 848	24.939 93	78.866 98	8.536 178	18.390 64	39.621 43
623	388 129	241 804 367	24.959 97	78.930 35	8.540 750	18.400 49	39.642 65
624	389 376	242 970 624	24.979 99	78.993 67	8.545 317	18.410 33	39.663 85
625	390 625	244 140 625	25.000 00	79.056 94	8.549 880	18.420 16	39.685 03
626	391 876	245 314 376	25.019 99	79.120 16	8.554 437	18.429 98	39.706 18
627	393 129	246 491 883	25.039 97	79.183 33	8.558 990	18.439 78	39.727 31
628	394 384	247 673 152	25.059 93	79.246 45	8.563 538	18.449 58	39.748 42
629	395 641	248 858 189	25.079 87	79.309 52	8.568 081	18.459 37	39.769 51
630	396 900	250 047 000	25.099 80	79.372 54	8.572 619	18.469 15	39.790 57
631	398 161	251 239 591	25.119 71	79.435 51	8.577 152	18.478 91	39.811 61
632	399 424	252 435 968	25.139 61	79.498 43	8.581 681	18.488 67	39.832 63
633	400 689	253 636 137	25.159 49	79.561 30	8.586 205	18.498 42	39.853 63
634	401 956	254 840 104	25.179 36	79.624 12	8.590 724	18.508 15	39.874 61
635	403 225	256 047 875	25.199 21	79.686 89	8.595 238	18.517 88	39.895 56
636	404 496	257 259 456	25.219 04	79.749 61	8.599 748	18.527 59	39.916 49
637	405 769	258 474 853	25.238 86	79.812 28	8.604 252	18.537 30	39.937 40
638	407 044	259 694 072	25.258 66	79.874 90	8.608 753	18.547 00	39.958 29
639	408 321	260 917 119	25.278 45	79.937 48	8.613 248	18.556 68	39.979 16
640	409 600	262 144 000	25.298 22	80.000 00	8.617 739	18.566 36	40.000 00
641	410 881	263 374 721	25.317 98	80.062 48	8.622 225	18.576 02	40.020 82
642	412 164	264 609 288	25.337 72	80.124 90	8.626 706	18.585 68	40.041 62
643	413 449	265 847 707	25.357 44	80.187 28	8.631 183	18.595 32	40.062 40
644	414 736	267 089 984	25.377 16	80.249 61	8.635 655	18.604 95	40.083 16
645	416 025	268 336 125	25.396 85	80.311 89	8.640 123	18.614 58	40.103 90
646	417 316	269 586 136	25.416 53	80.374 13	8.644 585	18.624 19	40.124 61
647	418 609	270 840 023	25.436 19	80.436 31	8.649 044	18.633 80	40.145 30
648	419 904	272 097 792	25.455 84	80.498 45	8.653 497	18.643 40	40.165 98
649	421 201	273 359 449	25.475 48	80.560 54	8.657 947	18.652 98	40.186 63

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
650	422 500	274 625 000	25.495 10	80.622 58	8.662 391	18.662 56	40.207 26
651	423 801	275 894 451	25.514 70	80.684 57	8.666 831	18.672 12	40.227 87
652	425 104	277 167 808	25.534 29	80.746 52	8.671 266	18.681 68	40.248 45
653	426 409	278 445 077	25.553 86	80.808 42	8.675 697	18.691 22	40.269 02
654	427 716	279 726 264	25.573 42	80.870 27	8.680 124	18.700 76	40.289 57
655	429 025	281 011 375	25.592 97	80.932 07	8.684 546	18.710 29	40.310 09
656	430 336	282 300 416	25.612 50	80.993 83	8.688 963	18.719 80	40.330 59
657	431 649	283 593 393	25.632 01	81.055 54	8.693 376	18.729 31	40.351 08
658	432 964	284 890 312	25.651 51	81.117 20	8.697 784	18.738 81	40.371 54
659	434 281	286 191 179	25.671 00	81.178 81	8.702 188	18.748 30	40.391 98
660	435 600	287 496 000	25.690 47	81.240 38	8.706 588	18.757 77	40.412 40
661	436 921	288 804 781	25.709 92	81.301 91	8.710 983	18.767 24	40.432 80
662	438 244	290 117 528	25.729 36	81.363 38	8.715 373	18.776 70	40.453 18
663	439 569	291 434 247	25.748 79	81.424 81	8.719 760	18.786 15	40.473 54
664	440 896	292 754 944	25.768 20	81.486 20	8.724 141	18.795 59	40.493 88
665	442 225	294 079 625	25.787 59	81.547 53	8.728 519	18.805 02	40.514 20
666	443 556	295 408 296	25.806 98	81.608 82	8.732 892	18.814 44	40.534 49
667	444 889	296 740 963	25.826 34	81.670 07	8.737 260	18.823 86	40.554 77
668	446 224	298 077 632	25.845 70	81.731 27	8.741 625	18.833 26	40.575 03
669	447 561	299 418 309	25.865 03	81.792 42	8.745 985	18.842 65	40.595 26
670	448 900	300 763 000	25.884 36	81.853 53	8.750 340	18.852 04	40.615 48
671	450 241	302 111 711	25.903 67	81.914 59	8.754 691	18.861 41	40.635 68
672	451 584	303 464 448	25.922 96	81.975 61	8.759 038	18.870 78	40.655 85
673	452 929	304 821 217	25.942 24	82.036 58	8.763 381	18.880 13	40.676 01
674	454 276	306 182 024	25.961 51	82.097 50	8.767 719	18.889 48	40.696 15
675	455 625	307 546 875	25.980 76	82.158 38	8.772 053	18.898 82	40.716 26
676	456 976	308 915 776	26.000 00	82.219 22	8.776 383	18.908 14	40.736 36
677	458 329	310 288 733	26.019 22	82.280 01	8.780 708	18.917 46	40.756 44
678	459 684	311 665 752	26.038 43	82.340 76	8.785 030	18.926 77	40.776 50
679	461 041	313 046 839	26.057 63	82.401 46	8.789 347	18.936 07	40.796 53
680	462 400	314 432 000	26.076 81	82.462 11	8.793 659	18.945 36	40.816 55
681	463 761	315 821 241	26.095 98	82.522 72	8.797 968	18.954 65	40.836 55
682	465 124	317 214 568	26.115 13	82.583 29	8.802 272	18.963 92	40.856 53
683	466 489	318 611 987	26.134 27	82.643 81	8.806 572	18.973 18	40.876 49
684	467 856	320 013 504	26.153 39	82.704 29	8.810 868	18.982 44	40.896 43
685	469 225	321 419 125	26.172 50	82.764 73	8.815 160	18.991 69	40.916 35
686	470 596	322 828 856	26.191 60	82.825 12	8.819 447	19.000 92	40.936 25
687	471 969	324 242 703	26.210 68	82.885 46	8.823 731	19.010 15	40.956 13
688	473 344	325 660 672	26.229 75	82.945 77	8.828 010	19.019 37	40.975 99
689	474 721	327 082 769	26.248 81	83.006 02	8.832 285	19.028 58	40.995 84
690	476 100	328 509 000	26.267 85	83.066 24	8.836 556	19.037 78	41.015 66
691	477 481	329 939 371	26.286 88	83.126 41	8.840 823	19.046 98	41.035 46
692	478 864	331 373 888	26.305 89	83.186 54	8.845 085	19.056 16	41.055 25
693	480 249	332 812 557	26.324 89	83.246 62	8.849 344	19.065 33	41.075 02
694	481 636	334 255 384	26.343 88	83.306 66	8.853 599	19.074 50	41.094 76
695	483 025	335 702 375	26.362 85	83.366 66	8.857 849	19.083 66	41.114 49
696	484 416	337 153 536	26.381 81	83.426 61	8.862 095	19.092 81	41.134 20
697	485 809	338 608 873	26.400 76	83.486 53	8.866 338	19.101 95	41.153 89
698	487 204	340 068 392	26.419 69	83.546 39	8.870 576	19.111 08	41.173 57
699	488 601	341 532 099	26.438 61	83.606 22	8.874 810	19.120 20	41.193 22

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
700	490 000	343 000 000	26.457 51	83.666 00	8.879 040	19.129 31	41.212 85
701	491 401	344 472 101	26.476 40	83.725 74	8.883 266	19.138 42	41.232 47
702	492 804	345 948 408	26.495 28	83.785 44	8.887 488	19.147 51	41.252 07
703	494 209	347 428 927	26.514 15	83.845 10	8.891 706	19.156 60	41.271 64
704	495 616	348 913 664	26.533 00	83.904 71	8.895 920	19.165 68	41.291 20
705	497 025	350 402 625	26.551 84	83.964 28	8.900 130	19.174 75	41.310 75
706	498 436	351 895 816	26.570 66	84.023 81	8.904 337	19.183 81	41.330 27
707	499 849	353 393 243	26.589 47	84.083 29	8.908 539	19.192 86	41.349 77
708	501 264	354 894 912	26.608 27	84.142 74	8.912 737	19.201 91	41.369 26
709	502 681	356 400 829	26.627 05	84.202 14	8.916 931	19.210 95	41.388 73
710	504 100	357 911 000	26.645 83	84.261 50	8.921 121	19.219 97	41.408 18
711	505 521	359 425 431	26.664 58	84.320 82	8.925 308	19.228 99	41.427 61
712	506 944	360 944 128	26.683 33	84.380 09	8.929 490	19.238 00	41.447 02
713	508 369	362 467 097	26.702 06	84.439 33	8.933 669	19.247 01	41.466 42
714	509 796	363 994 344	26.720 78	84.498 52	8.937 843	19.256 00	41.485 79
715	511 225	365 525 875	26.739 48	84.557 67	8.942 014	19.264 99	41.505 15
716	512 656	367 061 696	26.758 18	84.616 78	8.946 181	19.273 96	41.524 49
717	514 089	368 601 813	26.776 86	84.675 85	8.950 344	19.282 93	41.543 82
718	515 524	370 146 232	26.795 52	84.734 88	8.954 503	19.291 89	41.563 12
719	516 961	371 694 959	26.814 18	84.793 87	8.958 658	19.300 84	41.582 41
720	518 400	373 248 000	26.832 82	84.852 81	8.962 809	19.309 79	41.601 68
721	519 841	374 805 361	26.851 44	84.911 72	8.966 957	19.318 72	41.620 93
722	521 284	376 367 048	26.870 06	84.970 58	8.971 101	19.327 65	41.640 16
723	522 729	377 933 067	26.888 66	85.029 41	8.975 241	19.336 57	41.659 38
724	524 176	379 503 424	26.907 25	85.088 19	8.979 377	19.345 48	41.678 57
725	525 625	381 078 125	26.925 82	85.146 93	8.983 509	19.354 38	41.697 75
726	527 076	382 657 176	26.944 39	85.205 63	8.987 637	19.363 28	41.716 92
727	528 529	384 240 583	26.962 94	85.264 29	8.991 762	19.372 16	41.736 06
728	529 984	385 828 352	26.981 48	85.322 92	8.995 883	19.381 04	41.755 19
729	531 441	387 420 489	27.000 00	85.381 50	9.000 000	19.389 91	41.774 30
730	532 900	389 017 000	27.018 51	85.440 04	9.004 113	19.398 77	41.793 39
731	534 361	390 617 891	27.037 01	85.498 54	9.008 223	19.407 63	41.812 47
732	535 824	392 223 168	27.055 50	85.557 00	9.012 329	19.416 47	41.831 52
733	537 289	393 832 837	27.073 97	85.615 42	9.016 431	19.425 31	41.850 56
734	538 756	395 446 904	27.092 43	85.673 80	9.020 529	19.434 14	41.869 59
735	540 225	397 065 375	27.110 88	85.732 14	9.024 624	19.442 96	41.888 59
736	541 696	398 688 256	27.129 32	85.790 44	9.028 715	19.451 78	41.907 58
737	543 169	400 315 553	27.147 74	85.848 70	9.032 802	19.460 58	41.926 55
738	544 644	401 947 272	27.166 16	85.906 93	9.036 886	19.469 38	41.945 51
739	546 121	403 583 419	27.184 55	85.965 11	9.040 966	19.478 17	41.964 44
740	547 600	405 224 000	27.202 94	86.023 25	9.045 042	19.486 95	41.983 36
741	549 081	406 869 021	27.221 32	86.081 36	9.049 114	19.495 73	42.002 27
742	550 564	408 518 488	27.239 68	86.139 42	9.053 183	19.504 49	42.021 15
743	552 049	410 172 407	27.258 03	86.197 45	9.057 248	19.513 25	42.040 02
744	553 536	411 830 784	27.276 36	86.255 43	9.061 310	19.522 00	42.058 87
745	555 025	413 493 625	27.294 69	86.313 38	9.065 368	19.530 74	42.077 71
746	556 516	415 160 936	27.313 00	86.371 29	9.069 422	19.539 48	42.096 53
747	558 009	416 832 723	27.331 30	86.429 16	9.073 473	19.548 20	42.115 33
748	559 504	418 508 992	27.349 59	86.486 99	9.077 520	19.556 92	42.134 11
749	561 001	420 189 749	27.367 86	86.544 79	9.081 563	19.565 63	42.152 88

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
750	562 500	421 875 000	27.386 13	86.602 54	9.085 603	19.574 34	42.171 63
751	564 001	423 564 751	27.404 38	86.660 26	9.089 639	19.583 03	42.190 37
752	565 504	425 259 008	27.422 62	86.717 93	9.093 672	19.591 72	42.209 09
753	567 009	426 957 777	27.440 85	86.775 57	9.097 701	19.600 40	42.227 79
754	568 516	428 661 064	27.459 06	86.833 17	9.101 727	19.609 08	42.246 47
755	570 025	430 368 875	27.477 26	86.890 74	9.105 748	19.617 74	42.265 14
756	571 536	432 081 216	27.495 45	86.948 26	9.109 767	19.626 40	42.283 79
757	573 049	433 798 093	27.513 63	87.005 75	9.113 782	19.635 05	42.302 43
758	574 564	435 519 512	27.531 80	87.063 20	9.117 793	19.643 69	42 321 05
759	576 081	437 245 479	27.549 95	87.120 61	9.121 801	19.652 32	42.339 65
760	577 600	438 976 000	27.568 10	87.177 98	9.125 805	19.660 95	42.358 24
761	579 121	440 711 081	27.586 23	87.235 31	9.129 806	19.669 57	42.376 81
762	580 644	442 450 728	27.604 35	87.292 61	9.133 803	19.678 18	42.395 36
763	582 169	444 194 947	27.622 45	87.349 87	9.137 797	19.686 79	42.413 90
764	583 696	445 943 744	27.640 55	87.407 09	9.141 787	19.695 38	42.432 42
765	585 225	447 697 125	27.658 63	87.464 28	9.145 774	19.703 97	42.450 92
766	586 756	449 455 096	27.676 71	87.521 43	9.149 758	19.712 56	42.469 41
767	588 289	451 217 663	27.694 76	87.578 54	9.153 738	19.721 13	42.487 89
768	589 824	452 984 832	27.712 81	87.635 61	9.157 714	19.729 70	42.506 34
769	591 361	454 756 609	27.730 85	87.692 65	9.161 687	19.738 26	42.524 78
770	592 900	456 533 000	27.748 87	87.749 64	9.165 656	19.746 81	42.543 21
771	594 441	458 314 011	27.766 89	87.806 61	9.169 623	19.755 35	42.561 62
772	595 984	460 099 648	27.784 89	87.863 53	9.173 585	19.763 89	42.580 01
773	597 529	461 889 917	27.802 88	87.920 42	9.177 544	19.772 42	42.598 39
774	599 076	463 684 824	27.820 86	87.977 27	9.181 500	19.780 94	42.616 75
775	600 625	465 484 375	27.838 82	88.034 08	9.185 453	19.789 46	42.635 09
776	602 176	467 288 576	27.856 78	88.090 86	9.189 402	19.797 97	42.653 42
777	603 729	469 097 433	27.874 72	88.147 60	9.193 347	19.806 47	42.671 74
778	605 284	470 910 952	27.892 65	88.204 31	9.197 290	19.814 96	42.690 04
779	606 841	472 729 139	27.910 57	88.260 98	9.201 229	19.823 45	42.708 32
780	608 400	474 552 000	27.928 48	88.317 61	9.205 164	19.831 92	42.726 59
781	609 961	476 379 541	27.946 38	88.374 20	9.209 096	19.840 40	42.744 84
782	611 524	478 211 768	27.964 26	88.430 76	9.213 025	19.848 86	42.763 07
783	613 089	480 048 687	27.982 14	88.487 29	9.216 950	19.857 32	42.781 29
784	614 656	481 890 304	28.000 00	88.543 77	9.220 873	19.865 77	42.799 50
785	616 225	483 736 625	28.017 85	88.600 23	9.224 791	19.874 21	42.817 69
786	617 796	485 587 656	28.035 69	88.656 64	9.228 707	19.882 65	42.835 86
787	619 369	487 443 403	28.053 52	88.713 02	9.232 619	19.891 07	42.854 02
788	620 944	489 303 872	28.071 34	88.769 36	9.236 528	19.899 50	42.872 16
789	622 521	491 169 069	28.089 14	88.825 67	9.240 433	19.907 91	42.890 29
790	624 100	493 039 000	28.106 94	88.881 94	9.244 335	19.916 32	42.908 40
791	625 681	494 913 671	28.124 72	88.938 18	9.248 234	19.924 72	42.926 50
792	627 264	496 793 088	28.142 49	88.994 38	9.252 130	19.933 11	42.944 58
793	628 849	498 677 257	28.160 26	89.050 55	9.256 022	19.941 50	42.962 65
794	630 436	500 566 184	28.178 01	89.106 68	9.259 911	19.949 87	42.980 70
795	632 025	502 459 875	28.195 74	89.162 77	9.263 797	19.958 25	42.998 74
796	633 616	504 358 336	28.213 47	89.218 83	9.267 680	19.966 61	43.016 76
797	635 209	506 261 573	28.231 19	89.274 86	9.271 559	19.974 97	43.034 77
798	636 804	508 169 592	28.248 89	89.330 85	9.275 435	19.983 32	43.052 76
799	638 401	510 082 399	28.266 59	89.386 80	9.279 308	19.991 66	43.070 73

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
800	640 000	512 000 000	28.284 27	89.442 72	9.283 178	20.000 00	43.088 69
801	641 601	513 922 401	28.301 94	89.498 60	9.287 044	20.008 33	43.106 64
802	643 204	515 849 608	28.319 60	89.554 45	9.290 907	20.016 65	43.124 57
803	644 809	517 781 627	28.337 25	89.610 27	9.294 767	20.024 97	43.142 49
804	646 416	519 718 464	28.354 89	89.666 05	9.298 624	20.033 28	43.160 39
805	648 025	521 660 125	28.372 52	89.721 79	9.302 477	20.041 58	43.178 28
806	649 636	523 606 616	28.390 14	89.777 50	9.306 328	20.049 88	43.196 15
807	651 249	525 557 943	28.407 75	89.833 18	9.310 175	20.058 16	43.214 00
808	652 864	527 514 112	28.425 34	89.888 82	9.314 019	20.066 45	43.231 85
809	654 481	529 475 129	28.442 93	89.944 43	9.317 860	20.074 72	43.249 67
810	656 100	531 441 000	28.460 50	90.000 00	9.321 698	20.082 99	43.267 49
811	657 721	533 411 731	28.478 06	90.055 54	9.325 532	20.091 25	43.285 29
812	659 344	535 387 328	28.495 61	90.111 04	9.329 363	20.099 50	43.303 07
813	660 969	537 367 797	28.513 15	90.166 51	9.333 192	20.107 75	43.320 84
814	662 596	539 353 144	28.530 69	90.221 95	9.337 017	20.115 99	43.338 59
815	664 225	541 343 375	28.548 20	90.277 35	9.340 839	20.124 23	43.356 33
816	665 856	543 338 496	28.565 71	90.332 72	9.344 657	20.132 45	43.374 06
817	667 489	545 338 513	28.583 21	90.388 05	9.348 473	20.140 67	43.391 77
818	669 124	547 343 432	28.600 70	90.443 35	9.352 286	20.148 89	43.409 47
819	670 761	549 353 259	28.618 18	90.498 62	9.356 095	20.157 10	43.427 15
820	672 400	551 368 000	28.635 64	90.553 85	9.359 902	20.165 30	43.444 81
821	674 041	553 387 661	28.653 10	90.609 05	9.363 705	20.173 49	43.462 47
822	675 684	555 412 248	28.670 54	90.664 22	9.367 505	20.181 68	43.480 11
823	677 329	557 441 767	28.687 98	90.719 35	9.371 302	20.189 86	43.497 73
824	678 976	559 476 224	28.705 40	90.774 45	9.375 096	20.198 03	43.515 34
825	680 625	561 515 625	28.722 81	90.829 51	9.378 887	20.206 20	43.532 94
826	682 276	563 559 976	28.740 22	90.884 54	9.382 675	20.214 36	43.550 52
827	683 929	565 609 283	28.757 61	90.939 54	9.386 460	20.222 52	43.568 09
828	685 584	567 663 552	28.774 99	90.994 51	9.390 242	20.230 66	43.585 64
829	687 241	569 722 789	28.792 36	91.049 44	9.394 021	20.238 80	43.603 18
830	688 900	571 787 000	28.809 72	91.104 34	9.397 796	20.246 94	43.620 71
831	690 561	573 856 191	28.827 07	91.159 20	9.401 569	20.255 07	43.638 22
832	692 224	575 930 368	28.844 41	91.214 03	9.405 339	20.263 19	43.655 72
833	693 889	578 009 537	28.861 74	91.268 83	9.409 105	20.271 30	43.673 20
834	695 556	580 093 704	28.879 06	91.323 60	9.412 869	20.279 41	43.690 67
835	697 225	582 182 875	28.896 37	91.378 33	9.416 630	20.287 51	43.708 12
836	698 896	584 277 056	28.913 66	91.433 04	9.420 387	20.295 61	43.725 56
837	700 569	586 376 253	28.930 95	91.487 70	9.424 142	20.303 70	43.742 99
838	702 244	588 480 472	28.948 23	91.542 34	9.427 894	20.311 78	43.760 41
839	703 921	590 589 719	28.965 50	91.596 94	9.431 642	20.319 86	43.777 81
840	705 600	592 704 000	28.982 75	91.651 51	9.435 388	20.327 93	43.795 19
841	707 281	594 823 321	29.000 00	91.706 05	9.439 131	20.335 99	43.812 56
842	708 964	596 947 688	29.017 24	91.760 56	9.442 870	20.344 05	43.829 92
843	710 649	599 077 107	29.034 46	91.815 03	9.446 607	20.352 10	43.847 27
844	712 336	601 211 584	29.051 68	91.869 47	9.450 341	20.360 14	43.864 60
845	714 025	603 351 125	29.068 88	91.923 88	9.454 072	20.368 18	43.881 91
846	715 716	605 495 736	29.086 08	91.978 26	9.457 800	20.376 21	43.899 22
847	717 409	607 645 423	29.103 26	92.032 60	9.461 525	20.384 24	43.916 51
848	719 104	609 800 192	29.120 44	92.086 92	9.465 247	20.392 26	43.933 78
849	720 801	611 960 049	29.137 60	92.141 20	9.468 966	20.400 27	43.951 05

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
850	722 500	614 125 000	29.154 76	92.195 44	9.472 682	20.408 28	43.968 30
851	724 201	616 295 051	29.171 90	92.249 66	9.476 396	20.416 28	43.985 53
852	725 904	618 470 208	29.189 04	92.303 85	9.480 106	20.424 27	44.002 75
853	727 609	620 650 477	29.206 16	92.358 00	9.483 814	20.432 26	44.019 96
854	729 316	622 835 864	29.223 28	92.412 12	9.487 518	20.440 24	44.037 16
855	731 025	625 026 375	29.240 38	92.466 21	9.491 220	20.448 21	44.054 34
856	732 736	627 222 016	29.257 48	92.520 27	9.494 919	20.456 18	44.071 51
857	734 449	629 422 793	29.274 56	92.574 29	9.498 615	20.464 15	44.088 66
858	736 164	631 628 712	29.291 64	92.628 29	9.502 308	20.472 10	44.105 81
859	737 881	633 839 779	29.308 70	92.682 25	9.505 998	20.480 05	44.122 93
860	739 600	636 056 000	29.325 76	92.736 18	9.509 685	20.488 00	44.140 05
861	741 321	638 277 381	29.342 80	92.790 09	9.513 370	20.495 93	44.157 15
862	743 044	640 503 928	29.359 84	92.843 96	9.517 052	20.503 87	44.174 24
863	744 769	642 735 647	29.376 86	92.897 79	9.520 730	20.511 79	44.191 32
864	746 496	644 972 544	29.393 88	92.951 60	9.524 406	20.519 71	44.208 38
865	748 225	647 214 625	29.410 88	93.005 38	9.528 079	20.527 62	44.225 43
866	749 956	649 461 896	29.427 88	93.059 12	9.531 750	20.535 53	44.242 46
867	751 689	651 714 363	29.444 86	93.112 83	9.535 417	20.543 43	44.259 49
868	753 424	653 972 032	29.461 84	93.166 52	9.539 082	20.551 33	44.276 50
869	755 161	656 234 909	29.478 81	93.220 17	9.542 744	20.559 22	44.293 49
870	756 900	658 503 000	29.495 76	93.273 79	9.546 403	20.567 10	44.310 48
871	758 641	660 776 311	29.512 71	93.327 38	9.550 059	20.574 98	44.327 45
872	760 384	663 054 848	29.529 65	93.380 94	9.553 712	20.582 85	44.344 40
873	762 129	665 338 617	29.546 57	93.434 47	9.557 363	20.590 71	44.361 35
874	763 876	667 627 624	29.563 49	93.487 97	9.561 011	20.598 57	44.378 28
875	765 625	669 921 875	29.580 40	93.541 43	9.564 656	20.606 43	44.395 20
876	767 376	672 221 376	29.597 30	93.594 87	9.568 298	20.614 27	44.412 11
877	769 129	674 526 133	29.614 19	93.648 28	9.571 938	20.622 11	44.429 00
878	770 884	676 836 152	29.631 06	93.701 65	9.575 574	20.629 95	44.445 88
879	772 641	679 151 439	29.647 93	93.755 00	9.579 208	20.637 78	44.462 75
880	774 400	681 472 000	29.664 79	93.808 32	9.582 840	20.645 60	44.479 60
881	776 161	683 797 841	29.681 64	93.861 60	9.586 468	20.653 42	44.496 44
882	777 924	686 128 968	29.698 48	93.914 86	9.590 094	20.661 23	44.513 27
883	779 689	688 465 387	29.715 32	93.968 08	9.593 717	20.669 04	44.530 09
884	781 456	690 807 104	29.732 14	94.021 27	9.597 337	20.676 84	44.546 89
885	783 225	693 154 125	29.748 95	94.074 44	9.600 955	20.684 63	44.563 68
886	784 996	695 506 456	29.765 75	94.127 57	9.604 570	20.692 42	44.580 46
887	786 769	697 864 103	29.782 55	94.180 68	9.608 182	20.700 20	44.597 23
888	788 544	700 227 072	29.799 33	94.233 75	9.611 791	20.707 98	44.613 98
889	790 321	702 595 369	29.816 10	94.286 80	9.615 398	20.715 75	44.630 72
890	792 100	704 969 000	29.832 87	94.339 81	9.619 002	20.723 51	44.647 45
891	793 881	707 347 971	29.849 62	94.392 80	9.622 603	20.731 27	44.664 17
892	795 664	709 732 288	29.866 37	94.445 75	9.626 202	20.739 02	44.680 87
893	797 449	712 121 957	29.883 11	94.498 68	9.629 797	20.746 77	44.697 56
894	799 236	714 516 984	29.899 83	94.551 57	9.633 391	20.754 51	44.714 24
895	801 025	716 917 375	29.916 55	94.604 44	9.636 981	20.762 25	44.730 90
896	802 816	719 323 136	29.933 26	94.657 28	9.640 569	20.769 98	44.747 56
897	804 609	721 734 273	29.949 96	94.710 08	9.644 154	20.777 70	44.764 20
898	806 404	724 150 792	29.966 65	94.762 86	9.647 737	20.785 42	44.780 83
899	808 201	726 572 699	29.983 33	94.815 61	9.651 317	20.793 13	44.797 44

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
900	810 000	729 000 000	30.000 00	94.868 33	9.654 894	20.800 84	44.814 05
901	811 801	731 432 701	30.016 66	94.921 02	9.658 468	20.808 54	44.830 64
902	813 604	733 870 808	30.033 31	94.973 68	9.662 040	20.816 23	44.847 22
903	815 409	736 314 327	30.049 96	95.026 31	9.665 610	20.823 92	44.863 79
904	817 216	738 763 264	30.066 59	95.078 91	9.669 176	20.831 61	44.880 34
905	819 025	741 217 625	30.083 22	95.131 49	9.672 740	20.839 29	44.896 88
906	820 836	743 677 416	30.099 83	95.184 03	9.676 302	20.846 96	44.913 41
907	822 649	746 142 643	30.116 44	95.236 55	9.679 860	20.854 63	44.929 93
908	824 464	748 613 312	30.133 04	95.289 03	9.683 417	20.862 29	44.946 44
909	826 281	751 089 429	30.149 63	95.341 49	9.686 970	20.869 94	44.962 93
910	828 100	753 571 000	30.166 21	95.393 92	9.690 521	20.877 59	44.979 41
911	829 921	756 058 031	30.182 78	95.446 32	9.694 069	20.885 24	44.995 88
912	831 744	758 550 528	30.199 34	95.498 69	9.697 615	20.892 88	45.012 34
913	833 569	761 048 497	30.215 89	95.551 03	9.701 158	20.900 51	45.028 79
914	835 396	763 551 944	30.232 43	95.603 35	9.704 699	20.908 14	45.045 22
915	837 225	766 060 875	30.248 97	95.655 63	9.708 237	20.915 76	45.061 64
916	839 056	768 575 296	30.265 49	95.707 89	9.711 772	20.923 38	45.078 05
917	840 889	771 095 213	30.282 01	95.760 12	9.715 305	20.930 99	45.094 45
918	842 724	773 620 632	30.298 51	95.812 32	9.718 835	20.938 60	45.110 84
919	844 561	776 151 559	30.315 01	95.864 49	9.722 363	20.946 20	45.127 21
920	846 400	778 688 000	30.331 50	95.916 63	9.725 888	20.953 79	45.143 57
921	848 241	781 229 961	30.347 98	95.968 74	9.729 411	20.961 38	45.159 92
922	850 084	783 777 448	30.364 45	96.020 83	9.732 931	20.968 96	45.176 26
923	851 929	786 330 467	30.380 92	96.072 89	9.736 448	20.976 54	45.192 59
924	853 776	788 889 024	30.397 37	96.124 92	9.739 963	20.984 11	45.208 91
925	855 625	791 453 125	30.413 81	96.176 92	9.743 476	20.991 68	45.225 21
926	857 476	794 022 776	30.430 25	96.228 89	9.746 986	20.999 24	45.241 50
927	859 329	796 597 983	30.446 67	96.280 84	9.750 493	21.006 80	45.257 78
928	861 184	799 178 752	30.463 09	96.332 76	9.753 998	21.014 35	45.274 05
929	863 041	801 765 089	30.479 50	96.384 65	9.757 500	21.021 90	45.290 30
930	864 900	804 357 000	30.495 90	96.436 51	9.761 000	21.029 44	45.306 55
931	866 761	806 954 491	30.512 29	96.488 34	9.764 497	21.036 97	45.322 78
932	868 624	809 557 568	30.528 68	96.540 15	9.767 992	21.044 50	45.339 00
933	870 489	812 166 237	30.545 05	96.591 93	9.771 485	21.052 03	45.355 21
934	872 356	814 780 504	30.561 41	96.643 68	9.774 974	21.059 54	45.371 41
935	874 225	817 400 375	30.577 77	96.695 40	9.778 462	21.067 06	45.387 60
936	876 096	820 025 856	30.594 12	96.747 09	9.781 946	21.074 56	45.403 77
937	877 969	822 656 953	30.610 46	96.798 76	9.785 429	21.082 07	45.419 94
938	879 844	825 293 672	30.626 79	96.850 40	9.788 909	21.089 56	45.436 09
939	881 721	827 936 019	30.643 11	96.902 01	9.792 386	21.097 06	45.452 23
940	883 600	830 584 000	30.659 42	96.953 60	9.795 861	21.104 54	45.468 36
941	885 481	833 237 621	30.675 72	97.005 15	9.799 334	21.112 02	45.484 48
942	887 364	835 896 888	30.692 02	97.056 68	9.802 804	21.119 50	45.500 58
943	889 249	838 561 807	30.708 31	97.108 19	9.806 271	21.126 97	45.516 68
944	891 136	841 232 384	30.724 58	97.159 66	9.809 736	21.134 44	45.532 76
945	893 025	843 908 625	30.740 85	97.211 11	9.813 199	21.141 90	45.548 83
946	894 916	846 590 536	30.757 11	97.262 53	9.816 659	21.149 35	45.564 90
947	896 809	849 278 123	30.773 37	97.313 93	9.820 117	21.156 80	45.580 95
948	898 704	851 971 392	30.789 61	97.365 29	9.823 572	21.164 24	45.596 98
949	900 601	854 670 349	30.805 84	97.416 63	9.827 025	21.171 68	45.613 01

SQUARES, CUBES, SQUARE ROOTS, AND CUBE ROOTS

n	n^2	n^3	$\sqrt{n}$	$\sqrt{10n}$	$\sqrt[3]{n}$	$\sqrt[3]{10n}$	$\sqrt[3]{100n}$
950	902 500	857 375 000	30.822 07	97.467 94	9.830 476	21.179 12	45.629 03
951	904 401	860 085 351	30.838 29	97.519 23	9.833 924	21.186 55	45.645 03
952	906 304	862 801 408	30.854 50	97.570 49	9.837 369	21.193 97	45.661 02
953	908 209	865 523 177	30.870 70	97.621 72	9.840 813	21.201 39	45.677 01
954	910 116	868 250 664	30.886 89	97.672 92	9.844 254	21.208 80	45.692 98
955	912 025	870 983 875	30.903 07	97.724 10	9.847 692	21.216 21	45.708 94
956	913 936	873 722 816	30.919 25	97.775 25	9.851 128	21.223 61	45.724 89
957	915 849	876 467 493	30.935 42	97.826 38	9.854 562	21.231 01	45.740 82
958	917 764	879 217 912	30.951 58	97.877 47	9.857 993	21.238 40	45.756 75
959	919 681	881 974 079	30.967 73	97.928 55	9.861 422	21.245 79	45.772 67
960	921 600	884 736 000	30.983 87	97.979 59	9.864 848	21.253 17	45.788 57
961	923 521	887 503 681	31.000 00	98.030 61	9.868 272	21.260 55	45.804 46
962	925 444	890 277 128	31.016 12	98.081 60	9.871 694	21.267 92	45.820 35
963	927 369	893 056 347	31.032 24	98.132 56	9.875 113	21.275 29	45.836 22
964	929 296	895 841 344	31.048 35	98.183 50	9.878 530	21.282 65	45.852 08
965	931 225	898 632 125	31.064 45	98.234 41	9.881 945	21.290 01	45.867 93
966	933 156	901 428 696	31.080 54	98.285 30	9.885 357	21.297 36	45.883 76
967	935 089	904 231 063	31.096 62	98.336 16	9.888 767	21.304 70	45.899 59
968	937 024	907 039 232	31.112 70	98.386 99	9.892 175	21.312 04	45.915 41
969	938 961	909 853 209	31.128 76	98.437 80	9.895 580	21.319 38	45.931 21
970	940 900	912 673 000	31.144 82	98.488 58	9.898 983	21.326 71	45.947 01
971	942 841	915 498 611	31.160 87	98.539 33	9.902 384	21.334 04	45.962 79
972	944 784	918 330 048	31.176 91	98.590 06	9.905 782	21.341 36	45.978 57
973	946 729	921 167 317	31.192 95	98.640 76	9.909 178	21.348 68	45.994 33
974	948 676	924 010 424	31.208 97	98.691 44	9.912 571	21.355 99	46.010 08
975	950 625	926 859 375	31.224 99	98.742 09	9.915 962	21.363 29	46.025 82
976	952 576	929 714 176	31.241 00	98.792 71	9.919 351	21.370 59	46.041 55
977	954 529	932 574 833	31.257 00	98.843 31	9.922 738	21.377 89	46.057 27
978	956 484	935 441 352	31.272 99	98.893 88	9.926 122	21.385 18	46.072 98
979	958 441	938 313 739	31.288 98	98.944 43	9.929 504	21.392 47	46.088 68
980	960 400	941 192 000	31.304 95	98.994 95	9.932 884	21.399 75	46.104 36
981	962 361	944 076 141	31.320 92	99.045 44	9.936 261	21.407 03	46.120 04
982	964 324	946 966 168	31.336 88	99.095 91	9.939 636	21.414 30	46.135 71
983	966 289	949 862 087	31.352 83	99.146 36	9.943 009	21.421 56	46.151 36
984	968 256	952 763 904	31.368 77	99.196 77	9.946 380	21.428 83	46.167 00
985	970 225	955 671 625	31.384 71	99.247 17	9.949 748	21.436 08	46.182 64
986	972 196	958 585 256	31.400 64	99.297 53	9.953 114	21.443 33	46.198 26
987	974 169	961 504 803	31.416 56	99.347 87	9.956 478	21.450 58	46.213 87
988	976 144	964 430 272	31.432 47	99.398 19	9.959 839	21.457 82	46.229 48
989	978 121	967 361 669	31.448 37	99.448 48	9.963 198	21.465 06	46.245 07
990	980 100	970 299 000	31.464 27	99.498 74	9.966 555	21.472 29	46.260 65
991	982 081	973 242 271	31.480 15	99.548 98	9.969 910	21.479 52	46.276 22
992	984 064	976 191 488	31.496 03	99.599 20	9.973 262	21.486 74	46.291 78
993	986 049	979 146 657	31.511 90	99.649 39	9.976 612	21.493 96	46.307 33
994	988 036	982 107 784	31.527 77	99.699 55	9.979 960	21.501 17	46.322 87
995	990 025	985 074 875	31.543 62	99.749 69	9.983 305	21.508 38	46.338 40
996	992 016	988 047 936	31.559 47	99.799 80	9.986 649	21.515 58	46.353 92
997	994 009	991 026 973	31.575 31	99.849 89	9.989 990	21.522 78	46.369 43
998	996 004	994 011 992	31.591 14	99.899 95	9.993 329	21.529 97	46.384 92
999	998 001	997 002 999	31.606 96	99.949 99	9.996 666	21.537 16	46.400 41

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$	n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
				50	20.000 00	157.079 6	1 963.495
1	1000.000	3.141 593	.785 3982	51	19.607 84	160.221 2	2 042.821
2	500.000 0	6.283 185	3.141 593	52	19.230 77	163.362 8	2 123.717
3	333.333 3	9.424 778	7.068 583	53	18.867 92	166.504 4	2 206.183
4	250.000 0	12.566 37	12.566 37	54	18.518 52	169.646 0	2 290.221
5	200.000 0	15.707 96	19.634 95	55	18.181 82	172.787 6	2 375.829
6	166.666 7	18.849 56	28.274 33	56	17.857 14	175.929 2	2 463.009
7	142.857 1	21.991 15	38.484 51	57	17.543 86	179.070 8	2 551.759
8	125.000 0	25.132 74	50.265 48	58	17.241 38	182.212 4	2 642.079
9	111.111 1	28.274 33	63.617 25	59	16.949 15	185.354 0	2 733.971
10	100.000 0	31.415 93	78.539 82	60	16.666 67	188.495 6	2 827.433
11	90.909 09	34.557 52	95.033 18	61	16.393 44	191.637 2	2 922.467
12	83.333 33	37.699 11	113.097 3	62	16.129 03	194.778 7	3 019.071
13	76.923 08	40.840 70	132.732 3	63	15.873 02	197.920 3	3 117.245
14	71.428 57	43.982 30	153.938 0	64	15.625 00	201.061 9	3 216.991
15	66.666 67	47.123 89	176.714 6	65	15.384 62	204.203 5	3 318.307
16	62.500 00	50.265 48	201.061 9	66	15.151 52	207.345 1	3 421.194
17	58.823 53	53.407 08	226.980 1	67	14.925 37	210.486 7	3 525.652
18	55.555 56	56.548 67	254.469 0	68	14.705 88	213.628 3	3 631.681
19	52.631 58	59.690 26	283.528 7	69	14.492 75	216.769 9	3 739.281
20	50.000 00	62.831 85	314.159 3	70	14.285 71	219.911 5	3 848.451
21	47.619 05	65.973 45	346.360 6	71	14.084 51	223.053 1	3 959.192
22	45.454 55	69.115 04	380.132 7	72	13.888 89	226.194 7	4 071.504
23	43.478 26	72.256 63	415.475 6	73	13.698 63	229.336 3	4 185.387
24	41.666 67	75.398 22	452.389 3	74	13.513 51	232.477 9	4 300.840
25	40.000 00	78.539 82	490.873 9	75	13.333 33	235.619 4	4 417.865
26	38.461 54	81.681 41	530.929 2	76	13.157 89	238.761 0	4 536.460
27	37.037 04	84.823 00	572.555 3	77	12.987 01	241.902 6	4 656.626
28	35.714 29	87.964 59	615.752 2	78	12.820 51	245.044 2	4 778.362
29	34.482 76	91.106 19	660.519 9	79	12.658 23	248.185 8	4 901.670
30	33.333 33	94.247 78	706.858 3	80	12.500 00	251.327 4	5 026.548
31	32.258 06	97.389 37	754.767 6	81	12.345 68	254.469 0	5 152.997
32	31.250 00	100.531 0	804.247 7	82	12.195 12	257.610 6	5 281.017
33	30.303 03	103.672 6	855.298 6	83	12.048 19	260.752 2	5 410.608
34	29.411 76	106.814 2	907.920 3	84	11.904 76	263.893 8	5 541.769
35	28.571 43	109.955 7	962.112 8	85	11.764 71	267.035 4	5 674.502
36	27.777 78	113.097 3	1 017.876	86	11.627 91	270.177 0	5 808.805
37	27.027 03	116.238 9	1 075.210	87	11.494 25	273.318 6	5 944.679
38	26.315 79	119.380 5	1 134.115	88	11.363 64	276.460 2	6 082.123
39	25.641 03	122.522 1	1 194.591	89	11.235 96	279.601 7	6 221.139
40	25.000 00	125.663 7	1 256.637	90	11.111 11	282.743 3	6 361.725
41	24.390 24	128.805 3	1 320.254	91	10.989 01	285.884 9	6 503.882
42	23.809 52	131.946 9	1 385.442	92	10.869 57	289.026 5	6 647.610
43	23.255 81	135.088 5	1 452.201	93	10.752 69	292.168 1	6 792.909
44	22.727 27	138.230 1	1 520.531	94	10.638 30	295.309 7	6 939.778
45	22.222 22	141.371 7	1 590.431	95	10.526 32	298.451 3	7 088.218
46	21.739 13	144.513 3	1 661.903	96	10.416 67	301.592 9	7 238.229
47	21.276 60	147.654 9	1 734.945	97	10.309 28	304.734 5	7 389.811
48	20.833 33	150.796 4	1 809.557	98	10.204 08	307.876 1	7 542.964
49	20.408 16	153.938 0	1 885.741	99	10.101 01	311.017 7	7 697.687

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
100	10.000 000	314.159 3	7 853.982
101	9.900 990	317.300 9	8 011.847
102	9.803 922	320.442 5	8 171.282
103	9.708 738	323.584 0	8 332.289
104	9.615 385	326.725 6	8 494.867
105	9.523 810	329.867 2	8 659.015
106	9.433 962	333.008 8	8 824.734
107	9.345 794	336.150 4	8 992.024
108	9.259 259	339.292 0	9 160.884
109	9.174 312	342.433 6	9 331.316
110	9.090 909	345.575 2	9 503.318
111	9.009 009	348.716 8	9 676.891
112	8.928 571	351.858 4	9 852.035
113	8.849 558	355.000 0	10 028.75
114	8.771 930	358.141 6	10 207.03
115	8.695 652	361.283 2	10 386.89
116	8.620 690	364.424 7	10 568.32
117	8.547 009	367.566 3	10 751.32
118	8.474 576	370.707 9	10 935.88
119	8.403 361	373.849 5	11 122.02
120	8.333 333	376.991 1	11 309.73
121	8.264 463	380.132 7	11 499.01
122	8.196 721	383.274 3	11 689.87
123	8.130 081	386.415 9	11 882.29
124	8.064 516	389.557 5	12 076.28
125	8.000 000	392.699 1	12 271.85
126	7.936 508	395.840 7	12 468.98
127	7.874 016	398.982 3	12 667.69
128	7.812 500	402.123 9	12 867.96
129	7.751 938	405.265 5	13 069.81
130	7.692 308	408.407 0	13 273.23
131	7.633 588	411.548 6	13 478.22
132	7.575 758	414.690 2	13 684.78
133	7.518 797	417.831 8	13 892.91
134	7.462 687	420.973 4	14 102.61
135	7.407 407	424.115 0	14 313.88
136	7.352 941	427.256 6	14 526.72
137	7.299 270	430.398 2	14 741.14
138	7.246 377	433.539 8	14 957.12
139	7.194 245	436.681 4	15 174.68
140	7.142 857	439.823 0	15 393.80
141	7.092 199	442.964 6	15 614.50
142	7.042 254	446.106 2	15 836.77
143	6.993 007	449.247 7	16 060.61
144	6.944 444	452.389 3	16 286.02
145	6.896 552	455.530 9	16 513.00
146	6.849 315	458.672 5	16 741.55
147	6.802 721	461.814 1	16 971.67
148	6.756 757	464.955 7	17 203.36
149	6.711 409	468.097 3	17 436.62
150	6.666 667	471.238 9	17 671.46
151	6.622 517	474.380 5	17 907.86
152	6.578 947	477.522 1	18 145.84
153	6.535 948	480.663 7	18 385.39
154	6.493 506	483.805 3	18 626.50
155	6.451 613	486.946 9	18 869.19
156	6.410 256	490.088 5	19 113.45
157	6.369 427	493.230 0	19 359.28
158	6.329 114	496.371 6	19 606.68
159	6.289 308	499.513 2	19 855.65
160	6.250 000	502.654 8	20 106.19
161	6.211 180	505.796 4	20 358.31
162	6.172 840	508.938 0	20 611.99
163	6.134 969	512.079 6	20 867.24
164	6.097 561	515.221 2	21 124.07
165	6.060 606	518.362 8	21 382.46
166	6.024 096	521.504 4	21 642.43
167	5.988 024	524.646 0	21 903.97
168	5.952 381	527.787 6	22 167.08
169	5.917 160	530.929 2	22 431.76
170	5.882 353	534.070 8	22 698.01
171	5.847 953	537.212 3	22 965.83
172	5.813 953	540.353 9	23 235.22
173	5.780 347	543.495 5	23 506.18
174	5.747 126	546.637 1	23 778.71
175	5.714 286	549.778 7	24 052.82
176	5.681 818	552.920 3	24 328.49
177	5.649 718	556.061 9	24 605.74
178	5.617 978	559.203 5	24 884.56
179	5.586 592	562.345 1	25 164.94
180	5.555 556	565.486 7	25 446.90
181	5.524 862	568.628 3	25 730.43
182	5.494 505	571.769 9	26 015.53
183	5.464 481	574.911 5	26 302.20
184	5.434 783	578.053 0	26 590.44
185	5.405 405	581.194 6	26 880.25
186	5.376 344	584.336 2	27 171.63
187	5.347 594	587.477 8	27 464.59
188	5.319 149	590.619 4	27 759.11
189	5.291 005	593.761 0	28 055.21
190	5.263 158	596.902 6	28 352.87
191	5.235 602	600.044 2	28 652.11
192	5.208 333	603.185 8	28 952.92
193	5.181 347	606.327 4	29 255.30
194	5.154 639	609.469 0	29 559.25
195	5.128 205	612.610 6	29 864.77
196	5.102 041	615.752 2	30 171.86
197	5.076 142	618.893 8	30 480.52
198	5.050 505	622.035 3	30 790.75
199	5.025 126	625.176 9	31 102.55

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$	n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
200	5.000 000	628.318 5	31 415.93	250	4.000 000	785.398 2	49 087.39
201	4.975 124	631.460 1	31 730.87	251	3.984 064	788.539 8	49 480.87
202	4.950 495	634.601 7	32 047.39	252	3.968 254	791.681 3	49 875.92
203	4.926 108	637.743 3	32 365.47	253	3.952 569	794.822 9	50 272.55
204	4.901 961	640.884 9	32 685.13	254	3.937 008	797.964 5	50 670.75
205	4.878 049	644.026 5	33 006.36	255	3.921 569	801.106 1	51 070.52
206	4.854 369	647.168 1	33 329.16	256	3.906 250	804.247 7	51 471.85
207	4.830 918	650.309 7	33 653.53	257	3.891 051	807.389 3	51 874.76
208	4.807 692	653.451 3	33 979.47	258	3.875 969	810.530 9	52 279.24
209	4.784 689	656.592 9	34 306.98	259	3.861 004	813.672 5	52 685.29
210	4.761 905	659.734 5	34 636.06	260	3.846 154	816.814 1	53 092.92
211	4.739 336	662.876 0	34 966.71	261	3.831 418	819.955 7	53 502.11
212	4.716 981	666.017 6	35 298.94	262	3.816 794	823.097 3	53 912.87
213	4.694 836	669.159 2	35 632.73	263	3.802 281	826.238 9	54 325.21
214	4.672 897	672.300 8	35 968.09	264	3.787 879	829.380 5	54 739.11
215	4.651 163	675.442 4	36 305.03	265	3.773 585	832.522 1	55 154.59
216	4.629 630	678.584 0	36 643.54	266	3.759 398	835.663 6	55 571.63
217	4.608 295	681.725 6	36 983.61	267	3.745 318	838.805 2	55 990.25
218	4.587 156	684.867 2	37 325.26	268	3.731 343	841.946 8	56 410.44
219	4.566 210	688.008 8	37 668.48	269	3.717 472	845.088 4	56 832.20
220	4.545 455	691.150 4	38 013.27	270	3.703 704	848.230 0	57 255.53
221	4.524 887	694.292 0	38 359.63	271	3.690 037	851.371 6	57 680.43
222	4.504 505	697.433 6	38 707.56	272	3.676 471	854.513 2	58 106.90
223	4.484 305	700.575 2	39 057.07	273	3.663 004	857.654 8	58 534.94
224	4.464 286	703.716 8	39 408.14	274	3.649 635	860.796 4	58 964.55
225	4.444 444	706.858 3	39 760.78	275	3.636 364	863.938 0	59 395.74
226	4.424 779	709.999 9	40 115.00	276	3.623 188	867.079 6	59 828.49
227	4.405 286	713.141 5	40 470.78	277	3.610 108	870.221 2	60 262.82
228	4.385 965	716.283 1	40 828.14	278	3.597 122	873.362 8	60 698.71
229	4.366 812	719.424 7	41 187.07	279	3.584 229	876.504 4	61 136.18
230	4.347 826	722.566 3	41 547.56	280	3.571 429	879.645 9	61 575.22
231	4.329 004	725.707 9	41 909.63	281	3.558 719	882.787 5	62 015.82
232	4.310 345	728.849 5	42 273.27	282	3.546 099	885.929 1	62 458.00
233	4.291 845	731.991 1	42 638.48	283	3.533 569	839.070 7	62 901.75
234	4.273 504	735.132 7	43 005.26	284	3.521 127	892.212 3	63 347.07
235	4.255 319	738.274 3	43 373.61	285	3.508 772	895.353 9	63 793.97
236	4.237 288	741.415 9	43 743.54	286	3.496 503	898.495 5	64 242.43
237	4.219 409	744.557 5	44 115.03	287	3.484 321	901.637 1	64 692.46
238	4.201 681	747.699 1	44 488.09	288	3.472 222	904.778 7	65 144.07
239	4.184 100	750.840 6	44 862.73	289	3.460 208	907.920 3	65 597.24
240	4.166 667	753.982 2	45 238.93	290	3.448 276	911.061 9	66 051.99
241	4.149 378	757.123 8	45 616.71	291	3.436 426	914.203 5	66 508.30
242	4.132 231	760.265 4	45 996.06	292	3.424 658	917.345 1	66 966.19
243	4.115 226	763.407 0	46 376.98	293	3.412 969	920.486 6	67 425.65
244	4.098 361	766.548 6	46 759.47	294	3.401 361	923.628 2	67 886.68
245	4.081 633	769.690 2	47 143.52	295	3.389 831	926.769 8	68 349.28
246	4.065 041	772.831 8	47 529.16	296	3.378 378	929.911 4	68 813.45
247	4.048 583	775.973 4	47 916.36	297	3.367 003	933.053 0	69 279.19
248	4.032 258	779.115 0	48 305.13	298	3.355 705	936.194 6	69 746.50
249	4.016 064	782.256 6	48 695.47	299	3.344 482	939.336 2	70 215.38

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
300	3.333 333	942.477 8	70 685.83
301	3.322 259	945.619 4	71 157.86
302	3.311 258	948.761 0	71 631.45
303	3.300 330	951.902 6	72 106.62
304	3.289 474	955.044 2	72 583.36
305	3.278 689	958.185 8	73 061.66
306	3.267 974	961.327 4	73 541.54
307	3.257 329	964.468 9	74 022.99
308	3.246 753	967.610 5	74 506.01
309	3.236 246	970.752 1	74 990.60
310	3.225 806	973.893 7	75 476.76
311	3.215 434	977.035 3	75 964.50
312	3.205 128	980.176 9	76 453.80
313	3.194 888	983.318 5	76 944.67
314	3.184 713	986.460 1	77 437.12
315	3.174 603	989.601 7	77 931.13
316	3.164 557	992.743 3	78 426.72
317	3.154 574	995.884 9	78 923.88
318	3.144 654	999.026 5	79 422.60
319	3.134 796	1 002.168	79 922.90
320	3.125 000	1 005.310	80 424.77
321	3.115 265	1 008.451	80 928.21
322	3.105 590	1 011.593	81 433.22
323	3.095 975	1 014.734	81 939.80
324	3.086 420	1 017.876	82 447.96
325	3.076 923	1 021.018	82 957.68
326	3.067 485	1 024.159	83 468.97
327	3.058 104	1 027.301	83 981.84
328	3.048 780	1 030.442	84 496.28
329	3.039 514	1 033.584	85 012.28
330	3.030 303	1 036.726	85 529.86
331	3.021 148	1 039.867	86 049.01
332	3.012 048	1 043.009	86 569.73
333	3.003 003	1 046.150	87 092.02
334	2.994 012	1 049.292	87 615.88
335	2.985 075	1 052.434	88 141.31
336	2.976 190	1 055.575	88 668.31
337	2.967 359	1 058.717	89 196.88
338	2.958 580	1 061.858	89 727.03
339	2.949 853	1 065.000	90 258.74
340	2.941 176	1 068.142	90 792.03
341	2.932 551	1 071.283	91 326.88
342	2.923 977	1 074.425	91 863.31
343	2.915 452	1 077.566	92 401.31
344	2.906 977	1 080.708	92 940.88
345	2.898 551	1 083.849	93 482.02
346	2.890 173	1 086.991	94 024.73
347	2.881 844	1 090.133	94 569.01
348	2.873 563	1 093.274	95 114.86
349	2.865 330	1 096.416	95 662.28
350	2.857 143	1 099.557	96 211.28
351	2.849 003	1 102.699	96 761.84
352	2.840 909	1 105.841	97 313.97
353	2.832 861	1 108.982	97 867.68
354	2.824 859	1 112.124	98 422.96
355	2.816 901	1 115.265	98 979.80
356	2.808 989	1 118.407	99 538.22
357	2.801 120	1 121.549	100 098.2
358	2.793 296	1 124.690	100 659.8
359	2.785 515	1 127.832	101 222.9
360	2.777 778	1 130.973	101 787.6
361	2.770 083	1 134.115	102 353.9
362	2.762 431	1 137.257	102 921.7
363	2.754 821	1 140.398	103 491.1
364	2.747 253	1 143.540	104 062.1
365	2.739 726	1 146.681	104 634.7
366	2.732 240	1 149.823	105 208.8
367	2.724 796	1 152.965	105 784.5
368	2.717 391	1 156.106	106 361.8
369	2.710 027	1 159.248	106 940.6
370	2.702 703	1 162.389	107 521.0
371	2.695 418	1 165.531	108 103.0
372	2.688 172	1 168.672	108 686.5
373	2.680 965	1 171.814	109 271.7
374	2.673 797	1 174.956	109 858.4
375	2.666 667	1 178.097	110 446.6
376	2.659 574	1 181.239	111 036.5
377	2.652 520	1 184.380	111 627.9
378	2.645 503	1 187.522	112 220.8
379	2.638 522	1 190.664	112 815.4
380	2.631 579	1 193.805	113 411.5
381	2.624 672	1 196.947	114 009.2
382	2.617 801	1 200.088	114 608.4
383	2.610 966	1 203.230	115 209.3
384	2.604 167	1 206.372	115 811.7
385	2.597 403	1 209.513	116 415.6
386	2.590 674	1 212.655	117 021.2
387	2.583 979	1 215.796	117 628.3
388	2.577 320	1 218.938	118 237.0
389	2.570 694	1 222.080	118 847.2
390	2.564 103	1 225.221	119 459.1
391	2.557 545	1 228.363	120 072.5
392	2.551 020	1 231.504	120 687.4
393	2.544 529	1 234.646	121 304.0
394	2.538 071	1 237.788	121 922.1
395	2.531 646	1 240.929	122 541.7
396	2.525 253	1 244.071	123 163.0
397	2.518 892	1 247.212	123 785.8
398	2.512 563	1 250.354	124 410.2
399	2.506 266	1 253.495	125 036.2

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$	n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
400	2.500 000	1 256.637	125 663.7	450	2.222 222	1 413.717	159 043.1
401	2.493 766	1 259.779	126 292.8	451	2.217 295	1 416.858	159 750.8
402	2.487 562	1 262.920	126 923.5	452	2.212 389	1 420.000	160 460.0
403	2.481 390	1 266.062	127 555.7	453	2.207 506	1 423.141	161 170.8
404	2.475 248	1 269.203	128 189.5	454	2.202 643	1 426.283	161 883.1
405	2.469 136	1 272.345	128 824.9	455	2.197 802	1 429.425	162 597.1
406	2.463 054	1 275.487	129 461.9	456	2.192 982	1 432.566	163 312.6
407	2.457 002	1 278.628	130 100.4	457	2.188 184	1 435.708	164 029.6
408	2.450 980	1 281.770	130 740.5	458	2.183 406	1 438.849	164 748.3
409	2.444 988	1 284.911	131 382.2	459	2.178 649	1 441.991	165 468.5
410	2.439 024	1 288.053	132 025.4	460	2.173 913	1 445.133	166 190.3
411	2.433 090	1 291.195	132 670.2	461	2.169 197	1 448.274	166 913.6
412	2.427 184	1 294.336	133 316.6	462	2.164 502	1 451.416	167 638.5
413	2.421 308	1 297.478	133 964.6	463	2.159 827	1 454.557	168 365.0
414	2.415 459	1 300.619	134 614.1	464	2.155 172	1 457.699	169 093.1
415	2.409 639	1 303.761	135 265.2	465	2.150 538	1 460.841	169 822.7
416	2.403 846	1 306.903	135 917.9	466	2.145 923	1 463.982	170 553.9
417	2.398 082	1 310.044	136 572.1	467	2.141 328	1 467.124	171 286.7
418	2.392 344	1 313.186	137 227.9	468	2.136 752	1 470.265	172 021.0
419	2.386 635	1 316.327	137 885.3	469	2.132 196	1 473.407	172 757.0
420	2.380 952	1 319.469	138 544.2	470	2.127 660	1 476.549	173 494.5
421	2.375 297	1 322.611	139 204.8	471	2.123 142	1 479.690	174 233.5
422	2.369 668	1 325.752	139 866.8	472	2.118 644	1 482.832	174 974.1
423	2.364 066	1 328.894	140 530.5	473	2.114 165	1 485.973	175 716.3
424	2.358 491	1 332.035	141 195.7	474	2.109 705	1 489.115	176 460.1
425	2.352 941	1 335.177	141 862.5	475	2.105 263	1 492.257	177 205.5
426	2.347 418	1 338.318	142 530.9	476	2.100 840	1 495.398	177 952.4
427	2.341 920	1 341.460	143 200.9	477	2.096 436	1 498.540	178 700.9
428	2.336 449	1 344.602	143 872.4	478	2.092 050	1 501.681	179 450.9
429	2.331 002	1 347.743	144 545.5	479	2.087 683	1 504.823	180 202.5
430	2.325 581	1 350.885	145 220.1	480	2.083 333	1 507.964	180 955.7
431	2.320 186	1 354.026	145 896.3	481	2.079 002	1 511.106	181 710.5
432	2.314 815	1 357.168	146 574.1	482	2.074 689	1 514.248	182 466.8
433	2.309 469	1 360.310	147 253.5	483	2.070 393	1 517.389	183 224.8
434	2.304 147	1 363.451	147 934.5	484	2.066 116	1 520.531	183 984.2
435	2.298 851	1 366.593	148 617.0	485	2.061 856	1 523.672	184 745.3
436	2.293 578	1 369.734	149 301.0	486	2.057 613	1 526.814	185 507.9
437	2.288 330	1 372.876	149 986.7	487	2.053 388	1 529.956	186 272.1
438	2.283 105	1 376.018	150 673.9	488	2.049 180	1 533.097	187 037.9
439	2.277 904	1 379.159	151 362.7	489	2.044 990	1 536.239	187 805.2
440	2.272 727	1 382.301	152 053.1	490	2.040 816	1 539.380	188 574.1
441	2.267 574	1 385.442	152 745.0	491	2.036 660	1 542.522	189 344.6
442	2.262 443	1 388.584	153 438.5	492	2.032 520	1 545.664	190 116.6
443	2.257 336	1 391.726	154 133.6	493	2.028 398	1 548.805	190 890.2
444	2.252 252	1 394.867	154 830.3	494	2.024 291	1 551.947	191 665.4
445	2.247 191	1 398.009	155 528.5	495	2.020 202	1 555.088	192 442.2
446	2.242 152	1 401.150	156 228.3	496	2.016 129	1 558.230	193 220.5
447	2.237 136	1 404.292	156 929.6	497	2.012 072	1 561.372	194 000.4
448	2.232 143	1 407.434	157 632.6	498	2.008 032	1 564.513	194 781.9
449	2.227 171	1 410.575	158 337.1	499	2.004 008	1 567.655	195 564.9

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$	n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
500	2.000 000	1 570.796	196 349.5	550	1.818 182	1 727.876	237 582.9
501	1.996 008	1 573.938	197 135.7	551	1.814 882	1 731.018	238 447.7
502	1.992 032	1 577.080	197 923.5	552	1.811 594	1 734.159	239 314.0
503	1.988 072	1 580.221	198 712.8	553	1.808 318	1 737.301	240 181.8
504	1.984 127	1 583.363	199 503.7	554	1.805 054	1 740.442	241 051.3
505	1.980 198	1 586.504	200 296.2	555	1.801 802	1 743.584	241 922.3
506	1.976 285	1 589.646	201 090.2	556	1.798 561	1 746.726	242 794.8
507	1.972 387	1 592.787	201 885.8	557	1.795 332	1 749.867	243 669.0
508	1.968 504	1 595.929	202 683.0	558	1.792 115	1 753.009	244 544.7
509	1.964 637	1 599.071	203 481.7	559	1.788 909	1 756.150	245 422.0
510	1.960 784	1 602.212	204 282.1	560	1.785 714	1 759.292	246 300.9
511	1.956 947	1 605.354	205 084.0	561	1.782 531	1 762.433	247 181.3
512	1.953 125	1 608.495	205 887.4	562	1.779 359	1 765.575	248 063.3
513	1.949 318	1 611.637	206 692.4	563	1.776 199	1 768.717	248 946.9
514	1.945 525	1 614.779	207 499.1	564	1.773 050	1 771.858	249 832.0
515	1.941 748	1 617.920	208 307.2	565	1.769 912	1 775.000	250 718.7
516	1.937 984	1 621.062	209 117.0	566	1.766 784	1 778.141	251 607.0
517	1.934 236	1 624.203	209 928.3	567	1.763 668	1 781.283	252 496.9
518	1.930 502	1 627.345	210 741.2	568	1.760 563	1 784.425	253 388.3
519	1.926 782	1 630.487	211 555.6	569	1.757 469	1 787.566	254 281.3
520	1.923 077	1 633.628	212 371.7	570	1.754 386	1 790.708	255 175.9
521	1.919 386	1 636.770	213 189.3	571	1.751 313	1 793.849	256 072.0
522	1.915 709	1 639.911	214 008.4	572	1.748 252	1 796.991	256 969.7
523	1.912 046	1 643.053	214 829.2	573	1.745 201	1 800.133	257 869.0
524	1.908 397	1 646.195	215 651.5	574	1.742 160	1 803.274	258 769.8
525	1.904 762	1 649.336	216 475.4	575	1.739 130	1 806.416	259 672.3
526	1.901 141	1 652.478	217 300.8	576	1.736 111	1 809.557	260 576.3
527	1.897 533	1 655.619	218 127.8	577	1.733 102	1 812.699	261 481.8
528	1.893 939	1 658.761	218 956.4	578	1.730 104	1 815.841	262 389 0
529	1.890 359	1 661.903	219 786.6	579	1.727 116	1 818.982	263 297.7
530	1.886 792	1 665.044	220 618.3	580	1.724 138	1 822.124	264 207.9
531	1.883 239	1 668.186	221 451.7	581	1.721 170	1 825.265	265 119.8
532	1.879 699	1 671.327	222 286.5	582	1.718 213	1 828.407	266 033.2
533	1.876 173	1 674.469	223 123.0	583	1.715 266	1 831.549	266 948 2
534	1.872 659	1 677.610	223 961.0	584	1.712 329	1 834.690	267 864.8
535	1.869 159	1 680.752	224 800.6	585	1.709 402	1 837.832	268 782.9
536	1.865 672	1 683.894	225 641.8	586	1.706 485	1 840.973	269 702.6
537	1.862 197	1 687.035	226 484.5	587	1.703 578	1 844.115	270 623.9
538	1.858 736	1 690.177	227 328.8	588	1.700 680	1 847.256	271 546 7
539	1.855 288	1 693.318	228 174.7	589	1.697 793	1 850.398	272 471.1
540	1.851 852	1 696.460	229 022.1	590	1.694 915	1 853 540	273 397.1
541	1.848 429	1 699.602	229 871.1	591	1.692 047	1 856 681	274 324.7
542	1.845 018	1 702.743	230 721.7	592	1.689 189	1 859 823	275 253.8
543	1.841 621	1 705.885	231 573.9	593	1.686 341	1 862.964	276 184.5
544	1.838 235	1 709.026	232 427.6	594	1.683 502	1 866.106	277 116.7
545	1.834 862	1 712.168	233 282.9	595	1.680 672	1 869 248	278 050 6
546	1.831 502	1 715.310	234 139.8	596	1.677 852	1 872.389	278 986 0
547	1.828 154	1 718.451	234 998.2	597	1.675 042	1 875.531	279 923 0
548	1.824 818	1 721.593	235 858.2	598	1.672 241	1 878.672	280 861.5
549	1.821 494	1 724.734	236 719.8	599	1.669 449	1 881.814	281 801.6

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	$1000/n$	Circum of circle πn	Area of circle $\frac{1}{4}\pi n^2$	n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
600	1.666 667	1 884.956	282 743.3	650	1.538 462	2 042.035	331 830.7
601	1.663 894	1 888.097	283 686.6	651	1.536 098	2 045.177	332 852.5
602	1.661 130	1 891.239	284 631.4	652	1.533 742	2 048.318	333 875.9
603	1.658 375	1 894.380	285 577.8	653	1.531 394	2 051.460	334 900.8
604	1.655 629	1 897.522	286 525.8	654	1.529 052	2 054.602	335 927.4
605	1.652 893	1 900.664	287 475.4	655	1.526 718	2 057.743	336 955.4
606	1.650 165	1 903.805	288 426.5	656	1.524 390	2 060.885	337 985.1
607	1.647 446	1 906.947	289 379.2	657	1.522 070	2 064.026	339 016.3
608	1.644 737	1 910.088	290 333.4	658	1.519 757	2 067.168	340 049.1
609	1.642 036	1 913.230	291 289.3	659	1.517 451	2 070.310	341 083.5
610	1.639 344	1 916.372	292 246.7	660	1.515 152	2 073.451	342 119.4
611	1.636 661	1 919.513	293 205.6	661	1.512 859	2 076.593	343 157.0
612	1.633 987	1 922.655	294 166.2	662	1.510 574	2 079.734	344 196.0
613	1.631 321	1 925.796	295 128.3	663	1.508 296	2 082.876	345 236.7
614	1.628 664	1 928.938	296 092.0	664	1.506 024	2 086.018	346 278.9
615	1.626 016	1 932.079	297 057.2	665	1.503 759	2 089.159	347 322.7
616	1.623 377	1 935.221	298 024.0	666	1.501 502	2 092.301	348 368.1
617	1.620 746	1 938.363	298 992.4	667	1.499 250	2 095.442	349 415.0
618	1.618 123	1 941.504	299 962.4	668	1.497 006	2 098.584	350 463.5
619	1.615 509	1 944.646	300 933.9	669	1.494 768	2 101.725	351 513.6
620	1.612 903	1 947.787	301 907.1	670	1.492 537	2 104.867	352 565.2
621	1.610 306	1 950.929	302 881.7	671	1.490 313	2 108.009	353 618.5
622	1.607 717	1 954.071	303 858.0	672	1.488 095	2 111.150	354 673.2
623	1.605 136	1 957.212	304 835.8	673	1.485 884	2 114.292	355 729.6
624	1.602 564	1 960.354	305 815.2	674	1.483 680	2 117.433	356 787.5
625	1.600 000	1 963.495	306 796.2	675	1.481 481	2 120.575	357 847.0
626	1.597 444	1 966.637	307 778.7	676	1.479 290	2 123.717	358 908.1
627	1.594 896	1 969.779	308 762.8	677	1.477 105	2 126.858	359 970.8
628	1.592 357	1 972.920	309 748.5	678	1.474 926	2 130.000	361 035.0
629	1.589 825	1 976.062	310 735.7	679	1.472 754	2 133.141	362 100.8
630	1.587 302	1 979.203	311 724.5	680	1.470 588	2 136.283	363 168.1
631	1.584 786	1 982.345	312 714.9	681	1.468 429	2 139.425	364 237.0
632	1.582 278	1 985.487	313 706.9	682	1.466 276	2 142.566	365 307.5
633	1.579 779	1 988.628	314 700.4	683	1.464 129	2 145.708	366 379.6
634	1.577 287	1 991.770	315 695.5	684	1.461 988	2 148.849	367 453.2
635	1.574 803	1 994.911	316 692.2	685	1.459 854	2 151.991	368 528.5
636	1.572 327	1 998.053	317 690.4	686	1.457 726	2 155.133	369 605.2
637	1.569 859	2 001.195	318 690.2	687	1.455 604	2 158.274	370 683.6
638	1.567 398	2 004.336	319 691.6	688	1.453 488	2 161.416	371 763.5
639	1.564 945	2 007.478	320 694.6	689	1.451 379	2 164.557	372 845.0
640	1.562 500	2 010.619	321 699.1	690	1.449 275	2 167.699	373 928.1
641	1.560 062	2 013.761	322 705.2	691	1.447 178	2 170.841	375 012.7
642	1.557 632	2 016.902	323 712.8	692	1.445 087	2 173.982	376 098.9
643	1.555 210	2 020.044	324 722.1	693	1.443 001	2 177.124	377 186.7
644	1.552 795	2 023.186	325 732.9	694	1.440 922	2 180.265	378 276.0
645	1.550 388	2 026.327	326 745.3	695	1.438 849	2 183.407	379 366.9
646	1.547 988	2 029.469	327 759.2	696	1.436 782	2 186.548	380 459.4
647	1.545 595	2 032.610	328 774.7	697	1.434 720	2 189.690	381 553.5
648	1.543 210	2 035.752	329 791.8	698	1.432 665	2 192.832	382 649.1
649	1.540 832	2 038.894	330 810.5	699	1.430 615	2 195.973	383 746.3

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	1000/n	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$	n	1000/n	Circum of circle πn	Area of circle $\frac{1}{4}\pi n^2$
700	1.428 571	2 199.115	384 845.1	750	1.333 333	2 356.194	441 786.5
701	1.426 534	2 202.256	385 945.4	751	1.331 558	2 359.336	442 965.3
702	1.424 501	2 205.398	387 047.4	752	1.329 787	2 362.478	444 145.8
703	1.422 475	2 208.540	388 150.8	753	1.328 021	2 365.619	445 327.8
704	1.420 455	2 211.681	389 255.9	754	1.326 260	2 368.761	446 511.4
705	1.418 440	2 214.823	390 362.5	755	1.324 503	2 371.902	447 696.6
706	1.416 431	2 217.964	391 470.7	756	1.322 751	2 375.044	448 883.3
707	1.414 427	2 221.106	392 580.5	757	1.321 004	2 378.186	450 071.6
708	1.412 429	2 224.248	393 691.8	758	1.319 261	2 381.327	451 261.5
709	1.410 437	2 227.389	394 804.7	759	1.317 523	2 384.469	452 453.0
710	1.408 451	2 230.531	395 919.2	760	1.315 789	2 387.610	453 646.0
711	1.406 470	2 233.672	397 035.3	761	1.314 060	2 390.752	454 840.6
712	1.404 494	2 236.814	398 152.9	762	1.312 336	2 393.894	456 036.7
713	1.402 525	2 239.956	399 272.1	763	1.310 616	2 397.035	457 234.5
714	1.400 560	2 243.097	400 392.8	764	1.308 901	2 400.177	458 433.8
715	1.398 601	2 246.239	401 515.2	765	1.307 190	2 403.318	459 634.6
716	1.396 648	2 249.380	402 639.1	766	1.305 483	2 406.460	460 837.1
717	1.394 700	2 252.522	403 764.6	767	1.303 781	2 409.602	462 041.1
718	1.392 758	2 255.664	404 891.6	768	1.302 083	2 412.743	463 246.7
719	1.390 821	2 258.805	406 020.2	769	1.300 390	2 415.885	464 453.8
720	1.388 889	2 261.947	407 150.4	770	1.298 701	2 419.026	465 662.6
721	1.386 963	2 265.088	408 282.2	771	1.297 017	2 422.168	466 872.9
722	1.385 042	2 268.230	409 415.5	772	1.295 337	2 425.310	468 084.7
723	1.383 126	2 271.371	410 550.4	773	1.293 661	2 428.451	469 298.2
724	1.381 215	2 274.513	411 686.9	774	1.291 990	2 431.593	470 513.2
725	1.379 310	2 277.655	412 824.9	775	1.290 323	2 434.734	471 729.8
726	1.377 410	2 280.796	413 964.5	776	1.288 660	2 437.876	472 947.9
727	1.375 516	2 283.938	415 105.7	777	1.287 001	2 441.017	474 167.6
728	1.373 626	2 287.079	416 248.5	778	1.285 347	2 444.159	475 388.9
729	1.371 742	2 290.221	417 392.8	779	1.283 697	2 447.301	476 611.8
730	1.369 863	2 293.363	418 538.7	780	1.282 051	2 450.442	477 836.2
731	1.367 989	2 296.504	419 686.1	781	1.280 410	2 453.584	479 062.2
732	1.366 120	2 299.646	420 835.2	782	1.278 772	2 456.725	480 289.8
733	1.364 256	2 302.787	421 985.8	783	1.277 139	2 459.867	481 519.0
734	1.362 398	2 305.929	423 138.0	784	1.275 510	2 463.009	482 749.7
735	1.360 544	2 309.071	424 291.7	785	1.273 885	2 466.150	483 982.0
736	1.358 696	2 312.212	425 447.0	786	1.272 265	2 469.292	485 215.8
737	1.356 852	2 315.354	426 603.9	787	1.270 648	2 472.433	486 451.3
738	1.355 014	2 318.495	427 762.4	788	1.269 036	2 475.575	487 688.3
739	1.353 180	2 321.637	428 922.4	789	1.267 427	2 478.717	488 926.9
740	1.351 351	2 324.779	430 084.0	790	1.265 823	2 481.858	490 167.0
741	1.349 528	2 327.920	431 247.2	791	1.264 223	2 485.000	491 408.7
742	1.347 709	2 331.062	432 412.0	792	1.262 626	2 488.141	492 652.0
743	1.345 895	2 334.203	433 578.3	793	1.261 034	2 491.283	493 896.8
744	1.344 086	2 337.345	434 746.2	794	1.259 446	2 494.425	495 143.3
745	1.342 282	2 340.487	435 915.6	795	1.257 862	2 497.566	496 391.3
746	1.340 483	2 343.628	437 086.6	796	1.256 281	2 500.708	497 640.8
747	1.338 688	2 346.770	438 259.2	797	1.254 705	2 503.849	498 892.0
748	1.336 898	2 349.911	439 433.4	798	1.253 133	2 506.991	500 144.7
749	1.335 113	2 353.053	440 609.2	799	1.251 564	2 510.133	501 399.0

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$	n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
800	1.250 000	2 513.274	502 654.8	850	1.176 471	2 670.354	567 450.2
801	1.248 439	2 516.416	503 912.2	851	1.175 088	2 673.495	568 786.1
802	1.246 883	2 519.557	505 171.2	852	1.173 709	2 676.637	570 123.7
803	1.245 330	2 522.699	506 431.8	853	1.172 333	2 679.779	571 462.8
804	1.243 781	2 525.840	507 693.9	854	1.170 960	2 682.920	572 803.4
805	1.242 236	2 528.982	508 957.6	855	1.169 591	2 686.062	574 145.7
806	1.240 695	2 532.124	510 222.9	856	1.168 224	2 689.203	575 489.5
807	1.239 157	2 535.265	511 489.8	857	1.166 861	2 692.345	576 834.9
808	1.237 624	2 538.407	512 758.2	858	1.165 501	2 695.486	578 181.9
809	1.236 094	2 541.548	514 028.2	859	1.164 144	2 698.628	579 530.4
810	1.234 568	2 544.690	515 299.7	860	1.162 791	2 701.770	580 880.5
811	1.233 046	2 547.832	516 572.9	861	1.161 440	2 704.911	582 232.2
812	1.231 527	2 550.973	517 847.6	862	1.160 093	2 708.053	583 585.4
813	1.230 012	2 554.115	519 123.8	863	1.158 749	2 711.194	584 940.2
814	1.228 501	2 557.256	520 401.7	864	1.157 407	2 714.336	586 296.6
815	1.226 994	2 560.398	521 681.1	865	1.156 069	2 717.478	587 654.5
816	1.225 490	2 563.540	522 962.1	866	1.154 734	2 720.619	589 014.1
817	1.223 990	2 566.681	524 244.6	867	1.153 403	2 723.761	590 375.2
818	1.222 494	2 569.823	525 528.8	868	1.152 074	2 726.902	591 737.8
819	1.221 001	2 572.964	526 814.5	869	1.150 748	2 730.044	593 102.1
820	1.219 512	2 576.106	528 101.7	870	1.149 425	2 733.186	594 467.9
821	1.218 027	2 579.248	529 390.6	871	1.148 106	2 736.327	595 835.2
822	1.216 545	2 582.389	530 681.0	872	1.146 789	2 739.469	597 204.2
823	1.215 067	2 585.531	531 973.0	873	1.145 475	2 742.610	598 574.7
824	1.213 592	2 588.672	533 266.5	874	1.144 165	2 745.752	599 946.8
825	1.212 121	2 591.814	534 561.6	875	1.142 857	2 748.894	601 320.5
826	1.210 654	2 594.956	535 858.3	876	1.141 553	2 752.035	602 695.7
827	1.209 190	2 598.097	537 156.6	877	1.140 251	2 755.177	604 072.5
828	1.207 729	2 601.239	538 456.4	878	1.138 952	2 758.318	605 450.9
829	1.206 273	2 604.380	539 757.8	879	1.137 656	2 761.460	606 830.8
830	1.204 819	2 607.522	541 060.8	880	1.136 364	2 764.602	608 212.3
831	1.203 369	2 610.663	542 365.3	881	1.135 074	2 767.743	609 595.4
832	1.201 923	2 613.805	543 671.5	882	1.133 787	2 770.885	610 980.1
833	1.200 480	2 616.947	544 979.1	883	1.132 503	2 774.026	612 366.3
834	1.199 041	2 620.088	546 288.4	884	1.131 222	2 777.168	613 754.1
835	1.197 605	2 623.230	547 599.2	885	1.129 944	2 780.309	615 143.5
836	1.196 172	2 626.371	548 911.6	886	1.128 668	2 783.451	616 534.4
837	1.194 743	2 629.513	550 225.6	887	1.127 396	2 786.593	617 926.9
838	1.193 317	2 632.655	551 541.1	888	1.126 126	2 789.734	619 321.0
839	1.191 895	2 635.796	552 858.3	889	1.124 859	2 792.876	620 716.7
840	1.190 476	2 638.938	554 176.9	890	1.123 596	2 796.017	622 113.9
841	1.189 061	2 642.079	555 497.2	891	1.122 334	2 799.159	623 512.7
842	1.187 648	2 645.221	556 819.0	892	1.121 076	2 802.301	624 913.0
843	1.186 240	2 648.363	558 142.4	893	1.119 821	2 805.442	626 315.0
844	1.184 834	2 651.504	559 467.4	894	1.118 568	2 808.584	627 718.5
845	1.183 432	2 654.646	560 793.9	895	1.117 318	2 811.725	629 123.6
846	1.182 033	2 657.787	562 122.0	896	1.116 071	2 814.867	630 530.2
847	1.180 638	2 660.929	563 451.7	897	1.114 827	2 818.009	631 938.4
848	1.179 245	2 664.071	564 783.0	898	1.113 586	2 821.150	633 348.2
849	1.177 856	2 667.212	566 115.8	899	1.112 347	2 824.292	634 759.6

RECIPROCALS, CIRCUMFERENCES, AND AREAS OF CIRCLES

n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$	n	$1000/n$	Circum. of circle πn	Area of circle $\frac{1}{4}\pi n^2$
900	1.111 111	2 827.433	636 172.5	950	1.052 632	2 984.513	708 821.8
901	1.109 878	2 830.575	637 587.0	951	1.051 525	2 987.655	710 314.9
902	1.108 647	2 833.717	639 003.1	952	1.050 420	2 990.796	711 809.5
903	1.107 420	2 836.858	640 420.7	953	1.049 318	2 993.938	713 305.7
904	1.106 195	2 840.000	641 839.9	954	1.048 218	2 997.079	714 803.4
905	1.104 972	2 843.141	643 260.7	955	1.047 120	3 000.221	716 302.8
906	1.103 753	2 846.283	644 683.1	956	1.046 025	3 003.363	717 803.7
907	1.102 536	2 849.425	646 107.0	957	1.044 932	3 006.504	719 306.1
908	1.101 322	2 852.566	647 532.5	958	1.043 841	3 009.646	720 810.2
909	1.100 110	2 855.708	648 959.6	959	1.042 753	3 012.787	722 315.8
910	1.098 901	2 858.849	650 388.2	960	1.041 667	3 015.929	723 822.9
911	1.097 695	2 861.991	651 818.4	961	1.040 583	3 019.071	725 331.7
912	1.096 491	2 865.133	653 250.2	962	1.039 501	3 022.212	726 842.0
913	1.095 290	2 868.274	654 683.6	963	1.038 422	3 025.354	728 353.9
914	1.094 092	2 871.416	656 118.5	964	1.037 344	3 028.495	729 867.4
915	1.092 896	2 874.557	657 555.0	965	1.036 269	3 031.637	731 382.4
916	1.091 703	2 877.699	658 993.0	966	1.035 197	3 034.779	732 899.0
917	1.090 513	2 880.840	660 432.7	967	1.034 126	3 037.920	734 417.2
918	1.089 325	2 883.982	661 873.9	968	1.033 058	3 041.062	735 936.9
919	1.088 139	2 887.124	663 316.7	969	1.031 992	3 044.203	737 458.2
920	1.086 957	2 890.265	664 761.0	970	1.030 928	3 047.345	738 981.1
921	1.085 776	2 893.407	666 206.9	971	1.029 866	3 050.486	740 505.6
922	1.084 599	2 896.548	667 654.4	972	1.028 807	3 053.628	742 031.6
923	1.083 424	2 899.690	669 103.5	973	1.027 749	3 056.770	743 559.2
924	1.082 251	2 902.832	670 554.1	974	1.026 694	3 059.911	745 088.4
925	1.081 081	2 905.973	672 006.3	975	1.025 641	3 063.053	746 619.1
926	1.079 914	2 909.115	673 460.1	976	1.024 590	3 066.194	748 151.4
927	1.078 749	2 912.256	674 915.4	977	1.023 541	3 069.336	749 685.3
928	1.077 586	2 915.398	676 372.3	978	1.022 495	3 072.478	751 220.8
929	1.076 426	2 918.540	677 830.8	979	1.021 450	3 075.619	752 757.8
930	1.075 269	2 921.681	679 290.9	980	1.020 408	3 078.761	754 296.4
931	1.074 114	2 924.823	680 752.5	981	1.019 368	3 081.902	755 836.6
932	1.072 961	2 927.964	682 215.7	982	1.018 330	3 085.044	757 378.3
933	1.071 811	2 931.106	683 680.5	983	1.017 294	3 088.186	758 921.6
934	1.070 664	2 934.248	685 146.8	984	1.016 260	3 091.327	760 466.5
935	1.069 519	2 937.389	686 614.7	985	1.015 228	3 094.469	762 012.9
936	1.068 376	2 940.531	688 084.2	986	1.014 199	3 097.610	763 561.0
937	1.067 236	2 943.672	689 555.2	987	1.013 171	3 100.752	765 110.5
938	1.066 098	2 946.814	691 027.9	988	1.012 146	3 103.894	766 661.7
939	1.064 963	2 949.956	692 502.1	989	1.011 122	3 107.035	768 214.4
940	1.063 830	2 953.097	693 977.8	990	1.010 101	3 110.177	769 768.7
941	1.062 699	2 956.239	695 455.2	991	1.009 082	3 113.318	771 324.6
942	1.061 571	2 959.380	696 934.1	992	1.008 065	3 116.460	772 882.1
943	1.060 445	2 962.522	698 414.5	993	1.007 049	3 119.602	774 441.1
944	1.059 322	2 965.663	699 896.6	994	1.006 036	3 122.743	776 001.7
945	1.058 201	2 968.805	701 380.2	995	1.005 025	3 125.885	777 563.8
946	1.057 082	2 971.947	702 865.4	996	1.004 016	3 129.026	779 127.5
947	1.055 966	2 975.088	704 352.1	997	1.003 009	3 132.168	780 692.8
948	1.054 852	2 978.230	705 840.5	998	1.002 004	3 135.309	782 259.7
949	1.053 741	2 981.371	707 330.4	999	1.001 001	3 138.451	783 828.2

LOGARITHMS

Properties and Uses

Definition of Logarithm. The *logarithm* x of the number N to the base b is the exponent of the power to which b must be raised to give N. That is,

$$\log_b N = x \text{ or } b^x = N.$$

The number N is positive and b may be any positive number except 1.

Properties of Logarithms.

(*a*.) *The logarithm of a product is equal to the sum of the logarithms of the factors; thus,*

$$\log_b M \cdot N = \log_b M + \log_b N.$$

(*b*.) *The logarithm of a quotient is equal to the logarithm of the numerator minus the logarithm of the denominator; thus,*

$$\log_b \frac{M}{N} = \log_b M - \log_b N.$$

(*c*.) *The logarithm of a power of a number is equal to the logarithm of the base multiplied by the exponent of the power; thus,*

$$\log_b M^p = p \cdot \log_b M.$$

(*d*.) *The logarithm of a root of a number is equal to the logarithm of the number divided by the index of the root; thus,*

$$\log_b \sqrt[q]{M} = \frac{1}{q} \log_b M.$$

Other properties of logarithms:

$$\log_b b = 1.$$

$$\log_b 1 = 0.$$

$$\log_b (b^N) = N.$$

$$\log_b \sqrt[q]{M^p} = \frac{p}{q} \cdot \log_b M.$$

$$\log_b N = \log_a N \cdot \log_b a = \frac{\log_a N}{\log_a b}$$

$$b^{\log_b N} = N.$$

Systems of Logarithms. There are two common systems of logarithms in use: (1) the *natural* (Napierian or hyperbolic) system which uses the base $e = 2.71828\ldots$; (2) the *common* (Briggsian) system which uses the base 10.

We shall use the abbreviation $\log N \equiv \log_{10} N$ in this section.

Unless otherwise stated, tables of logarithms are always tables of common logarithms.

Characteristic of a Common Logarithm of a Number. Every real positive number has a real common logarithm such that if $a < b$, $\log a < \log b$. Neither zero nor any negative number has a real logarithm.

A common logarithm, in general, consists of an integer, which is called the *characteristic*, and a decimal (usually endless) which is called the *mantissa*. The characteristic of any number may be determined from the following rules.

> *Rule* I. *The characteristic of any number greater than* 1 *is one less than the number of digits before the decimal point.*
>
> *Rule* II.† *The characteristic of a number less than* 1 *is found by subtracting from* 9 *the number of ciphers between the decimal point and the first significant digit, and writing* −10 *after the result.*

Thus the characteristic of log 936 is 2; the characteristic of log 9.36 is 0; of log 0.936 is 9 −10; of log 0.00936 is 7 −10.

Mantissa of a Common Logarithm of a Number. An important consequence of the use of base 10 is that the mantissa of a number is independent of the position of the decimal point. Thus 93,600, 93.600, 0.000936, all have the same mantissa. Hence in Tables of Common Logarithms only mantissas are given. A five place table gives the values of the mantissa correct to five places of decimals.

To Find the Logarithm of a Given Number N. By means of Rules I and II determine the characteristic. Then use the Table to find mantissa.

To find mantissa when the given number (neglecting decimal point) consists of four, or less, digits (exclusive of ciphers at the beginning or end), look in the column marked N for the first three significant digits and pick the column headed by the fourth digit—the mantissa is the number appearing at the intersection of this row and column. Thus to find the logarithm of 64030, first note (by Rule I) that the characteristic is 4. Next, in the Table, find 640 in column marked N

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† Some writers use a dash over the characteristic to indicate a negative value; for example,

$$\log .004657 = 7.66811 - 10 = \bar{3}.66811.$$

and opposite it in column 3 is the desired mantissa, .80638. Hence log 64030 = 4.80638. Likewise, log 0.0064030 = 7.80638 − 10; log 0.64030 = 9.80638 −10.

Interpolation. The mantissa of a number of more than four significant figures can be found approximately by assuming that the mantissa varies directly as the number in the small interval not tabulated. Thus if N has five digits (significant), and f is the fifth digit of N, the mantissa of N is

$$m = m_1 + \frac{f}{10}\left(m_2 - m_1\right),$$

where m_1 is the mantissa corresponding to the first four digits of N, m_2 is the next larger mantissa in the table. $(m_2 - m_1)$ is called a *tabular difference.* The proportional part of the difference $m_2 - m_1$ is called the *correction.* These proportional parts are printed without zeros at the right-hand side of each page as an aid to mental multiplications.

For example, find log 64034. Here $f = 4$. From the table we see $m_1 = .80638$, $m_2 = .80645$, whence $m = .80638 + (4/10)\ (.00007)$, log 64034 $= 4 + m = 4.80641$.

To Find the Number N when its Logarithm is Known. (The number N whose logarithm is k is called the *anti logarithm* of k.)

Case 1. If the mantissa m is found exactly in the Table, join the figure at the top of the column containing m to the right of the figures in the column marked N and in the same row as m, and place the decimal point according to the characteristic of the logarithm.

Case 2. If the mantissa m is not found exactly in the table, interpolate as follows: find the next smaller mantissa m_1 to m: the first four significant digits of N correspond to the mantissa m_1, and the fifth digit f equals the nearest whole number to

$$f = 10\left(\frac{m - m_1}{m_2 - m_1}\right),$$

where m_2 is the next larger mantissa to m appearing in the table. Then locate the decimal point according to the characteristic.

The decimal point may be located by means of the following rules:

Rule III. *If the characteristic of the logarithm is positive (then the mantissa is not followed by* −10*), begin at the left, count digits one more than the characteristic, and place the decimal point to the right of the last digit counted.*

Rule IV. *If the characteristic is negative (then the mantissa will be preceded by an integer n and followed by -10), prefix $(9-n)$ ciphers, and place the decimal point to the left of these ciphers.*

Illustrations of the Use of Logarithms.

Example 1. Given $\log x = 2.91089$, find x. The mantissa .91089 appears in the table. Join the figure 5 which appears at the top of the column to the right of the number 814 in the column N, giving the number 8145. By Rule III, the decimal point is placed to the right of 4, thus giving $x = 814.5$.

Example 2. Given $\log x = 2.34917$, find x. The mantissa $m = .34917$ does not appear in the table. The next smaller and next larger mantissas are m_1 and m_2,

$$m_1 = .34908, \quad m = .34917, \quad m_2 = .34928.$$

The first four digits of N, corresponding to m_1, are 2234 and the fifth digit is the nearest whole number (5) to

$$10\left(\frac{m - m_1}{m_2 - m_1}\right) = 10\left(\frac{.00009}{.00020}\right) = 4.5$$

By Rule III, we locate decimal point, thus giving $x = 223.45$.

Example 3. Find $x = (396.21)\,(.004657)\,(21.21)$.

$$\begin{array}{lll}
\log 396.21 & = 2.59792 & \\
\log .004657 & = 7.66811 - 10 & \\
\log 21.210 & = \underline{1.32654} & \text{(add)} \\
\log x & = 11.59257 - 10, & x = 39.135.
\end{array}$$

Example 4. Find $x = \dfrac{396.21^*}{24.3}$.

$$\begin{array}{lll}
\log 396.21 & = 2.59792 & \\
\log 24.3 & = \underline{1.38561} & \text{(subtract)} \\
\log x & = 1.21231, & x = 16.305.
\end{array}$$

Example 5. Find $x = (3.5273)^4$.

$$\begin{array}{lll}
\log 3.5273 & = 0.54745 & \\
 & \quad\;\; \underline{\qquad\quad 4} & \text{(multiply)} \\
\log x & = 2.18980, & x = 154.81.
\end{array}$$

---

* Some writers use *cologarithms*. The cologarithm of a number N is the negative of the logarithm of N; i. e., colog $N = 10.09000 - \log N - 10$. Adding the cologrithm is equivalent to subtracting the logarithm. Thus in our example, colog $24.3 = (10.00000 - 1.38561) - 10 = 8.61139 - 10$, $\log 396.21 - \log 24.3 = \log 396.21 + \text{colog } 24.3 = 2.59792 + 8.61139 - 10 = 11.21231 - 10 =$ anti log 16.305.

Example 6. Given $\log x = -2.23653$, to find x. To convert this logarithm to one with a positive mantissa, add algebraically -2.23653 to $10.00000-10$. Thus

$$\begin{array}{lrl} & & 10.00000-10 \\ & & \underline{-2.23653} \\ \log x & = & 7.76347-10, \text{ hence } x = 0.0058006. \end{array}$$

Example 7. Find $x = \sqrt[3]{.04657}$.

$$\begin{aligned} \log x &= \tfrac{1}{3}\log(.04657), \\ &= \tfrac{1}{3}(8.66811-10) = \tfrac{1}{3}(-1.33189), \\ \log x &= -0.44396 = 9.55604-10, \quad x = 0.35978. \end{aligned}$$

or

$$\begin{aligned} \log x &= \tfrac{1}{3}(8.66811-10) = \tfrac{1}{3}(28.66811-30) \\ \log x &= 9.55604-10, \quad x = 0.35978. \end{aligned}$$

Example 8. Find $x = \dfrac{1}{21.210}$.

$$\begin{array}{lrl} \log x & = & \log 1 - \log 21.210 \\ \log 1 & = & 10.00000-10 \\ \log 21.210 & = & \underline{1.32654} \qquad \text{(subtract)} \\ \log x & = & 8.67346-10, \ x = 0.047148. \end{array}$$

The preceding pages of mathematical data titled *Surface Areas and Volumes* and numerical data, and the following pages of logarithms are from

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HANDBOOK PUBLISHERS, INC.
SANDUSKY, OHIO

COMMON LOGARITHMS OF NUMBERS

100 — 150

N.		0	1	2	3	4	5	6	7	8	9
100	00	000	043	087	130	173	217	260	303	346	389
101		432	475	518	561	604	647	689	732	775	817
102		860	903	945	988	*030	*072	*115	*157	*199	*242
103	01	284	326	368	410	452	494	536	578	620	662
104		703	745	787	828	870	912	953	995	*036	*078
105	02	119	160	202	243	284	325	366	407	449	490
106		531	572	612	653	694	735	776	816	857	898
107		938	979	*019	*060	*100	*141	*181	*222	*262	*302
108	03	342	383	423	463	503	543	583	623	663	703
109		743	782	822	862	902	941	981	*021	*060	*100
110	04	139	179	218	258	297	336	376	415	454	493
111		532	571	610	650	689	727	766	805	844	883
112		922	961	999	*038	*077	*115	*154	*192	*231	*269
113	05	308	346	385	423	461	500	538	576	614	652
114		690	729	767	805	843	881	918	956	994	*032
115	06	070	108	145	183	221	258	296	333	371	408
116		446	483	521	558	595	633	670	707	744	781
117		819	856	893	930	967	*004	*041	*078	*115	*151
118	07	188	225	262	298	335	372	408	445	482	518
119		555	591	628	664	700	737	773	809	846	882
120		918	954	990	*027	*063	*099	*135	*171	*207	*243
121	08	279	314	350	386	422	458	493	529	565	600
122		636	672	707	743	778	814	849	884	920	955
123		991	*026	*061	*096	*132	*167	*202	*237	*272	*307
124	09	342	377	412	447	482	517	552	587	621	656
125		691	726	760	795	830	864	899	934	968	*003
126	10	037	072	106	140	175	209	243	278	312	346
127		380	415	449	483	517	551	585	619	653	687
128		721	755	789	823	857	890	924	958	992	*025
129	11	059	093	126	160	193	227	261	294	327	361
130		394	428	461	494	528	561	594	628	661	694
131		727	760	793	826	860	893	926	959	992	*024
132	12	057	090	123	156	189	222	254	287	320	352
133		385	418	450	483	516	548	581	613	646	678
134		710	743	775	808	840	872	905	937	969	*001
135	13	033	066	098	130	162	194	226	258	290	322
136		354	386	418	450	481	513	545	577	609	640
137		672	704	735	767	799	830	862	893	925	956
138		988	*019	*051	*082	*114	*145	*176	*208	*239	*270
139	14	301	333	364	395	426	457	489	520	551	582
140		613	644	675	706	737	768	799	829	860	891
141		922	953	983	*014	*045	*076	*106	*137	*168	*198
142	15	229	259	290	320	351	381	412	442	473	503
143		534	564	594	625	655	685	715	746	776	806
144		836	866	897	927	957	987	*017	*047	*077	*107
145	16	137	167	197	227	256	286	316	346	376	406
146		435	465	495	524	554	584	613	643	673	702
147		732	761	791	820	850	879	909	938	967	997
148	17	026	056	085	114	143	173	202	231	260	289
149		319	348	377	406	435	464	493	522	551	580
150		609	638	667	696	725	754	782	811	840	869
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	44	43	42
1	4.4	4.3	4.2
2	8.8	8.6	8.4
3	13.2	12.9	12.6
4	17.6	17.2	16.8
5	22.0	21.5	21.0
6	26.4	25.8	25.2
7	30.8	30.1	29.4
8	35.2	34.4	33.6
9	39.6	38.7	37.8

	41	40	39
1	4.1	4.0	3.9
2	8.2	8.0	7.8
3	12.3	12.0	11.7
4	16.4	16.0	15.6
5	20.5	20.0	19.5
6	24.6	24.0	23.4
7	28.7	28.0	27.3
8	32.8	32.0	31.2
9	36.9	36.0	35.1

	38	37	36
1	3.8	3.7	3.6
2	7.6	7.4	7.2
3	11.4	11.1	10.8
4	15.2	14.8	14.4
5	19.0	18.5	18.0
6	22.8	22.2	21.6
7	26.6	25.9	25.2
8	30.4	29.6	28.8
9	34.2	33.3	32.4

	35	34	33
1	3.5	3.4	3.3
2	7.0	6.8	6.6
3	10.5	10.2	9.9
4	14.0	13.6	13.2
5	17.5	17.0	16.5
6	21.0	20.4	19.8
7	24.5	23.8	23.1
8	28.0	27.2	26.4
9	31.5	30.6	29.7

	32	31	30
1	3.2	3.1	3.0
2	6.4	6.2	6.0
3	9.6	9.3	9.0
4	12.8	12.4	12.0
5	16.0	15.5	15.0
6	19.2	18.6	18.0
7	22.4	21.7	21.0
8	25.6	24.8	24.0
9	28.8	27.9	27.0

Proportional parts

.00 000 — .17 869

COMMON LOGARITHMS OF NUMBERS

150 — 200

N.		0	1	2	3	4	5	6	7	8	9
150	17	609	638	667	696	725	754	782	811	840	869
151		898	926	955	984	*013	*041	*070	*099	*127	*156
152	18	184	213	241	270	298	327	355	384	412	441
153		469	498	526	554	583	611	639	667	696	724
154		752	780	808	837	865	893	921	949	977	*005
155	19	033	061	089	117	145	173	201	229	257	285
156		312	340	368	396	424	451	479	507	535	562
157		590	618	645	673	700	728	756	783	811	838
158		866	893	921	948	976	*003	*030	*058	*085	*112
159	20	140	167	194	222	249	276	303	330	358	385
160		412	439	466	493	520	548	575	602	629	656
161		683	710	737	763	790	817	844	871	898	925
162		952	978	*005	*032	*059	*085	*112	*139	*165	*192
163	21	219	245	272	299	325	352	378	405	431	458
164		484	511	537	564	590	617	643	669	696	722
165		748	775	801	827	854	880	906	932	958	985
166	22	011	037	063	089	115	141	167	194	220	246
167		272	298	324	350	376	401	427	453	479	505
168		531	557	583	608	634	660	686	712	737	763
169		789	814	840	866	891	917	943	968	994	*019
170	23	045	070	096	121	147	172	198	223	249	274
171		300	325	350	376	401	426	452	477	502	528
172		553	578	603	629	654	679	704	729	754	779
173		805	830	855	880	905	930	955	980	*005	*030
174	24	055	080	105	130	155	180	204	229	254	279
175		304	329	353	378	403	428	452	477	502	527
176		551	576	601	625	650	674	699	724	748	773
177		797	822	846	871	895	920	944	969	993	*018
178	25	042	066	091	115	139	164	188	212	237	261
179		285	310	334	358	382	406	431	455	479	503
180		527	551	575	600	624	648	672	696	720	744
181		768	792	816	840	864	888	912	935	959	983
182	26	007	031	055	079	102	126	150	174	198	221
183		245	269	293	316	340	364	387	411	435	458
184		482	505	529	553	576	600	623	647	670	694
185		717	741	764	788	811	834	858	881	905	928
186		951	975	998	*021	*045	*068	*091	*114	*138	*161
187	27	184	207	231	254	277	300	323	346	370	393
188		416	439	462	485	508	531	554	577	600	623
189		646	669	692	715	738	761	784	807	830	852
190		875	898	921	944	967	989	*012	*035	*058	*081
191	28	103	126	149	171	194	217	240	262	285	307
192		330	353	375	398	421	443	466	488	511	533
193		556	578	601	623	646	668	691	713	735	758
194		780	803	825	847	870	892	914	937	959	981
195	29	003	026	048	070	092	115	137	159	181	203
196		226	248	270	292	314	336	358	380	403	425
197		447	469	491	513	535	557	579	601	623	645
198		667	688	710	732	754	776	798	820	842	863
199		885	907	929	951	973	994	*016	*038	*060	*081
200	30	103	125	146	168	190	211	233	255	276	298
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	29	28	27	26	25	24	23	22	21
1	2.9	2.8	2.7	2.6	2.5	2.4	2.3	2.2	2.1
2	5.8	5.6	5.4	5.2	5.0	4.8	4.6	4.4	4.2
3	8.7	8.4	8.1	7.8	7.5	7.2	6.9	6.6	6.3
4	11.6	11.2	10.8	10.4	10.0	9.6	9.2	8.8	8.4
5	14.5	14.0	13.5	13.0	12.5	12.0	11.5	11.0	10.5
6	17.4	16.8	16.2	15.6	15.0	14.4	13.8	13.2	12.6
7	20.3	19.6	18.9	18.2	17.5	16.8	16.1	15.4	14.7
8	23.2	22.4	21.6	20.8	20.0	19.2	18.4	17.6	16.8
9	26.1	25.2	24.3	23.4	22.5	21.6	20.7	19.8	18.9

Proportional parts

COMMON LOGARITHMS OF NUMBERS

200 — 250

N.		0	1	2	3	4	5	6	7	8	9
200	30	103	125	146	168	190	211	233	255	276	298
201		320	341	363	384	406	428	449	471	492	514
202		535	557	578	600	621	643	664	685	707	728
203		750	771	792	814	835	856	878	899	920	942
204		963	984	*006	*027	*048	*069	*091	*112	*133	*154
205	31	175	197	218	239	260	281	302	323	345	366
206		387	408	429	450	471	492	513	534	555	576
207		597	618	639	660	681	702	723	744	765	785
208		806	827	848	869	890	911	931	952	973	994
209	32	015	035	056	077	098	118	139	160	181	201
210		222	243	263	284	305	325	346	366	387	408
211		428	449	469	490	510	531	552	572	593	613
212		634	654	675	695	715	736	756	777	797	818
213		838	858	879	899	919	940	960	980	*001	*021
214	33	041	062	082	102	122	143	163	183	203	224
215		244	264	284	304	325	345	365	385	405	425
216		445	465	486	506	526	546	566	586	606	626
217		646	666	686	706	726	746	766	786	806	826
218		846	866	885	905	925	945	965	985	*005	*025
219	34	044	064	084	104	124	143	163	183	203	223
220		242	262	282	301	321	341	361	380	400	420
221		439	459	479	498	518	537	557	577	596	616
222		635	655	674	694	713	733	753	772	792	811
223		830	850	869	889	908	928	947	967	986	*005
224	35	025	044	064	083	102	122	141	160	180	199
225		218	238	257	276	295	315	334	353	372	392
226		411	430	449	468	488	507	526	545	564	583
227		603	622	641	660	679	698	717	736	755	774
228		793	813	832	851	870	889	908	927	946	965
229		984	*003	*021	*040	*059	*078	*097	*116	*135	*154
230	36	173	192	211	229	248	267	286	305	324	342
231		361	380	399	418	436	455	474	493	511	530
232		549	568	586	605	624	642	661	680	698	717
233		736	754	773	791	810	829	847	866	884	903
234		922	940	959	977	996	*014	*033	*051	*070	*088
235	37	107	125	144	162	181	199	218	236	254	273
236		291	310	328	346	365	383	401	420	438	457
237		475	493	511	530	548	566	585	603	621	639
238		658	676	694	712	731	749	767	785	803	822
239		840	858	876	894	912	931	949	967	985	*003
240	38	021	039	057	075	093	112	130	148	166	184
241		202	220	238	256	274	292	310	328	346	364
242		382	399	417	435	453	471	489	507	525	543
243		561	578	596	614	632	650	668	686	703	721
244		739	757	775	792	810	828	846	863	881	899
245		917	934	952	970	987	*005	*023	*041	*058	*076
246	39	094	111	129	146	164	182	199	217	235	252
247		270	287	305	322	340	358	375	393	410	428
248		445	463	480	498	515	533	550	568	585	602
249		620	637	655	672	690	707	724	742	759	777
250		794	811	829	846	863	881	898	915	933	950
N.	—	0	1	2	3	4	5	6	7	8	9

Proportional parts

	22	21
1	2.2	2.1
2	4.4	4.2
3	6.6	6.3
4	8.8	8.4
5	11.0	10.5
6	13.2	12.6
7	15.4	14.7
8	17.6	16.8
9	19.8	18.9

	20
1	2.0
2	4.0
3	6.0
4	8.0
5	10.0
6	12.0
7	14.0
8	16.0
9	18.0

	19
1	1.9
2	3.8
3	5.7
4	7.6
5	9.5
6	11.4
7	13.3
8	15.2
9	17.1

	18
1	1.8
2	3.6
3	5.4
4	7.2
5	9.0
6	10.8
7	12.6
8	14.4
9	16.2

	17
1	1.7
2	3.4
3	5.1
4	6.8
5	8.5
6	10.2
7	11.9
8	13.6
9	15.3

Proportional parts

COMMON LOGARITHMS OF NUMBERS

250 — 300

N.		0	1	2	3	4	5	6	7	8	9
250	39	794	811	829	846	863	881	898	915	933	950
251		967	985	*002	*019	*037	*054	*071	*088	*106	*123
252	40	140	157	175	192	209	226	243	261	278	295
253		312	329	346	364	381	398	415	432	449	466
254		483	500	518	535	552	569	586	603	620	637
255		654	671	688	705	722	739	756	773	790	807
256		824	841	858	875	892	909	926	943	960	976
257		993	*010	*027	*044	*061	*078	*095	*111	*128	*145
258	41	162	179	196	212	229	246	263	280	296	313
259		330	347	363	380	397	414	430	447	464	481
260		497	514	531	547	564	581	597	614	631	647
261		664	681	697	714	731	747	764	780	797	814
262		830	847	863	880	896	913	929	946	963	979
263		996	*012	*029	*045	*062	*078	*095	*111	*127	*144
264	42	160	177	193	210	226	243	259	275	292	308
265		325	341	357	374	390	406	423	439	455	472
266		488	504	521	537	553	570	586	602	619	635
267		651	667	684	700	716	732	749	765	781	797
268		813	830	846	862	878	894	911	927	943	959
269		975	991	*008	*024	*040	*056	*072	*088	*104	*120
270	43	136	152	169	185	201	217	233	249	265	281
271		297	313	329	345	361	377	393	409	425	441
272		457	473	489	505	521	537	553	569	584	600
273		616	632	648	664	680	696	712	727	743	759
274		775	791	807	823	838	854	870	886	902	917
275		933	949	965	981	996	*012	*028	*044	*059	*075
276	44	091	107	122	138	154	170	185	201	217	232
277		248	264	279	295	311	326	342	358	373	389
278		404	420	436	451	467	483	498	514	529	545
279		560	576	592	607	623	638	654	669	685	700
280		716	731	747	762	778	793	809	824	840	855
281		871	886	902	917	932	948	963	979	994	*010
282	45	025	040	056	071	086	102	117	133	148	163
283		179	194	209	225	240	255	271	286	301	317
284		332	347	362	378	393	408	423	439	454	469
285		484	500	515	530	545	561	576	591	606	621
286		637	652	667	682	697	712	728	743	758	773
287		788	803	818	834	849	864	879	894	909	924
288		939	954	969	984	*000	*015	*030	*045	*060	*075
289	46	090	105	120	135	150	165	180	195	210	225
290		240	255	270	285	300	315	330	345	359	374
291		389	404	419	434	449	464	479	494	509	523
292		538	553	568	583	598	613	627	642	657	672
293		687	702	716	731	746	761	776	790	805	820
294		835	850	864	879	894	909	923	938	953	967
295		982	997	*012	*026	*041	*056	*070	*085	*100	*114
296	47	129	144	159	173	188	202	217	232	246	261
297		276	290	305	319	334	349	363	378	392	407
298		422	436	451	465	480	494	509	524	538	553
299		567	582	596	611	625	640	654	669	683	698
300		712	727	741	756	770	784	799	813	828	842
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	18
1	1.8
2	3.6
3	5.4
4	7.2
5	[illegible]
6	10.8
7	12.6
8	14.4
9	16.2

	17
1	1.7
2	3.4
3	5.1
4	6.8
5	8.[illegible]
6	10.2
7	11.9
8	13.6
9	15.3

	16
1	1.6
2	3.2
3	4.8
4	6.4
5	8.0
6	9.6
7	11.2
8	12.8
9	14.4

	15
1	1.5
2	3.0
3	4.5
4	6.0
5	7.5
6	9.0
7	10.5
8	12.0
9	13.5

	14
1	1.4
2	2.8
3	4.2
4	5.6
5	7.0
6	8.4
7	9.8
8	11.2
9	12.6

log *e* = 0.43429

Proportional parts

COMMON LOGARITHMS OF NUMBERS

300 — 350

N.	0	1	2	3	4	5	6	7	8	9
300	47 712	727	741	756	770	784	799	813	828	842
301	857	871	885	900	914	929	943	958	972	986
302	48 001	015	029	044	058	073	087	101	116	130
303	144	159	173	187	202	216	230	244	259	273
304	287	302	316	330	344	359	373	387	401	416
305	430	444	458	473	487	501	515	530	544	558
306	572	586	601	615	629	643	657	671	686	700
307	714	728	742	756	770	785	799	813	827	841
308	855	869	883	897	911	926	940	954	968	982
309	996	*010	*024	*038	*052	*066	*080	*094	*108	*122
310	49 136	150	164	178	192	206	220	234	248	262
311	276	290	304	318	332	346	360	374	388	402
312	415	429	443	457	471	485	499	513	527	541
313	554	568	582	596	610	624	638	651	665	679
314	693	707	721	734	748	762	776	790	803	817
315	831	845	859	872	886	900	914	927	941	955
316	969	982	996	*010	*024	*037	*051	*065	*079	*092
317	50 106	120	133	147	161	174	188	202	215	229
318	243	256	270	284	297	311	325	338	352	365
319	379	393	406	420	433	447	461	474	488	501
320	515	529	542	556	569	583	596	610	623	637
321	651	664	678	691	705	718	732	745	759	772
322	786	799	813	826	840	853	866	880	893	907
323	920	934	947	961	974	987	*001	*014	*028	*041
324	51 055	068	081	095	108	121	135	148	162	175
325	188	202	215	228	242	255	268	282	295	308
326	322	335	348	362	375	388	402	415	428	441
327	455	468	481	495	508	521	534	548	561	574
328	587	601	614	627	640	654	667	680	693	706
329	720	733	746	759	772	786	799	812	825	838
330	851	865	878	891	904	917	930	943	957	970
331	983	996	*009	*022	*035	*048	*061	*075	*088	*101
332	52 114	127	140	153	166	179	192	205	218	231
333	244	257	270	284	297	310	323	336	349	362
334	375	388	401	414	427	440	453	466	479	492
335	504	517	530	543	556	569	582	595	608	621
336	634	647	660	673	686	699	711	724	737	750
337	763	776	789	802	815	827	840	853	866	879
338	892	905	917	930	943	956	969	982	994	*007
339	53 020	033	046	058	071	084	097	110	122	135
340	148	161	173	186	199	212	224	237	250	263
341	275	288	301	314	326	339	352	364	377	390
342	403	415	428	441	453	466	479	491	504	517
343	529	542	555	567	580	593	605	618	631	643
344	656	668	681	694	706	719	732	744	757	769
345	782	794	807	820	832	845	857	870	882	895
346	908	920	933	945	958	970	983	995	*008	*020
347	54 033	045	058	070	083	095	108	120	133	145
348	158	170	183	195	208	220	233	245	258	270
349	283	295	307	320	332	345	357	370	382	394
350	407	419	432	444	456	469	481	494	506	518
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	15	14	13	12
1	1.5	1.4	1.3	1.2
2	3.0	2.8	2.6	2.4
3	4.5	4.2	3.9	3.6
4	6.0	5.6	5.2	4.8
5	7.5	7.0	6.5	6.0
6	9.0	8.4	7.8	7.2
7	10.5	9.8	9.1	8.4
8	12.0	11.2	10.4	9.6
9	13.5	12.6	11.7	10.8

$\log \pi = 0.49715$

Proportional parts

COMMON LOGARITHMS OF NUMBERS

350 — 400

N.		0	1	2	3	4	5	6	7	8	9
350	54	407	419	432	444	456	469	481	494	506	518
351		531	543	555	568	580	593	605	617	630	642
352		654	667	679	691	704	716	728	741	753	765
353		777	790	802	814	827	839	851	864	876	888
354		900	913	925	937	949	962	974	986	998	*011
355	55	023	035	047	060	072	084	096	108	121	133
356		145	157	169	182	194	206	218	230	242	255
357		267	279	291	303	315	328	340	352	364	376
358		388	400	413	425	437	449	461	473	485	497
359		509	522	534	546	558	570	582	594	606	618
360		630	642	654	666	678	691	703	715	727	739
361		751	763	775	787	799	811	823	835	847	859
362		871	883	895	907	919	931	943	955	967	979
363		991	*003	*015	*027	*038	*050	*062	*074	*086	*098
364	56	110	122	134	146	158	170	182	194	205	217
365		229	241	253	265	277	289	301	312	324	336
366		348	360	372	384	396	407	419	431	443	455
367		467	478	490	502	514	526	538	549	561	573
368		585	597	608	620	632	644	656	667	679	691
369		703	714	726	738	750	761	773	785	797	808
370		820	832	844	855	867	879	891	902	914	926
371		937	949	961	972	984	996	*008	*019	*031	*043
372	57	054	066	078	089	101	113	124	136	148	159
373		171	183	194	206	217	229	241	252	264	276
374		287	299	310	322	334	345	357	368	380	392
375		403	415	426	438	449	461	473	484	496	507
376		519	530	542	553	565	576	588	600	611	623
377		634	646	657	669	680	692	703	715	726	738
378		749	761	772	784	795	807	818	830	841	852
379		864	875	887	898	910	921	933	944	955	967
380		978	990	*001	*013	*024	*035	*047	*058	*070	*081
381	58	092	104	115	127	138	149	161	172	184	195
382		206	218	229	240	252	263	274	286	297	309
383		320	331	343	354	365	377	388	399	410	422
384		433	444	456	467	478	490	501	512	524	535
385		546	557	569	580	591	602	614	625	636	647
386		659	670	681	692	704	715	726	737	749	760
387		771	782	794	805	816	827	838	850	861	872
388		883	894	906	917	928	939	950	961	973	984
389		995	*006	*017	*028	*040	*051	*062	*073	*084	*095
390	59	106	118	129	140	151	162	173	184	195	207
391		218	229	240	251	262	273	284	295	306	318
392		329	340	351	362	373	384	395	406	417	428
393		439	450	461	472	483	494	506	517	528	539
394		550	561	572	583	594	605	616	627	638	649
395		660	671	682	693	704	715	726	737	748	759
396		770	780	791	802	813	824	835	846	857	868
397		879	890	901	912	923	934	945	956	966	977
398		988	999	*010	*021	*032	*043	*054	*065	*076	*086
399	60	097	108	119	130	141	152	163	173	184	195
400		206	217	228	239	249	260	271	282	293	304
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	13
1	1.3
2	2.6
3	3.9
4	5.2
5	6.5
6	7.8
7	9.1
8	10.4
9	11.7

	12
1	1.2
2	2.4
3	3.6
4	4.8
5	6.0
6	7.2
7	8.4
8	9.6
9	10.8

	11
1	1.1
2	2.2
3	3.3
4	4.4
5	5.5
6	6.6
7	7.7
8	8.8
9	9.9

	10
1	1.0
2	2.0
3	3.0
4	4.0
5	5.0
6	6.0
7	7.0
8	8.0
9	9.0

Proportional parts

COMMON LOGARITHMS OF NUMBERS

400 — 450

N.		0	1	2	3	4	5	6	7	8	9
400	60	206	217	228	239	249	260	271	282	293	304
401		314	325	336	347	358	369	379	390	401	412
402		423	433	444	455	466	477	487	498	509	520
403		531	541	552	563	574	584	595	606	617	627
404		638	649	660	670	681	692	703	713	724	735
405		746	756	767	778	788	799	810	821	831	842
406		853	863	874	885	895	906	917	927	938	949
407		959	970	981	991	*002	*013	*023	*034	*045	*055
408	61	066	077	087	098	109	119	130	140	151	162
409		172	183	194	204	215	225	236	247	257	268
410		278	289	300	310	321	331	342	352	363	374
411		384	395	405	416	426	437	448	458	469	479
412		490	500	511	521	532	542	553	563	574	584
413		595	606	616	627	637	648	658	669	679	690
414		700	711	721	731	742	752	763	773	784	794
415		805	815	826	836	847	857	868	878	888	899
416		909	920	930	941	951	962	972	982	993	*003
417	62	014	024	034	045	055	066	076	086	097	107
418		118	128	138	149	159	170	180	190	201	211
419		221	232	242	252	263	273	284	294	304	315
420		325	335	346	356	366	377	387	397	408	418
421		428	439	449	459	469	480	490	500	511	521
422		531	542	552	562	572	583	593	603	613	624
423		634	644	655	665	675	685	696	706	716	726
424		737	747	757	767	778	788	798	808	818	829
425		839	849	859	870	880	890	900	910	921	931
426		941	951	961	972	982	992	*002	*012	*022	*033
427	63	043	053	063	073	083	094	104	114	124	134
428		144	155	165	175	185	195	205	215	225	236
429		246	256	266	276	286	296	306	317	327	337
430		347	357	367	377	387	397	407	417	428	438
431		448	458	468	478	488	498	508	518	528	538
432		548	558	568	579	589	599	609	619	629	639
433		649	659	669	679	689	699	709	719	729	739
434		749	759	769	779	789	799	809	819	829	839
435		849	859	869	879	889	899	909	919	929	939
436		949	959	969	979	988	998	*008	*018	*028	*038
437	64	048	058	068	078	088	098	108	118	128	137
438		147	157	167	177	187	197	207	217	227	237
439		246	256	266	276	286	296	306	316	326	335
440		345	355	365	375	385	395	404	414	424	434
441		444	454	464	473	483	493	503	513	523	532
442		542	552	562	572	582	591	601	611	621	631
443		640	650	660	670	680	689	699	709	719	729
444		738	748	758	768	777	787	797	807	816	826
445		836	846	856	865	875	885	895	904	914	924
446		933	943	953	963	972	982	992	*002	*011	*021
447	65	031	040	050	060	070	079	089	099	108	118
448		128	137	147	157	167	176	186	196	205	215
449		225	234	244	254	263	273	283	292	302	312
450		321	331	341	350	360	369	379	389	398	408
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	11
1	1.1
2	2.2
3	3.3
4	4.4
5	5.5
6	6.6
7	7.7
8	8.8
9	9.9

	10
1	1.0
2	2.0
3	3.0
4	4.0
5	5.0
6	6.0
7	7.0
8	8.0
9	9.0

	9
1	0.9
2	1.8
3	2.7
4	3.6
5	4.5
6	5.4
7	6.3
8	7.2
9	8.1

Proportional parts

.60 206 — .65 408

COMMON LOGARITHMS OF NUMBERS

450 — 500

N.		0	1	2	3	4	5	6	7	8	9
450	65	321	331	341	350	360	369	379	389	398	408
451		418	427	437	447	456	466	475	485	495	504
452		514	523	533	543	552	562	571	581	591	600
453		610	619	629	639	648	658	667	677	686	696
454		706	715	725	734	744	753	763	772	782	792
455		801	811	820	830	839	849	858	868	877	887
456		896	906	916	925	935	944	954	963	973	982
457		992	*001	*011	*020	*030	*039	*049	*058	*068	*077
458	66	087	096	106	115	124	134	143	153	162	172
459		181	191	200	210	219	229	238	247	257	266
460		276	285	295	304	314	323	332	342	351	361
461		370	380	389	398	408	417	427	436	445	455
462		464	474	483	492	502	511	521	530	539	549
463		558	567	577	586	596	605	614	624	633	642
464		652	661	671	680	689	699	708	717	727	736
465		745	755	764	773	783	792	801	811	820	829
466		839	848	857	867	876	885	894	904	913	922
467		932	941	950	960	969	978	987	997	*006	*015
468	67	025	034	043	052	062	071	080	089	099	108
469		117	127	136	145	154	164	173	182	191	201
470		210	219	228	237	247	256	265	274	284	293
471		302	311	321	330	339	348	357	367	376	385
472		394	403	413	422	431	440	449	459	468	477
473		486	495	504	514	523	532	541	550	560	569
474		578	587	596	605	614	624	633	642	651	660
475		669	679	688	697	706	715	724	733	742	752
476		761	770	779	788	797	806	815	825	834	843
477		852	861	870	879	888	897	906	916	925	934
478		943	952	961	970	979	988	997	*006	*015	*024
479	68	034	043	052	061	070	079	088	097	106	115
480		124	133	142	151	160	169	178	187	196	205
481		215	224	233	242	251	260	269	278	287	296
482		305	314	323	332	341	350	359	368	377	386
483		395	404	413	422	431	440	449	458	467	476
484		485	494	502	511	520	529	538	547	556	565
485		574	583	592	601	610	619	628	637	646	655
486		664	673	681	690	699	708	717	726	735	744
487		753	762	771	780	789	797	806	815	824	833
488		842	851	860	869	878	886	895	904	913	922
489		931	940	949	958	966	975	984	993	*002	*011
490	69	020	028	037	046	055	064	073	082	090	099
491		108	117	126	135	144	152	161	170	179	188
492		197	205	214	223	232	241	249	258	267	276
493		285	294	302	311	320	329	338	346	355	364
494		373	381	390	399	408	417	425	434	443	452
495		461	469	478	487	496	504	513	522	531	539
496		548	557	566	574	583	592	601	609	618	627
497		636	644	653	662	671	679	688	697	705	714
498		723	732	740	749	758	767	775	784	793	801
499		810	819	827	836	845	854	862	871	880	888
500		897	906	914	923	932	940	949	958	966	975
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	10
1	1.0
2	2.0
3	3.0
4	4.0
5	5.0
6	6.0
7	7.0
8	8.0
9	9.0

	9
1	0.9
2	1.8
3	2.7
4	3.6
5	4.5
6	5.4
7	6.3
8	7.2
9	8.1

	8
1	0.8
2	1.6
3	2.4
4	3.2
5	4.0
6	4.8
7	5.6
8	6.4
9	7.2

Proportional parts

COMMON LOGARITHMS OF NUMBERS

500 — 550

N.	0	1	2	3	4	5	6	7	8	9
500	69 897	906	914	923	932	940	949	958	966	975
501	984	992	*001	*010	*018	*027	*036	*044	*053	*062
502	70 070	079	088	096	105	114	122	131	140	148
503	157	165	174	183	191	200	209	217	226	234
504	243	252	260	269	278	286	295	303	312	321
505	329	338	346	355	364	372	381	389	398	406
506	415	424	432	441	449	458	467	475	484	492
507	501	509	518	526	535	544	552	561	569	578
508	586	595	603	612	621	629	638	646	655	663
509	672	680	689	697	706	714	723	731	740	749
510	757	766	774	783	791	800	808	817	825	834
511	842	851	859	868	876	885	893	902	910	919
512	927	935	944	952	961	969	978	986	995	*003
513	71 012	020	029	037	046	054	063	071	079	088
514	096	105	113	122	130	139	147	155	164	172
515	181	189	198	206	214	223	231	240	248	257
516	265	273	282	290	299	307	315	324	332	341
517	349	357	366	374	383	391	399	408	416	425
518	433	441	450	458	466	475	483	492	500	508
519	517	525	533	542	550	559	567	575	584	592
520	600	609	617	625	634	642	650	659	667	675
521	684	692	700	709	717	725	734	742	750	759
522	767	775	784	792	800	809	817	825	834	842
523	850	858	867	875	883	892	900	908	917	925
524	933	941	950	958	966	975	983	991	999	*008
525	72 016	024	032	041	049	057	066	074	082	090
526	099	107	115	123	132	140	148	156	165	173
527	181	189	198	206	214	222	230	239	247	255
528	263	272	280	288	296	304	313	321	329	337
529	346	354	362	370	378	387	395	403	411	419
530	428	436	444	452	460	469	477	485	493	501
531	509	518	526	534	542	550	558	567	575	583
532	591	599	607	616	624	632	640	648	656	665
533	673	681	689	697	706	713	722	730	738	746
534	754	762	770	779	787	795	803	811	819	827
535	835	843	852	860	868	876	884	892	900	908
536	916	925	933	941	949	957	965	973	981	989
537	997	*006	*014	*022	*030	*038	*046	*054	*062	*070
538	73 078	086	094	102	111	119	127	135	143	151
539	159	167	175	183	191	199	207	215	223	231
540	239	247	255	263	272	280	288	296	304	312
541	320	328	336	344	352	360	368	376	384	392
542	400	408	416	424	432	440	448	456	464	472
543	480	488	496	504	512	520	528	536	544	552
544	560	568	576	584	592	600	608	616	624	632
545	640	648	656	664	672	679	687	695	703	711
546	719	727	735	743	751	759	767	775	783	791
547	799	807	815	823	830	838	846	854	862	870
548	878	886	894	902	910	918	926	933	941	949
549	957	965	973	981	989	997	*005	*013	*020	*028
550	74 036	044	052	060	068	076	084	092	099	107
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	9
1	0.9
2	1.8
3	2.7
4	3.6
5	4.5
6	5.4
7	6.3
8	7.2
9	8.1

	8
1	0.8
2	1.6
3	2.4
4	3.2
5	4.0
6	4.8
7	5.6
8	6.4
9	7.2

	7
1	0.7
2	1.4
3	2.1
4	2.8
5	3.5
6	4.2
7	4.9
8	5.6
9	6.3

Proportional parts

69 897 — .74 107

COMMON LOGARITHMS OF NUMBERS

550 — 600

N.		0	1	2	3	4	5	6	7	8	9
550	74	036	044	052	060	068	076	084	092	099	107
551		115	123	131	139	147	155	162	170	178	186
552		194	202	210	218	225	233	241	249	257	265
553		273	280	288	296	304	312	320	327	335	343
554		351	359	367	374	382	390	398	406	414	421
555		429	437	445	453	461	468	476	484	492	500
556		507	515	523	531	539	547	554	562	570	578
557		586	593	601	609	617	624	632	640	648	656
558		663	671	679	687	695	702	710	718	726	733
559		741	749	757	764	772	780	788	796	803	811
560		819	827	834	842	850	858	865	873	881	889
561		896	904	912	920	927	935	943	950	958	966
562		974	981	989	997	*005	*012	*020	*028	*035	*043
563	75	051	059	066	074	082	089	097	105	113	120
564		128	136	143	151	159	166	174	182	189	197
565		205	213	220	228	236	243	251	259	266	274
566		282	289	297	305	312	320	328	335	343	351
567		358	366	374	381	389	397	404	412	420	427
568		435	442	450	458	465	473	481	488	496	504
569		511	519	526	534	542	549	557	565	572	580
570		587	595	603	610	618	626	633	641	648	656
571		664	671	679	686	694	702	709	717	724	732
572		740	747	755	762	770	778	785	793	800	808
573		815	823	831	838	846	853	861	868	876	884
574		891	899	906	914	921	929	937	944	952	959
575		967	974	982	989	997	*005	*012	*020	*027	*035
576	76	042	050	057	065	072	080	087	095	103	110
577		118	125	133	140	148	155	163	170	178	185
578		193	200	208	215	223	230	238	245	253	260
579		268	275	283	290	298	305	313	320	328	335
580		343	350	358	365	373	380	388	395	403	410
581		418	425	433	440	448	455	462	470	477	485
582		492	500	507	515	522	530	537	545	552	559
583		567	574	582	589	597	604	612	619	626	634
584		641	649	656	664	671	678	686	693	701	708
585		716	723	730	738	745	753	760	768	775	782
586		790	797	805	812	819	827	834	842	849	856
587		864	871	879	886	893	901	908	916	923	930
588		938	945	953	960	967	975	982	989	997	*004
589	77	012	019	026	034	041	048	056	063	070	078
590		085	093	100	107	115	122	129	137	144	151
591		159	166	173	181	188	195	203	210	217	225
592		232	240	247	254	262	269	276	283	291	298
593		305	313	320	327	335	342	349	357	364	371
594		379	386	393	401	408	415	422	430	437	444
595		452	459	466	474	481	488	495	503	510	517
596		525	532	539	546	554	561	568	576	583	590
597		597	605	612	619	627	634	641	648	656	663
598		670	677	685	692	699	706	714	721	728	735
599		743	750	757	764	772	779	786	793	801	808
600		815	822	830	837	844	851	859	866	873	880
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	8
1	0.8
2	1.6
3	2.4
4	3.2
5	4.0
6	4.8
7	5.6
8	6.4
9	7.2

	7
1	0.7
2	1.4
3	2.1
4	2.8
5	3.5
6	4.2
7	4.9
8	5.6
9	6.3

Proportional parts

COMMON LOGARITHMS OF NUMBERS

600 — 650

N.	0	1	2	3	4	5	6	7	8	9
600	77 815	822	830	837	844	851	859	866	873	880
601	887	895	902	909	916	924	931	938	945	952
602	960	967	974	981	988	996	*003	*010	*017	*025
603	78 032	039	046	053	061	068	075	082	089	097
604	104	111	118	125	132	140	147	154	161	168
605	176	183	190	197	204	211	219	226	233	240
606	247	254	262	269	276	283	290	297	305	312
607	319	326	333	340	347	355	362	369	376	383
608	390	398	405	412	419	426	433	440	447	455
609	462	469	476	483	490	497	504	512	519	526
610	533	540	547	554	561	569	576	583	590	597
611	604	611	618	625	633	640	647	654	661	668
612	675	682	689	696	704	711	718	725	732	739
613	746	753	760	767	774	781	789	796	803	810
614	817	824	831	838	845	852	859	866	873	880
615	888	895	902	909	916	923	930	937	944	951
616	958	965	972	979	986	993	*000	*007	*014	*021
617	79 029	036	043	050	057	064	071	078	085	092
618	099	106	113	120	127	134	141	148	155	162
619	169	176	183	190	197	204	211	218	225	232
620	239	246	253	260	267	274	281	288	295	302
621	309	316	323	330	337	344	351	358	365	372
622	379	386	393	400	407	414	421	428	435	442
623	449	456	463	470	477	484	491	498	505	511
624	518	525	532	539	546	553	560	567	574	581
625	588	595	602	609	616	623	630	637	644	650
626	657	664	671	678	685	692	699	706	713	720
627	727	734	741	748	754	761	768	775	782	789
628	796	803	810	817	824	831	837	844	851	858
629	865	872	879	886	893	900	906	913	920	927
630	934	941	948	955	962	969	975	982	989	996
631	80 003	010	017	024	030	037	044	051	058	065
632	072	079	085	092	099	106	113	120	127	134
633	140	147	154	161	168	175	182	188	195	202
634	209	216	223	229	236	243	250	257	264	271
635	277	284	291	298	305	312	318	325	332	339
636	346	353	359	366	373	380	387	393	400	407
637	414	421	428	434	441	448	455	462	468	475
638	482	489	496	502	509	516	523	530	536	543
639	550	557	564	570	577	584	591	598	604	611
640	618	625	632	638	645	652	659	665	672	679
641	686	693	699	706	713	720	726	733	740	747
642	754	760	767	774	781	787	794	801	808	814
643	821	828	835	841	848	855	862	868	875	882
644	889	895	902	909	916	922	929	936	943	949
645	956	963	969	976	983	990	996	*003	*010	*017
646	81 023	030	037	043	050	057	064	070	077	084
647	090	097	104	111	117	124	131	137	144	151
648	158	164	171	178	184	191	198	204	211	218
649	224	231	238	245	251	258	265	271	278	285
650	291	298	305	311	318	325	331	338	345	351
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	8
1	0.8
2	1.6
3	2.4
4	3.2
5	4.0
6	4.8
7	5.6
8	6.4
9	7.2

	7
1	0.7
2	1.4
3	2.1
4	2.8
5	3.5
6	4.2
7	4.9
8	5.6
9	6.3

	6
1	0.6
2	1.2
3	1.8
4	2.4
5	3.0
6	3.6
7	4.2
8	4.8
9	5.4

Proportional parts

COMMON LOGARITHMS OF NUMBERS

650 — 700

N.		0	1	2	3	4	5	6	7	8	9
650	81	291	298	305	311	318	325	331	338	345	351
651		358	365	371	378	385	391	398	405	411	418
652		425	431	438	445	451	458	465	471	478	485
653		491	498	505	511	518	525	531	538	544	551
654		558	564	571	578	584	591	598	604	611	617
655		624	631	637	644	651	657	664	671	677	684
656		690	697	704	710	717	723	730	737	743	750
657		757	763	770	776	783	790	796	803	809	816
658		823	829	836	842	849	856	862	869	875	882
659		889	895	902	908	915	921	928	935	941	948
660		954	961	968	974	981	987	994	*000	*007	*014
661	82	020	027	033	040	046	053	060	066	073	079
662		086	092	099	105	112	119	125	132	138	145
663		151	158	164	171	178	184	191	197	204	210
664		217	223	230	236	243	249	256	263	269	276
665		282	289	295	302	308	315	321	328	334	341
666		347	354	360	367	373	380	387	393	400	406
667		413	419	426	432	439	445	452	458	465	471
668		478	484	491	497	504	510	517	523	530	536
669		543	549	556	562	569	575	582	588	595	601
670		607	614	620	627	633	640	646	653	659	666
671		672	679	685	692	698	705	711	718	724	730
672		737	743	750	756	763	769	776	782	789	795
673		802	808	814	821	827	834	840	847	853	860
674		866	872	879	885	892	898	905	911	918	924
675		930	937	943	950	956	963	969	975	982	988
676		995	*001	*008	*014	*020	*027	*033	*040	*046	*052
677	83	059	065	072	078	085	091	097	104	110	117
678		123	129	136	142	149	155	161	168	174	181
679		187	193	200	206	213	219	225	232	238	245
680		251	257	264	270	276	283	289	296	302	308
681		315	321	327	334	340	347	353	359	366	372
682		378	385	391	398	404	410	417	423	429	436
683		442	448	455	461	467	474	480	487	493	499
684		506	512	518	525	531	537	544	550	556	563
685		569	575	582	588	594	601	607	613	620	626
686		632	639	645	651	658	664	670	677	683	689
687		696	702	708	715	721	727	734	740	746	753
688		759	765	771	778	784	790	797	803	809	816
689		822	828	835	841	847	853	860	866	872	879
690		885	891	897	904	910	916	923	929	935	942
691		948	954	960	967	973	979	985	992	998	*004
692	84	011	017	023	029	036	042	048	055	061	067
693		073	080	086	092	098	105	111	117	123	130
694		136	142	148	155	161	167	173	180	186	192
695		198	205	211	217	223	230	236	242	248	255
696		261	267	273	280	286	292	298	305	311	317
697		323	330	336	342	348	354	361	367	373	379
698		386	392	398	404	410	417	423	429	435	442
699		448	454	460	466	473	479	485	491	497	504
700		510	516	522	528	535	541	547	553	559	566
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	7
1	0.7
2	1.4
3	2.1
4	2.8
5	3.5
6	4.2
7	4.9
8	5.6
9	6.3

	6
1	0.6
2	1.2
3	1.8
4	2.4
5	3.0
6	3.6
7	4.2
8	4.8
9	5.4

Proportional parts

.81 291 — .84 566

COMMON LOGARITHMS OF NUMBERS

700 — 750

N.		0	1	2	3	4	5	6	7	8	9
700	84	510	516	522	528	535	541	547	553	559	566
701		572	578	584	590	597	603	609	615	621	628
702		634	640	646	652	658	665	671	677	683	689
703		696	702	708	714	720	726	733	739	745	751
704		757	763	770	776	782	788	794	800	807	813
705		819	825	831	837	844	850	856	862	868	874
706		880	887	893	899	905	911	917	924	930	936
707		942	948	954	960	967	973	979	985	991	997
708	85	003	009	016	022	028	034	040	046	052	058
709		065	071	077	083	089	095	101	107	114	120
710		126	132	138	144	150	156	163	169	175	181
711		187	193	199	205	211	217	224	230	236	242
712		248	254	260	266	272	278	285	291	297	303
713		309	315	321	327	333	339	345	352	358	364
714		370	376	382	388	394	400	406	412	418	425
715		431	437	443	449	455	461	467	473	479	485
716		491	497	503	509	516	522	528	534	540	546
717		552	558	564	570	576	582	588	594	600	606
718		612	618	625	631	637	643	649	655	661	667
719		673	679	685	691	697	703	709	715	721	727
720		733	739	745	751	757	763	769	775	781	788
721		794	800	806	812	818	824	830	836	842	848
722		854	860	866	872	878	884	890	896	902	908
723		914	920	926	932	938	944	950	956	962	968
724		974	980	986	992	998	*004	*010	*016	*022	*028
725	86	034	040	046	052	058	064	070	076	082	088
726		094	100	106	112	118	124	130	136	141	147
727		153	159	165	171	177	183	189	195	201	207
728		213	219	225	231	237	243	249	255	261	267
729		273	279	285	291	297	303	308	314	320	326
730		332	338	344	350	356	362	368	374	380	386
731		392	398	404	410	415	421	427	433	439	445
732		451	457	463	469	475	481	487	493	499	504
733		510	516	522	528	534	540	546	552	558	564
734		570	576	581	587	593	599	605	611	617	623
735		629	635	641	646	652	658	664	670	676	682
736		688	694	700	705	711	717	723	729	735	741
737		747	753	759	764	770	776	782	788	794	800
738		806	812	817	823	829	835	841	847	853	859
739		864	870	876	882	888	894	900	906	911	917
740		923	929	935	941	947	953	958	964	970	976
741		982	988	994	999	*005	*011	*017	*023	*029	*035
742	87	040	046	052	058	064	070	075	081	087	093
743		099	105	111	116	122	128	134	140	146	151
744		157	163	169	175	181	186	192	198	204	210
745		216	221	227	233	239	245	251	256	262	268
746		274	280	286	291	297	303	309	315	320	326
747		332	338	344	349	355	361	367	373	379	384
748		390	396	402	408	413	419	425	431	437	442
749		448	454	460	466	471	477	483	489	495	500
750		506	512	518	523	529	535	541	547	552	558
N.	—	0	1	2	3	4	5	6	7	8	9

Proportional parts

	7
1	0.7
2	1.4
3	2.1
4	2.8
5	3.5
6	4.2
7	4.9
8	5.6
9	6.3

	6
1	0.6
2	1.2
3	1.8
4	2.4
5	3.0
6	3.6
7	4.2
8	4.8
9	5.4

	5
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5
8	4.0
9	4.5

Proportional parts

COMMON LOGARITHMS OF NUMBERS

750 — 800

N.		0	1	2	3	4	5	6	7	8	9
750	87	506	512	518	523	529	535	541	547	552	558
751		564	570	576	581	587	593	599	604	610	616
752		622	628	633	639	645	651	656	662	668	674
753		679	685	691	697	703	708	714	720	726	731
754		737	743	749	754	760	766	772	777	783	789
755		795	800	806	812	818	823	829	835	841	846
756		852	858	864	869	875	881	887	892	898	904
757		910	915	921	927	933	938	944	950	955	961
758		967	973	978	984	990	996	*001	*007	*013	*018
759	88	024	030	036	041	047	053	058	064	070	076
760		081	087	093	098	104	110	116	121	127	133
761		138	144	150	156	161	167	173	178	184	190
762		195	201	207	213	218	224	230	235	241	247
763		252	258	264	270	275	281	287	292	298	304
764		309	315	321	326	332	338	343	349	355	360
765		366	372	377	383	389	395	400	406	412	417
766		423	429	434	440	446	451	457	463	468	474
767		480	485	491	497	502	508	513	519	525	530
768		536	542	547	553	559	564	570	576	581	587
769		593	598	604	610	615	621	627	632	638	643
770		649	655	660	666	672	677	683	689	694	700
771		705	711	717	722	728	734	739	745	750	756
772		762	767	773	779	784	790	795	801	807	812
773		818	824	829	835	840	846	852	857	863	868
774		874	880	885	891	897	902	908	913	919	925
775		930	936	941	947	953	958	964	969	975	981
776		986	992	997	*003	*009	*014	*020	*025	*031	*037
777	89	042	048	053	059	064	070	076	081	087	092
778		098	104	109	115	120	126	131	137	143	148
779		154	159	165	170	176	182	187	193	198	204
780		209	215	221	226	232	237	243	248	254	260
781		265	271	276	282	287	293	298	304	310	315
782		321	326	332	337	343	348	354	360	365	371
783		376	382	387	393	398	404	409	415	421	426
784		432	437	443	448	454	459	465	470	476	481
785		487	492	498	504	509	515	520	526	531	537
786		542	548	553	559	564	570	575	581	586	592
787		597	603	609	614	620	625	631	636	642	647
788		653	658	664	669	675	680	686	691	697	702
789		708	713	719	724	730	735	741	746	752	757
790		763	768	774	779	785	790	796	801	807	812
791		818	823	829	834	840	845	851	856	862	867
792		873	878	883	889	894	900	905	911	916	922
793		927	933	938	944	949	955	960	966	971	977
794		982	988	993	998	*004	*009	*015	*020	*026	*031
795	90	037	042	048	053	059	064	069	075	080	086
796		091	097	102	108	113	119	124	129	135	140
797		146	151	157	162	168	173	179	184	189	195
798		200	206	211	217	222	227	233	238	244	249
799		255	260	266	271	276	282	287	293	298	304
800		309	314	320	325	331	336	342	347	352	358
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	6
1	0.6
2	1.2
3	1.8
4	2.4
5	3.0
6	3.6
7	4.2
8	4.8
9	5.4

	5
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5
8	4.0
9	4.5

Proportional parts

COMMON LOGARITHMS OF NUMBERS

800 — 850

N.		0	1	2	3	4	5	6	7	8	9
800	90	309	314	320	325	331	336	342	347	352	358
801		363	369	374	380	385	390	396	401	407	412
802		417	423	428	434	439	445	450	455	461	466
803		472	477	482	488	493	499	504	509	515	520
804		526	531	536	542	547	553	558	563	569	574
805		580	585	590	596	601	607	612	617	623	628
806		634	639	644	650	655	660	666	671	677	682
807		687	693	698	703	709	714	720	725	730	736
808		741	747	752	757	763	768	773	779	784	789
809		795	800	806	811	816	822	827	832	838	843
810		849	854	859	865	870	875	881	886	891	897
811		902	907	913	918	924	929	934	940	945	950
812		956	961	966	972	977	982	988	993	998	*004
813	91	009	014	020	025	030	036	041	046	052	057
814		062	068	073	078	084	089	094	100	105	110
815		116	121	126	132	137	142	148	153	158	164
816		169	174	180	185	190	196	201	206	212	217
817		222	228	233	238	243	249	254	259	265	270
818		275	281	286	291	297	302	307	312	318	323
819		328	334	339	344	350	355	360	365	371	376
820		381	387	392	397	403	408	413	418	424	429
821		434	440	445	450	455	461	466	471	477	482
822		487	492	498	503	508	514	519	524	529	535
823		540	545	551	556	561	566	572	577	582	587
824		593	598	603	609	614	619	624	630	635	640
825		645	651	656	661	666	672	677	682	687	693
826		698	703	709	714	719	724	730	735	740	745
827		751	756	761	766	772	777	782	787	793	798
828		803	808	814	819	824	829	834	840	845	850
829		855	861	866	871	876	882	887	892	897	903
830		908	913	918	924	929	934	939	944	950	955
831		960	965	971	976	981	986	991	997	*002	*007
832	92	012	018	023	028	033	038	044	049	054	059
833		065	070	075	080	085	091	096	101	106	111
834		117	122	127	132	137	143	148	153	158	163
835		169	174	179	184	189	195	200	205	210	215
836		221	226	231	236	241	247	252	257	262	267
837		273	278	283	288	293	298	304	309	314	319
838		324	330	335	340	345	350	355	361	366	371
839		376	381	387	392	397	402	407	412	418	423
840		428	433	438	443	449	454	459	464	469	474
841		480	485	490	495	500	505	511	516	521	526
842		531	536	542	547	552	557	562	567	572	578
843		583	588	593	598	603	609	614	619	624	629
844		634	639	645	650	655	660	665	670	675	681
845		686	691	696	701	706	711	716	722	727	732
846		737	742	747	752	758	763	768	773	778	783
847		788	793	799	804	809	814	819	824	829	834
848		840	845	850	855	860	865	870	875	881	886
849		891	896	901	906	911	916	921	927	932	937
850		942	947	952	957	962	967	973	978	983	988
N.		0	1	2	3	4	5	6	7	8	9

Proportional parts

	6
1	0.6
2	1.2
3	1.8
4	2.4
5	3.0
6	3.6
7	4.2
8	4.8
9	5.4

	5
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5
8	4.0
9	4.5

Proportional parts

.90 309 — .92 988

COMMON LOGARITHMS OF NUMBERS

850 — 900

N.	0	1	2	3	4	5	6	7	8	9
850	92 942	947	952	957	962	967	973	978	983	988
851	993	998	*003	*008	*013	*018	*024	*029	*034	*039
852	93 044	049	054	059	064	069	075	080	085	090
853	095	100	105	110	115	120	125	131	136	141
854	146	151	156	161	166	171	176	181	186	192
855	197	202	207	212	217	222	227	232	237	242
856	247	252	258	263	268	273	278	283	288	293
857	298	303	308	313	318	323	328	334	339	344
858	349	354	359	364	369	374	379	384	389	394
859	399	404	409	414	420	425	430	435	440	445
860	450	455	460	465	470	475	480	485	490	495
861	500	505	510	515	520	526	531	536	541	546
862	551	556	561	566	571	576	581	586	591	596
863	601	606	611	616	621	626	631	636	641	646
864	651	656	661	666	671	676	682	687	692	697
865	702	707	712	717	722	727	732	737	742	747
866	752	757	762	767	772	777	782	787	792	797
867	802	807	812	817	822	827	832	837	842	847
868	852	857	862	867	872	877	882	887	892	897
869	902	907	912	917	922	927	932	937	942	947
870	952	957	962	967	972	977	982	987	992	997
871	94 002	007	012	017	022	027	032	037	042	047
872	052	057	062	067	072	077	082	086	091	096
873	101	106	111	116	121	126	131	136	141	146
874	151	156	161	166	171	176	181	186	191	196
875	201	206	211	216	221	226	231	236	240	245
876	250	255	260	265	270	275	280	285	290	295
877	300	305	310	315	320	325	330	335	340	345
878	349	354	359	364	369	374	379	384	389	394
879	399	404	409	414	419	424	429	433	438	443
880	448	453	458	463	468	473	478	483	488	493
881	498	503	507	512	517	522	527	532	537	542
882	547	552	557	562	567	571	576	581	586	591
883	596	601	606	611	616	621	626	630	635	640
884	645	650	655	660	665	670	675	680	685	689
885	694	699	704	709	714	719	724	729	734	738
886	743	748	753	758	763	768	773	778	783	787
887	792	797	802	807	812	817	822	827	832	836
888	841	846	851	856	861	866	871	876	880	885
889	890	895	900	905	910	915	919	924	929	934
890	939	944	949	954	959	963	968	973	978	983
891	988	993	998	*002	*007	*012	*017	*022	*027	*032
892	95 036	041	046	051	056	061	066	071	075	080
893	085	090	095	100	105	109	114	119	124	129
894	134	139	143	148	153	158	163	168	173	177
895	182	187	192	197	202	207	211	216	221	226
896	231	236	240	245	250	255	260	265	270	274
897	279	284	289	294	299	303	308	313	318	323
898	328	332	337	342	347	352	357	361	366	371
899	376	381	386	390	395	400	405	410	415	419
900	424	429	434	439	444	448	453	458	463	468
N.	0	1	2	3	4	5	6	7	8	9

Proportional parts

	6
1	0.6
2	1.2
3	1.8
4	2.4
5	3.0
6	3.6
7	4.2
8	4.8
9	5.4

	5
1	0.5
2	1.0
3	1.5
4	2.0
5	2.5
6	3.0
7	3.5
8	4.0
9	4.5

	4
1	0.4
2	0.8
3	1.2
4	1.6
5	2.0
6	2.4
7	2.8
8	3.2
9	3.6

Proportional parts

COMMON LOGARITHMS OF NUMBERS

900 — 950

N.		0	1	2	3	4	5	6	7	8	9	Proportional parts
900	95	424	429	434	439	444	448	453	458	463	468	
901		472	477	482	487	492	497	501	506	511	516	
902		521	525	530	535	540	545	550	554	559	564	
903		569	574	578	583	588	593	598	602	607	612	
904		617	622	626	631	636	641	646	650	655	660	
905		665	670	674	679	684	689	694	698	703	708	
906		713	718	722	727	732	737	742	746	751	756	
907		761	766	770	775	780	785	789	794	799	804	
908		809	813	818	823	828	832	837	842	847	852	
909		856	861	866	871	875	880	885	890	895	899	
910		904	909	914	918	923	928	933	938	942	947	5
911		952	957	961	966	971	976	980	985	990	995	1 0.5
912		999	*004	*009	*014	*019	*023	*028	*033	*038	*042	2 1.0
913	96	047	052	057	061	066	071	076	080	085	090	3 1.5
914		095	099	104	109	114	118	123	128	133	137	4 2.0
915		142	147	152	156	161	166	171	175	180	185	5 2.5
916		190	194	199	204	209	213	218	223	227	232	6 3.0
917		237	242	246	251	256	261	265	270	275	280	7 3.5
918		284	289	294	298	303	308	313	317	322	327	8 4.0
919		332	336	341	346	350	355	360	365	369	374	9 4.5
920		379	384	388	393	398	402	407	412	417	421	
921		426	431	435	440	445	450	454	459	464	468	
922		473	478	483	487	492	497	501	506	511	515	
923		520	525	530	534	539	544	548	553	558	562	
924		567	572	577	581	586	591	595	600	605	609	
925		614	619	624	628	633	638	642	647	652	656	
926		661	666	670	675	680	685	689	694	699	703	
927		708	713	717	722	727	731	736	741	745	750	
928		755	759	764	769	774	778	783	788	792	797	
929		802	806	811	816	820	825	830	834	839	844	
930		848	853	858	862	867	872	876	881	886	890	4
931		895	900	904	909	914	918	923	928	932	937	1 0.4
932		942	946	951	956	960	965	970	974	979	984	2 0.8
933		988	993	997	*002	*007	*011	*016	*021	*025	*030	3 1.2
934	97	035	039	044	049	053	058	063	067	072	077	4 1.6
935		081	086	090	095	100	104	109	114	118	123	5 2.0
936		128	132	137	142	146	151	155	160	165	169	6 2.4
937		174	179	183	188	192	197	202	206	211	216	7 2.8
938		220	225	230	234	239	243	248	253	257	262	8 3.2
939		267	271	276	280	285	290	294	299	304	308	9 3.6
940		313	317	322	327	331	336	340	345	350	354	
941		359	364	368	373	377	382	387	391	396	400	
942		405	410	414	419	424	428	433	437	442	447	
943		451	456	460	465	470	474	479	483	488	493	
944		497	502	506	511	516	520	525	529	534	539	
945		543	548	552	557	562	566	571	575	580	585	
946		589	594	598	603	607	612	617	621	626	630	
947		635	640	644	649	653	658	663	667	672	676	
948		681	685	690	695	699	704	708	713	717	722	
949		727	731	736	740	745	749	754	759	763	768	
950		772	777	782	786	791	795	800	804	809	813	
N.		0	1	2	3	4	5	6	7	8	9	Proportional parts

.95 424 — .97 813

COMMON LOGARITHMS OF NUMBERS

950 — 1000

N.		0	1	2	3	4	5	6	7	8	9	Proportional parts
950	97	772	777	782	786	791	795	800	804	809	813	
951		818	823	827	832	836	841	845	850	855	859	
952		864	868	873	877	882	886	891	896	900	905	
953		909	914	918	923	928	932	937	941	946	950	
954		955	959	964	968	973	978	982	987	991	996	
955	98	000	005	009	014	019	023	028	032	037	041	
956		046	050	055	059	064	068	073	078	082	087	
957		091	096	100	105	109	114	118	123	127	132	
958		137	141	146	150	155	159	164	168	173	177	
959		182	186	191	195	200	204	209	214	218	223	5
960		227	232	236	241	245	250	254	259	263	268	1 0.5
961		272	277	281	286	290	295	299	304	308	313	2 1.0
962		318	322	327	331	336	340	345	349	354	358	3 1.5
963		363	367	372	376	381	385	390	394	399	403	4 2.0
964		408	412	417	421	426	430	435	439	444	448	5 2.5
965		453	457	462	466	471	475	480	484	489	493	6 3.0
966		498	502	507	511	516	520	525	529	534	538	7 3.5
967		543	547	552	556	561	565	570	574	579	583	8 4.0
968		588	592	597	601	605	610	614	619	623	628	9 4.5
969		632	637	641	646	650	655	659	664	668	673	
970		677	682	686	691	695	700	704	709	713	717	
971		722	726	731	735	740	744	749	753	758	762	
972		767	771	776	780	784	789	793	798	802	807	
973		811	816	820	825	829	834	838	843	847	851	
974		856	860	865	869	874	878	883	887	892	896	
975		900	905	909	914	918	923	927	932	936	941	
976		945	949	954	958	963	967	972	976	981	985	
977		989	994	998	*003	*007	*012	*016	*021	*025	*029	
978	99	034	038	043	047	052	056	061	065	069	074	
979		078	083	087	092	096	100	105	109	114	118	4
980		123	127	131	136	140	145	149	154	158	162	1 0.4
981		167	171	176	180	185	189	193	198	202	207	2 0.8
982		211	216	220	224	229	233	238	242	247	251	3 1.2
983		255	260	264	269	273	277	282	286	291	295	4 1.6
984		300	304	308	313	317	322	326	330	335	339	5 2.0
985		344	348	352	357	361	366	370	374	379	383	6 2.4
986		388	392	396	401	405	410	414	419	423	427	7 2.8
987		432	436	441	445	449	454	458	463	467	471	8 3.2
988		476	480	484	489	493	498	502	506	511	515	9 3.6
989		520	524	528	533	537	542	546	550	555	559	
990		564	568	572	577	581	585	590	594	599	603	
991		607	612	616	621	625	629	634	638	642	647	
992		651	656	660	664	669	673	677	682	686	691	
993		695	699	704	708	712	717	721	726	730	734	
994		739	743	747	752	756	760	765	769	774	778	
995		782	787	791	795	800	804	808	813	817	822	
996		826	830	835	839	843	848	852	856	861	865	
997		870	874	878	883	887	891	896	900	904	909	
998		913	917	922	926	930	935	939	944	948	952	
999		957	961	965	970	974	978	983	987	991	996	
1000	00	000	004	009	013	017	022	026	030	035	039	
N.		0	1	2	3	4	5	6	7	8	9	Proportional parts

COMMON LOGARITHMS OF NUMBERS

1000 — 1050

N.	0	1	2	3	4	5	6	7	8	9	d.
1000	000 0000	0434	0869	1303	1737	2171	2605	3039	3473	3907	434
1001	4341	4775	5208	5642	6076	6510	6943	7377	7810	8244	434
1002	8677	9111	9544	9977	*0411	*0844	*1277	*1710	*2143	*2576	433
1003	001 3009	3442	3875	4308	4741	5174	5607	6039	6472	6905	433
1004	7337	7770	8202	8635	9067	9499	9932	*0364	*0796	*1228	432
1005	002 1661	2093	2525	2957	3389	3821	4253	4685	5116	5548	432
1006	5980	6411	6843	7275	7706	8138	8569	9001	9432	9863	431
1007	003 0295	0726	1157	1588	2019	2451	2882	3313	3744	4174	431
1008	4605	5036	5467	5898	6328	6759	7190	7620	8051	8481	431
1009	8912	9342	9772	*0203	*0633	*1063	*1493	*1924	*2354	*2784	430
1010	004 3214	3644	4074	4504	4933	5363	5793	6223	6652	7082	430
1011	7512	7941	8371	8800	9229	9659	*0088	*0517	*0947	*1376	429
1012	005 1805	2234	2663	3092	3521	3950	4379	4808	5237	5666	429
1013	6094	6523	6952	7380	7809	8238	8666	9094	9523	9951	429
1014	006 0380	0808	1236	1664	2092	2521	2949	3377	3805	4233	428
1015	4660	5088	5516	5944	6372	6799	7227	7655	8082	8510	428
1016	8937	9365	9792	*0219	*0647	*1074	*1501	*1928	*2355	*2782	427
1017	007 3210	3637	4064	4490	4917	5344	5771	6198	6624	7051	427
1018	7478	7904	8331	8757	9184	9610	*0037	*0463	*0889	*1316	426
1019	008 1742	2168	2594	3020	3446	3872	4298	4724	5150	5576	426
1020	6002	6427	6853	7279	7704	8130	8556	8981	9407	9832	426
1021	009 0257	0683	1108	1533	1959	2384	2809	3234	3659	4084	425
1022	4509	4934	5359	5784	6208	6633	7058	7483	7907	8332	425
1023	8756	9181	9605	*0030	*0454	*0878	*1303	*1727	*2151	*2575	424
1024	010 3000	3424	3848	4272	4696	5120	5544	5967	6391	6815	424
1025	7239	7662	8086	8510	8933	9357	9780	*0204	*0627	*1050	424
1026	011 1474	1897	2320	2743	3166	3590	4013	4436	4859	5282	423
1027	5704	6127	6550	6973	7396	7818	8241	8664	9086	9509	423
1028	9931	*0354	*0776	*1198	*1621	*2043	*2465	*2887	*3310	*3732	422
1029	012 4154	4576	4998	5420	5842	6264	6685	7107	7529	7951	422
1030	8372	8794	9215	9637	*0059	*0480	*0901	*1323	*1744	*2165	422
1031	013 2587	3008	3429	3850	4271	4692	5113	5534	5955	6376	421
1032	6797	7218	7639	8059	8480	8901	9321	9742	*0162	*0583	421
1033	014 1003	1424	1844	2264	2685	3105	3525	3945	4365	4785	420
1034	5205	5625	6045	6465	6885	7305	7725	8144	8564	8984	420
1035	9403	9823	*0243	*0662	*1082	*1501	*1920	*2340	*2759	*3178	420
1036	015 3598	4017	4436	4855	5274	5693	6112	6531	6950	7369	419
1037	7788	8206	8625	9044	9462	9881	*0300	*0718	*1137	*1555	419
1038	016 1974	2392	2810	3229	3647	4065	4483	4901	5319	5737	418
1039	6155	6573	6991	7409	7827	8245	8663	9080	9498	9916	418
1040	017 0333	0751	1168	1586	2003	2421	2838	3256	3673	4090	417
1041	4507	4924	5342	5759	6176	6593	7010	7427	7844	8260	417
1042	8677	9094	9511	9927	*0344	*0761	*1177	*1594	*2010	*2427	417
1043	018 2843	3259	3676	4092	4508	4925	5341	5757	6173	6589	416
1044	7005	7421	7837	8253	8669	9084	9500	9916	*0332	*0747	416
1045	019 1163	1578	1994	2410	2825	3240	3656	4071	4486	4902	415
1046	5317	5732	6147	6562	6977	7392	7807	8222	8637	9052	415
1047	9467	9882	*0296	*0711	*1126	*1540	*1955	*2369	*2784	*3198	415
1048	020 3613	4027	4442	4856	5270	5684	6099	6513	6927	7341	414
1049	7755	8169	8583	8997	9411	9824	*0238	*0652	*1066	*1479	414
1050	021 1893	2307	2720	3134	3547	3961	4374	4787	5201	5614	413
N.	0	1	2	3	4	5	6	7	8	9	d.

.000 0000 — .021 5614

COMMON LOGARITHMS OF NUMBERS

1050 — 1100

N.		0	1	2	3	4	5	6	7	8	9	d.
1050	021	1893	2307	2720	3134	3547	3961	4374	4787	5201	5614	413
1051		6027	6440	6854	7267	7680	8093	8506	8919	9332	9745	413
1052	022	0157	0570	0983	1396	1808	2221	2634	3046	3459	3871	413
1053		4284	4696	5109	5521	5933	6345	6758	7170	7582	7994	412
1054		8406	8818	9230	9642	*0054	*0466	*0878	*1289	*1701	*2113	412
1055	023	2525	2936	3348	3759	4171	4582	4994	5405	5817	6228	411
1056		6639	7050	7462	7873	8284	8695	9106	9517	9928	*0339	411
1057	024	0750	1161	1572	1982	2393	2804	3214	3625	4036	4446	411
1058		4857	5267	5678	6088	6498	6909	7319	7729	8139	8549	410
1059		8960	9370	9780	*0190	*0600	*1010	*1419	*1829	*2239	*2649	410
1060	025	3059	3468	3878	4288	4697	5107	5516	5926	6335	6744	410
1061		7154	7563	7972	8382	8791	9200	9609	*0018	*0427	*0836	409
1062	026	1245	1654	2063	2472	2881	3289	3698	4107	4515	4924	409
1063		5333	5741	6150	6558	6967	7375	7783	8192	8600	9008	408
1064		9416	9824	*0233	*0641	*1049	*1457	*1865	*2273	*2680	*3088	408
1065	027	3496	3904	4312	4719	5127	5535	5942	6350	6757	7165	408
1066		7572	7979	8387	8794	9201	9609	*0016	*0423	*0830	*1237	407
1067	028	1644	2051	2458	2865	3272	3679	4086	4492	4899	5306	407
1068		5713	6119	6526	6932	7339	7745	8152	8558	8964	9371	406
1069		9777	*0183	*0590	*0996	*1402	*1808	*2214	*2620	*3026	*3432	406
1070	029	3838	4244	4649	5055	5461	5867	6272	6678	7084	7489	406
1071		7895	8300	8706	9111	9516	9922	*0327	*0732	*1138	*1543	405
1072	030	1948	2353	2758	3163	3568	3973	4378	4783	5188	5592	405
1073		5997	6402	6807	7211	7616	8020	8425	8830	9234	9638	405
1074	031	0043	0447	0851	1256	1660	2064	2468	2872	3277	3681	404
1075		4085	4489	4893	5296	5700	6104	6508	6912	7315	7719	404
1076		8123	8526	8930	9333	9737	*0140	*0544	*0947	*1350	*1754	403
1077	032	2157	2560	2963	3367	3770	4173	4576	4979	5382	5785	403
1078		6188	6590	6993	7396	7799	8201	8604	9007	9409	9812	403
1079	033	0214	0617	1019	1422	1824	2226	2629	3031	3433	3835	402
1080		4238	4640	5042	5444	5846	6248	6650	7052	7453	7855	402
1081		8257	8659	9060	9462	9864	*0265	*0667	*1068	*1470	*1871	402
1082	034	2273	2674	3075	3477	3878	4279	4680	5081	5482	5884	401
1083		6285	6686	7087	7487	7888	8289	8690	9091	9491	9892	401
1084	035	0293	0693	1094	1495	1895	2296	2696	3096	3497	3897	400
1085		4297	4698	5098	5498	5898	6298	6698	7098	7498	7898	400
1086		8298	8698	9098	9498	9898	*0297	*0697	*1097	*1496	*1896	400
1087	036	2295	2695	3094	3494	3893	4293	4692	5091	5491	5890	399
1088		6289	6688	7087	7486	7885	8284	8683	9082	9481	9880	399
1089	037	0279	0678	1076	1475	1874	2272	2671	3070	3468	3867	399
1090		4265	4663	5062	5460	5858	6257	6655	7053	7451	7849	398
1091		8248	8646	9044	9442	9839	*0237	*0635	*1033	*1431	*1829	398
1092	038	2226	2624	3022	3419	3817	4214	4612	5009	5407	5804	398
1093		6202	6599	6996	7393	7791	8188	8585	8982	9379	9776	397
1094	039	0173	0570	0967	1364	1761	2158	2554	2951	3348	3745	397
1095		4141	4538	4934	5331	5727	6124	6520	6917	7313	7709	397
1096		8106	8502	8898	9294	9690	*0086	*0482	*0878	*1274	*1670	396
1097	040	2066	2462	2858	3254	3650	4045	4441	4837	5232	5628	396
1098		6023	6419	6814	7210	7605	8001	8396	8791	9187	9582	395
1099		9977	*0372	*0767	*1162	*1557	*1952	*2347	*2742	*3137	*3532	395
1100	041	3927	4322	4716	5111	5506	5900	6295	6690	7084	7479	395
N.		0	1	2	3	4	5	6	7	8	9	d.

COMMON LOGARITHMS OF NUMBERS

1100 — 1150

N.	0	1	2	3	4	5	6	7	8	9	d.
1100	041 3927	4322	4716	5111	5506	5900	6295	6690	7084	7479	395
1101	7873	8268	8662	9056	9451	9845	*0239	*0633	*1028	*1422	394
1102	042 1816	2210	2604	2998	3392	3786	4180	4574	4968	5361	394
1103	5755	6149	6543	6936	7330	7723	8117	8510	8904	9297	394
1104	9691	*0084	*0477	*0871	*1264	*1657	*2050	*2444	*2837	*3230	393
1105	043 3623	4016	4409	4802	5195	5587	5980	6373	6766	7159	393
1106	7551	7944	8337	8729	9122	9514	9907	*0299	*0692	*1084	393
1107	044 1476	1869	2261	2653	3045	3437	3829	4222	4614	5006	392
1108	5398	5790	6181	6573	6965	7357	7749	8140	8532	8924	392
1109	9315	9707	*0099	*0490	*0882	*1273	*1664	*2056	*2447	*2839	392
1110	045 3230	3621	4012	4403	4795	5186	5577	5968	6359	6750	391
1111	7141	7531	7922	8313	8704	9095	9485	9876	*0267	*0657	391
1112	046 1048	1438	1829	2219	2610	3000	3391	3781	4171	4561	390
1113	4952	5342	5732	6122	6512	6902	7292	7682	8072	8462	390
1114	8852	9242	9632	*0021	*0411	*0801	*1190	*1580	*1970	*2359	390
1115	047 2749	3138	3528	3917	4306	4696	5085	5474	5864	6253	389
1116	6642	7031	7420	7809	8198	8587	8976	9365	9754	*0143	389
1117	048 0532	0921	1309	1698	2087	2475	2864	3253	3641	4030	389
1118	4418	4806	5195	5583	5972	6360	6748	7136	7525	7913	388
1119	8301	8689	9077	9465	9853	*0241	*0629	*1017	*1405	*1792	388
1120	049 2180	2568	2956	3343	3731	4119	4506	4894	5281	5669	388
1121	6056	6444	6831	7218	7606	7993	8380	8767	9154	9541	387
1122	9929	*0316	*0703	*1090	*1477	*1863	*2250	*2637	*3024	*3411	387
1123	050 3798	4184	4571	4958	5344	5731	6117	6504	6890	7277	387
1124	7663	8049	8436	8822	9208	9595	9981	*0367	*0753	*1139	386
1125	051 1525	1911	2297	2683	3069	3455	3841	4227	4612	4998	386
1126	5384	5770	6155	6541	6926	7312	7697	8083	8468	8854	386
1127	9239	9624	*0010	*0395	*0780	*1166	*1551	*1936	*2321	*2706	385
1128	052 3091	3476	3861	4246	4631	5016	5400	5785	6170	6555	385
1129	6939	7324	7709	8093	8478	8862	9247	9631	*0016	*0400	385
1130	053 0784	1169	1553	1937	2321	2706	3090	3474	3858	4242	384
1131	4626	5010	5394	5778	6162	6546	6929	7313	7697	8081	384
1132	8464	8848	9232	9615	9999	*0382	*0766	*1149	*1532	*1916	384
1133	054 2299	2682	3066	3449	3832	4215	4598	4981	5365	5748	383
1134	6131	6514	6896	7279	7662	8045	8428	8811	9193	9576	383
1135	9959	*0341	*0724	*1106	*1489	*1871	*2254	*2636	*3019	*3401	382
1136	055 3783	4166	4548	4930	5312	5694	6077	6459	6841	7223	382
1137	7605	7987	8369	8750	9132	9514	9896	*0278	*0659	*1041	382
1138	056 1423	1804	2186	2567	2949	3330	3712	4093	4475	4856	381
1139	5237	5619	6000	6381	6762	7143	7524	7905	8287	8668	381
1140	9049	9429	9810	*0191	*0572	*0953	*1334	*1714	*2095	*2476	381
1141	057 2856	3237	3618	3998	4379	4759	5140	5520	5900	6281	381
1142	6661	7041	7422	7802	8182	8562	8942	9322	9702	*0082	380
1143	058 0462	0842	1222	1602	1982	2362	2741	3121	3501	3881	380
1144	4260	4640	5019	5399	5778	6158	6537	6917	7296	7676	380
1145	8055	8434	8813	9193	9572	9951	*0330	*0709	*1088	*1467	379
1146	059 1846	2225	2604	2983	3362	3741	4119	4498	4877	5256	379
1147	5634	6013	6391	6770	7148	7527	7905	8284	8662	9041	379
1148	9419	9797	*0175	*0554	*0932	*1310	*1688	*2066	*2444	*2822	378
1149	060 3200	3578	3956	4334	4712	5090	5468	5845	6223	6601	378
1150	6978	7356	7734	8111	8489	8866	9244	9621	9999	*0376	378
N.	0	1	2	3	4	5	6	7	8	9	d.

COMMON LOGARITHMS OF NUMBERS

											Proportional parts				
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5
10	0000	0043	0086	0128	0170	0212	0253	0294	0334	0374	4	8	12	17	21
11	0414	0453	0492	0531	0569	0607	0645	0682	0719	0755	4	8	11	15	19
12	0792	0828	0864	0899	0934	0969	1004	1038	1072	1106	3	7	10	14	17
13	1139	1173	1206	1239	1271	1303	1335	1367	1399	1430	3	6	10	13	16
14	1461	1492	1523	1553	1584	1614	1644	1673	1703	1732	3	6	9	12	15
15	1761	1790	1818	1847	1875	1903	1931	1959	1987	2014	3	6	8	11	14
16	2041	2068	2095	2122	2148	2175	2201	2227	2253	2279	3	5	8	11	13
17	2304	2330	2355	2380	2405	2430	2455	2480	2504	2529	2	5	7	10	12
18	2553	2577	2601	2625	2648	2672	2695	2718	2742	2765	2	5	7	9	12
19	2788	2810	2833	2856	2878	2900	2923	2945	2967	2989	2	4	7	9	11
20	3010	3032	3054	3075	3096	3118	3139	3160	3181	3201	2	4	6	8	11
21	3222	3243	3263	3284	3304	3324	3345	3365	3385	3404	2	4	6	8	10
22	3424	3444	3464	3483	3502	3522	3541	3560	3579	3598	2	4	6	8	10
23	3617	3636	3655	3674	3692	3711	3729	3747	3766	3784	2	4	6	7	9
24	3802	3820	3838	3856	3874	3892	3909	3927	3945	3962	2	4	5	7	9
25	3979	3997	4014	4031	4048	4065	4082	4099	4116	4133	2	4	5	7	9
26	4150	4166	4183	4200	4216	4232	4249	4265	4281	4298	2	3	5	7	8
27	4314	4330	4346	4362	4378	4393	4409	4425	4440	4456	2	3	5	6	8
28	4472	4487	4502	4518	4533	4548	4564	4579	4594	4609	2	3	5	6	8
29	4624	4639	4654	4669	4683	4698	4713	4728	4742	4757	1	3	4	6	7
30	4771	4786	4800	4814	4829	4843	4857	4871	4886	4900	1	3	4	6	7
31	4914	4928	4942	4955	4969	4983	4997	5011	5024	5038	1	3	4	5	7
32	5051	5065	5079	5092	5105	5119	5132	5145	5159	5172	1	3	4	5	7
33	5185	5198	5211	5224	5237	5250	5263	5276	5289	5302	1	3	4	5	7
34	5315	5328	5340	5353	5366	5378	5391	5403	5416	5428	1	2	4	5	6
35	5441	5453	5465	5478	5490	5502	5514	5527	5539	5551	1	2	4	5	6
36	5563	5575	5587	5599	5611	5623	5635	5647	5658	5670	1	2	4	5	6
37	5682	5694	5705	5717	5729	5740	5752	5763	5775	5786	1	2	4	5	6
38	5798	5809	5821	5832	5843	5855	5866	5877	5888	5899	1	2	3	5	6
39	5911	5922	5933	5944	5955	5966	5977	5988	5999	6010	1	2	3	4	5
40	6021	6031	6042	6053	6064	6075	6085	6096	6107	6117	1	2	3	4	5
41	6128	6138	6149	6160	6170	6180	6191	6201	6212	6222	1	2	3	4	5
42	6232	6243	6253	6263	6274	6284	6294	6304	6314	6325	1	2	3	4	5
43	6335	6345	6355	6365	6375	6385	6395	6405	6415	6425	1	2	3	4	5
44	6435	6444	6454	6464	6474	6484	6493	6503	6513	6522	1	2	3	4	5
45	6532	6542	6551	6561	6571	6580	6590	6599	6609	6618	1	2	3	4	5
46	6628	6637	6646	6656	6665	6675	6684	6693	6702	6712	1	2	3	4	5
47	6721	6730	6739	6749	6758	6767	6776	6785	6794	6803	1	2	3	4	5
48	6812	6821	6830	6839	6848	6857	6866	6875	6884	6893	1	2	3	4	5
49	6902	6911	6920	6928	6937	6946	6955	6964	6972	6981	1	2	3	4	4
50	6990	6998	7007	7016	7024	7033	7042	7050	7059	7067	1	2	3	3	4
51	7076	7084	7093	7101	7110	7118	7126	7135	7143	7152	1	2	3	3	4
52	7160	7168	7177	7185	7193	7202	7210	7218	7226	7235	1	2	3	3	4
53	7243	7251	7259	7267	7275	7284	7292	7300	7308	7316	1	2	2	3	4
54	7324	7332	7340	7348	7356	7364	7372	7380	7388	7396	1	2	2	3	4
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5

COMMON LOGARITHMS OF NUMBERS

											Proportional parts				
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5
55	7404	7412	7419	7427	7435	7443	7451	7459	7466	7474	1	2	2	3	4
56	7482	7490	7497	7505	7513	7520	7528	7536	7543	7551	1	2	2	3	4
57	7559	7566	7574	7582	7589	7597	7604	7612	7619	7627	1	1	2	3	4
58	7634	7642	7649	7657	7664	7672	7679	7686	7694	7701	1	1	2	3	4
59	7709	7716	7723	7731	7738	7745	7752	7760	7767	7774	1	1	2	3	4
60	7782	7789	7796	7803	7810	7818	7825	7832	7839	7846	1	1	2	3	4
61	7853	7860	7868	7875	7882	7889	7896	7903	7910	7917	1	1	2	3	3
62	7924	7931	7938	7945	7952	7959	7966	7973	7980	7987	1	1	2	3	3
63	7993	8000	8007	8014	8021	8028	8035	8041	8048	8055	1	1	2	3	3
64	8062	8069	8075	8082	8089	8096	8102	8109	8116	8122	1	1	2	3	3
65	8129	8136	8142	8149	8156	8162	8169	8176	8182	8189	1	1	2	3	3
66	8195	8202	8209	8215	8222	8228	8235	8241	8248	8254	1	1	2	3	3
67	8261	8267	8274	8280	8287	8293	8299	8306	8312	8319	1	1	2	3	3
68	8325	8331	8338	8344	8351	8357	8363	8370	8376	8382	1	1	2	3	3
69	8388	8395	8401	8407	8414	8420	8426	8432	8439	8445	1	1	2	3	3
70	8451	8457	8463	8470	8476	8482	8488	8494	8500	8506	1	1	2	3	3
71	8513	8519	8525	8531	8537	8543	8549	8555	8561	8567	1	1	2	3	3
72	8573	8579	8585	8591	8597	8603	8609	8615	8621	8627	1	1	2	3	3
73	8633	8639	8645	8651	8657	8663	8669	8675	8681	8686	1	1	2	2	3
74	8692	8698	8704	8710	8716	8722	8727	8733	8739	8745	1	1	2	2	3
75	8751	8756	8762	8768	8774	8779	8785	8791	8797	8802	1	1	2	2	3
76	8808	8814	8820	8825	8831	8837	8842	8848	8854	8859	1	1	2	2	3
77	8865	8871	8876	8882	8887	8893	8899	8904	8910	8915	1	1	2	2	3
78	8921	8927	8932	8938	8943	8949	8954	8960	8965	8971	1	1	2	2	3
79	8976	8982	8987	8993	8998	9004	9009	9015	9020	9025	1	1	2	2	3
80	9031	9036	9042	9047	9053	9058	9063	9069	9074	9079	1	1	2	2	3
81	9085	9090	9096	9101	9106	9112	9117	9122	9128	9133	1	1	2	2	3
82	9138	9143	9149	9154	9159	9165	9170	9175	9180	9186	1	1	2	2	3
83	9191	9196	9201	9206	9212	9217	9222	9227	9232	9238	1	1	2	2	3
84	9243	9248	9253	9258	9263	9269	9274	9279	9284	9289	1	1	2	2	3
85	9294	9299	9304	9309	9315	9320	9325	9330	9335	9340	1	1	2	2	3
86	9345	9350	9355	9360	9365	9370	9375	9380	9385	9390	1	1	2	2	3
87	9395	9400	9405	9410	9415	9420	9425	9430	9435	9440	1	1	2	2	3
88	9445	9450	9455	9460	9465	9469	9474	9479	9484	9489	0	1	1	2	2
89	9494	9499	9504	9509	9513	9518	9523	9528	9533	9538	0	1	1	2	2
90	9542	9547	9552	9557	9562	9566	9571	9576	9581	9586	0	1	1	2	2
91	9590	9595	9600	9605	9609	9614	9619	9624	9628	9633	0	1	1	2	2
92	9638	9643	9647	9652	9657	9661	9666	9671	9675	9680	0	1	1	2	2
93	9685	9689	9694	9699	9703	9708	9713	9717	9722	9727	0	1	1	2	2
94	9731	9736	9741	9745	9750	9754	9759	9763	9768	9773	0	1	1	2	2
95	9777	9782	9786	9791	9795	9800	9805	9809	9814	9818	0	1	1	2	2
96	9823	9827	9832	9836	9841	9845	9850	9854	9859	9863	0	1	1	2	2
97	9868	9872	9877	9881	9886	9890	9894	9899	9903	9908	0	1	1	2	2
98	9912	9917	9921	9926	9930	9934	9939	9943	9948	9952	0	1	1	2	2
99	9956	9961	9965	9969	9974	9978	9983	9987	9991	9996	0	1	1	2	2
N	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5

COMMON ANTILOGARITHMS

Enter from the margins with the given (common) logarithm, the corresponding number is given in the body of the table.

L	0	1	2	3	4	5	6	7	8	9	Proportional parts				
											1	2	3	4	5
.00	1000	1002	1005	1007	1009	1012	1014	1016	1019	1021	0	0	1	1	1
.01	1023	1026	1028	1030	1033	1035	1038	1040	1042	1045	0	0	1	1	1
.02	1047	1050	1052	1054	1057	1059	1062	1064	1067	1069	0	0	1	1	1
.03	1072	1074	1076	1079	1081	1084	1086	1089	1091	1094	0	0	1	1	1
.04	1096	1099	1102	1104	1107	1109	1112	1114	1117	1119	0	1	1	1	1
.05	1122	1125	1127	1130	1132	1135	1138	1140	1143	1146	0	1	1	1	1
.06	1148	1151	1153	1156	1159	1161	1164	1167	1169	1172	0	1	1	1	1
.07	1175	1178	1180	1183	1186	1189	1191	1194	1197	1199	0	1	1	1	1
.08	1202	1205	1208	1211	1213	1216	1219	1222	1225	1227	0	1	1	1	1
.09	1230	1233	1236	1239	1242	1245	1247	1250	1253	1256	0	1	1	1	1
.10	1259	1262	1265	1268	1271	1274	1276	1279	1282	1285	0	1	1	1	1
.11	1288	1291	1294	1297	1300	1303	1306	1309	1312	1315	0	1	1	1	2
.12	1318	1321	1324	1327	1330	1334	1337	1340	1343	1346	0	1	1	1	2
.13	1349	1352	1355	1358	1361	1365	1368	1371	1374	1377	0	1	1	1	2
.14	1380	1384	1387	1390	1393	1396	1400	1403	1406	1409	0	1	1	1	2
.15	1413	1416	1419	1422	1426	1429	1432	1435	1439	1442	0	1	1	1	2
.16	1445	1449	1452	1455	1459	1462	1466	1469	1472	1476	0	1	1	1	2
.17	1479	1483	1486	1489	1493	1496	1500	1503	1507	1510	0	1	1	1	2
.18	1514	1517	1521	1524	1528	1531	1535	1538	1542	1545	0	1	1	1	2
.19	1549	1552	1556	1560	1563	1567	1570	1574	1578	1581	0	1	1	1	2
.20	1585	1589	1592	1596	1600	1603	1607	1611	1614	1618	0	1	1	1	2
.21	1622	1626	1629	1633	1637	1641	1644	1648	1652	1656	0	1	1	1	2
.22	1660	1663	1667	1671	1675	1679	1683	1687	1690	1694	0	1	1	2	2
.23	1698	1702	1706	1710	1714	1718	1722	1726	1730	1734	0	1	1	2	2
.24	1738	1742	1746	1750	1754	1758	1762	1766	1770	1774	0	1	1	2	2
.25	1778	1782	1786	1791	1795	1799	1803	1807	1811	1816	0	1	1	2	2
.26	1820	1824	1828	1832	1837	1841	1845	1849	1854	1858	0	1	1	2	2
.27	1862	1866	1871	1875	1879	1884	1888	1892	1897	1901	0	1	1	2	2
.28	1905	1910	1914	1919	1923	1928	1932	1936	1941	1945	0	1	1	2	2
.29	1950	1954	1959	1963	1968	1972	1977	1982	1986	1991	0	1	1	2	2
.30	1995	2000	2004	2009	2014	2018	2023	2028	2032	2037	0	1	1	2	2
.31	2042	2046	2051	2056	2061	2065	2070	2075	2080	2084	0	1	1	2	2
.32	2089	2094	2099	2104	2109	2113	2118	2123	2128	2133	0	1	1	2	2
.33	2138	2143	2148	2153	2158	2163	2168	2173	2178	2183	0	1	1	2	2
.34	2188	2193	2198	2203	2208	2213	2218	2223	2228	2234	1	1	2	2	3
.35	2239	2244	2249	2254	2259	2265	2270	2275	2280	2286	1	1	2	2	3
.36	2291	2296	2301	2307	2312	2317	2323	2328	2333	2339	1	1	2	2	3
.37	2344	2350	2355	2360	2366	2371	2377	2382	2388	2393	1	1	2	2	3
.38	2399	2404	2410	2415	2421	2427	2432	2438	2443	2449	1	1	2	2	3
.39	2455	2460	2466	2472	2477	2483	2489	2495	2500	2506	1	1	2	2	3
.40	2512	2518	2523	2529	2535	2541	2547	2553	2559	2564	1	1	2	2	3
.41	2570	2576	2582	2588	2594	2600	2606	2612	2618	2624	1	1	2	2	3
.42	2630	2636	2642	2649	2655	2661	2667	2673	2679	2685	1	1	2	2	3
.43	2692	2698	2704	2710	2716	2723	2729	2735	2742	2748	1	1	2	2	3
.44	2754	2761	2767	2773	2780	2786	2793	2799	2805	2812	1	1	2	3	3
.45	2818	2825	2831	2838	2844	2851	2858	2864	2871	2877	1	1	2	3	3
.46	2884	2891	2897	2904	2911	2917	2924	2931	2938	2944	1	1	2	3	3
.47	2951	2958	2965	2972	2979	2985	2992	2999	3006	3013	1	1	2	3	3
.48	3020	3027	3034	3041	3048	3055	3062	3069	3076	3083	1	1	2	3	3
.49	3090	3097	3105	3112	3119	3126	3133	3141	3148	3155	1	1	2	3	4
L	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5

COMMON ANTILOGARITHMS

											Proportional parts				
L	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5
.50	3162	3170	3177	3184	3192	3199	3206	3214	3221	3228	1	1	2	3	4
.51	3236	3243	3251	3258	3266	3273	3281	3289	3296	3304	1	1	2	3	4
.52	3311	3319	3327	3334	3342	3350	3357	3365	3373	3381	1	1	2	3	4
.53	3388	3396	3404	3412	3420	3428	3436	3443	3451	3459	1	2	2	3	4
.54	3467	3475	3483	3491	3499	3508	3516	3524	3532	3540	1	2	2	3	4
.55	3548	3556	3565	3573	3581	3589	3597	3606	3614	3622	1	2	2	3	4
.56	3631	3639	3648	3656	3664	3673	3681	3690	3698	3707	1	2	2	3	4
.57	3715	3724	3733	3741	3750	3758	3767	3776	3784	3793	1	2	3	3	4
.58	3802	3811	3819	3828	3837	3846	3855	3864	3873	3882	1	2	3	3	4
.59	3890	3899	3908	3917	3926	3936	3945	3954	3963	3972	1	2	3	4	5
.60	3981	3990	3999	4009	4018	4027	4036	4046	4055	4064	1	2	3	4	5
.61	4074	4083	4093	4102	4111	4121	4130	4140	4150	4159	1	2	3	4	5
.62	4169	4178	4188	4198	4207	4217	4227	4236	4246	4256	1	2	3	4	5
.63	4266	4276	4285	4295	4305	4315	4325	4335	4345	4355	1	2	3	4	5
.64	4365	4375	4385	4395	4406	4416	4426	4436	4446	4457	1	2	3	4	5
.65	4467	4477	4487	4498	4508	4519	4529	4539	4550	4560	1	2	3	4	5
.66	4571	4581	4592	4603	4613	4624	4634	4645	4656	4667	1	2	3	4	5
.67	4677	4688	4699	4710	4721	4732	4742	4753	4764	4775	1	2	3	4	5
.68	4786	4797	4808	4819	4831	4842	4853	4864	4875	4887	1	2	3	5	6
.69	4898	4909	4920	4932	4943	4955	4966	4977	4989	5000	1	2	3	5	6
.70	5012	5023	5035	5047	5058	5070	5082	5093	5105	5117	1	2	3	5	6
.71	5129	5140	5152	5164	5176	5188	5200	5212	5224	5236	1	2	4	5	6
.72	5248	5260	5272	5284	5297	5309	5321	5333	5346	5358	1	2	4	5	6
.73	5370	5383	5395	5408	5420	5433	5445	5458	5470	5483	1	3	4	5	6
.74	5495	5508	5521	5534	5546	5559	5572	5585	5598	5610	1	3	4	5	6
.75	5623	5636	5649	5662	5675	5689	5702	5715	5728	5741	1	3	4	5	7
.76	5754	5768	5781	5794	5808	5821	5834	5848	5861	5875	1	3	4	5	7
.77	5888	5902	5916	5929	5943	5957	5970	5984	5998	6012	1	3	4	5	7
.78	6026	6039	6053	6067	6081	6095	6109	6124	6138	6152	1	3	4	6	7
.79	6166	6180	6194	6209	6223	6237	6252	6266	6281	6295	1	3	4	6	7
.80	6310	6324	6339	6353	6368	6383	6397	6412	6427	6442	1	3	4	6	7
.81	6457	6471	6486	6501	6516	6531	6546	6561	6577	6592	2	3	5	6	8
.82	6607	6622	6637	6653	6668	6683	6699	6714	6730	6745	2	3	6	6	8
.83	6761	6776	6792	6808	6823	6839	6855	6871	6887	6902	2	3	5	6	8
.84	6918	6934	6950	6966	6982	6998	7015	7031	7047	7063	2	3	5	7	8
.85	7079	7096	7112	7129	7145	7161	7178	7194	7211	7228	2	3	5	7	8
.86	7244	7261	7278	7295	7311	7328	7345	7362	7379	7396	2	3	5	7	8
.87	7413	7430	7447	7464	7482	7499	7516	7534	7551	7568	2	4	5	7	9
.88	7586	7603	7621	7638	7656	7674	7691	7709	7727	7745	2	4	5	7	9
.89	7762	7780	7798	7816	7834	7852	7870	7889	7907	7925	2	4	6	7	9
.90	7943	7962	7980	7998	8017	8035	8054	8072	8091	8110	2	4	6	7	9
.91	8128	8147	8166	8185	8204	8222	8241	8260	8279	8299	2	4	6	8	9
.92	8318	8337	8356	8375	8395	8414	8433	8453	8472	8492	2	4	6	8	10
.93	8511	8531	8551	8570	8590	8610	8630	8650	8670	8690	2	4	6	8	10
.94	8710	8730	8750	8770	8790	8810	8831	8851	8872	8892	2	4	6	8	10
.95	8913	8933	8954	8974	8995	9016	9036	9057	9078	9099	2	4	6	8	10
.96	9120	9141	9162	9183	9204	9226	9247	9268	9290	9311	2	4	6	9	11
.97	9333	9354	9376	9397	9419	9441	9462	9484	9506	9528	2	4	6	9	11
.98	9550	9572	9594	9616	9638	9661	9683	9705	9727	9750	2	4	7	9	11
.99	9772	9795	9817	9840	9863	9886	9908	9931	9954	9977	2	5	7	9	11
L	0	1	2	3	4	5	6	7	8	9	1	2	3	4	5

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INTERNATIONAL ATOMIC WEIGHTS 1950*

	Symbol	Atomic Number	Atomic Weight
Actinium	Ac	89	227
Aluminium	Al	13	26.97
Americium	Am	95	[241]
Antimony	Sb	51	121.76
Argon	A	18	39.944
Arsenic	As	33	74.91
Astatine	At	85	[211]
Barium	Ba	56	137.36
Beryllium	Be	4	9.013
Bismuth	Bi	83	209.00
Boron	B	5	10.82
Bromine	Br	35	79.916
Cadmium	Cd	48	112.41
Calcium	Ca	20	40.08
Carbon	C	6	12.010
Cerium	Ce	58	140.13
Cesium	Cs	55	132.91
Chlorine	Cl	17	35.457
Chromium	Cr	24	52.01
Cobalt	Co	27	58.94
Columbium (see *Niobium*)	Cb		
Copper	Cu	29	63.54
Curium	Cm	96	[242]
Dysprosium	Dy	66	162.46
Erbium	Er	68	167.2
Europium	Eu	63	152.0
Fluorine	F	9	19.00
Francium	Fr	87	[223]
Gadolinium	Gd	64	156.9
Gallium	Ga	31	69.72
Germanium	Ge	32	72.60
Gold	Au	79	197.2
Hafnium	Hf	72	178.6
Helium	He	2	4.003
Holmium	Ho	67	164.94
Hydrogen	H	1	1.0080
Indium	In	49	114.76
Iodine	I	53	126.92
Iridium	Ir	77	193.1
Iron	Fe	26	55.85
Krypton	Kr	36	83.7
Lanthanum	La	57	138.92
Lead	Pb	82	207.21
Lithium	Li	3	6.940
Lutetium	Lu	71	174.99
Magnesium	Mg	12	24.32
Manganese	Mn	25	54.93
Mercury	Hg	80	200.61
Molybdenum	Mo	42	95.95
Neodymium	Nd	60	144.27
Neptunium	Np	93	[237]
Neon	Ne	10	20.183
Nickel	Ni	28	58.69
Niobium	Nb	41	92.91
Nitrogen	N	7	14.008
Osmium	Os	76	190.2
Oxygen	O	8	16.0000
Palladium	Pd	46	106.7
Phosphorus	P	15	30.98
Platinum	Pt	78	195.23
Plutonium	Pu	94	[239]
Polonium	Po	84	210
Potassium	K	19	39.096
Praseodymium	Pr	59	140.92
Promethium	Pm	61	[147]
Protactinium	Pa	91	231
Radium	Ra	88	226.05
Radon	Rn	86	222
Rhenium	Re	75	186.31
Rhodium	Rh	45	102.91
Rubidium	Rb	37	85.48
Ruthenium	Ru	44	101.7
Samarium	Sm	62	150.43
Scandium	Sc	21	45.10
Selenium	Se	34	78.96
Silicon	Si	14	28.06
Silver	Ag	47	107.880
Sodium	Na	11	22.997
Strontium	Sr	38	87.63
Sulfur	S	16	32.066
Tantalum	Ta	73	180.88
Technetium	Tc	43	[99]
Tellurium	Te	52	127.61
Terbium	Tb	65	159.2
Thallium	Tl	81	204.39
Thorium	Th	90	232.12
Thulium	Tm	69	169.4
Tin	Sn	50	118.70
Titanium	Ti	22	47.90
Tungsten (see *Wolfram*)	W		
Uranium	U	92	238.07
Vanadium	V	23	50.95
Wolfram	W	74	183.92
Xenon	Xe	54	131.3
Ytterbium	Yb	70	173.04
Yttrium	Y	39	88.92
Zinc	Zn	30	65.38
Zirconium	Zr	40	91.22

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* A value given in brackets denotes the mass number of the most stable known isotope.